040 Combined with Form 1040A

US Department of the Treasury / Internal Revenue Service
Individual Income Tax Return

1969

e year January 1–December 31, 1969, or other taxable year beginning ..... 1969, ending ..... 19.....

t name and initial (If joint return, use first names and middle initials of both) | Last name | Security number

May 1970

75¢

ent home a | Your occupation

y, town or pos | Spouse's social security number

ter below n
son. If cha | 1968 (if same as above write "Same"). If none filed, give separate returns, enter 1968 names and addresses. | Spouse's occupation

me and add

ur
ng
atus—
heck
y one)

1
2

y one had income)
spouse is also filing a return.
curity number in space provided

4 ☐ Unmarried Head of Household
5 ☐ Surviving widow(er) with dependant chil
6 ☐ Married filing separate return and spous is not filing a return

Your Exemptions

oxes for exemptions which ap

	Regular	65 or over	Blind	
7a Yourself	☐	☐	☐	Enter number of boxes checked ▶
7b Spouse (applies only if line 2 or line 6 is checked)	☐	☐	☐	

8 First names of your dependent children who lived with you — Enter number ▶

	(d) $500 or more income?	(e) Support you furnished. If 100% write "ALL"	(f) Support furnished by dependent and others
9 OTHER DEPENDENTS		$	$ ▶
			▶
10 Total exemptions (add lines 7a, 7b, and 9 above)			▶

Your Income

11 W k) 11

12a Dividends [ ] [See Item 2 on 1040–1] 12b Less Exclusion $ ..... Balance ▶ 12c

13 Inte if over $100, also list in Schedule B, Part II) 13

14 Oth schedules (check schedules used—C ☐, D ☐, E ☐, F ☐) . . 14

Adjusted

15a Total 1.

- If line 1 for ax credit, or inves
- Go to S (Om ies 16 and 17.)
ment c
- If neither of above two items applies, go to Tax Tables instead of Sch. T. Complete lines 16, 17, & 18.

16 Tax from Tax Table (see tables on T–2 and T–3) 16

17 Tax surcharge on line 16 (see T–1 for tax surcharge tables) . 17

See 1040–1 for rules under which the IRS will figure your tax and surcharge.

Tax Surcharge

18 Enter if fr

19 Tot

20 Excess

21 ☐ Nonhighway federal gasoline tax, Form 4136; ☐ Reg. Inv., Form 2439 — 21

22 1969 Estimated tax payments (include 1968 overpayment allowed as a credit) — 22

23 Total (add lines 19, 20, 21, a 23

Tax Credits or Refund

24 If line 18 is larger than line 23, enter BALANCE DUE. P ... full with return ▶ 24

25 If line 23 is larger than line 18, enter OVERPAYMENT ▶ 25

26 Line 25 to be: (a) Credited on 1970 estimated tax ▶ $; (b) Refunded ▶ $

ak heck or money order payable to Internal Revenue Service.

Under penalties of perjury, I declare that I have examined this return, including accompanying schedules and statements, and to the best of my knowledge and belief is true, correct, and complete.

Sign here

▶ Your signature Date

▶ Spou

▶ Signature of preparer other than taxpayer, based on all information of which he has any knowledge. Date

Address

10-00000

See Page 5

introducing

the NEW

Heathkit® SB-102...

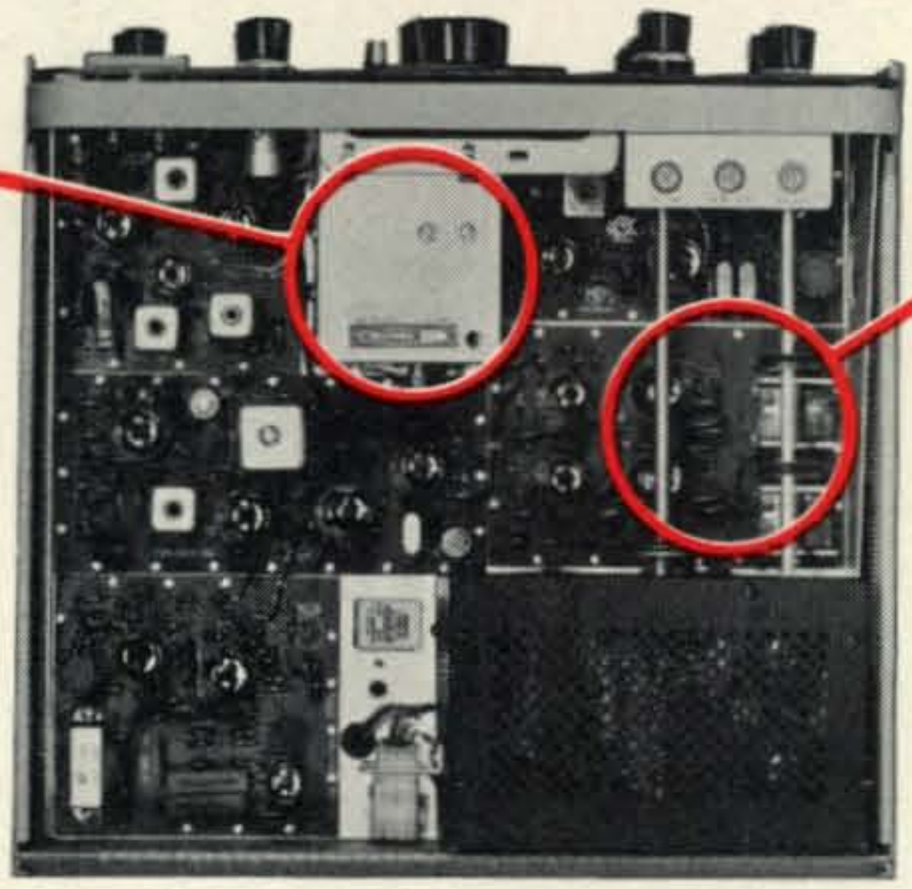
now the world's best rig

(the SB-101) is even better

Heathkit SB-102 . . . the new standard of performance & value

NEW Solid-State Linear Master Oscillator

provides improved frequency stability, better linearity and shorter warm-up



NEW Receiver Circuitry

for increased sensitivity . . . now 0.35 uV for 10 dB S+N/N

The New Heathkit SB-102 . . . proud descendant of the rigs that put many thousands of hams on the air — the famous "100" and "101". With a heritage like this, you expect top performance, reliability and value . . . and you get it.

We improved the already excellent frequency stability and dial linearity of the "101" by using an all solid-state LMO . . . the result is a rig that stabilizes in half the time and tracks more accurately than ever before.

The receiver portion of the "102" is even hotter than the "101" . . . sensitivity is now less than 0.35 uV for 10 dB S+N/N ratio . . . an increase that gives you solid copy longer when the band is on the way out.

The new "102" . . . all the flexibility and performance that made the "101" the world's most popular transceiver plus important new features. When you get ready to buy a new transceiver, check out the new "102" . . . the world's best made even better. From the Hams at Heath, of course.

• New all solid-state Linear Master Oscillator features 1 kHz dial calibration • Bandspread equal to 10 feet per Megahertz • Less than 100 Hz per hour drift after 10 minute warm up • Dial resettable to 200 Hz • New receiver circuitry provides sensitivity of better than 0.35 uV for 10 dB S+N/N • 180 watts PEP SSB input — 170 watts CW input • 80 through 10 meter coverage • Switch-selection of USB, LSB or CW • Built-in CW sidetone • Built-in 100 kHz crystal calibrator • Triple Action Level Control™ reduces clipping and distortion • Front panel switch selection of built-in 2.1 kHz SSB or optional 400 Hz CW crystal filters • Operate with built-in VOX or PTT • Fast, easy circuit board-wiring harness construction • Run fixed or mobile with appropriate low cost power supplies

SB-102, 23 lbs.....**$380.00***
SB-600, Communications Speaker, 6 lbs.....**$19.95***
HP-23A, AC Power Supply, 19 lbs.....**$51.95***
HP-13A, DC Power Supply, 7 lbs.....**$69.95***
SBA-301-2, 400 Hz CW Crystal Filter, 1lb.....**$21.95***
SBA-100-1, Mobile Mounting Kit, 6 lbs.....**$14.95***

SB-102 SPECIFICATIONS — RECEIVER SECTION: Sensitivity: Better than 0.35 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **SSB selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down — 2:1 nominal shape factor — 6:60 dB. **CW Selectivity:** (With optional CW filter SBA-301-2 installed) 400 Hz minimum at 6 dB down, 2.0 kHz maximum at 60 dB down. **Input impedance:** Low impedance for unbalanced coaxial input. **Output impedance:** Unbalanced 8 and 600 ohm speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Spurious response:** Image and IF rejection better than 50 dB. Internal spurious signals below equivalent antenna input of 1 microvolt. **TRANSMITTER SECTION: DC power input: SSB:** 180 watts P.E.P. continuous voice. **CW:** 170 watts — 50% duty cycle. **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm non-reactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2:1 SWR. **Oscillator feedthrough or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit-receive operation: SSB:** Push-to-talk or VOX. **CW:** Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker in CW mode. Approx. 1000 Hz tone. **Microphone input impedance:** High impedance. **Carrier suppression:** 50 dB down from single-tone output. **Unwanted sideband suppression:** 55 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **Noise level:** At least 40 dB below single-tone carrier. **RF compression (TALC):** 10 dB or greater at .1 ma final grid current. **GENERAL: Frequency coverage:** 3.5 to 4.0; 7.0 to 7.3; 14.0 to 14.5; 21.0 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megahertz). **Frequency stability:** Less than 100 Hz per hour after 10 minutes warm-up from normal ambient conditions. Less than 100 Hz for ±10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Visual Dial Accuracy — "resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration or nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 Hz. **Calibration:** 100 kHz crystal. **Audio frequency response:** 350 to 2450 Hz ±3 dB. **Phone patch impedance:** 8 ohm receiver output to phone patch; high impedance phone patch input to transmitter. **Front panel controls:** Main (LMO) tuning dial; Driver tuning and Preselector; Final tuning; Final loading; Mic and CW Level Control; Mode switch; Band switch; Function switch; Freq. Control switch; Meter switch; RF gain control; SSB-CW filter switch. Audio Gain control. **Internal controls:** VOX Sensitivity; VOX Delay; Anti-Trip; Carrier Null (control and capacitor); Meter Zero control; CW Side-Tone Gain control; Relative Power Meter Adjust control; P.A. — Bias; Phone Vol (headphone volume); Neutralizing. **Rear Apron Connections:** CW Key jack; 8 ohm output; Spare A; Spare B; Phone patch input; ALC input; Power and accessory plug; RF output; Antenna switch; Receiver Antenna. **Power requirements:** 700 to 800 volts at 250 ma; 300 volts at 150 ma; —115 volts at 10 ma; 12 volts at 4.76 amps. **Cabinet dimensions:** 14⅞" W x 6⅝" H x 13⅜" D.

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All the outstanding features of the famous 500-C, plus the following improvements:

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- And 550 watts P.E.P. input.

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117-XC AC supply	$105
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VX-2 Plug-in VOX	$ 35
FP-1 Phone Patch	$ 48
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Notice to 500-C owners: These improvements can be incorporated in your set if you're handy with a soldering iron. Write Swan Customer Service for kit information.

SWAN ELECTRONICS

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MAY, 1970 VOL. 26, No. 5

CQ The Radio Amateur's Journal

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DEPARTMENTS

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

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. Allow six weeks for change of address. Printed in the United States of America.

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See page 102 for New Reader Service

EIMAC's new family of outstanding power tetrodes offers 13 impressive features:-

(1) High linearity. 3d order products −40 dB or better.

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EIMAC's advanced segmented cathode and electron focussing combine with an unusually high figure of merit in this family, providing you with tubes useful in widely diversified services: linear amplification, high reliability aircraft-to-ground communication, wideband distributed amplifier service in airborne ECM gear, and r-f pulse application.

Another example of EIMAC's ability to provide morrow's tube today! Here are the numbers to prov

TUBE TYPE	FIL. VOLTS	RATED TO: (MHz)	BASE	COOLING	MAX. RATINGS		TYPICAL POWER OUTPUT (150 MHz)	USE FO
					Plate Volts	Plate Amperes		
4CX600B	6.0	890	5-PIN SPEC.	Air	3000	0.6	750W	WIDE AMPL SER
4CX600F	26.5							
4CW800B	6.0	890	5-PIN SPEC.	Liquid	3000	0.6	750W	WIDE AMPL SER
4CW800F	26.5							
4CX600J / 8809	6.0	150	OCTAL SPEC.	Air	3000	0.6	750W	CLASS LIN SER

More? Our Application Engineering Departme ability to design tube into circuit means less engin ing time for you. For all-around capability, tal EIMAC. For circuit and application information these new power tetrodes, write to EIMAC for our f free application bulletin #14, *Using the 4CX600 Fa Tetrodes*. Or contact your nearest Varian/Eimac E tron Tube and Device Group Office. They are locate

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See page 102 for New Reader Service

ZERO BIAS

The following petition was filed with the U. S. Internal Revenue Service on March 25, 1970. It needs your immediate support.

Internal Revenue Service
Department of Taxation
Washington, D. C.

On behalf of approximately three hundred thousand licensed radio amateur operators residing within the United States, CQ/THE RADIO AMATEUR'S JOURNAL does hereby petition the Internal Revenue Service to designate radio equipment used by such amateurs as having as its primary purpose the good and welfare of the public, and as such, that the purchase price of said amateur radio stations and license fees to operate said stations, be thereby eligible as deductible from individual personal income taxes.

The Federal Communications Commission, an official agency of the United States Government, under whose authority said Amateur Radio Stations are licensed, recognizes that the primary purpose of the Amateur Radio service is for the public welfare.

Part 97.1 of the FCC Rules and Regulations state the Basis and Purpose of the Amateur Radio service as follows:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary non-commercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

(e) Continuation and extension of the amateur's unique ability to enhance international good will.

We, therefore, request that the Internal Revenue Service take immediate action to declare all future purchases of radio equipment by radio amateurs which are to be used in the public welfare as being worthy of tax-exempt status on individual income tax returns. We also request that fees for amateur radio licenses collected by the Federal Communications Commission be tax exempt.

Cordially yours,

Richard A. Cowan,
Publisher

We urge strong and vocal support for this petition. To that end, copies of the original petition are available at no cost by writing: CQ Petition, 14 Vanderventer Ave., Port Washington, N. Y. 11050. Please include s.a.s.e. and state the number of copies needed. Your local Congressman or Senator might well be interested in seeing a copy.

See page 102 for New Reader Service

OUR READERS SAY

Australis-OSCAR 5

Editor, *CQ:*

This letter is being written expressly to thank *CQ* Magazine and the Cowan Publishing Corp. for the assistance given in furthering the Australis-OSCAR 5 amateur satellite project. The coverage which you have devoted to this program, particularly in the many fine articles written by George Jacobs, W3ASK, has been very valuable in generating interest among amateurs and other radio hobbiests, and in dispensing information necessary to enable these people to track and obtain telemetry data from Australis-OSCAR 5.

Actually, we were not surprised by the enthusiasm with which your journal approached this endeavor, since *CQ* has consistently supported and fostered amateur interest in space and related subjects. AMSAT looks forward to further participation by your magazine in future amateur space projects in which we are now embarking.

Dr. Perry I. Klein, K3JTE
AMSAT, Washington, D.C.

Incentive Controversy

Editor, *CQ:*

The big controversy over incentive licensing still goes on, the good code man, especially the older ones feel that one needs to be a college graduate to pass the theory, the s.s.b. men seem to feel that the required code speed for the Extra class should be substantially reduced or eliminated altogether.

I passed my Extra class license year before last at the age of 65, I had to do some boning up and primarily I had to practice writing to loosen up my stiff arm before I could write twenty words a minute even though copying the code was easy. I believe if a still higher class license was available that required the learning of Chinese I would tackle that one too and thank goodness we have a lot of men in the amateur game that are willing to do whatever it takes to earn the top license.

Here is one man's opinion for what it may be worth, neither amateurs nor commercial operators really study theory to pass the multiple choice examination, they learn the answers to questions which is the much easier and quicker way to do it, but the code requires the ability to copy twenty words a minute and there is no easy way out on this. It seems to me that the holder of an Extra class license should know as much as he can about amateur radio and should be able to point to his license with pride. Learning the answers to the questions does not necessarily mean that he can even tune his rig, but he can certainly verify that he can copy code, or at least could at the time he took his examination, at the rate of twenty words a minute.

The quicker everyone quits arguing about the thing and gets busy preparing himself to meet all the requirements, the quicker he will own the top grade license and enjoy the privileges that come with it.

T. Frank Smith, W5VA
Corpus Christi, Texas

Editor, *CQ:*

John Attaway's article in the January 1970 issue of your magazine prompted me to dash off the following:

On August 20, 1969 at approximately 0100Z I turned on the old Super Duper transceiver to hear what sort of assistance the amateur radio service was rendering to the victims of the hurricane which had devastated Mississippi. The 75 meter band was sheer bedlam. Between 3900 kc and 4000 kc there simply weren't any gaps in the QRM. Newly organized nets were clobbering the old established nets and individuals were attempting to squeeze in QSOs whenever a momentary break occurred. All parties involved appeared to be cooperative and apologetic for stepping on each other's toes and frequent QSYing was the order of the evening.

I then listened between the frequencies of 3800 kc and 3825 kc where the patriarchs of our service, the revered and respected ones, the Extra class licenses are allowed to operate. I heard only one QSO. One of the great ones was switching microphones on a DX-40 and his compatriot was supplying S-meter readings with the usual accompanying comments concerning "audio quality," attenuation of highs, etc.

For the first time I thought seriously about Incentive Licensing and the means by which the additional privileges are obtained. I hold an Advanced class license and consider myself as being vastly superior to the common, ordinary, run-of-the-mill General class licensee, since I spent a total of two hours preparing myself for the examination which separates the men from the boys.

Extra class privileges may be obtained if one passes another examination and is able to copy and transmit code at the prescribed rate. Neither of my junior operators is wearing a Phi Beta Kappa key on his chain, and both have extreme difficulty in locating the proper knobs to turn my mess off when I fall asleep and the sounds from my wireless interfere with their dedication to the boob tube. However, I will gamble that within a three-month period, both of them could pass the Extra class examination if they applied themselves diligently to the task. But the really idiotic aspect of Extra class licensing in my judgement is the requirement for handling an antique, archaic, obsoleted mode of communication at a specific rate. People from Maine habitually speak at a brisk clip and Southerners drawl, but we don't hang a "second-class citizen" placard around the neck of an individual from Georgia or Alabama.

I suggest that until a really adequate method of separation of skills, courtesies, and dedications to public service is determined, all ama-

See page 102 for New Reader Service

WHILE MOBILE

Hearing is believing!

IGNITION NOISE IS GONE!

DRAKE TR-4 SIDEBAND TRANSCEIVER

Now with Noise Blanker built-in!

34-NB now factory-installed

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Years of Drake transceiver design experience make the TR-4 one of the finest available. Ahead in circuitry and compact lightweight packaging, it is ideal for mobile use, portable, and vacations. USB, LSB, CW or AM.

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ACCESSORIES

AC-4 120V 50/60 Hertz Power Supply	$ 99.95
DC-4 12 VDC Solid State Power Supply	$125.00
MS-4 Matching Speaker	$ 22.00
RV-4 Remote VFO— Separate Receive and Transmit frequencies on same ham band	$110.00
FF-1 Crystal-Control Adaptor	$ 26.95
MMK-3 Mobile Mounting Kit	$ 6.95

R. L. DRAKE COMPANY 540 Richard Street, Miamisburg, Ohio 45342

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teurs be thrown in the same pot of frequencies and the lower frequencies in each amateur band be donated to services which need them desperately and will use them for the good of the public.

Brice Tarleton, WA4VJW
Charlotte, N.C.

Propagation Special

Editor, *CQ:*

I would like to compliment your magazine and Messrs. Jacobs and Leinwoll on the November 1969 issue. The articles on Ionospheric Propagation were superb. I have been involved in commercial h.f. communications in Northwestern Canada for 20 years yet I have never seen this information in such a complete, clear and practical form.

Many of the ham publications seem to dwell on gadgetry. "Yet Another Electronic Keyer" and "Add an 813 to Your Two'er" and similar titles abound, but clear, well researched articles on basic information, are few. Thank you.

J. S. Robinson
Vancouver, B. C.

Editor, *CQ:*

Congratulations. Your November "Propagation Special" issue was superb. Particularly the articles by Jacobs and Leinwoll explaining in simple, concise but accurate terms the intricacies of ionospheric transmission.

While this information exists in numerous technical publications and reference texts, these authors have boiled it down and presented it in a very easy-to-digest manner. I predict that your November issue will become a collector's item for all serious minded amateurs.

You have done a real service to the amateur radio fraternity by publishing technical articles of this caliber. Keep up the good work!

James E. Swafford, W7FF
Tuscon, Arizona

Slower Code For Extra?

Editor, *CQ:*

The purpose of this letter is to commend John Attaway on his comments on c.w. I have the Advanced and would like to get the Extra, but the code has me slowed way down. I can get about 16 w.p.m. so far.

I have felt very strongly on the same thing that John has stated. If the purpose of the new regs are to enhance the operators knowledge, then why the 20 w.p.m.? The only reason that I can see is that this will make a class thing out of it. I am very positive that if the code were at, say, 15 w.p.m., we could have Extras coming out in droves and the Generals jumping from there right to Extra class. I sure would like to see it tried. I have written to *QST* and ARRL with this proposition, but they had no comment, only that they would print it in the letters column —and I would like to get something going.

Thank you very much for listening and keep up the good work.

Jack Golden, WA2YPW
Portville, N.Y.

Editor, *CQ:*

This is just a short note to let the ham fra-

[Continued on page 88]

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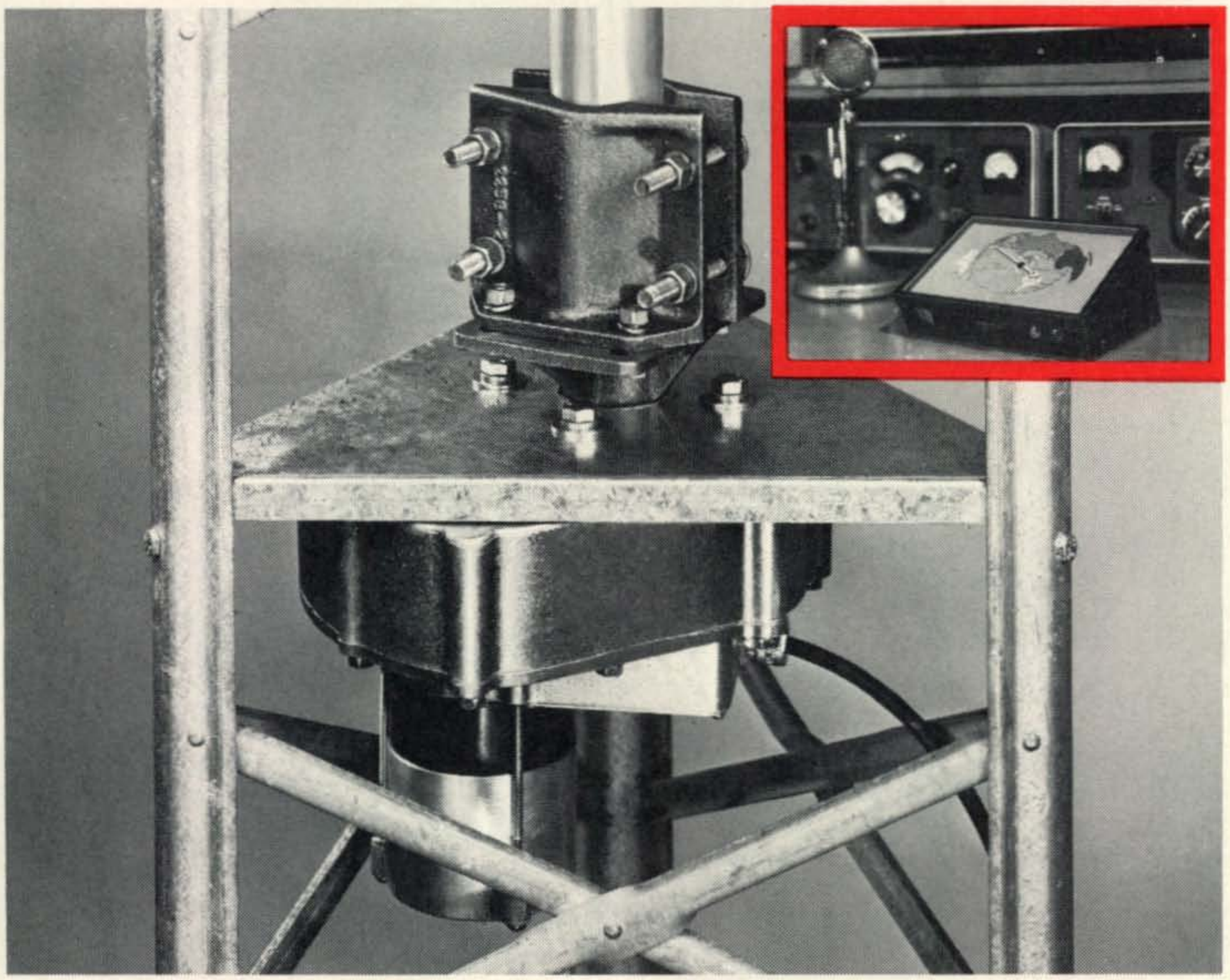

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Up to 10 times the mechanical and braking capability of any rotator on the market!

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Handsome control unit features sweep pointer over choice of great circle map or compass rose. Select desired position and capacitor-start rotator (operating off 110VAC 60 cycle power source through five-conductor cable) moves until null seeking circuit brings into position. No blind spots. As a matter of fact, rotator will move 380°, giving you a generous overlap. And, if antenna should move during severe environmental conditions, it will automatically return to original position when control is activated. All circuitry is highly reliable—no troublesome selsyns used.

Heavy duty mast clamp takes up to 3" O.D. mast. Mounts to standard tower plate with minimum of 10" tower leg spacing. Mounting kits available for poles and small towers; universal tower mount available for towers without a plate.

There's just nothing like the ROTO-BRAKE for performance. Buy one from the best distributor under the sun—the one who stocks Hy-Gain.

Model No. 400 Suggested Retail Price $189.95.

HY-GAIN ELECTRONICS CORPORATION

P.O. Box 5407-FE, Lincoln, Nebraska 68505

See page 102 for New Reader Service

Feenix, Ariz.

Deer Hon. Ed:

Friend of Hon. Brother Itchi are coming out to visit us at Itchi's ranch, and after the "how are you's" and "whats new with you's" are over, he explaneing his problem.

It seeming he in charge on annual Feenix Home Show. You knowing what a Home Show is, Hon. Ed. They getting grate big hall to holding eggshibits, then they having companies take booths to showing there wares. Like manufacturer of window screens having booth where they displaying all kinds window screens.

Well, this feller saying they want to have amchoor stayshun there on eggshibit. Nothing grate, just enuf power into dummy load so peeple can seeing see-w being sent and hearing it.

That being simple enuf. Howsumever, this feller having red-hots flash that he wanting rig and reseever to being bilt out of stuff normally available in the home. Hokendoke Hackensaki!! He wanting me to do it!

First desiding I using just a transistorized oscillator for the xmitter, and a transistorized super-regen detector. Also desiding having to use a cupple reel transistors. Not being easy to making those!

Having to have plenty of room for both reseever and xmitter, so using a big plywood door—which I can putting on sawhorses—for the xmitter and same for reseever. (Door and sawhorses courtesy Handy Dandy Hardware Co.)

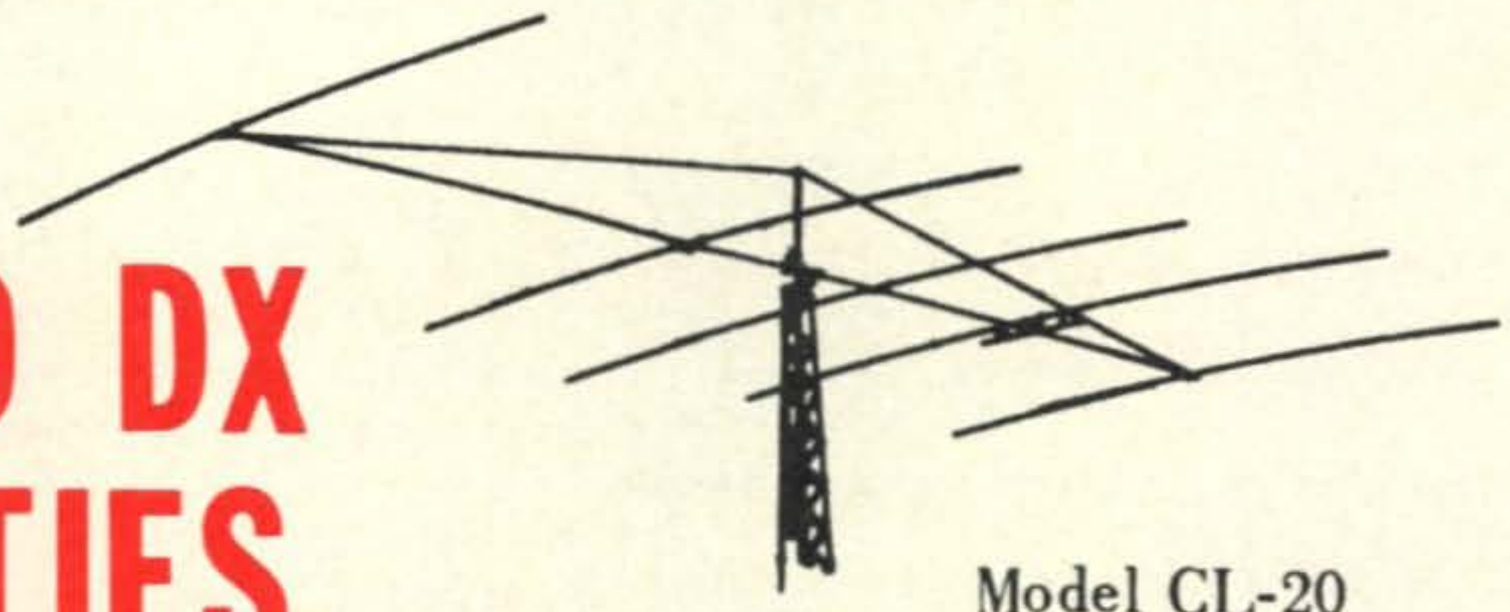
After doing lotsa deep thinking, xmitter ending up like this. Making R-F choke by getting spool of thread and taking thread off (spool courtesy Western Knit, Weave and Tat Shop), cutting grooves in it, and winding on eleventeen turns of tiny wire from electric motor (courtesy Sooperstishun Electric Co.)

Fixed capacitors lots more trubble. Getting

See page 102 for New Reader Service

NEW SINGLE-BAND BEAM FROM MOSLEY

The Classic 20 WITH EXPANDED DX CAPABILITIES ON 20 METERS



Model CL-20

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TAKE A LOOK AT THE VITAL STATISTICS!

- FORWARD GAIN: 9.8 db compared to reference dipole; 11.9 db over isotropic source.
- POWER RATED: 1 KW AM/CW; 2 KW P.E.P. SSB input to the final.
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- FEED POINT IMPEDANCE: 52 ohms.
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- RECOMMENDED MAST SIZE: 3 in. OD.
- TURNING RADIUS: 28 ft.
- WIND SURFACE: 18.7 sq. ft.
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- ASSEMBLED WEIGHT: Approx. 139 lbs.
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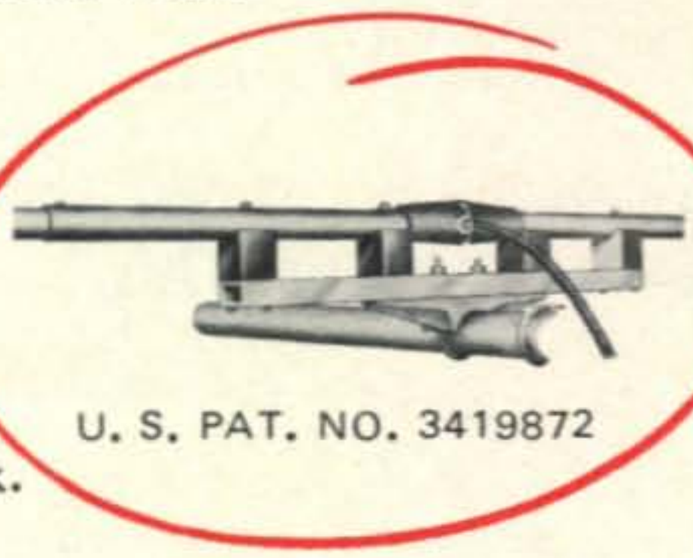

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See page 102 for New Reader Service

many boxes of alloominum foil and waxed paper (courtesy Red Giant Grocery and Feed Store) and cutting 2 foots by 2 foots squares, laying them on top of each other on the door until getting enuf capacity, then nailing down tabs of alloominum foil sticking out each end. To compressing hole mess are getting cinder blocks and laying them on top of capacitors (cinder blocks courtesy Osaki Constructshun Co.–Hon. Uncle of mine). Having to make three capacitors for xmitter. Taking up lotsa room on the door. Most of it, in fackly.

Resistors are no big problem. Just a lot of work. I getting some electric heeter coils (courtesy Home, Lawn, Patio and Pool Supply Center) and stratening out the wire. Then getting an indoor clothes drying rack (courtesy A to Z Emporium). You know kind rack I meening, Hon. Ed. It about 4 feets long and made of one inch dowels.

I winding wire around hole thing, making a big 5 or 6 foots diameter circle, and winding and winding until I getting the different resistors I needing. What a monstrosity! It taking up so much room I having to prop it up on top of the cinder blocks what are on top of the capacitors.

For variable capacitor getting few dozen metal pie plates (Handy Dandy Hardware again), strate and flexible metal knitting needles (Western Knit, Weave and Tat again) and some hunks of wood (courtesy Sequoyia Lumber and Coal Co.)

Slotting wood strips to holding few pie plates, connecting them together with three metal kneedles and having stator. For rotor piercing more pie plates and mounting on strate knitting needles, using flexible knitting needle for pigtail, supporting on two pieces of wood–presto, variable capacitor.

Reseever made about same as xmitter, except having to make variable resistor. Doing this by using bobby pin (courtesy of Lil Watanabe, my XYL-to-be) as sliding contact on resistor wire which making up on another clothes rack.

For both reseever and xmitter using transistors from portable BC radio (courtesy Lost Dutchman Appliance Co.) The alloominum clothes line wire I using for coils and the flashlite I using for dummy load both courtesy Cross Town General Store and Pool Hall.

Getting it all bilt in shack, and when finally finishing, I turning on xmitter and wondering if it working. Listening on main shack re-

[*Continued on page 86*]

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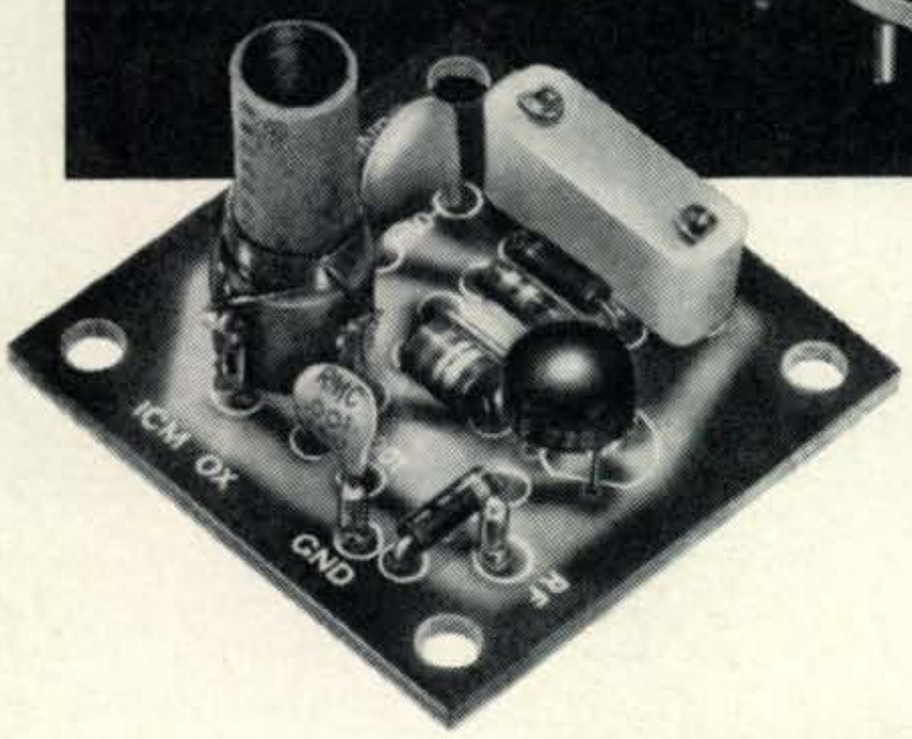

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MXX-1

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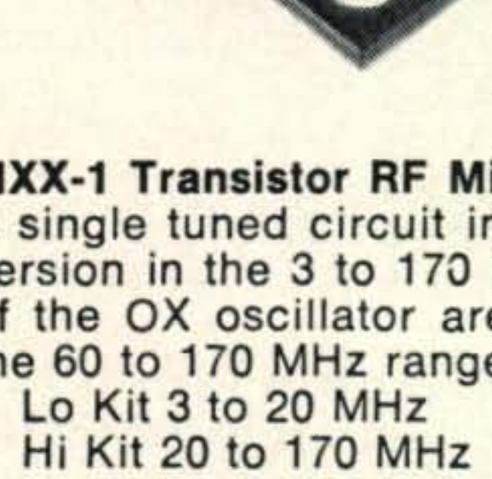
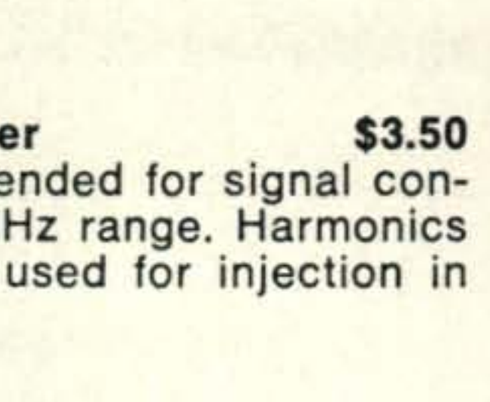

PAX-1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Announcements

Rochester, New York

Rochester is the location for the 37th annual Western New York Hamfest and VHF Conference, the weekend of May 16. Activities start Friday night followed by a full day of technical programming with outstanding speakers. Special activities include Navy MARS; AREC and QCWA meetings, YL fashion show, code contests and huge flea market. Same location as last year. Bristol 50 Acres, Rte. 15 just south of N.Y. Thruway exit 46. Advance registration and banquet only $6.75. Unlimited registration (includes entire Hamfest except dinner) only $2.75. Advance sale closes May 9th. Send check or request for information to Western New York Hamfest, Box 1388, Rochester, N.Y. 14603.

Milwaukee, Wisconsin

For Armed Forces Day, May 16, 1970, the 128th Air Refueling Group, Wisconsin Air National Guard, Mitchell Field, Milwaukee, Wisconsin, will operate all day on s.s.b. only on 40, 20, 15 and 10 as WA9DZL. A certificate of appreciation will go to every station contacted. You can QSL to Wisconsin Air National Guard, 128th Comm. Flt., Geb. Mitchell Field, Milwaukee, Wisconsin.

Quincy, Illinois

The Western Illinois Amateur Radio Club is holding its 10th Annual Hamfest on June 7th, 1970, at Adams County Fairgrounds located North and East of Quincy, Illinois. Calling frequencies will be 3.910 mc, 7.258 mc (Mid-Cars) 146.94 and 146.34 mc f.m. repeater. There will be prizes, swap-shop, games, lunch. The Hamfest will be held rain or shine, the event will take place under covered facilities. Camping spaces are available on the fairgrounds. For further information, contact WA9ARG, Marshall Goins, 2316 Van Buren St., Quincy, Illinois 62301.

Rome, New York

The Rome Radio Club presents the 17th consecutive Ham Family Day on Sunday, June 7th at Beck's Grove, ten miles west of Rome, N.Y. Features include technical talks, roundtable on v.h.f. repeaters, technical quiz plus other contests, MARS Meeting, mobile frequency checking and other activities. The N.Y. State MARS Director will be there. Participants in the popular flea market are invited. An afternoon of entertainment for the ladies and children has been arranged. Registration will start at noon with that famous steak and chicken dinner served at 5:00 P.M. Advance adult reservations $5.00, at the gate $5.50. Children under 12, $2.00, under 6 free. Send your reservations to: Rome Radio Club, P.O. Box #721, Rome, N.Y. 13440.

[*Continued on page 87*]

See page 102 for New Reader Service

The Yaesu FTdx 560 is a great rig, but it's no bargain.

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A NO COMPROMISE FIVE BAND TWO ELEMENT QUAD

BY RICHARD E. JAMES,* W4DQU

THE quad described here is designed to give maximum gain with minimum feed line losses, to be of minimum weight with maximum strength obtainable, and, being a quad, it will give a low angle of radiation with low antenna elevation. At 35 feet of elevation it will compare, on 20 meters, with a beam at 65 feet.

Maximum gain (5.7 db) on a two element quad, using a driven element and a reflector, occurs at about 1/8 wave length spacing (0.125λ). This is the spacing selected and the feed point impedance is approximately 72 ohms (balanced). I made the decision to feed the driven elements with a single 72 ohm (Belden No. 8210) transmitting type twin lead because:

1—There would be an almost perfect match with the feed line to the driven elements.

2—The 72 ohm twin lead is not heavy or bulky. It compares favorably, in this respect, with RG-58/U or RG-59/U.

3—The line loss on this 72 ohm twin lead is somewhere between RG-58/U and RG-8/U.

4—No baluns are required at the antenna. If coax had been used, baluns would have been needed for optimum performance, and they are bulky and heavy.

5—It is easy to connect twin lead to the feed points on five antennas. Try this with coax.

6—A matching device will be needed to match a transmitter with an output of 52 ohms to 72 ohms unbalanced, but you can use a balun at the transmitter, a Transmatch or a Matchbox. I personally am using a Transmatch built from June 1964 *QST*[1] and the results are excellent. If you do not have a Transmatch or a Matchbox any 1 to 1 ratio unbalanced to balanced balun can be used at the transmitter. These can be built from the handbooks or can be purchased for from $9.00 to $12.95 each.

7—Line losses with this antenna at about 35 feet can be about half as much as a beam at about 65 feet because the feed line can be made about half as long.

*3653 Crestside Road, Birmingham, Alabama 35223.

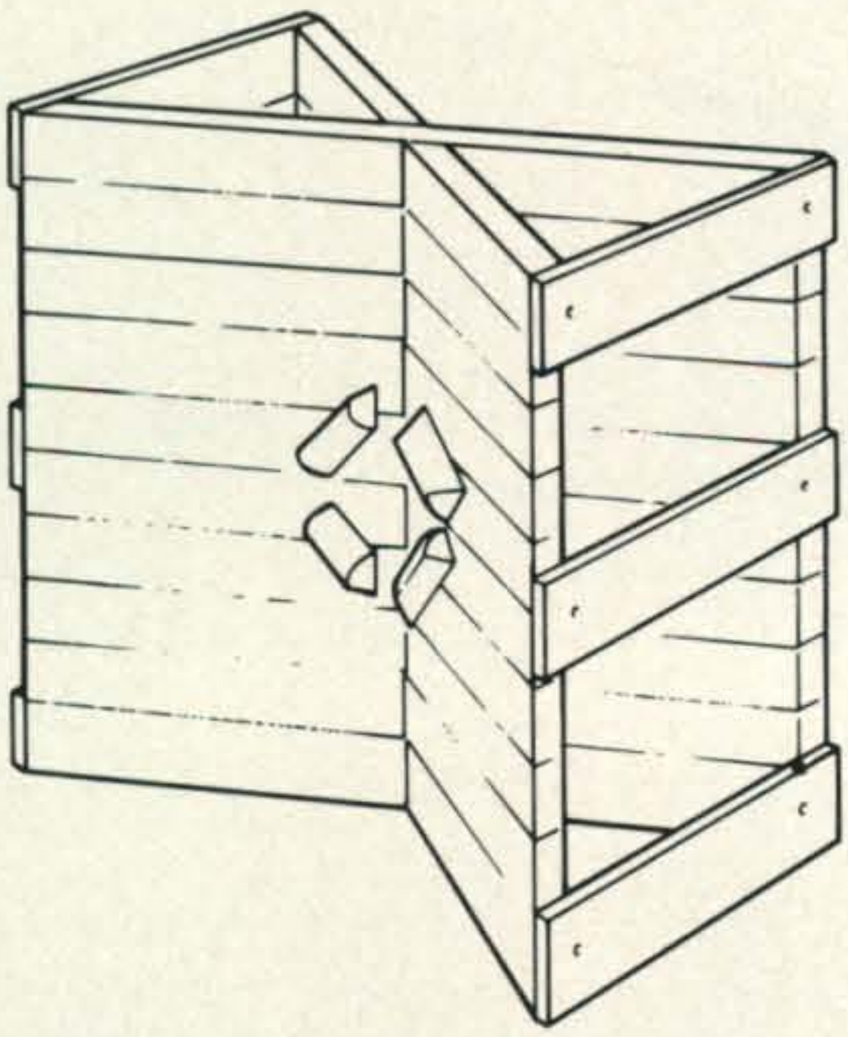

Fig. 1—Isometric view of the laminated quad hub. Three quarter inch pine or fir is secured with Weldwood Plastic Resin glue.

Construction

The hub of this antenna is constructed of ordinary pine or fir lumber which can be obtained in any lumber yard. The wood is glued together with U.S. Plywood Weldwood Plastic Resin Glue.

[1]McCoy, L., "A Completely Flexible Transmatch for One Watt to 1000", *QST*, June 1964, p. 39.

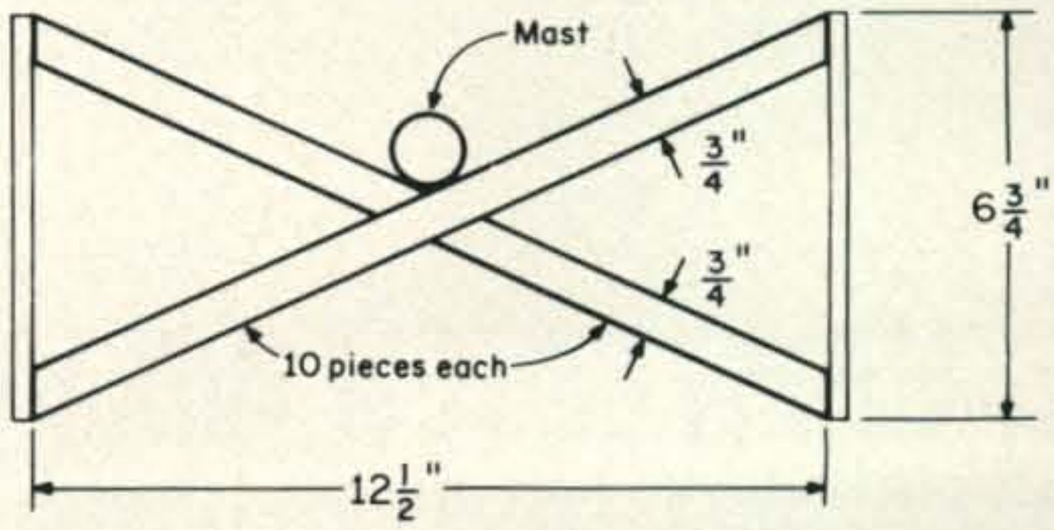

Fig. 2—Top view of the hub showing the dimensions and angles that must be cut.

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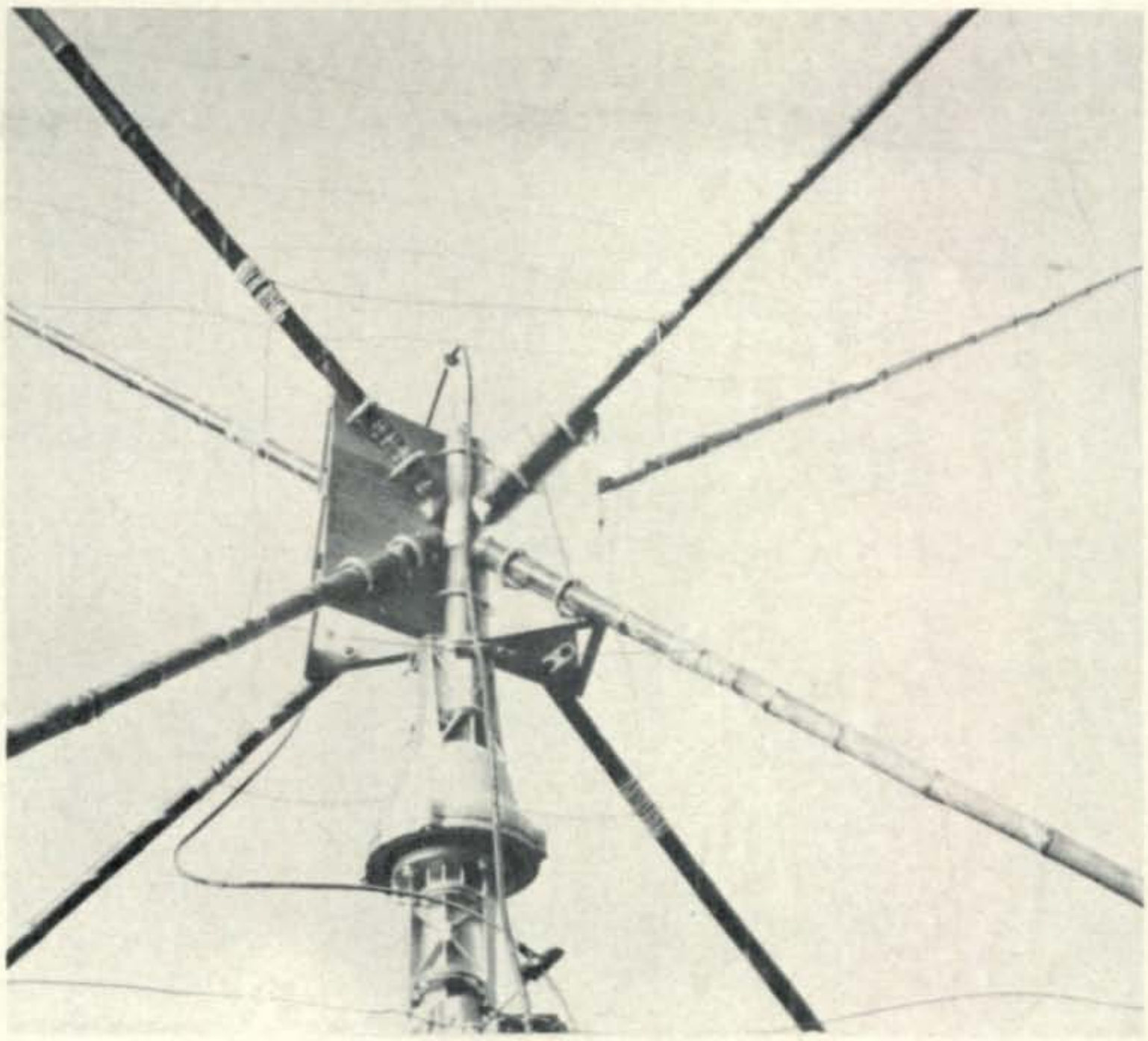

View of the hub and rotor of the five band two element quad.

Figure 1 shows the completed hub. Figure 2 shows the top view and the assembly of the component parts. First, make a scale drawing of fig. 2. Saw ten of the long pieces out of 3/4" × 1¼" pieces of wood. Saw 20 of the short pieces out of the same size wood. Using the full scale drawing, place one of the long pieces and two of the short pieces (with glue on the inner ends) on top of the drawing. Next, spread glue over the top of the three pieces and place a long piece on top of the two short pieces. Next, place two of the short pieces (with glue on inner ends) on top of the long piece. Press all pieces down firmly and wipe off excess glue. Continue this process until all the pieces are used up, remembering to always put a long piece on top of two short pieces and two short pieces on top of a long piece. Leave the assembly in a warm place (70° *F* or more) for 24 hours for the glue to set.

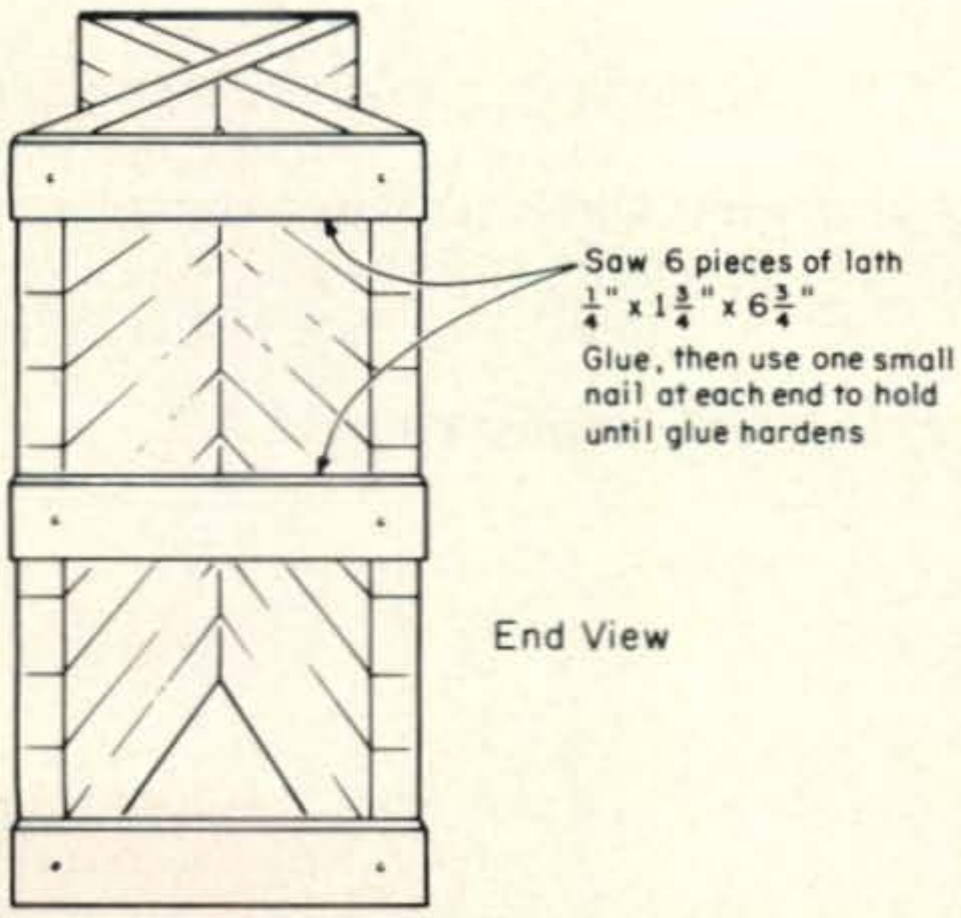

Fig. 3—End view of the quad hub shows the location of the braces desirable for reinforcement. They each measure 1/4" × 1¾" × 6¾". They are glued and secured with small brads.

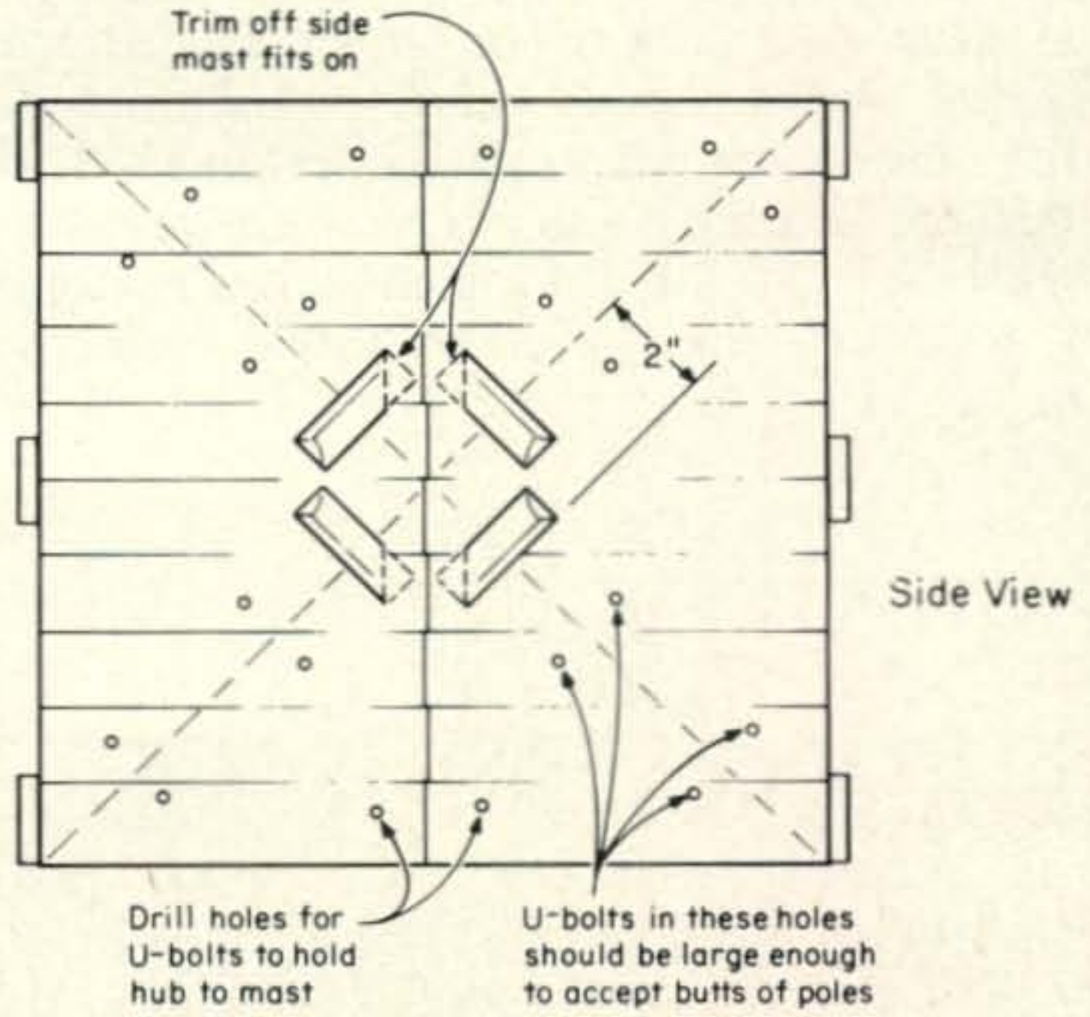

Fig. 4—Side view of the quad hub showing the positions of the wooden blocks used to keep the butts of the poles 2" from the hub center. Be sure the insides of the blocks are cut to clear the mast.

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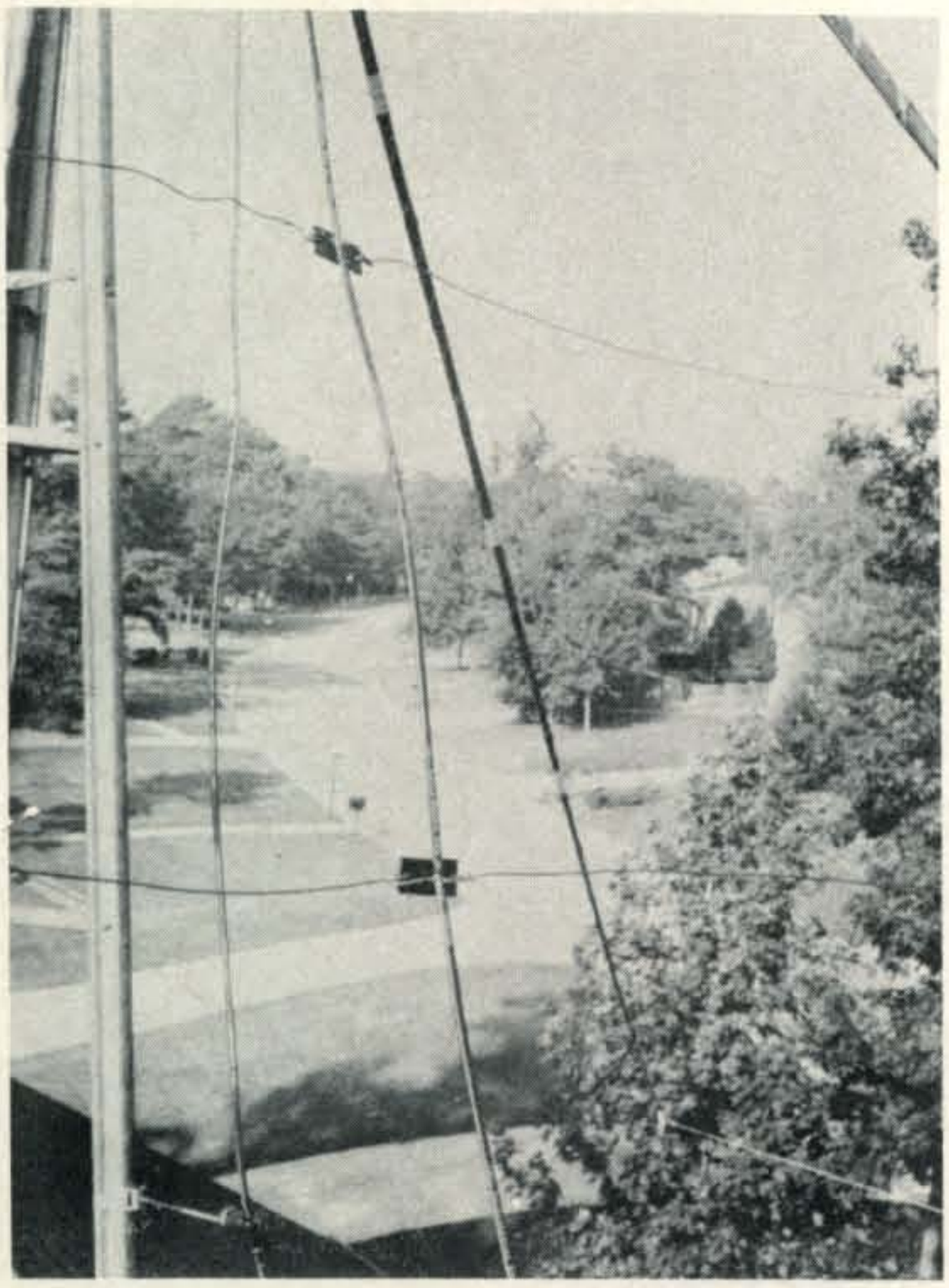
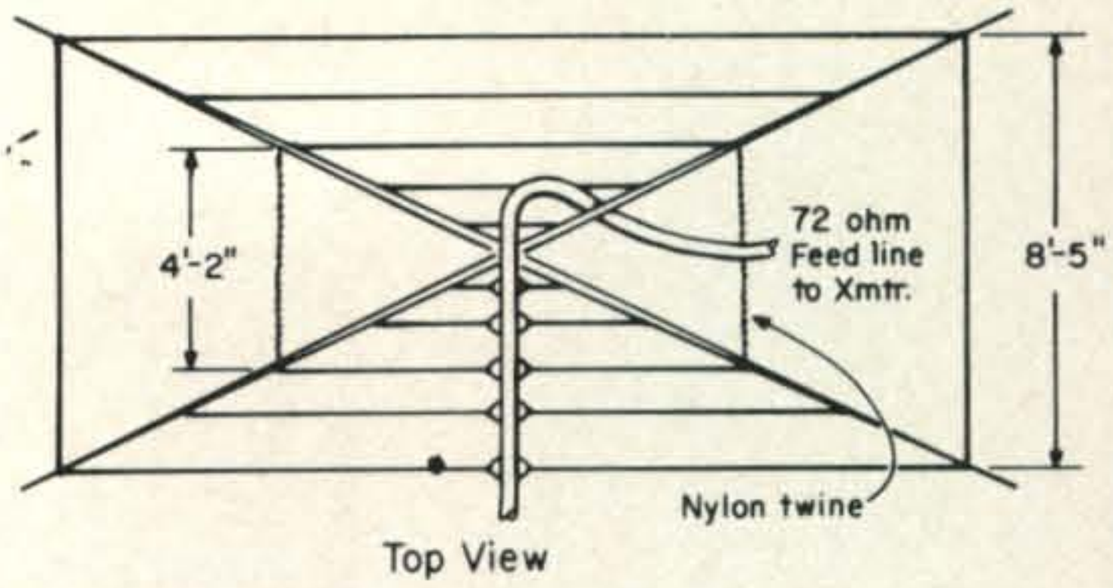


View of the 72 ohm ribbon feedline at the connection points to two of the driven elements.



Top View

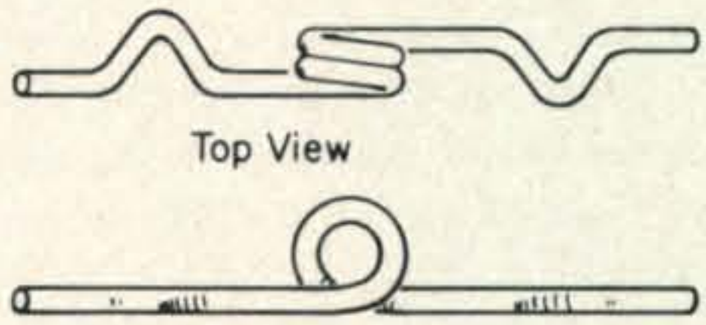
Fig. 5—Top view of the 5 band quad. Note the use of nylon twine at two points along each of spreaders to avoid bowing and sagging. The insulators and feedline connections are on the bottom of the driven element.

The location of the wires for each band is shown in fig. 5. The measurements used to locate these points are given in Table I.

Locate the listed points and secure eyelets of the type shown in fig. 6. You will need forty of these eyelets and they can be made from #16 copper wire. The eyelets are secured to the poles by wrapping the legs with string and securing the string with model airplane glue. The string should then be doped with clear airplane dope.

Next install the braces as shown in fig. 3. While probably not absolutely necessary, (the cross laminated, glued construction is very strong) the braces probably do add greatly to the strength and only weigh a few ounces.

Refer to fig. 4 and glue eight wood blocks of 3/4" × 3/4" × 2" with their faces two inches from center of hub. These are used to keep the butts of the poles spaced two inches from the dead center of the hub. All the dimensions out to the eyelets have taken this into account. If all the poles converged at the center, all the dimensions given in Table I, would have to have two inches added to them.



Top View

Side View

Fig. 6—Top and side views of the eyelets made from #16 copper wire. Forty are needed.

After assembling the quad, thread #14 wires through the eyelets. Check the lengths of wire with Table II; wires should not be tight. As matching stubs are not used on the reflector, just solder the ends of the reflector

[*Continued on page 91*]

Band	Driven Element Poles	Reflector Poles
2 M	1′ 1″	1′ 1⅝″
6 M	3′ 5¼″	3′ 6⅝″
10 M	6′ 3″	6′ 5″
15 M	8′ 6½″	8′ 9¼″
20 M	12′ 11½″	13′ 3½″

Table I—Measurements from pole butts to eyelet centers.

Band	Driven Element	Reflector
2 M	1′ 8½″	1′ 9″
6 M	4′ 10″	5′ 0″
10 M	8′ 7″	8′ 10″
15 M	11′ 8″	12′ 0″
20 M	17′ 7″	18′ 1″

Table II—Lengths for one side of each element (λ/4).

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SOLID STATE—REED RELAY OUTPUT

Top of the line squeeze keyer. Designed for the serious CW operator. A technique of dit-dah insertion that reduces effort and error. Produces smoother, easier to send and copy CW. Full memories. Adjustable paddle force down to 3 grams. Side-tone. Variable dit-dah-to-space ratio.

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Keyer, less paddle assembly

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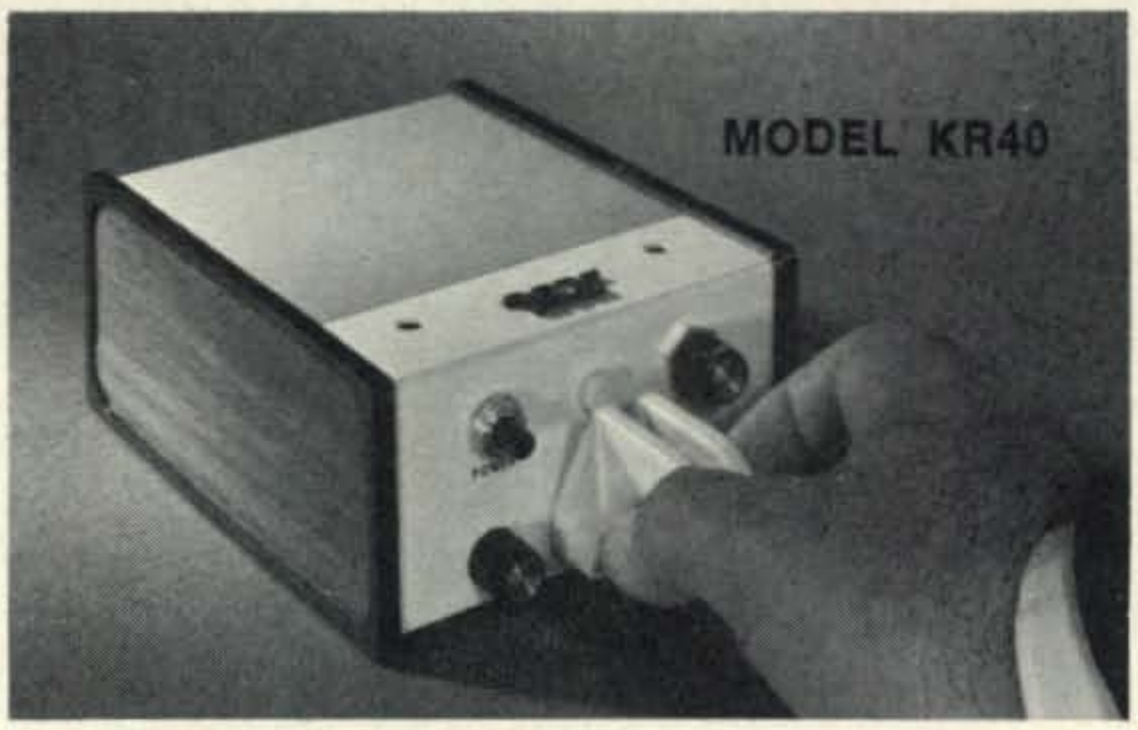

MODEL KR20

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KR20 **Price $59.95**

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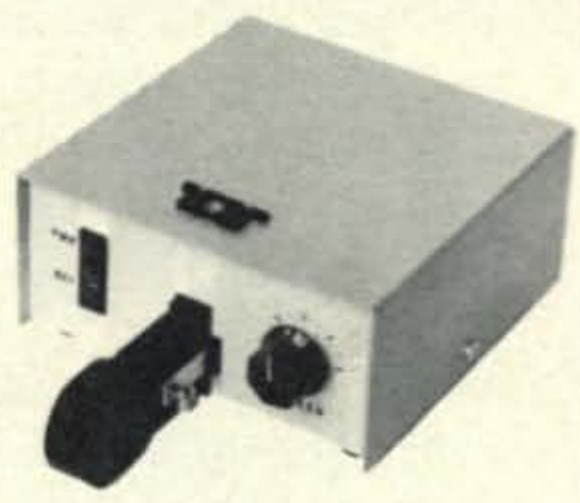

MODEL KR5

The KR5 embodies a new principle in paddle construction. It provides action usually associated with higher priced instruments. Operates from 12 volt DC source. Self-completing characters. Fixed factory adjusted paddle return and weight ratio. Ideal for fixed or mobile station.

KR5 **Price $34.95**

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MODEL KR1

The model KR1 assembly is used in the KR40 and KR20. Paddles are mounted on torque bars which actuate the contacts. Return force is magnetically controlled. Each paddle is individually adjustable down to a few grams of force. Best of all, there is a positive "feel" that enhances the enjoyment of CW communication.

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MODEL KR2

The model KR2 assembly is used in the KR5 complete keyer. It uses a unique principle allowing low actuation force, yet retaining excellent "feel". Paddle tension is factory adjusted. Contacts are easily adjusted from the front.

KR2 **Price $12.95**

TEN-TEC, INC.
HIGHWAY 411 EAST, SEVIERVILLE, TENNESSEE 37862

See page 102 for New Reader Service

A 24-HOUR CLOCK FOR THE SHACK

BY DOUGLAS L. JONES,* K3AAY

A normal electrical clock operated on 30 cycles will take 24 hours to complete a 12 hour sweep. The author uses a divide-by-two circuit to provide the 30 cycle source plus a few other tricks.

No ham shack is complete without a 24-hour clock. Keeping the log in Greenwich Mean Time is often done by DXers, and a visitor is always impressed if you point to a complicated looking clock full of odd numbers and tell him it's 1900 hours.

The 24-hour clock described here also serves some other purposes: a bit of experimentation and development with semiconductors, a pleasant construction project, and finally a use for an acquired clock with beer advertising on the face.

Theory of Operation

Electric clocks have synchronous motors. The power line current sets up within the motor a rotating magnetic field with which the rotor locks into step. Since the power line frequency is 60 c.p.s., even the most inexpensive of electric clocks keep accurate time as they are synchronized with the line frequency.

By running a clock at a frequency other than 60 c.p.s., the clock will either run faster or slower, depending on the line frequency. The circuit described here will run a clock at 30 c.p.s., just half as fast as normal. Thus, it will take the hour hand 24 hours to complete one revolution.

Circuit Description

The 110 volt 60 c.p.s. power line is first stepped down to 6.3 volts by a small filament transformer as shown in fig. 1. The output of

*R. D. #1, Box 58, Alburtis, Pennsylvania 18011.

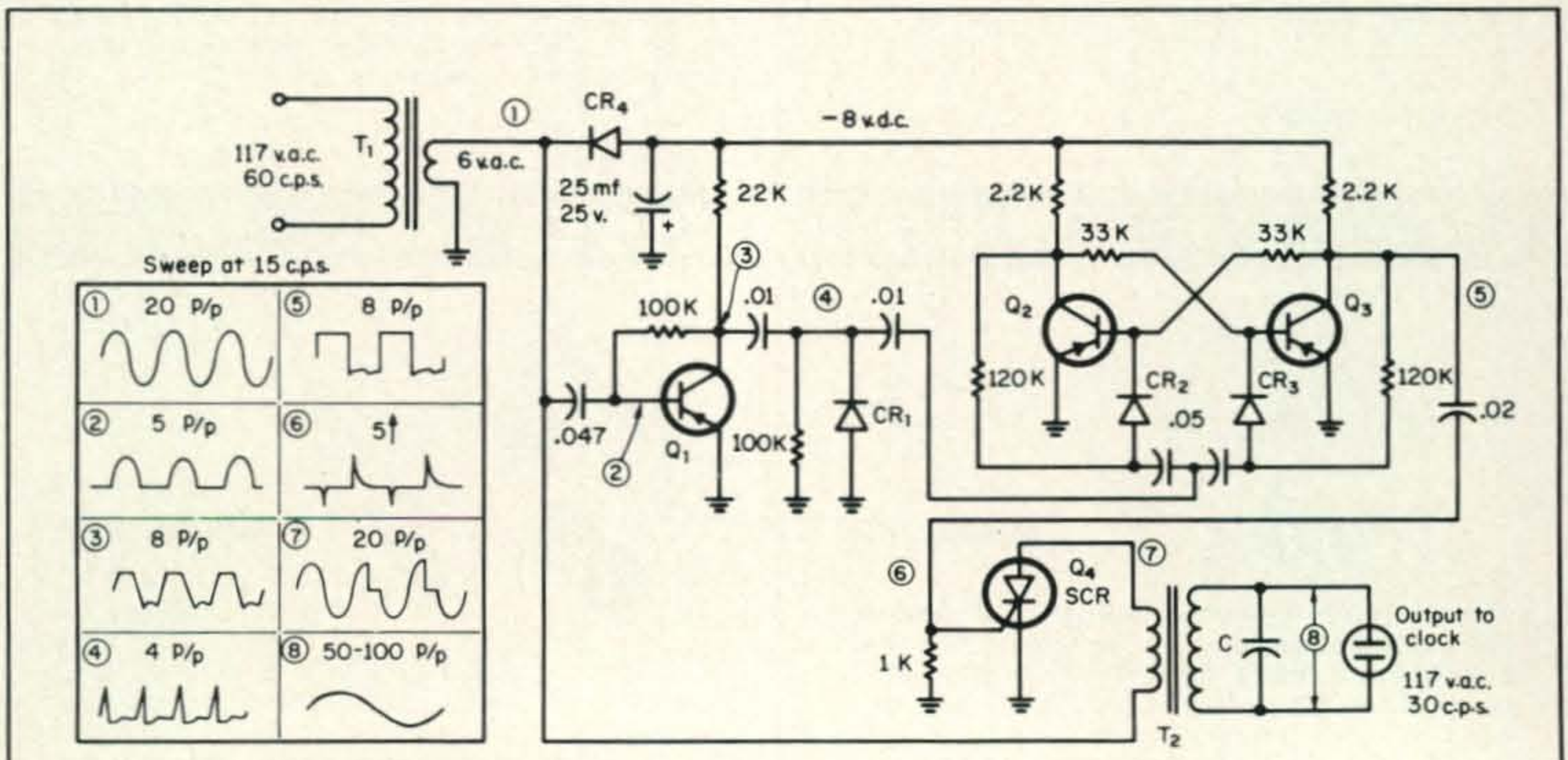

Fig. 1—Circuit of a 30 cycle power supply. The circled numbers refer to the waveforms shown above. The value of capacitor C is discussed in the text.

CR_1, CR_2, CR_3,—1N34
CR_4—Any top hat type diode at 750 ma, 400 p.i.v.
Q_1, Q_2, Q_3—2N404 (G.E.)
Q_4—S.C.R. International Rectifier, 2 amps 50 volts.
T_1, T_2—117 v. to 6.3 at 2 amps.

See page 102 for New Reader Serv

this is simultaneously fed to three points in the circuit.

The 6.3 volts goes to a half wave negative power supply. The diode and filter capacitor furnish the negative d.c. voltage necessary for the PNP transistors.

At the same time, the 6.3 volts is fed through a capacitor to the base of the shaping amplifier. The capacitor serves to sample the 60 cycle frequency and to shift the phase of it with respect to what is at the transformer.

The first transistor, Q_1, is an overdriven amplifier. The output at the collector is essentially a square wave also at 60 c.p.s. A square wave is needed as we want to derive one pulse for each alteration of the line frequency. This is easier to do with a square wave than a sinusodial wave.

The square wave output goes through a differentiator and clipper circuit. The capacitors and resistor supply sharp pulses each time there is a transistion on the square wave. The diode removes the negative pulses. Thus we have one positive pulse for each alternation of the 60 cycle line.

These pulses drive a flip-flop circuit which will produce one complete alternation for each two pulses that drive it. This is sometimes referred to as a *divide-by-2* circuit. Two resistors serve as coupling in this network, coupling the output of the one transistor to the input of the other. The two biased steering diodes serve to guide the pulse to the proper transistor a the appropriate time. The output of the flip-flop is a 30 c.p.s. square wave. This is also differentiated and produces one positive pulse per square wave.

This positive pulse fires the gate of the silicon controlled rectifier (SCR). The 6.3 volts 60 c.p.s. is fed to the plate of the SCR. Alternating current is needed so the SCR will turn back off on the negative excursion of the sine wave.

Waveshapes #6 and #7 show the gate pulse and the plate waveshapes of the SCR. The positive pulse occurs at 30 c.p.s. while the sine wave occurs at 60 c.p.s. Thus the SCR is fired on every other cycle.

Transformer T_2 is another filament transformer only it is being utilized backwards. The pulse of current from the SCR is being fed into the 6.3 volt winding. A very distorted waveshape is present at the output (110 volt winding). Capacitor C is utilized to resonate the 110 volt windings. This is necessary as the electric clock demands power that at least

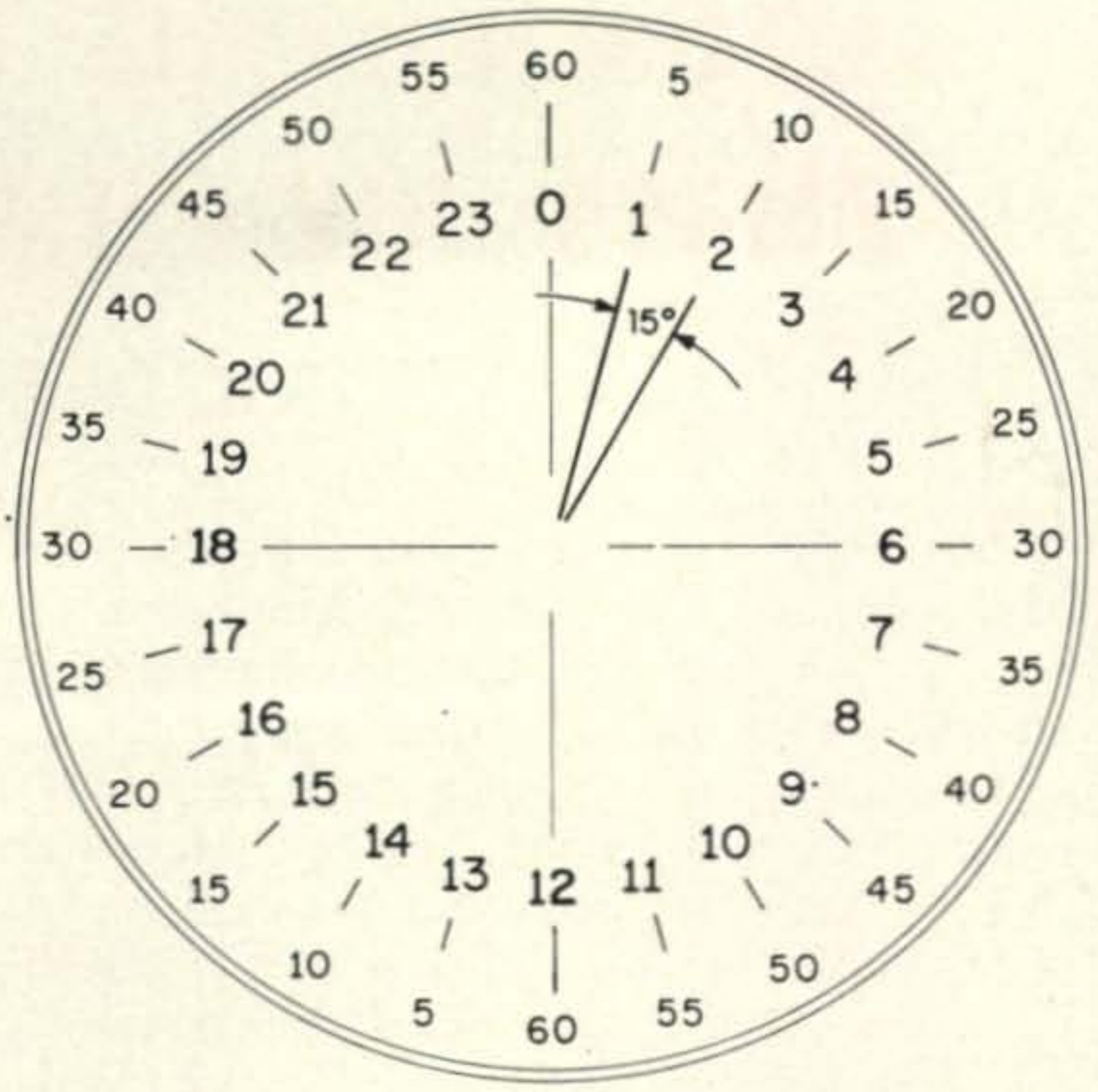

Fig. 2—Face pattern for a 24 hour clock.

looks something like a sine wave. The value of C is determined by cut and try. The size will vary depending on the particular transformer and clock. In the prototype model it was found that a 20 mf at 450 v. d.c. worked fine. The polarity is unimportant.

With a 30 c.p.s. sine wave, the clock will now run just half as fast; everything will. The hour hand takes 24 hours to get around; the minute hand takes 2 hours, and the second hand takes 2 minutes to complete a revolution.

Construction was done on a small piece of vector board using point-to-point wiring. There is nothing critical about the wiring. Be sure to heat sink the silicon control rectifier.

The entire vector board and the two transformers were mounted inside the clock with plenty of room left for the light bulbs. (Remember, is was for beer advertising.)

All of the advertising came off quite easy with an electric sander. The new face or types of numbers is left to your imagination. The layout is as shown in fig. 2. Suggested methods include decals, stencils, or house numbers. If you are lucky, perhaps an obliging friend or relative is good with a paint brush.

It is a true 24-hour clock that can look impressive and professional. ■

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UPGRADING THE HEATHKIT SB-10 SIDEBAND ADAPTER

BY HUBERT H. WHEELER,* W4IBU/5

For those hams who still are using, or have available to use, or who are interested in acquiring a Heathkit SB-10 single sideband adapter, this article may be of some interest.

The SB-10 is a fundamental frequency, phasing type, sideband adapter. Had the manufacturer included an r.f. oscillator and a power supply it would have been a sideband generator. As is, it depends on another source for these supplies and any source will work work equally well though most SB-10 adapters are coupled to a Heathkit transmitter of one type or another.

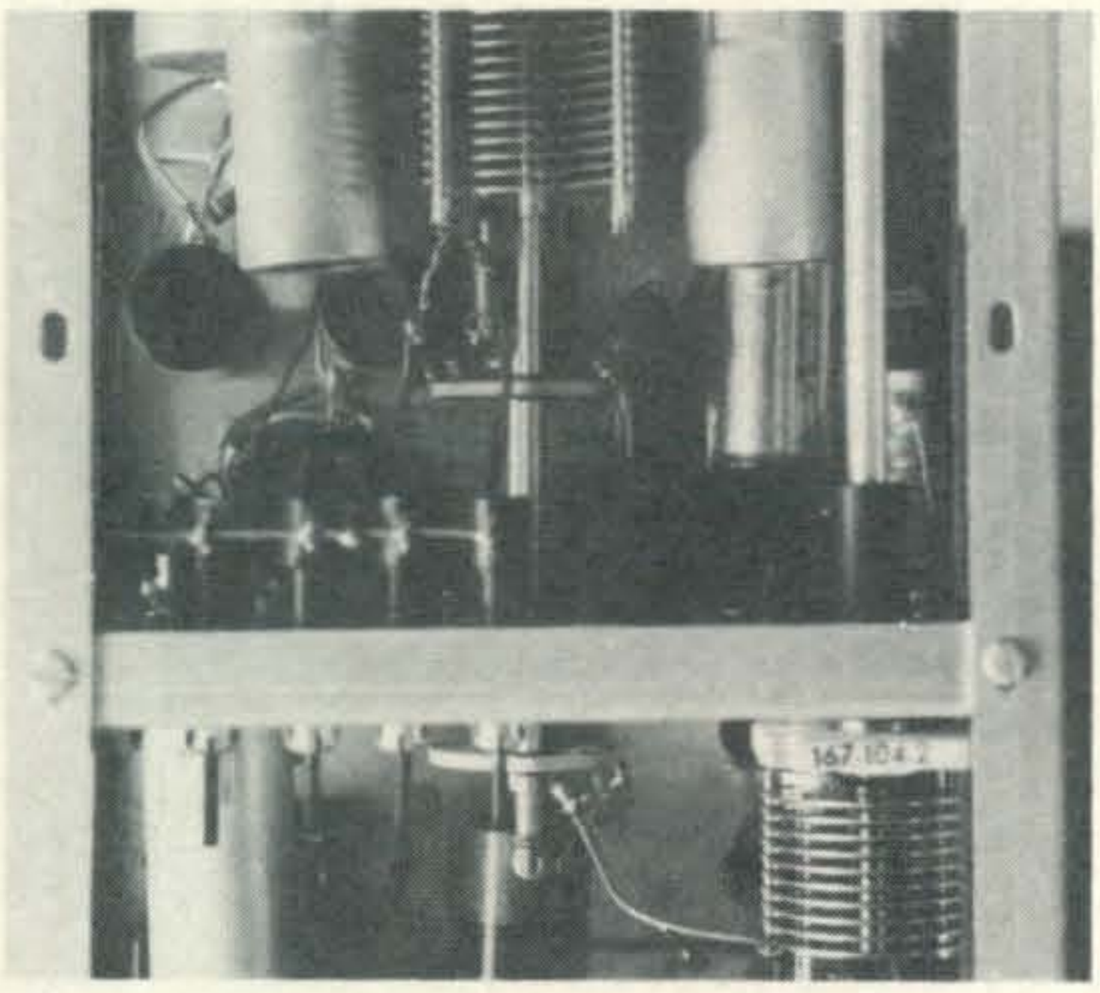
Theoretically, the phasing type sideband generator is capable of almost infinite unwanted sideband rejection at some fixed audio frequency. As marketed, the Heath Company specifications state that the unwanted sideband suppression should exceed 30 db and that the carrier suppression should exceed 40 db.

With some slight modification of the SB-10, the suppression of both the unwanted sideband and the carrier should considerably exceed the specifications quoted above.

The conversion that follows is primarily the brainchild of K4EWC, Dave McDonald, now residing in Seminole, Florida. Anyone who has listened to his signal will agree, I believe, that it leaves little, if anything, to be desired, either in audio quality or suppression.

Like myself, Dave is using a converted (several times) DX-100 and an SB-10 sideband adapter (also converted several times) driving into a linear.

*10910 Chef Menteur B-2, New Orleans, La. 70127.



Interior view of the Heathkit SB-10 showing the rear of the ten turn 500 ohm potentiometers (upper left) used for Audio and Ratio balance.

Improved Suppression

The method of obtaining the additional suppression of both the carrier and unwanted sideband is fairly simple and consists of the following:

A) Replacing the ratio balance potentiometer with a ten turn, 500 ohm potentiometer.

6) Replacing the audio balance potentiometer in the balanced modulator circuit with a ten turn, 500 ohm potentiometer.

C) Relocating one 50 ohm resistor.

D) Replacing five capacitors with five slug tuned coils in the r.f. phase shift network.

E) Tuning up

Materials Needed

The equipment needed for the conversion is probably already in your shack; if not it will be easy to improvise. The material to be purchased, unless you have them in the junk box, is as follows:

A) Ratio Balance Potentiometer, 500 ohm, ten turn potentiometer, Spectrol Model 162, one-half inch in diameter. (There is room for a seven-eighths inch diameter pot but it is close.)

B) Audio Balance Potentiometer, as above except that there is room here for the larger size.

C) Five Cambion PN slug tuned coils as follows;

L_1.....#3500-17.....2.2 Microhenries
L_2.....#3500-14.....1.2 Microhenries
L_3.....#3500-10.....56 Microhenries
L_4.....#3500-8 .....39 Microhenries
L_5.....#3500-6 .....22 Microhenries

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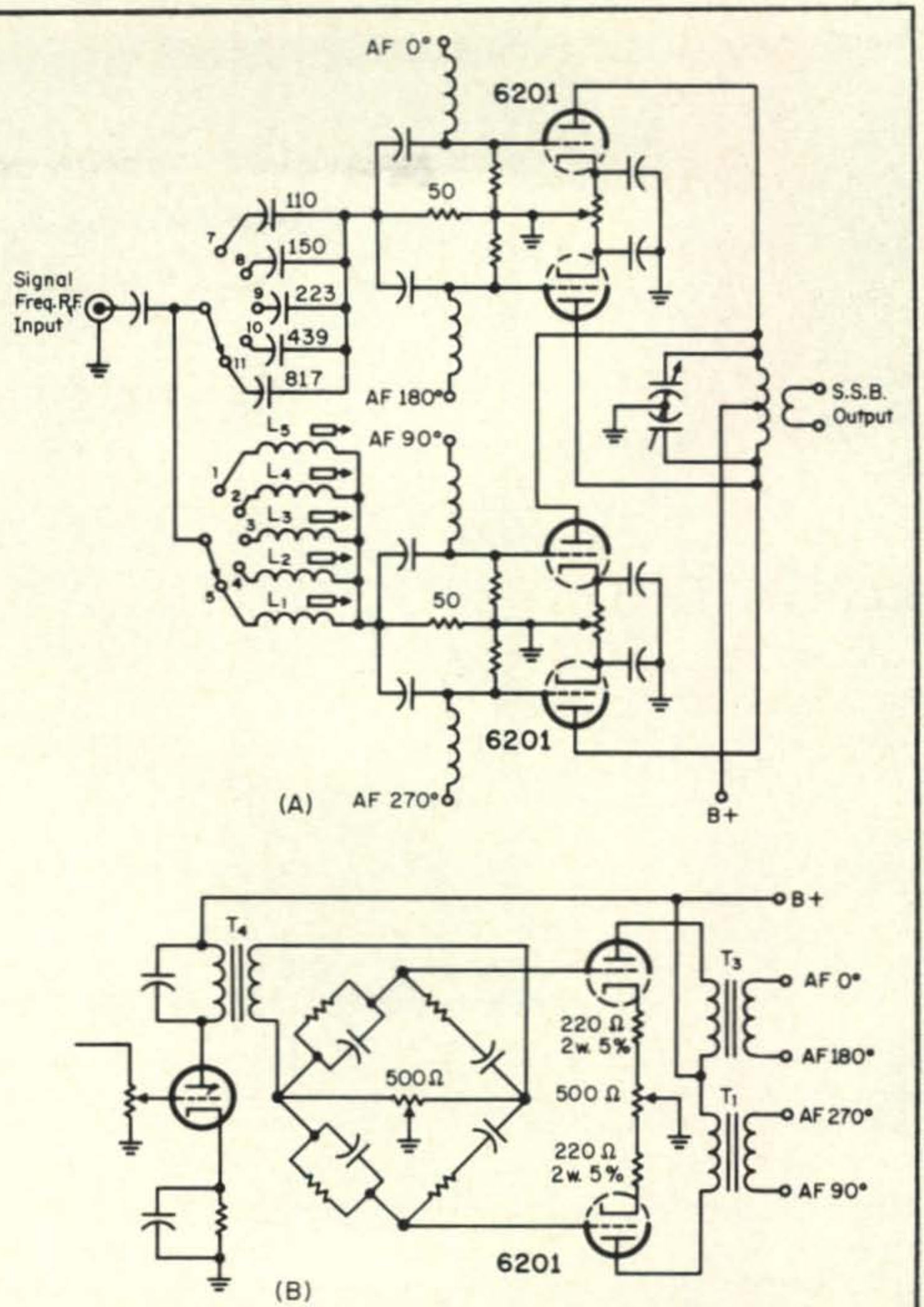

Fig. 1(A)—Circuit of the modified r.f. phase shift network in the balanced modulator of the Heath SB-10. The switch shown is deck #1 of the bandswitch. (B) Modulation portion of the speech amplifier shows the 500 ohm ten turn units. Also changed are the 200 ohm 2 watt resistors.

TEST FREQUENCY	
L_5	3.9 mc
L_4	7.25 mc
L_3	14.275 mc
L_2	21.22 mc
L_1	28.940 mc

D) One Cambion tuning tool No. 237-1

E) Two 2 watt, 220 ohm, 5% carbon resistors.

F (Operational) Four one-half watt, 100 ohm, 1% precision carbon resistors. They may be used to replace the two fifty ohm resistors in the r.f. phase shift network to provide closer tolerance and more stable operation.

Modification

Before you begin the modification outlined below I suggest that you study the unit and the pictorials in the manual so as to familiarize yourself with the adapter.

You may now proceed in the following manner:

1. Remove the 500 ohm RATIO BALANCE potentiometer and install a 500 ohm, ten turn pot in its place making all connections in the same manner as those removed from the original. This potentiometer is the one located between pins 3, 7 and 1, 5 of the socket holding the audio phase shift network and is the potentiometer located nearest the center of the chassis at position PB on the SB-10 pictorial #2.

2. In like manner remove the AUDIO BALANCE potentiometer at position AB on pictorial #3 (it is adjacent to the first one removed) and replace it with the second ten turn, 500 ohm potentiometer. Again make the same connections as removed from the original.

3. Remove the two 220 ohm resistors connected between the AUDIO BALANCE potentiometer and pins 3 and 8 of the balanced modulator tube, 12AT7, immediately adjacent. Replace these resistors with the two 220 ohm, 2 watt, 5% carbon resistors. The original resistors had a tendency to overheat and reduce the stability of operation.

4. Unsolder the shielded wire running from the chassis to pin of the three point terminal strip AA at the relative output meter. Do not

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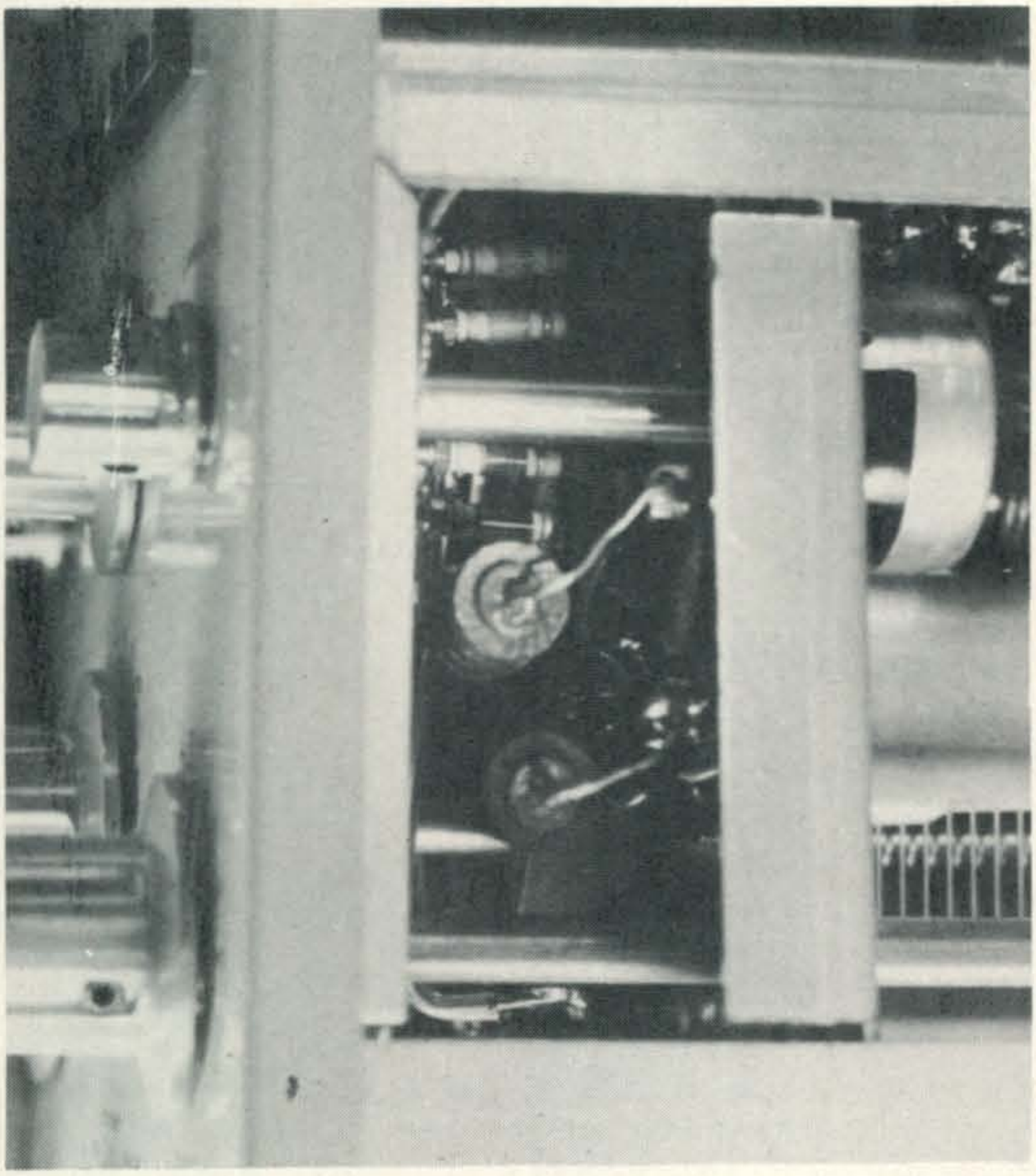

Side view of the Heath SB-10 sideband adapter showing the newly installed coils (L_1 to L_5) in the r.f. phase shift network. Four coils are visible with one hidden by the Carrier Null control shaft.

remove any other wiring from this terminal strip.

5. Remove the six top control knobs from the front panel of the SB-10. Do not remove the microphone connector, the FUNCTION SWITCH, or the AUDIO GAIN CONTROL. Also remove the sheet metal screws from the apron front immediately behind the face of the front panel. There are two at the top and two at the bottom.

6. Now carefully remove the front panel by sliding it forward off the six top control shafts. Place a piece of cardboard, slightly larger than the front panel, on top of the chassis and place the front panel on the cardboard. The wiring to the bottom half of the front panel has enough length to permit this and it will be convenient later for tuning.

7. Remove the 50 ohm resistor located between lugs 6 and 12 of the bandswitch and replace it with a solid jumper using #20 hookup wire and sleeving. Keep the jumper as short as practicable. Since I replaced each of the two fifty ohm resistors in the r.f. phase shift network with two 100 ohm, 1% carbon precision resistors in parallel I simply cut off the resistor lead at the resistor body and used the lead soldered to lug 12 of the bandswitch as part of the jumper by making a splice. It wastes a resistor but it certainly works in very close quarlowing step I suggest you use a heat sink when using the soldering iron.

8. Remove the jumper between lug 6 of the bandswitch and terminal 4 of the terminal strip CC.

9. Install the fifty ohm resistor removed in step 7 between terminal 4 of terminal strip CC and the ground lug on the same terminal strip.

10. Remove the five capacitors from lugs 1, 2, 3, 4, and 5 of the bandswitch. Also remove the common correction of the five capacitors from ground.

11. Cut a piece of #16 tinned copper wire to 5/8" and bend at a right angle 1/8" from one end. Insert this short end into the center of the rivet holding the solder lug and switch contact to the porcelain wafer of the bandswitch at lug #1 of the bandswitch. Be sure to use #16 wire for this step as the extra rigidity is important. Solder in place and repeat at positions 2, 3, 4, and 5 of the bandswitch. See photo for details.

12. Install the variable inductor, L_5, at lug #1 of the bandswitch being very *careful* soldering the bottom inductor terminal to the wire previously installed at that position.

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Be sure to use a heat sink on the inductor for this step. The inductor is installed with the tuning screw facing out.

13. Repeat the above step at bandswitch lug #2 using L_4.

14. Repeat the step at lug #3 using L_3.

15. Repeat at lug #4 using L_2.

16. Install the last inductor, L_1, at lug #5 of the bandswitch.

17. Solder a piece of #16 tinned copper wire to terminal 4 of terminal strip CC. Form the free end to contact the upper terminal of each inductor and cut off any excess beyond the inductor at switch position #1. Using a heat sink, carefully solder the lug of each inductor to this common wire. This completes the wiring changes for this modification.

At this point I would suggest that, if you have not already done so, you replace the 12AT7 tubes in the balanced modulators with the Sylvania 6201 tubes, or their equivalent, to obtain more stable operation.

Tune Up

For tuning you may proceed as follows:

A) Provide a temporary jumper from the end of the shielded wire removed in step 4 to the terminal strip AA, terminal #1. Be sure that power is off to the SB-10 when handling it. There is B plus present on the front panel and it will smart.

6) Temporarily install the six knobs that were removed earlier.

C) For the tuning of the ten turn potentiometers installed for ratio balance and audio balance follow the instructions in the Heath manual for the original potentiometers. You will, however, now find the tuning much more precise.

D) Using the test frequencies shown in fig. 1 for the separate coils proceed as follows;

1. With carrier inserted from both null controls, tune the output control and balanced modulator control for maximum output. Be sure not to overdrive the SB-10. Now null the carrier using the CARRIER NULL controls. You may find that a *slight* adjustment of the balanced modulator control will produce some additional null.

2. Feed in a one kc signal at the microphone input being sure to maintain the proper signal level.

3. Using an s.s.b. receiver, (it should be one with not more than 500 cycle bandwidth) tune for the unwanted sideband, up or down one kc from the nulled carrier, depending on which sideband is being transmitted. Tune

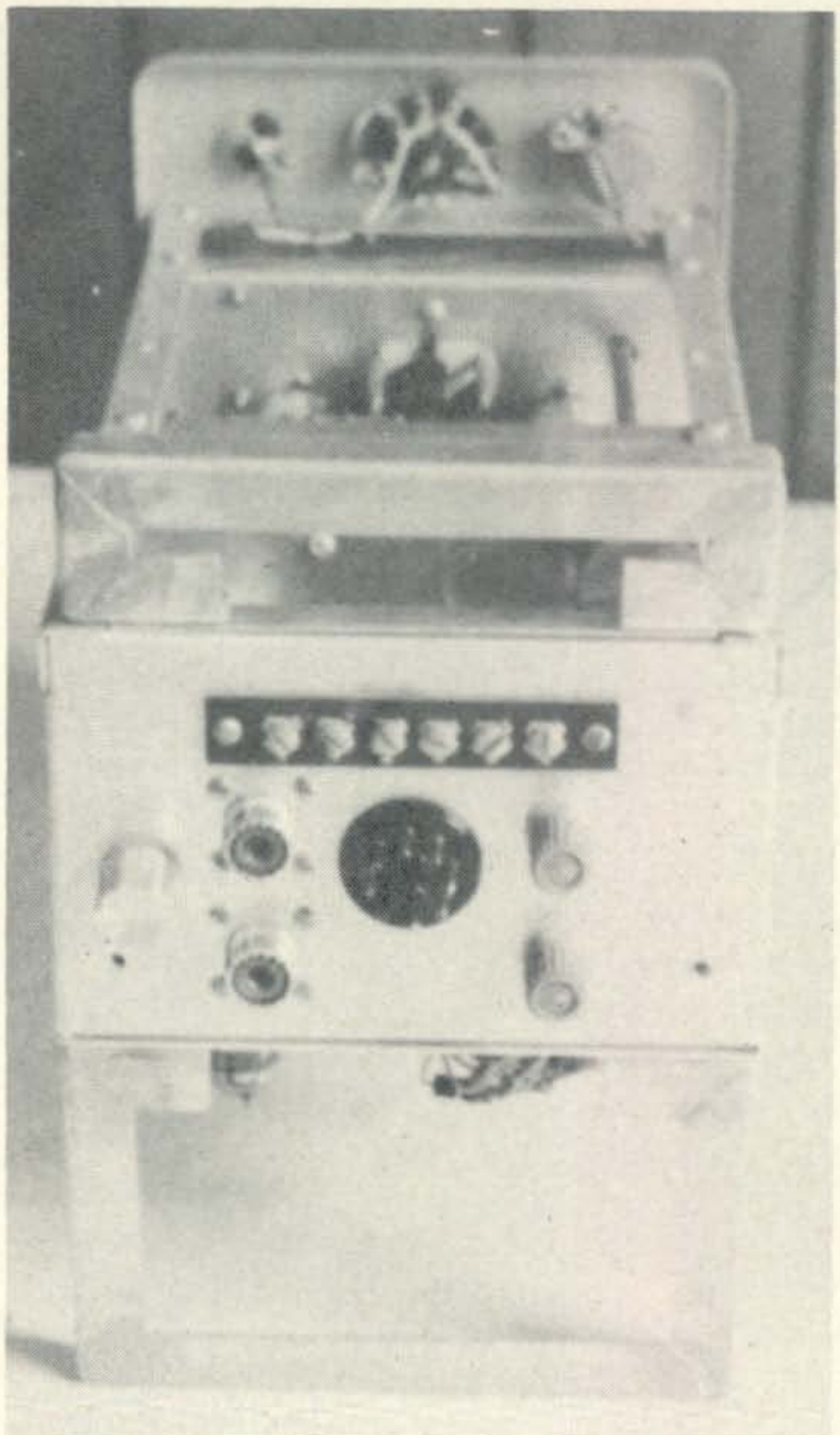

Photo of the Heath SB-10 removed from its case. The brackets were installed to prevent the chassis from leaning on the tubes and relay. The knob to the left of the coax connectors controls the vox release time.

the newly installed inductor associated with the band in use for maximum suppression of the unwanted sideband. These are the inductors L_1 to L_5 shown in fig. 1(A). Switch between upper and lower sideband until the optimum is achieved on both sidebands, which may be slightly less than that possible on either. Before moving on to the next band be sure to touch up on the tuning of the audio and ratio balance potentiometers and recheck the sideband suppression. It may require some slight adjustment.

4. Repeat this process until all the inductors have been tuned being sure to change the carrier frequency when changing from band to band.

5. Remove the temporary jumper, the temporarily installed knobs and replace the panel front, all control knobs, resolder the shielded wire to the output meter and check the dress

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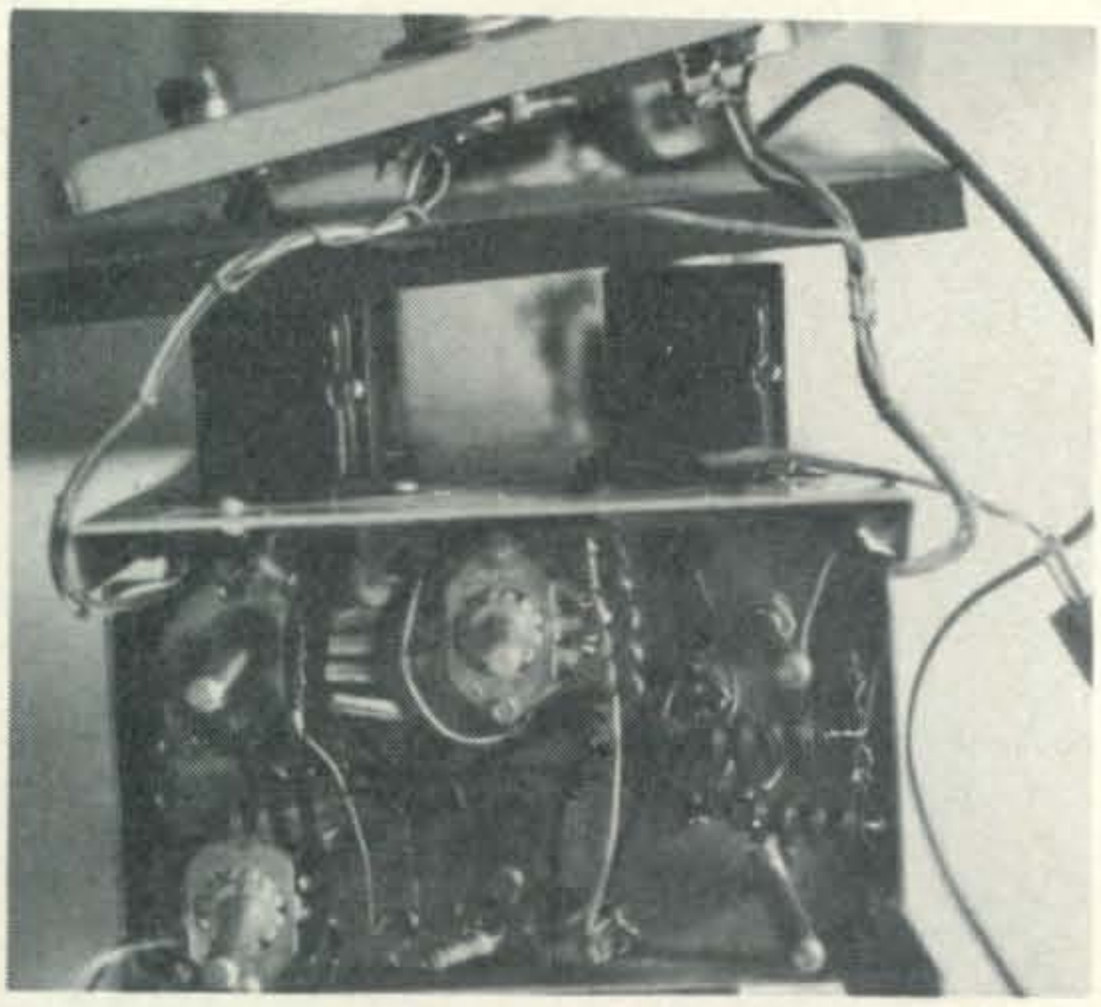

Front view of the SB-10 with the removed shows the mounting of the new slug tuned coils. The resistors below the bandswitch (near bottom of photo) are the paralled 10 ohm, 1% units to replace the original 50 ohm resistors.

of the wires leading to the microphone terminal, the FUNCTION SWITCH and the AUDIO GAIN control. Insert the four sheet metal screws in the apron behind the front panel. This completes the work on this modification.

Additional Modifications

If you are interested in making further modifications to your SB-10 you might consider some of the following ideas that I have put in mine. For openers, install 3 turn, 1000 ohm potentiometers at the CARRIER NULL for finer, more precise tuning.

The Heath manual states that the vox time constant can be changed by changing resistor values, *i.e.*, replacing the 3.3 megohm resistor between F7 and FF2 with a different value. A 5 megohm potentiometer installed on the back of the chassis for this purpose works very well.

It was extremely difficult to work on the SB-10 because there was no support to keep the back end from lying on the relay and/or tubes unless they were removed or unless some awkward support was used temporarily. As the photos will show, I have rectified this by building brackets of one-half inch aluminum channel. The unit now sits level, in or out of the case.

Remembering that an R-C coupling circuit should have a long time constant with respect to the period of the lowest frequency it must pass it seemed to me that the time constant of the R-C coupling circuit in the audio amplifier was much too short. At a voice frequency of 200-3000 cycles, the lowest frequency to be considered is 200 cycles which has a duration of 5000 microseconds. And since R (in ohms) $\times$ C (in microfarads) = Time (in microseconds) the time constant of the 0.001 microfarad capacitor and the 100K resistor is equal to only 1000 microseconds. Increasing the capacitor to a 0.05 microfarad value seemed indicated. I actually installed four 0.01 microfarad, disc ceramic capacitors in parallel, because of the space problem, and they work quite well, giving much better voice fidelity at the lower voice frequencies.

Previously a separate v.f.o. and power supply for the SB-10 will permit you to use a double pole, double throw switch in the coax jumpers on the back of the unit thereby enabling you to switch from sideband to a.m. or c.w. at the flick of a switch.

It will permit you to leave all the tubes in the companion transmitter without endangering the transmitter power supply.

I am told there isn't much of a market for SB-10 adapters but I believe that once you have made these modifications you won't particularly care; you probably won't be selling yours anyway. ■

BY THE WAY...

WE have all heard about them, but few have seen one. So here is a photo of a QSL Manager submitted by Ray Howe, WØFWN. Ray reports that the bunny is very intelligent and accepts only those QSLs reporting S9 or better signals and enclosing IRCs. He is also very good in DX contests as he is a good multiplier.

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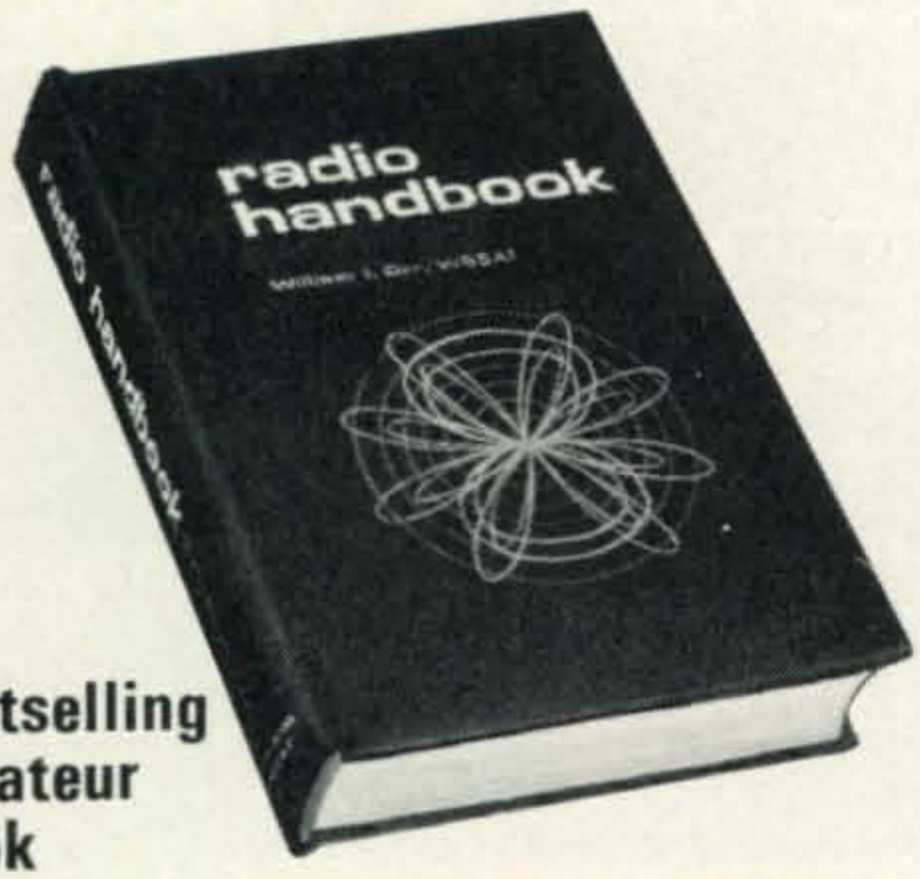

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A "NO MODIFICATION" 6 METER TRANSMITTER CONVERTER

BY ALBERT D. HELFRICK,* K2BLA

SINCE the advent of single sideband transceivers many fine a.m.-c.w. transmitters have been put into mothballs. A number of amateurs have eyed these rigs as potential v.h.f. equipment; however, the thought of butchering or completely rewiring the transmitter for v.h.f. usually deters the conversion. The best method of converting an 80-10 meter transmitter to 2 or 6 meters is with heterodyning type transmitting converter. Consequently, several transmitting converters have appeared as construction articles in recent amateur radio publications. These units are intended mainly for single sideband utilizing their own power supplies, metering and switching. When used with an a.m.-c.w. transmitter, they have a few disadvantages. First, when using a transmitting converter with a 100-200 watt transmitter, most of the power capability of the transmitter is wasted, since only a few watts are needed to drive the usual converter. Secondly, since most converters are designed for single sideband linear operation, the overall effeciency on a.m. or c.w. leaves much to be desired. Finally the cost can be considerably reduced of the unused power capabilities of the driving transmitter are utilized.

The method of overcoming these disadvantages is quite simple. By removing the final power output tube(s) there are available at the tube socket and plate cap: (1) modulated B+; (2) heater voltage; (3) r.f. drive at a low level; (4) fixed grid bias; (5) keying; (6) power switching; and (7) metering.

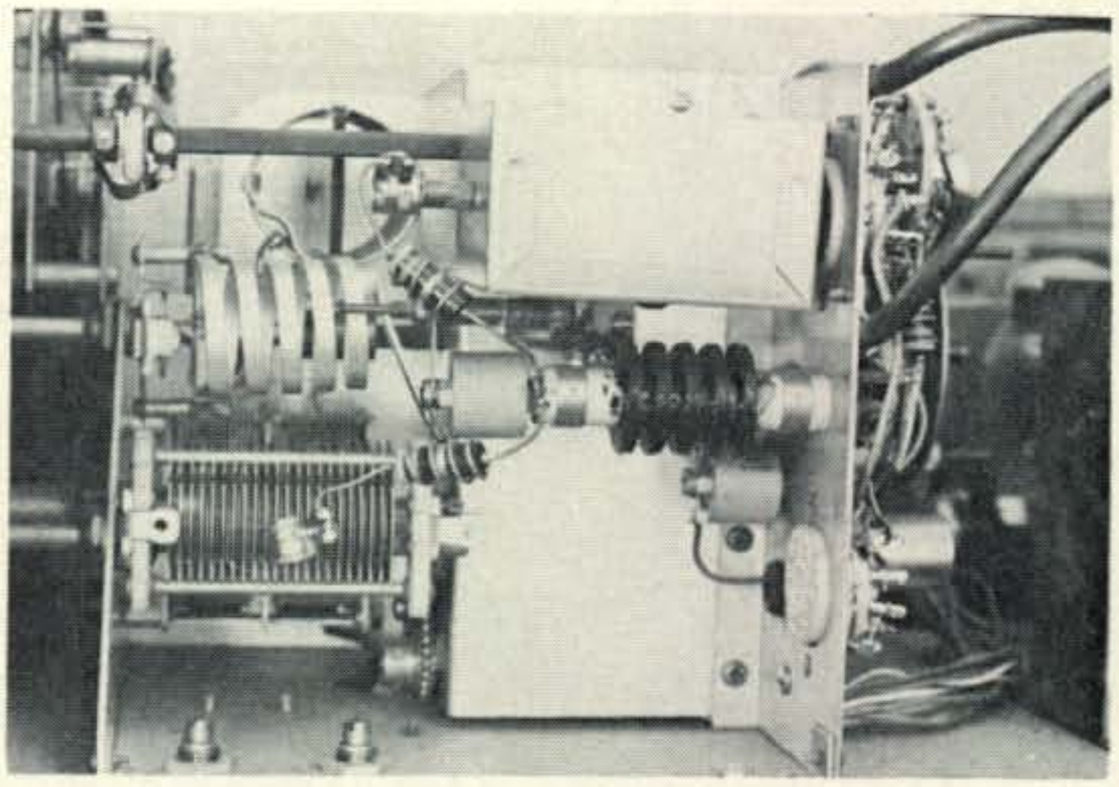
By inserting a plug into the final amplifier tube socket, decoupling and impedance matching, practically all power supply voltages and r.f. drive requirements for a transmitting converter are supplied.

Construction

The type of power output tube(s) used in the driving transmitter will determine the type of the adapter plug. The author's adapter is constructed for a 6146. This tube is very popular and one or two of them are found in most low or medium powered transmitters. A CU3000 Bud Minibox is used for the 6146 adapter plug. A feedthrough insulator on the 2⅛ × 1⅝ side of the Minibox with an old tube cap soldered to it is used for the B+ connection. An octal plug is used on the opposite side. The ground connection is made through a clip lead. See fig. 1.

All power supply leads are bypassed, many at the final tube of the transmitter. Grid bias is decoupled from the 28 mc drive with a 2.5 mh r.f. choke and a .001 mf capacitor. The 24 mmf trimmer capacitor is needed to compensate for the grid capacitance of the now missing final output tube(s).

The transmitting converter uses a 6EA8 for the actual conversion. (Fig. 2.) The triode section is a simple tuned plate tuned grid crystal oscillator using a 22 mc third overtone crystal. The output of the oscillator is coupled to the control grid of the 6EA8 pentode section. The 28 mc drive from the transmitter is coupled to the screen of the



Top view of the adapter plug installed in a B&W 5100B. Both final tubes have been removed and one socket remains empty. Exercise caution when working around the plate caps.

*US155343954, Co. E 3d Bn SCH Bde, USASESS, Fort Gordon, Ga. 30905.

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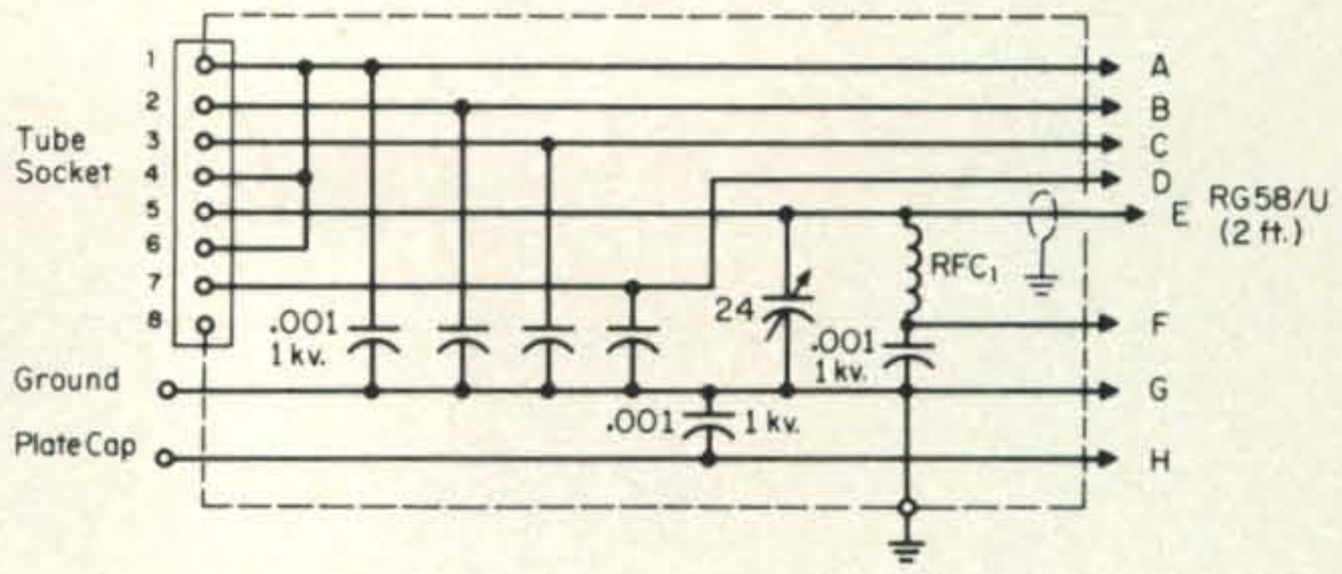


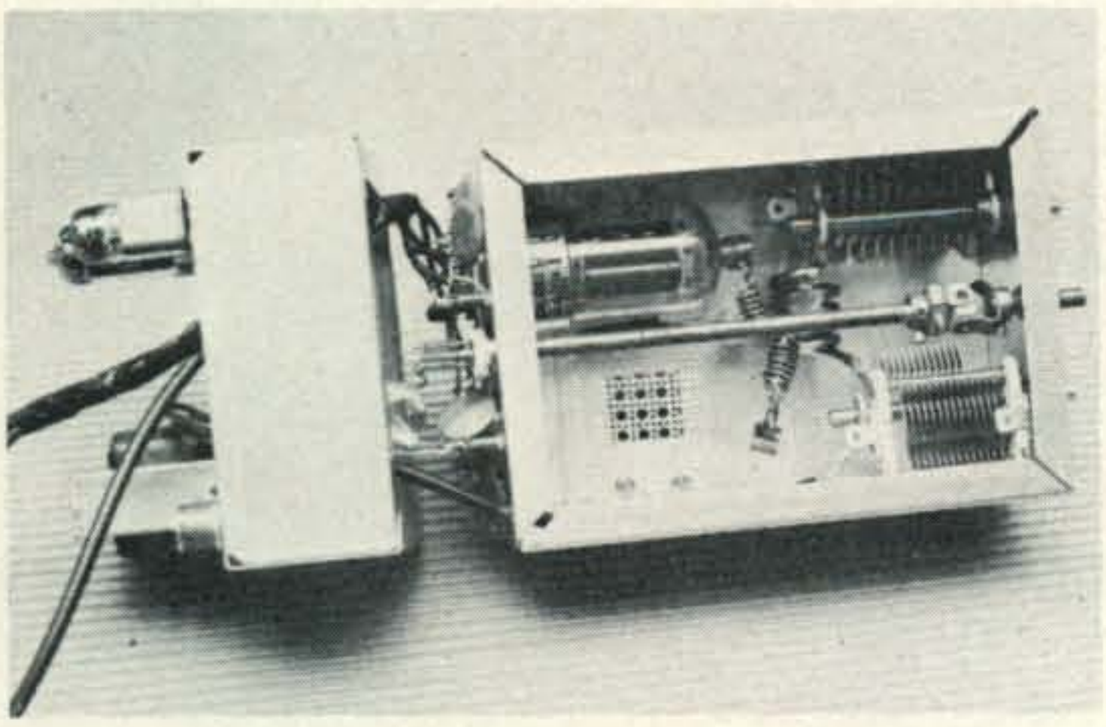
Fig. 1—Circuit of the adapter which is plugged into the final amplifier tube socket of an i.f. transmitter to provide power, signal and control functions to the 6-meter adapter shown in fig. 2. Letter designations refer to corresponding points in fig. 2. RFC_1 is an Ohmite Z-50.

pentode and the sum frequency, 50 mc, is tuned in the plate circuit. Most transmitters using one or two 6146's have about 80 or 90 volts peak to peak r.f. drive available at the final tube grid, which is sufficient for mixing with screen grid drive. A 6CL6 driver follows in order to supply sufficient r.f. drive for the final amplifier.

Except for neutralization, the final amplifier stage needs no explanation. The final in the author's converter uses parallel 6146's running class C with a pi net output. The final amplifier should actually be a 6 meter copy of the transmitter's original final. Thus all supply voltages would be correct for best operation. Use of the original final tube(s) would also be a saving in cost.

Neutralizing is accomplished by wrapping four turns of insulated hook-up wire around the plate choke. The wire must be wound in such a manner as to supply a 180° phase shift. If neutralization cannot be achieved, reverse the leads of L_5. The neutralization can be adjusted by Cn and the position of L_5 on the Z50 plate choke.

The entire converter is built on two aluminum chassis. The final amplifier is located within a 3" × 5" × 7" chassis, and a smaller one is bolted to the rear. It contains the converter and the driver stages. The driver plate tuning is coupled to the front panel via a shaft extension. The three controls on the front are the DRIVER PLATE, FINAL TUNE and LOAD. It is not necessary or advisable to tune the mixer in routine operation.



The final amplifier is built inside a 3" × 5" × 7" chassis blank. One of the 6146 tubes has been removed to show the ventilation holes above the 6146 plates. The low powered stages are bolted to the rear of the final.

Operation

Before installing the converter, tune the driver stages of the driving transmitter. It is necessary to remove the final tube(s) and install the adapter plug in one socket. Connect the ground but do not affix the plate cap. Also disconnect the screen voltage from the 6 meter final. Apply 115 volts a.c. to the converter and tune the crystal oscillator. Apply r.f. drive to the converter and tune the mixer plate, the 24 mmf trimmer in the adapter plug and the driver plate for maximum grid drive. One word of caution here; be sure the mixer and driver are tuned to 50 mc and not 56 mc, the second harmonic of the 28 mc driving signal. Remove the crystal from the local oscillator and watch the grid drive. If it drops considerably, the mixer and driver are tuned to 50 mc. If the drive does not drop, the mixer and driver are tuned to 56 mc, in which case add small fixed capacitances to the plate tanks until they do not tune to 56 mc but will resonate at the highest operating frequency desired. Fix the plate cap, connect the screens and tune the final. Routine operation includes the DRIVER PLATE and FINAL TUNE and LOAD. As with all 6 meter transmitters it is helpful to use a low pass filter before the antenna to reduce the possibility of radiating spurious emissions.

The converter has no provisions for self-bias, as the B&W 5100 uses fixed bias for all modes. Other transmitters may require grid leak bias.

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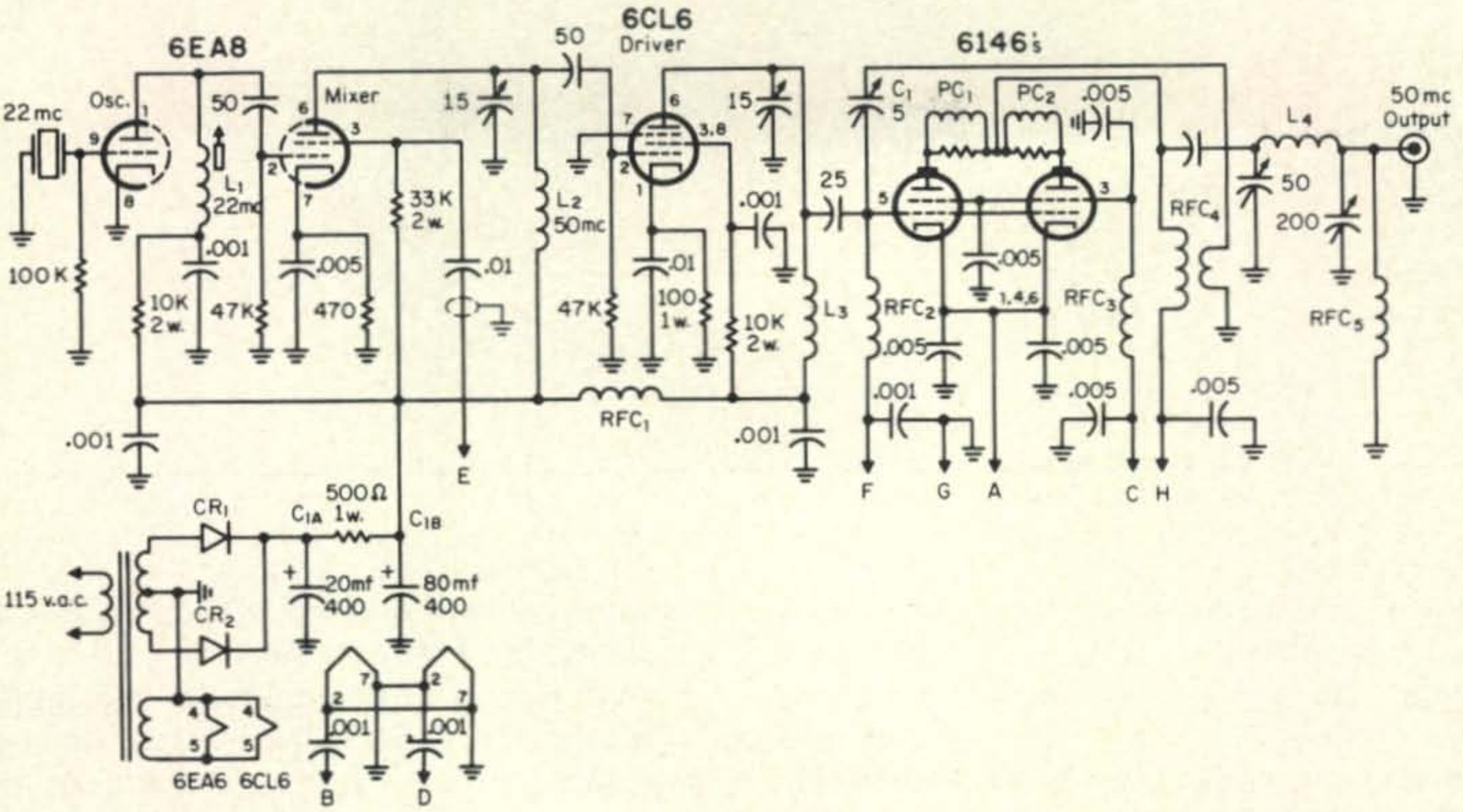

Fig. 2—Circuit of a 6 meter converter that requires a 28 mc input from the driver stage of the a.m. transmitter. Modulated plate voltage is picked up from the driving transmitter. All resistors are 1/2 watt, 10% tolerance. Capacitors are 1 kv disc ceramics except for electrolytics, bariables and where noted otherwise. All capacitors with values greater than one are in mmf; those less than one are in mf.

C_1—5 mmf neutralizing capacitor.
C_2—50 mmf variable capacitor. Hammarlund MC50-SX
C_3—200 mmf variable capacitor. Hammarlund MC200-M
CR_1, CR2—Motorola HEP-159 diodes, 800 p.i.v., 1 a.
L_1—16 t. #28 e. on 1/4" dia. slug tuned form.
L_2—5 t. #18, 1/2" long. Air Dux #409T.
L_3—4 t. #18, 1/2" long. Air Dux #408T.
L_4—4 1/2 t. 1/8" o.d. copper tubing, 1" dia., 1 1/4" long.
L_5—4 t. insulated hookup wire around RFC_3.
PC_1, PC_2—5 t. #18 e. on 10 ohm 2 watt carbon resistor.
RFC_1, RFC_2, RFC_3, RFC_4—Ohmite Z-50 r.f. chokes.
RFC_5—2.5 mh r.f. chokes.
T_1—Power transformer, 520 v.c.t., 90 ma; 6.3 v., 4 a. Stancor PC-8420 or equiv.

Though the author's converter is not intended for single sideband operation, the B&W 5100 as well as other medium powered transmitters was designed for s.s.b. operation using an "on frequency" phasing type s.s.b. generator. There is nothing limiting the converter to a.m.-c.w. operation only. The same techniques can be used for s.s.b. as well.

Conclusion

Depending on what the junk box supplies, the cost of the entire unit (excluding the final tube(s) can be less than $30. The converter will provide a stable transmitter for 6 meter a.m. or c.w. operation, with a minimum of cost and no modifications to the existing transmitter. Although the transmitting converter in fig. 2 is built for a B&W 5100, it will work in many transmitters using a 6146 in a similar output circuit. ■

RADIO AMATEUR VOLUNTEERS NEEDED FOR 6 m. PROPAGATION RESEARCH

This summer the Institute of Telecommunication Sciences of the Environmental Science Service Administration, plans to study the movement of sporadic-*E* clouds over Kansas and Oklahoma. Radio amateurs operating on the 6 m. band, and living within a 600-mile radius of these states, who would like to participate in this study during June and July, are invited to write for further details to Dr. Ernest K. Smith, Box 2, Essa Research Laboratories, Boulder, Colorado 80302.

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SPLIT FREQUENCY OPERATION WITH THE HEATHKIT HW-100

BY RUDOLPH J. BACHER,* WA3JYI

In the July issue of *CQ*, the Q & A column had an interesting article on incremental tuning for the Heath HW-100 transceiver. There has been much interest in incremental tuning for the SB-100, SB-101, and the HW-100. Many owners of transceivers are looking for an inexpensive way to provide split-frequency operation. Incremental tuning has its limitations and usually requires alterations to the original equipment. To my way of thinking the best solution to the problem is an extra v.f.o.

A good answer both for economy and performance is found in the v.f.o. for the HW-100. I totaled up all the parts including the dial assembly and the figure came to around $30. If one uses parts from his own supply, the figure could be halved. I took the lazy man's approach and ordered everything, including the stuff that was in my junk box.

Switching between the two v.f.o.'s is accomplished by switching the B+ going into them. See fig. 1. In switch #1 position only, the transceiver's v.f.o. is in operation both in RECEIVE and TRANSMIT. With the switch in #2 position, the v.f.o. in the transceiver works on TRANSMIT and the outboard works on RECEIVE. When the switch is placed in the #3 position, the outboard v.f.o. works on both TRANSMIT and RECEIVE. The bias and filament voltages for the outboard v.f.o. are obtained from the same source as that of the transceiver's v.f.o.

In order to provide switching for the v.f.o. outputs, a few minor changes have to be made. Resistor R_{221} (47) should be removed along with the wire connecting pin 7 of V_{12A} to pin 7 of V_{5A}. The removed 47 ohm resistor can be made use of in wiring the new switch. Capacitor C_{202} (0.005 mf) remains in place and a 0.005 mf capacitor should be added from pin 7 of V_{5A} to the connecting coax. A 1000 ohm resistor is added from pin 7 of V_{12A} to ground.

A diagram for the HW-100's v.f.o. has been omitted, since the instruction manual should be used for the construction of the v.f.o. Owners of SB-100 and SB-101 can omit many of the above steps. Many of the readers might do me one better by using the Swan 500's dial for their outboard v.f.o. I found, however, that the HW-100's dial worked very smoothly after applying Heath's recommended silicon oil. The outboard v.f.o. shows a slight non-linearity, as also does the one in the HW-100. The mechanical construction is left up to the reader. I put the outboard v.f.o. on a 7 × 5 × 2 chassis with a slot cut out for the calibration wheel. The outboard v.f.o. has really helped out in QRM and DX. ■

*209 Mendell Place, New Castle, Del. 19720.

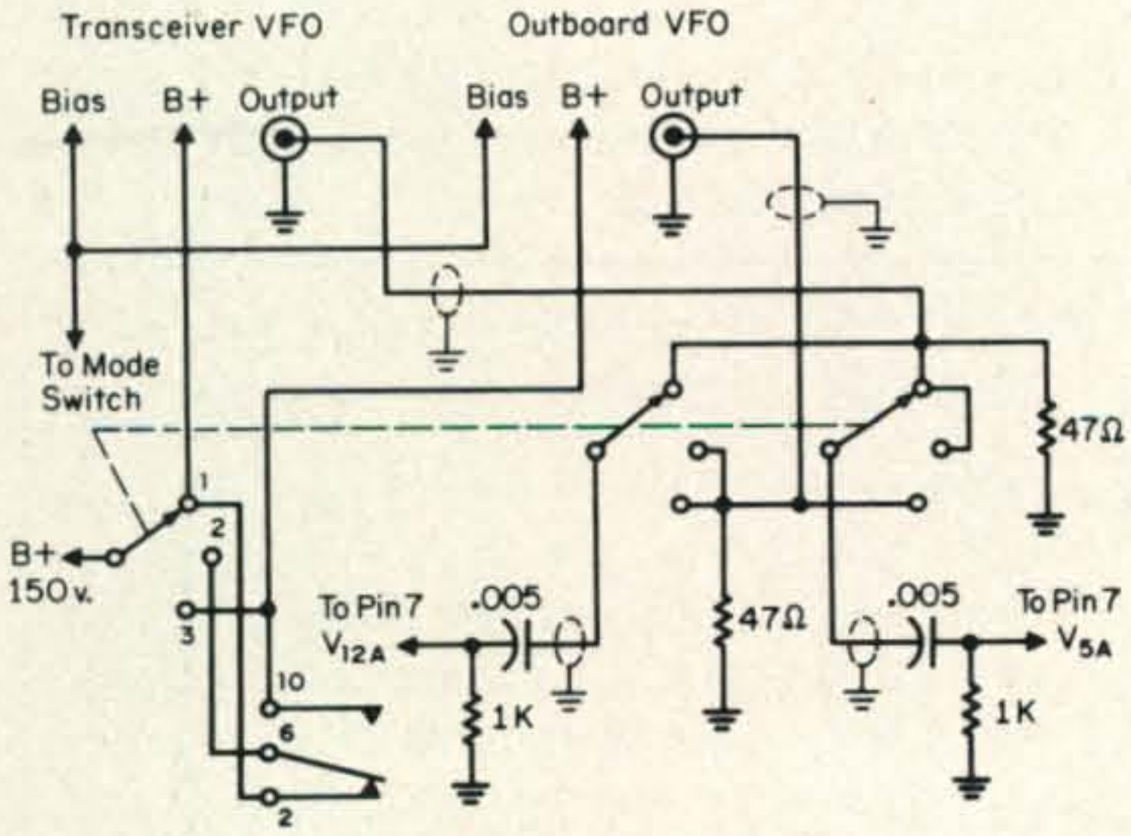

Fig. 1—Circuit of the switching needed for operation of the outboard v.f.o. with the Heath HW-100. The relay contacts shown are those of the antenna relay RL-1. The added switch is a 3 pole triple throw non-shorting rotary. The coax used is RG-58/U.

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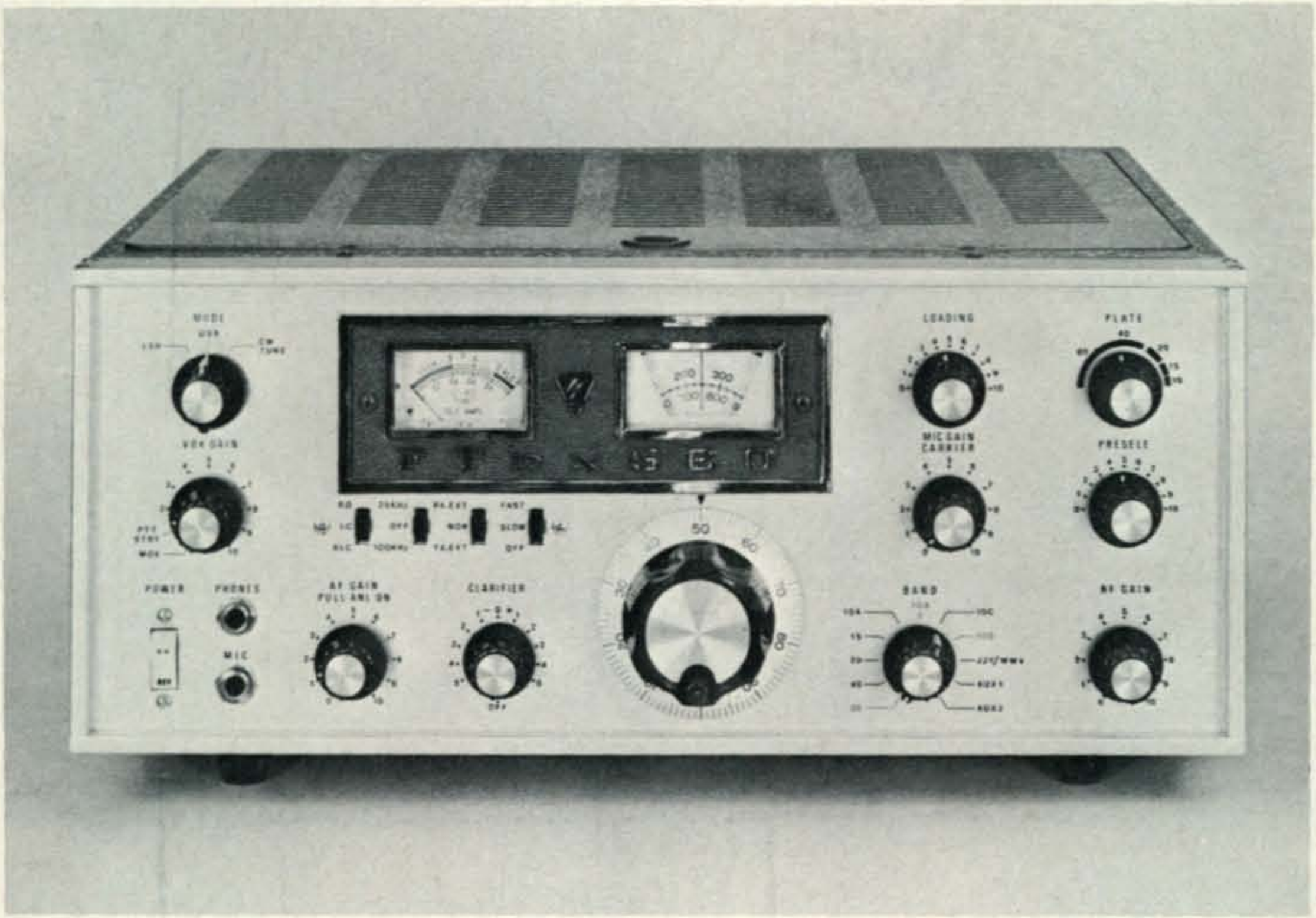

The Yaesu Musen FTdx560 S.S.B./C.W. Transceiver.

CQ Reviews:
The Yaesu Musen FTdx560 Transceiver

BY WILFRED M. SCHERER,* W2AEF

WE'VE come across many pieces of amateur gear of foreign manufacture, both good and poor, but the FTdx560, made in Japan, has been found to be an excellent unit both electronically and mechanically. It not only offers many features found only in the most sophisticated domestic jobs, but it also includes additional features as standard equipment.

The FTdx560 is an s.s.b./c.w. transceiver that functions with a transmitter p.e.p. input of 560 watts for s.s.b. and d.c. input of 500 watts for c.w.

It provides full coverage of the 3.5-28 mc amateur bands and is supplied with all crystals, including those for the full 28 mc band. There also is a 10-10.5 mc range for WWV reception in addition to two auxiliary-band positions where appropriate crystals may be installed and associated circuitry connected to provide transceive operation on any two other 500 kc segments within the 3-30 mc range (except 5.2-5.8 mc).

Each range is covered with an identical linear-tuning rate with frequency calibrations at 1 kc intervals. A high-ratio tuning control is equipped with a spinner-type knob.

*Technical Director, *CQ*.

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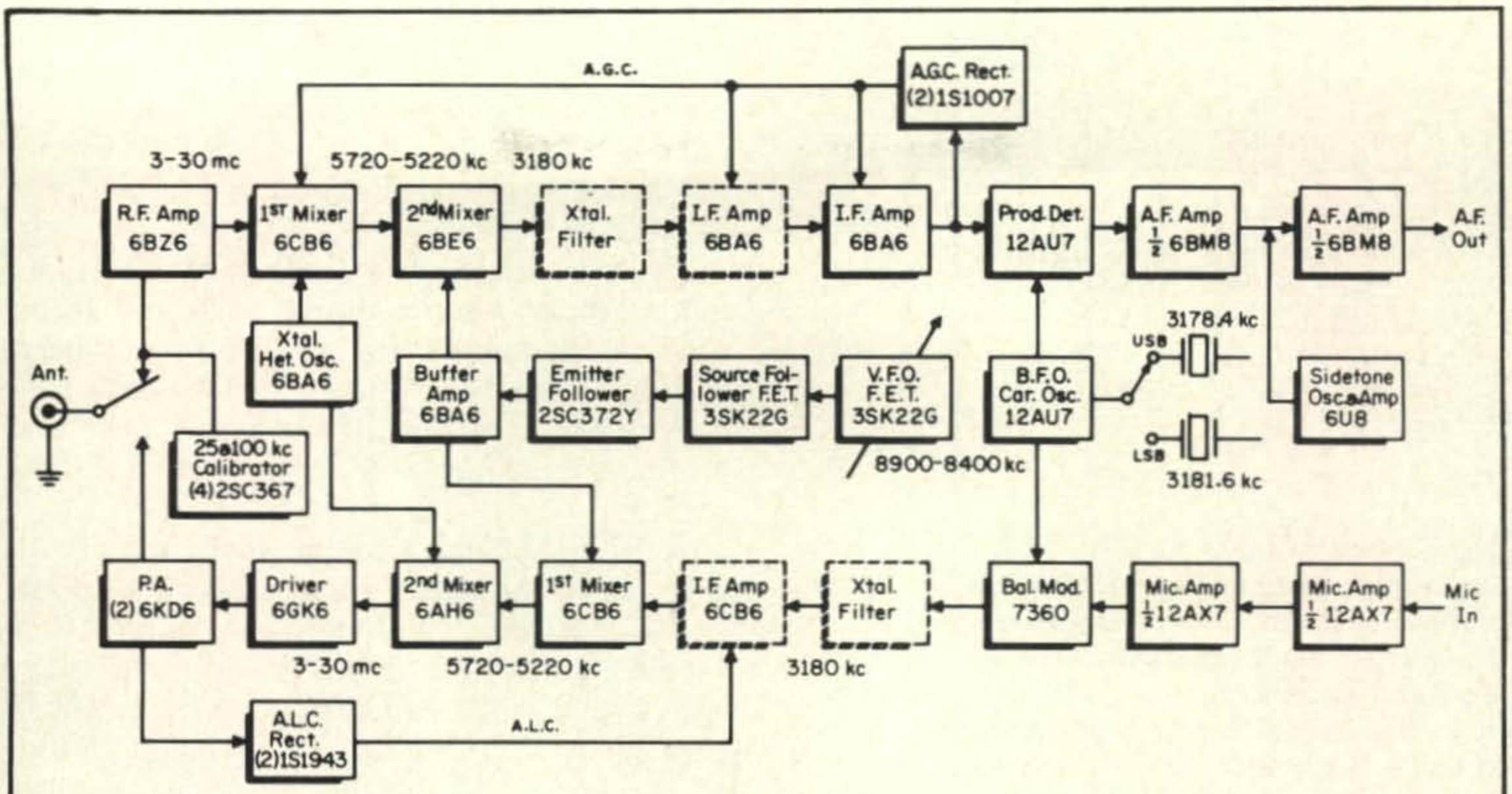

Fig. 1—Block diagram for the FTdx560. Dashed blocks are common to receiver and transmitter. Crystal frequencies and other details are given in the text.

Either u.s.b. or l.s.b. operation may be selected on any range. A "CLARIFIER" control furnishes incremental tuning to allow up to ±5 kc frequency-offset operation on receive

A high order of frequency stability is attained with an f.e.t. v.f.o. Provisions are also included for split-frequency operation using an external v.f.o. accessory, for which front-panel switching is provided. This v.f.o. unit includes four crystal positions, allowing Novice operation also, and at reduced power levels.

The output of a crystal-controlled calibrating setup provides accurate marker signals at the 100 or 25 kc points.

Selectivity or sideband selection is obtained with a 2.3 kc filter having a 1.6:1 shape factor. An optional 600 c.p.s. bandpass filter is available for c.w. operation and is automatically switched in when the transceiver is set for the c.w. mode (as normally supplied, the 2.3 kc filter is used for c.w.).

P.t.t. or built-in v.o.x. operation may be had with the v.o.x gain adjustable from the panel. V.o.x. type break-in or manual operation is used on c.w. for which waveshaping of the keying is provided. There is also a sidetone monitor.

Fast or slow a.g.c. may be selected and a meter may be switched to indicate p.a. cathode current, receiver S-units, a.l.c. level and relative power output. A noise limiter also may be switched in or out.

A.f. outputs of 8 and 600 ohms are available. An accessory socket provides voltages and control circuits for operating external gear, together with which are provisions for use of a 6-meter transceiver accessory. There also is a phone-patch input.

The power supply is built-in. This is a special feature not usually found in transceivers. You don't have to horse around an additional unit. It is a solid-state job built with attractive styling and is set up for convenient operation. The size is 6¼" × 15¾" × 13¾" (H.W.D.) and it weighs 40 lbs.

Conversion Scheme

Dual conversion is used throughout in the FTdx560 as shown at the block diagram at fig. 1. On receive the 1st conversion is made to a 5720-5220 kc bandpass i.f., the 2nd to a 3180 kc fixed i.f. On transmit the signal is generated at 3180 kc with the 1st conversion made to the 5720-4220 kc i.f. and the 2nd to the output signal frequency.

A crystal-controlled oscillator is used for the 1st receiver conversion and the 2nd transmitter conversion. The crystal-controlled frequencies are the signal frequency at the low end of each range plus 5720 kc.

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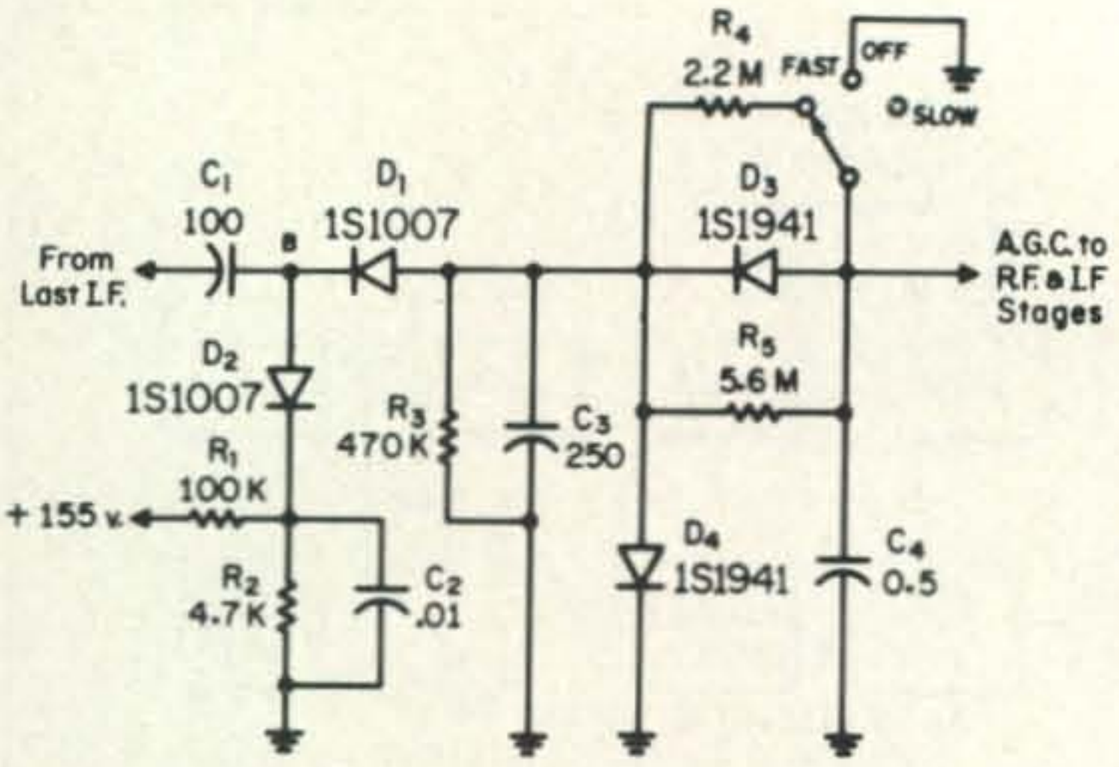

Fig. 2—A.g.c. setup for FTdx560. D_1, D_2 make up a voltage-doubling rectifier. A small fixed positive voltage a *A* reverse-biases D_2 into non-conduction, until the positive value of the voltage at *B* exceeds that at *A*. D_2 thus cannot perform its function for voltage doubling on weak signals. The overall result is delayed a.g.c. On the attack, the negative voltage that appears at D_3 cathode causes D_3 to conduct, allowing C_4 to quickly charge and the a.g.c. voltage to instantly appear on the a.g.c. line. On the release, D_3 is biased into non-conduction by the charge on C_4 which then discharges through R_3 and R_4 or R_5 at a rate depending on whether or not R_4 is engaged. D_4 provides a minimum bias on the a.g.c. line, due to the barrier potential of the diode.

Circuit Details

Preselected-tuning is used at the r.f. stage for the receiver. Separate inductors are used at the input for each band with the antenna individually coupled to each one. This always ensures the same 50-ohm input. A parallel-tuned series-connected trap at the antenna-input line is tuned to 5470 kc to minimize signal-input leakthrough at the 1st i.f.

The bandswitch for the preselector tuned circuits at the input and output of the r.f. stage has two unwired auxiliary positions. When an auxiliary range is to be set up, the desired positions may be connected to any of the existing preselector inductor/capacitor combinations that will resonate on the desired auxiliary-frequency range. This would be limited in most cases to a range adjacent to one of the amateur bands, such as for MARS work, since the preselector circuits have a limited range in themselves. For other cases, additional suitable *L/C* combinations may be installed, for which mounting brackets are already in place for securing the slug-tuned inductors that would be involved.

The bandswitch at the crystal-controlled oscillator is a similar setup where two spare crystal sockets are wired to the extra switch contacts. Other spare switch contacts are already wired with the trimmers that would be needed in conjunction with existing circuitry.

To further improve i.f.-signal rejection, there are two series-tuned 5470 mc traps each shunted across the mixer output. These may be individually tuned to the same frequency or stagger-tuned if necessary for more uniform rejection over the whole i.f. passband.

A 5720-5220 kc bandpass-coupled circuit with toroid inductors is used between the 1st and 2nd mixers. The 3180 kc s.s.b. filter is a 6-pole crystal-lattice job. An additional filter with a 600 c.p.s. bandpass may be installed for c.w. use. The filters are switched in or out of the circuit by means of diode switches both at the input and output of each filter. This enables the insertion of either filter to be made with a d.c. control circuit to simplify switching at the panel. Stray coupling around the filters also is minimized, resulting in good isolation for avoiding spurious responses outside of the passband.

One half of a dual triode functions as the product detector, while the other half is a cathode-follower for matching the b.f.o. output by means of cathode coupling to the product detector. The b.f.o., or carrier oscillator, is a dual triode, each section of which functions as a crystal oscillator. One oscillator operates with a 3178.5 kc crystal for u.s.b. use, the other with a 3181.5 kc one for l.s.b. Sidebands are changed by switching between either of the two oscillators. This is done by opening and closing the cathode return of the triodes accordingly. The v.f.o. frequency is not conjunctively shifted, so it must be retuned by 3 kc when sidebands are changed.

The r.f. gain controls the cathode bias of the r.f. and i.f. stages.

A.g.c. is obtained from a voltage-doubling rectifier at the i.f. output, using a small d.c. voltage to provide a delay on weak signals and charging diodes to ensure a fast attack. The setup is shown at fig. 2.

The crystal-controlled heterodyning oscillator is a pentode with a Pierce type circuit for the crystals used between the grid and screen. For 3.5 and 7 mc operation, the plate is tuned to the crystal frequency. For 14, 21 and 28 mc use the crystal frequency is tripled at the tube plate. The crystal frequencies for these bands thus are one-third that re-

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quired for the heterodyning frequency.

Output from the oscillator is obtained from a link winding on the plate inductors which is in series with the cathode return of the receiver mixer. The oscillator signal required for the transmitter is obtained by capacitive coupling between the oscillator plate and mixer grid.

The noise limiter is an a.f. type and precedes the 1st a.f. amplifier. It is a simple affair as shown at fig. 3.

V.F.O.

The v.f.o. employs an f.e.t. in a series-tuned Colpitts-type circuit. Output is obtained from the source of the f.e.t. and is applied to the gate of another f.e.t. that functions as a source-follower buffer amplifier coupled o the base of a bipolar-transistor amplifier. Output from its emitter goes to a pentode buffer amplifier that has a 8400-8900 kc band-pass-coupled output to the grids of the 2nd mixers. This amplifier also serves as a buffer for an external v.f.o. A high degree of isolation is provided by the various stages after the oscillator proper, thus ensuring excellent overall stability with changes in loading.

Temperature compensation of the v.f.o. is precisely adjustable by a differential capacitor that can be set to provide the optimum ratio of compensation between a zero-temperature and a negative-temperature coefficient capacitor.

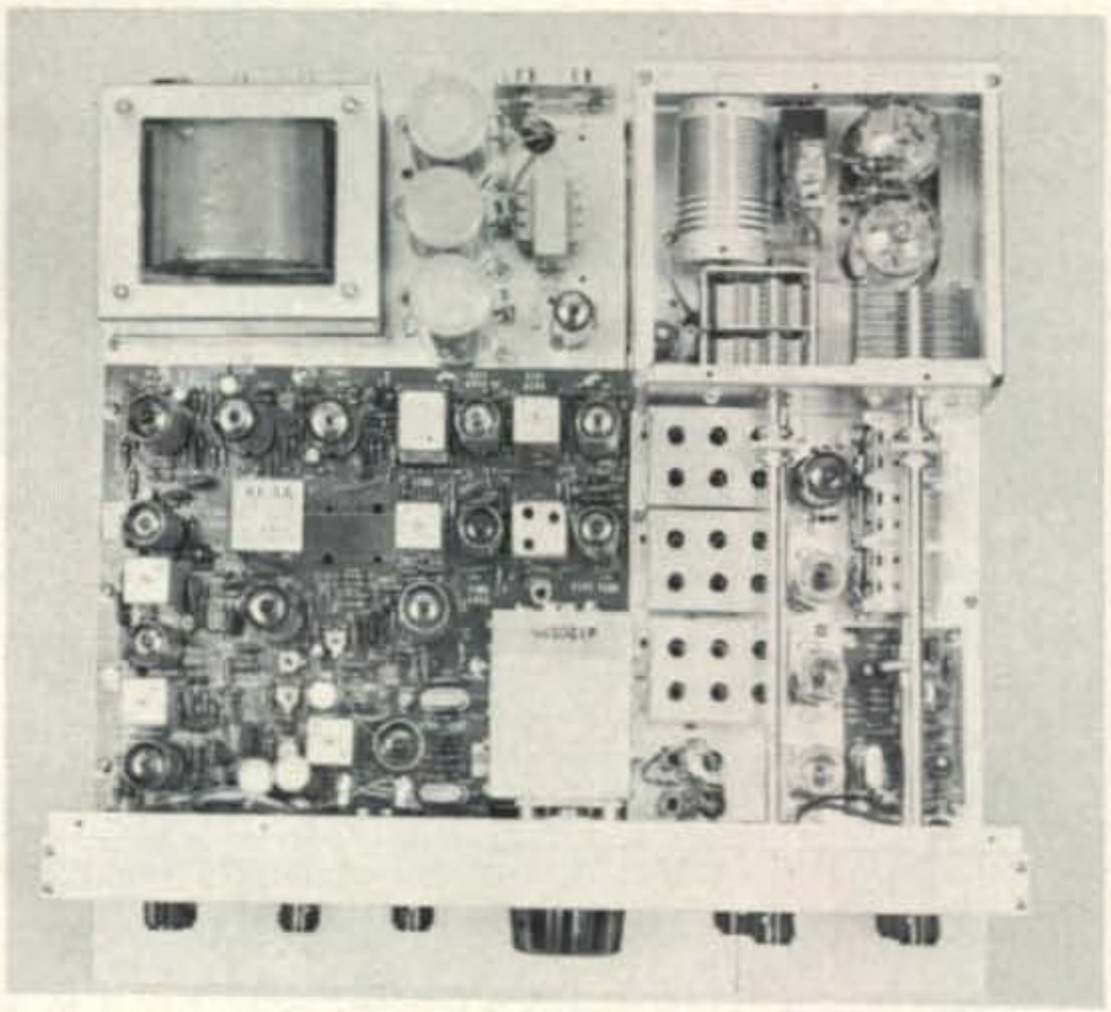
Incremental tuning is provided by a variable-capacitance diode that is added to the oscillator tuned circuit and controlled during receive by a d.c. voltage adjustable at the panel. On transmit it is automatically disengaged by the control relay.

Calibrator

The calibrator is a transistorized 100 kc job with a succeeding 25 kc multivibrator followed by an amplifier. Either the 100 kc or the 25 kc signals may be selected by a panel switch.

Transmitter

Two stages of speech amplification are used ahead of the balanced modulator which utilizes a 7360 sheet-beam deflection tube with typical circuitry. A stable carrier balance is maintained through the use of a regulated operating potential for the 7360. Pentodes are used for both mixers with signal and oscillator injection made at the control grids.



Top view of the FTdx560. The p.a. is in the enclosure (with cover removed) at upped right. R.F. inductors are in the shielded boxes with holes on top along right section. The v.f.o. is in the box at front center.

The 6GK6 driver is stabilized with neutralization and parasitic suppressors at the grid and plate. The tuned circuits at the input are the same ones used for the preselector at the plate of the receiver r.f. stage. The circuits at the driver output are ganged with the receiver preselector tuning. The receiver and transmitter r.f. drive circuits are thus simultaneously peaked with one control.

The p.a. has two 6KD6 TV sweep-type tubes which have greater power-handling capabilities than many other similar types. Grid and plate parasitic suppressors plus capacitance-bridge neutralization provide stable operation. This is enhanced by different capacitors switched in one leg of the bridge network for each band to ensure optimum neutralization in each case.

A Pi-network output is designed for operation into essentially non-reactive loads of 25-100 ohms presenting an s.w.r. within 2:1. This is done by various size fixed capacitors switched in for loading on each band, together with a variable loading capacitor. An unusual feature here is that different value fixed capacitors also are switched across the plate-tune capacitor in order to maintain the proper Q and optimum impedance matching to the tube plates on all bands.

As at the receiver r.f. circuits, there are two spare positions at the bandswitch for the driver output and the p.a. tank. These may be wired to the necessary components or to

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taps on the p.a. tank for operation on the auxiliary ranges. In this respect the p.a. tank inductor is wound on a grooved ceramic form that has a recess along its length to allow any turn to be easily accessible for tapping.

In order to prevent accidental transmission on the WWV range, no connections are made to the above switches at this position.

A conventional a.l.c. system is incorporated in the FTdx560.

V.O.X.

The v.o.x. setup, not indicated at fig. 1, is conventional, except for an adjustable control that allows the bias on the relay tube to be set for optimum pull-in of the relay. It is of particular value for operation with c.w. and in cases where changes in tube characteristics may impair good v.o.x. operation, a situation often experienced with usual systems.

Another feature of the v.o.x. is that the v.o.x. gain control is located on the panel. It is equipped with a switch that at the OFF position activates the transmitter for tuneup or manual c.w. operation. When the control is first advanced, the switch operates and sets up the transmitter for p.t.t. operation. When the control is further advanced, v.o.x. operaion is available simply due to the fact that sufficient gain is now provided from the speech amplifier to operate the v.o.x. The other normal v.o.x. controls are finger-adjust types on the rear of the set.

C.W. Operation

Grid-block keying is used for c.w. at the 2nd transmitter mixer. Waveshaping for minimizing key clicks is done with a 1 henry and a 0.5 mf combination in the keying line.

The necessary carrier is obtained by unbalancing the modulator at one of the 7360 deflection plates. This is done with the mode switch that also inserts a control by which the degree of unbalance may be adjusted to provide the desired carrier level. The switch also disables the speech amplifier and sets up the sidetone oscillator which is a phase shift type with an 800 c.p.s. tone. It is followed by a triode amplifier (with an internally adjustable gain control) coupled to the receiver output amplifier. The grid-block keying also is applied to the tone oscillator and the relay-control tube. The control tube is not keyed by the tone, as sometimes is the case, which together with a fast-charge diode, results in quick relay pickup. The diode also ensures instantaneous v.o.x. action with voice operation.

In order to place the carrier within the filter passband, the frequency of the u.s.b. crystal (the one used for c.w. work and tune-up) is shifted accordingly by switching a capacitor across the crystal. This is handled by a transistor switch arranged in a fast-acting switching network that during receive on key-up returns the frequency to normal.

Power Supply

The built-in power supply is a solid-state affair using full-wave bridge rectification at two individual h.v. secondaries of the power transformer to provide potentials of 315 and 800 volts. There also is a bias supply. A VR tube used to provide a regulated potential of 105 volts is used for the balanced modulator, the crystal oscillators and the screen grids of several intermediate stages.

Zener diodes are often used in modern equipment to provide a regulated low voltage for operating transistors; however, their stability for use in connection with a solid-state v.f.o. often leaves something to be desired for maintaining optimum frequency stability with supply- or line-voltage variations, such as may occur with s.s.b. operation, resulting in incidental frequency modulation. In the FTdx560, extremely good voltage regulation for the v.f.o. is had by using an electronic voltage regulator consisting of two transistors with zener reference diodes. Its operating voltage is obtained from a stiff source derived from an individual low-voltage winding on the power transformer.

Two primary windings on the transformer may be connected in parallel or in series for 117 or 234 volt operation respectively. These are also tapped for use with slightly lower voltages.

There are no provisions for mobile operation with an external 12 v.d.c. supply. Although this could be set up, it would require rewiring of the tube heaters which are now connected in parallel for 6.3 volt operation.

Construction

The FTdx560 is neatly built on a heavy-gauge chassis together with a rugged panel with a die-cast escutcheon for the meter and main-dial windows. Much of the assembly is made on one large printed-circuit board. All components appear to be of top quality.

The r.f. inductors for the receiver and the

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low-power transmitter stages are completely and individually shielded. The p.a. is installed in a separate enclosure. The v.f.o., including its tuning capacitor, is likewise enclosed in an individual shielded compartment. Access holes thereat are covered with a removable metallic-coated tape which thus provides *complete* shielding and eliminates the flow of air through the v.f.o., thereby improving stability under various environmental changes.

The v.f.o. is operated by a high-ratio drive covering 15 kc with one revolution of the knob. Spring-loaded split gears are utilized for maintaining an accurate calibration and eliminating backlash. There are two scales on the main dial. These have reference calibrations at the 25 kc increments with the major 100 kc points identified on a black 0-500 kc scale and a red 500-1000 kc scale. A dial at the tuning knob shaft is calibrated in 1 kc steps of 0-100 about 1/8" apart. This dial may be manually slipped on the shaft for precise calibration indexing. The frequency readout is the sum of the reading on the two dials plus the frequency representative of the range at the bandswitch setting the band identification is color-coded for correlation with the main-dial scale).

An SO-239 coax connector is used for the antenna; phono jacks are used for other functions. The mic jack accepts a standard 3-circuit phone plug, while jacks for headphones and the c.w. key accept a standard two-circuit phone plug. These are supplied with the unit.

Performance

The FTdx560 is handy to operate and on-the-air performance leaves little to be desired. The a.f. quality on both transmit and receive was found to be pleasant with clean sounding signals, although in some cases with very strong signals a slight reduction in the r.f. gain was needed on receive to maintain the cleanest signal.[1] The noise limiter was quite effective, although a bit of distortion on an s.s.b. signal was sometimes experienced. However, the intelligibility was not impared, especially in view of the extent to which the signal might not otherwise have been readable in the presence of heavy impulse noise.

The v.o.x. system functioned smoothly and quietely—a relief from some of the clattering setups we've experienced.

No adverse key clicks were observed on c.w. The keying was clean, but somewhat on

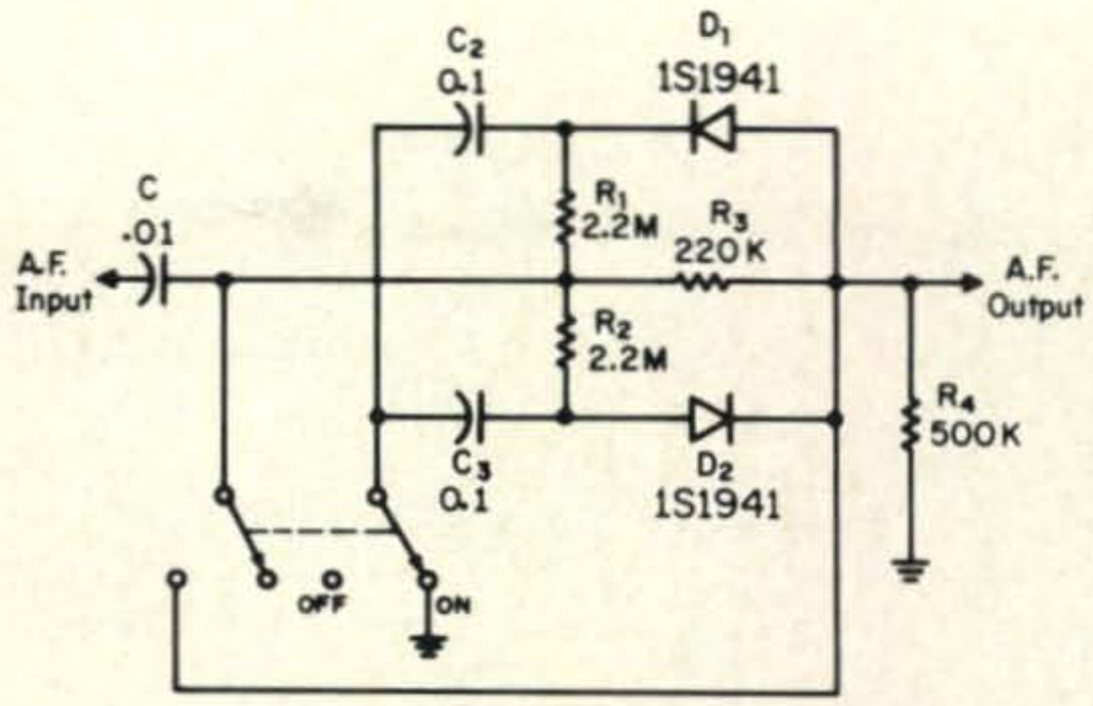

Fig. 3—Circuitry for the simple a.f. type noise limiter used in the FTdx560.

the "soft" side due to a slow rise time, making characters (particularly dots) noticeably shortened with the overall effect of a lisping and lilting signal.[1]

The v.o.x. type break-in could be set as fast, if not more so, as with other similar systems. No shortening of characters was due to hesitancy in the v.o.x. keying setup. Semi-break-in, of course, may be set up using the v.o.x. delay. The sidetone monitor keyed cleanly with a pleasant and stable tone and without chirping. The unit on hand did not include the c.w. filter, so performance in this respect could not be evaluated.

As noted earlier, switching sidebands requires retuning the v.f.o.; however this can be done without retuning (during receive only) by intelligent use of the incremental tuning (clarifier). In any case, retuning the v.f.o. exactly 3 kc is a simple expedient.

One thing that requires getting use to, is that the meter works backwards on a.l.c. and S-units. Also, the p.a. cathode-current position is identified in an unfamiliar way as *IC*, which it really denotes.

The a.g.c. works smoothly without pumping effects, but as will be seen from the measurements, there is little difference between the fast and slow positions. A.l.c. also works well with only a slight rounding off of r.f. peaks at maximum compression.

Fine performance also is indicated by the results of the following lab measurements (figures in parenthesis denote the rating where given in the manual):

RECEIVER SENSITIVITY (0.5 μv for 20 db S+N/N, at 14 mc): 0.2 μv or less for 10 db S+N/N on all bands, except 3.5 mc, 0.3 μv; BAND-TO-BAND GAIN: Within 3 db referred to

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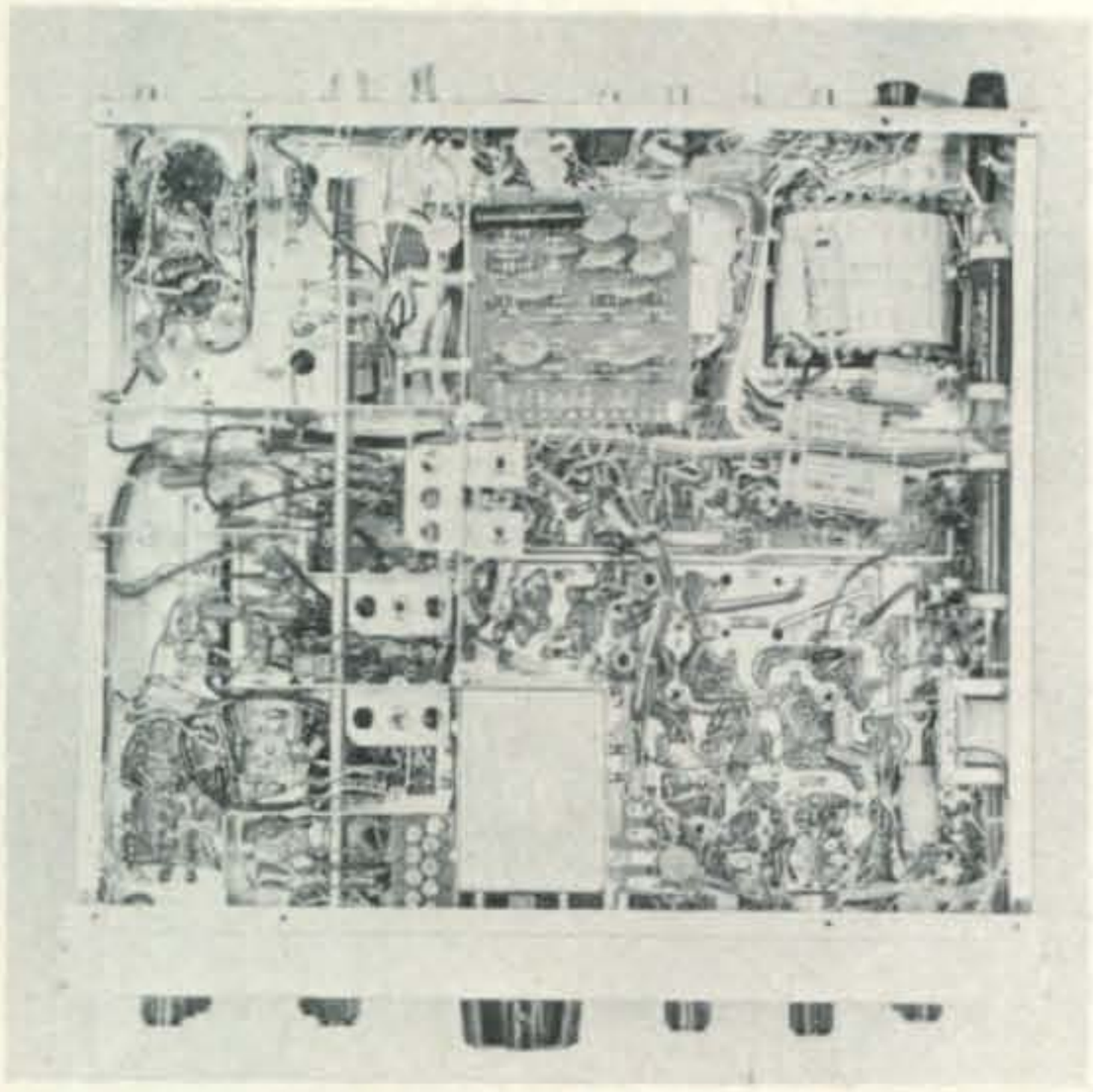


Bottom View of the FTdx560. The r.f. section is at the left. The brackets with empty holes installed on the shield partitions are for mounting auxiliary-range inductors. The silicon rectifiers with capacitor transient suppressors are on the board at top center.

28 mc, except +6 db on 7 mc; SELECTIVITY (2.3 kc at 6 db and 3.7 kc at 60 db): Same as rating with unwanted-sideband suppression at 1 kc 56 db down with u.s.b. position and 50 db with l.s.b., 5720-5220 KC I.F. SIGNAL REJECTION (50 db): 62 db on 3.5 mc band to 68 db on 28 mc; 3180 KC REJECTION: 84 db on 3.5 mc, over 90 db otherwise; IMAGE REJECTION (50 db): 74 db on 3.5 mc band to 90 db on 28 mc; INTERNAL SPURIOUS RESPONSES: Two found equivalent to 1 μv signal input, four others at less than 0.5 μv; A.G.C.: 10 db a.f. output change with r.f. input change of 10 db (1-3 μv), 7 db output change with input change of 80 db (3-30,000 μv), fast release 0.5 sec., slow release 1 sec.

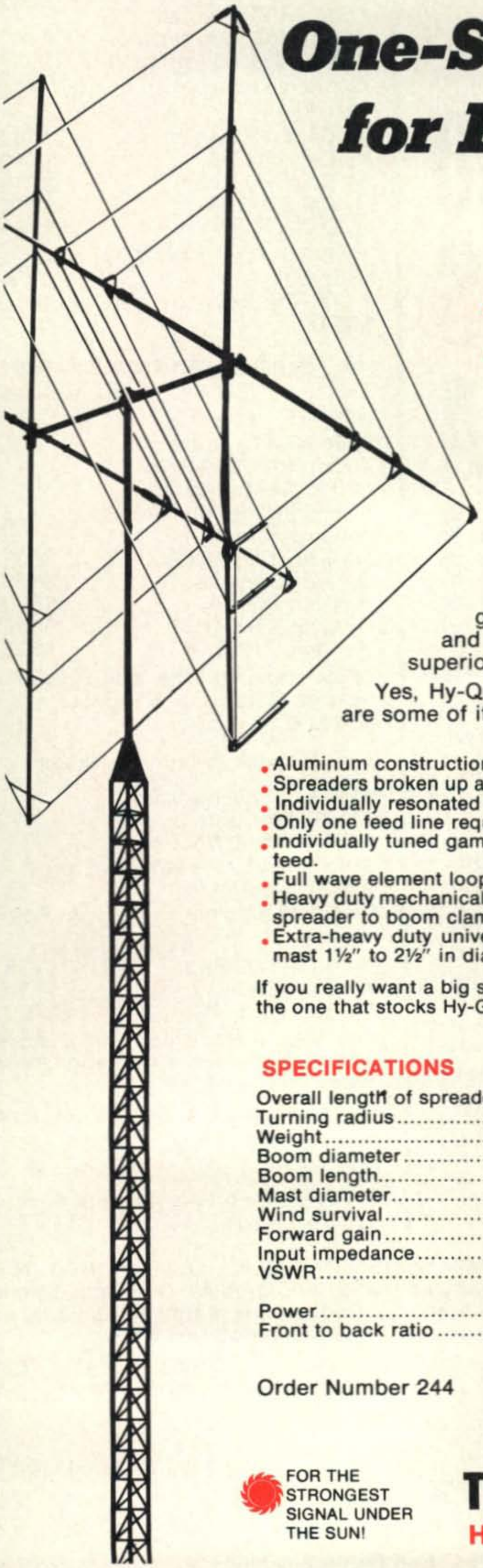
TRANSMITTER POWER OUTPUT (input rated at 500 watts c.w., 560 watts p.e.p.): 260 watts output c.w. and tuneup, 300 wats p.e.p. on all bands; UNWANTED SIDEBAND SUPRESSION (50 db or more at 1 kc): Same as receiver measurement: CARRIER SUPPRESSION (better than 40 db): at least 50 db. DISTORTION PRODUCTS (better than −25 db): within the rating.

FREQUENCY STABILITY (100 c.p.s. for any 30-minute period after warmup): Average for all bands—300 c.p.s. drift during first 30 minutes from cold start at 72°F. ambient, 200 c.p.s. or less per hour thereafter. With ±10% line-voltage variations, ±15 c.p.s. slow change, attributable to crystal oscillators, not the v.f.o. No adverse effects on frequency when cabinet banged by hand. CALIBRATION LINEARITY: Within 0.5 kc when indexed at nearest 25 kc point.

The FTdb560 is priced at $449.95. The optional c.w. filter, factory installed or as a kit, is priced at $39.95. Where auxiliary ranges are to be set up, factory installation is recommended at the time of order. On the other hand, instructions are available for installation by the customer.

A matching speaker-console, Model SP-560, is priced at $19.95. The Model FV400S external v.f.o. is $99.95 and the Model FTV-560 6-meter Transceiver is $139.95. These are products of Yaesu Musen Co., Ltd, Tokyo, Japan. Further information may be obtained from the exclusive supplier for the USA: Spectronics, Box 338, Lakewood, California 90714. An important consideration is the availability of spare parts, a full line of which is carried at the supplier's headquarters and at their Eastern outlet. A one year guarantee is included with the FTdx560. —*W2AEF*

See page 102 for New Reader Service



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Overall length of spreaders	305"
Turning radius	13' 6"
Weight	42 lbs.
Boom diameter	2"
Boom length	8"
Mast diameter	1¼" to 2½"
Wind survival	100 MPH
Forward gain	8.5 db
Input impedance	52 ohms
VSWR	1.2:1 or better at resonance on all bands.
Power	Maximum legal
Front to back ratio	25-35 db depending upon electrical height.

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Tristao MM-35 "Mini-Mast"* tubular tower — crank-up
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**TR-44 Rotator and cable, add $35.00

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Hy-Gain 204BA	$590.00
Hy-Gain TH3MK3	$590.00
Hy-Gain TH6DXX	$615.00

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**Ham-M rotator, RG-8/U Coax, add $50.00

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See page 102 for New Reader Service

THE 6-METER BENT H ANTENNA

BY W. O. ENDERLE,* W6GNV/4

A stacked folded dipole for six meter operation.

THERE are a number of very successful commercial and home brew antenna types in regular use on six meters. The Yagi style beam in four or five element configuration is probably the most popular in the greater Washington D.C. area at least, although there are a number of operators apparently having good fixed station results with simpler antennas such as the Squalo and Halo. My particular problem, which I am sure is not uncommon, was that I wanted a horizontally polarized, omnidirectional antenna for roundtable or net operations to supplement my 5 element Yagi, and I wanted some gain as well. Another long run of expensive coaxial cable did not appeal so I hoped to work out a design that would make use of an existing antenna coupler and some ordinary TV twinline. Finally, I wanted to install it in the attic where I could forget about wind and rain, and make use of rafters for support.

Construction

The design of an antenna that met the above requirements took considerably longer than it did to construct it. Actually, it was built and installed one Saturday afternoon. The antenna can be verbally described much better than it can be photographed. It consists (see fig. 1) of two horizontal 600 ohm folded dipoles (3 parallel conductors per each dipole), stacked vertically one above the other at a distance of about four tenths of a wavelength (for gain), and each bent 90 degrees in the middle (for an omni pattern). The two dipoles are connected together, in phase, by an electrical half wavelength of twinline, and its length determines the actual vertical spacing of the parallel dipoles. The antenna manual I referenced gave a velocity factor of 0.82 for ordinary TV twinline, and thus an electrical half wavelength computed out of my slide rule to be 94½ in. at 50.4 mc. An open wire type phasing line, with a larger velocity factor, would allow greater spacing of the two dipoles, and slightly greater efficiency, but the difference would probably not be noticeable. Stranded copper wire (7 × 22) was used for the antenna conductors, and the length of each dipole element was figured at 110 inches. This design is not particularly frequency sensitive, at least in comparison with a Yagi, and an inch one way or the other in dimensions will not be critical. The insulators and spacers were fabricated from flat pieces of Plexiglass (old C-47 windshield), but for attic or other inside location where water can be disregarded, masonite or even dry

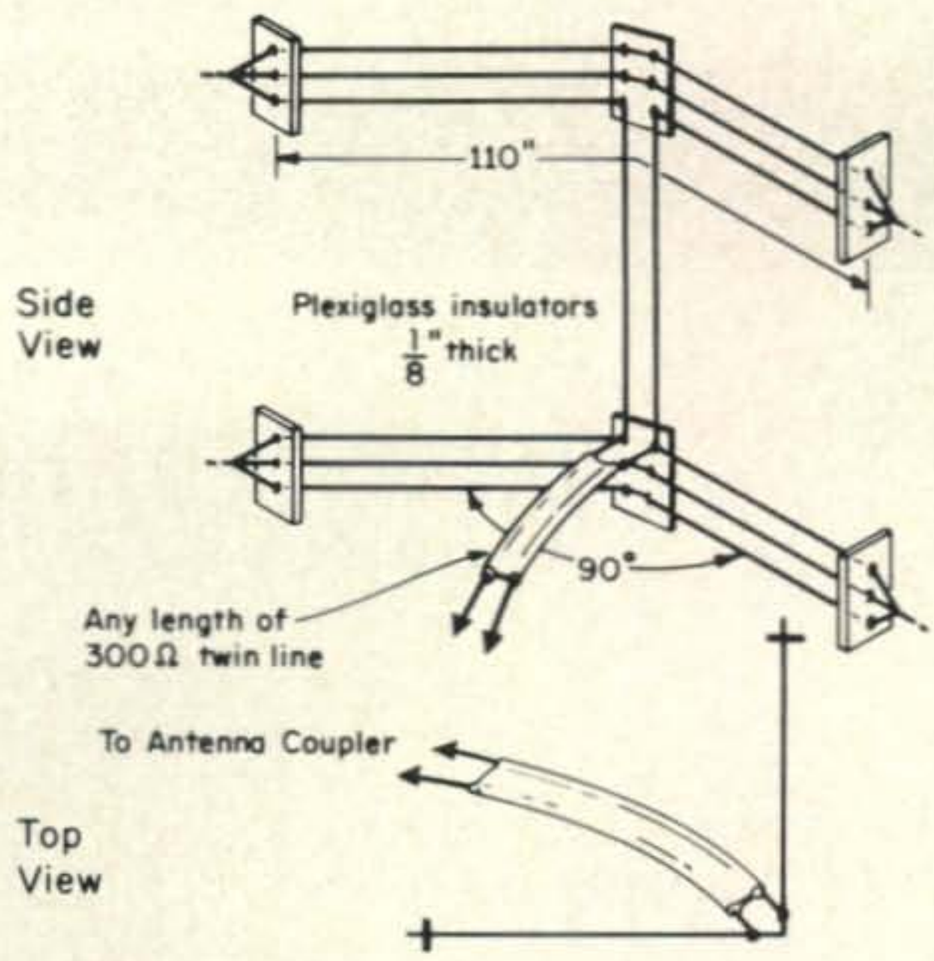

Fig. 1—Layout of the bent H stacked dipoles. The insulators, made of plexiglass, space the dipole elements one or two inches apart. The phasing line is 300 ohm ribbon 94½" long with one twist for proper phasing.

*4205 Maple Avenue, Fairfax, Virginia 22030.

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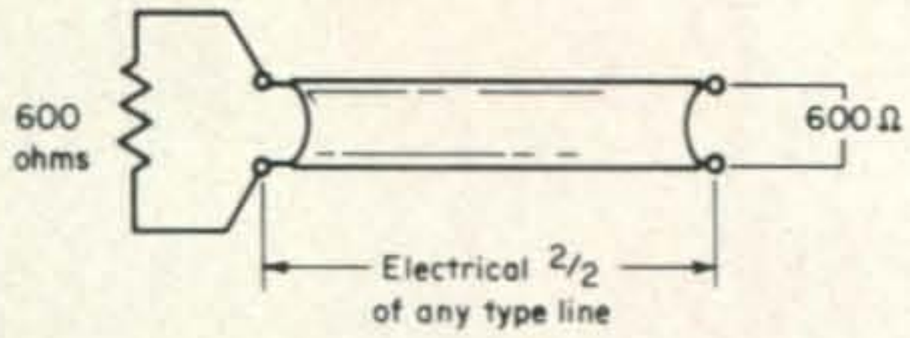

Fig. 2—Simple sketch illustrates how an electrical half-wave line of any type repeats the impedance connected to it.

hardwood could probably be used with no problem.

Theory of Operation

As far as the theory of operation is concerned, those persons familiar with a Squalo or Halo will not have any qualms about bending a dipole and wondering if it will still work. The rest of the design was based on obtaining gain and matching the antenna to the feed line without complexity. Transmission line theory says that the impedance connected to one end of an electrical half wavelength line is repeated at the other end. (See fig. 2.) Hence the 600 ohm or so of the upper dipole is presented at the bottom end of the phasing line where it is then attached in parallel with the 600 ohms of the bottom antenna. (See fig. 3C) The resulting 300 ohms or so of impedance is thus a good match for a random length of TV twinline down to the antenna coupler or to a balun, and thence to an s.w.r. bridge and the rest of the station. Don't forget that the phasing line beween the two dipoles must be twisted 1/2 turn before it's connected to the bottom dipole in order for the pair of them to act as a broadside array.

Although the proximity of the two dipoles to one another, the fact that they are bent, and the fact that they will possibly be near some house wiring in the attic will all affect their impedance to some extent, I think you will find that the s.w.r. on the feed line is well below 2 to 1. In any case, the losses in twin

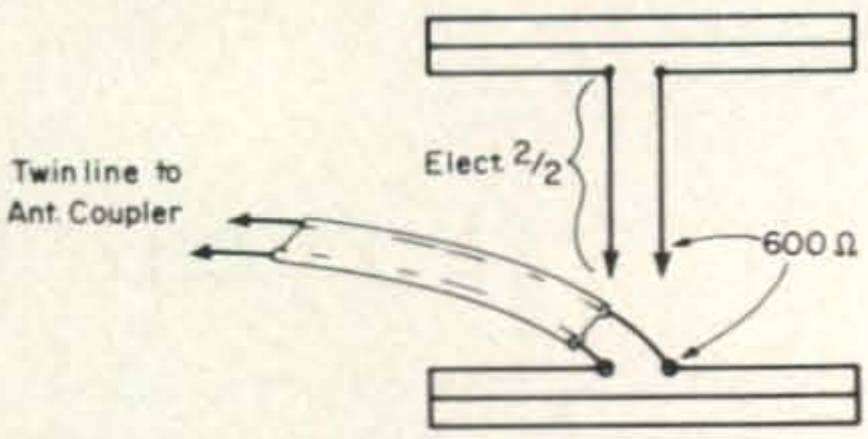

Fig. 3—Illustration of two 600 ohm folded dipoles are paralleled by the phasing line to match the 300 ohm transmission line.

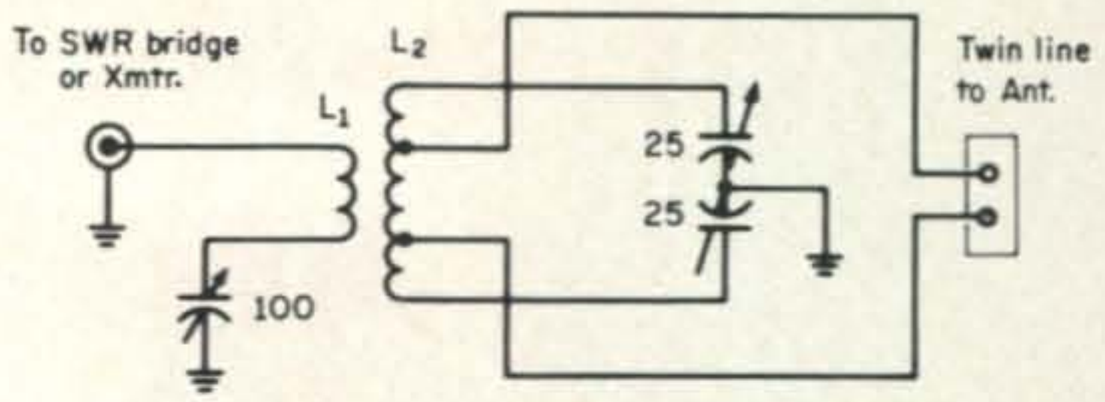

Fig. 4—Circuit of an antenna tuner to match the 300 ohm twin lead to the 52 ohm unbalanced source.
L_1—2t #14, 3" dia. over the center of L_2.
L_2—7t #12, 1½" dia., 2" long, tapped at the second and fifth turn.

line are much less than in coax and I have found no evidence of hot spots after feeding mine with a class "C" a.m. kilowatt for a couple of late QSO's. Further confirmation of a low s.w.r. is the nearly identical antenna coupler settings for a 300 ohm resistor substituted at the antenna terminals of the coupler.

The Bent H is far superior to a standard design, full sized lazy H antenna in the latters best direction, which has been installed for some time at this QTH. The center of the Bent H is about 15 feet higher than the center of the big lazy H, so the comparison is not entirely fair. However, an ordinary folded dipole was far outclassed by the big H so I feel that a reasonable standard of comparison has been selected.

Either an antenna coupler as shown in fig. 4 or a simple coax balun (fig. 5) should accomplish the transformation from the unbalanced output of the s.w.r. bridge or transmitter to twinline feeder. I have not personally tried the coax balun, and am only providing its dimensions for convenience.

The Bent H has seen regular use on Army MARS, AREC, and Rebel Nets in the Northern Virginia area. I certainly hope you have as much pleasure in building and using one as I have had. ■

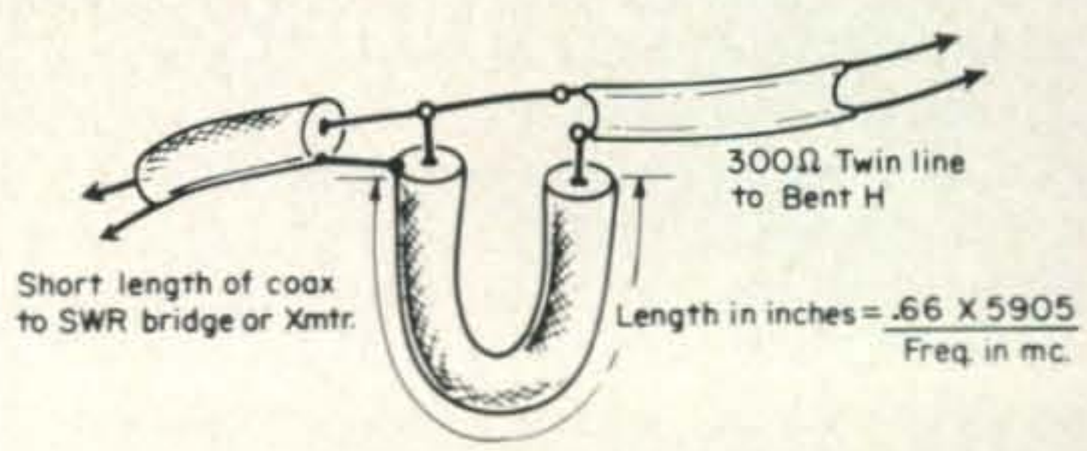

Fig. 5—Arrangement for a balun to convert from 300 ohms balanced to 75 ohms unbalanced (4:1 transformation). Fifty two ohm line can be fed without any problem, however. The balun length by the formula shown is about 77" for 50.4 mc.

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Late Oscar News

BY GEORGE JACOBS,* W3ASK

THE OSCAR-5 radio amateur satellite is silent!

The 10 m. beacon transmitter operating on 29.450 mc completed its life cycle sometime during the late hours of March 8 and the early hours of March 9. The 2 meter beacon, operating on 144.050 mc had previously gone silent on Feb. 14. .

With both beacon transmitters now silent, the initial phase of the OSCAR-5 project is completed. The transmitters operated for their planned life period and this phase of the project is considered to be an outstanding success.

There now remains the arduous task of data collation, reduction and analysis and the preparation of the final report to NASA. This task has been undertaken by members of the Melbourne (Australia) University Astonautical Society and the Melbourne University Radio Club.

A large volume of reports from radio amateurs all over the world is flowing into Melbourne's computer center. It is extremely important that all reports of the satellite's signals be reported as soon as possible to the nearest AMSAT coordinator for inclusion in this study. The AMSAT coordinator for the western hemisphere is the Radio Amateur Satellite Corporation (AMSAT), P.O. Box 27, Washington, D.C. 20044.

For Europe and Africa, reports should be sent to Mr. W. Browning, G2AOX, 47 Brampton Grove, Hendon, London N.W. 4, England.

Reports from all other areas of the world should be sent directly to Project Australis, Union House, University of Melbourne, Parkville, Victoria, Australia, 3052.

All reports of OSCAR-5 reception, from the simple "I heard it," to the most advanced measurements and observations, will be verified 100% with a distinctive QSL card.

It will not be necessary to request this card. QSL cards will be sent as soon as reports are entered in the computer at the University of Melbourne.

*Space Communications Editor, *CQ*.

More to Come

AMSAT, which prepared OSCAR-5 for launch, is actively working on plans for future amateur satellites. The next OSCAR satelite will be called AMSAT-OSCAR B (AOB), until it's successfully launched.

While the design of AOB is still pretty much wide open to ideas and suggestions, some preliminary thought has been given to it. AMSAT hopes that it will be a solar powered, multi-repeater satellite, with a life period of at least a year.

AMSAT will be responsible for the design of the solar power supply and the general structure of the space craft. Groups of European and Australian radio amateurs have so far indicated a desire to design and construct repeaters and other necessary sub-systems.

A group of European radio amateurs, under the banner of the Region 1 of the International Radio Union are designing a repeater also to be carried aboard the AOB satellite. This will be a non-linear repeater similar to the types carried aboard OSCAR's 3 and 4. This repeater will be capable of receiving a segment of the 432 mc band (probably 100 kc wide), and repeated back to Earth in the 2 meter band.

AMSAT emphasizes that these are preliminary plans, and that they are soliciting other ideas and suggestions from serious radio amateurs and groups of radio amateurs that would like to participate in this project. A new membership drive is underway, and all radio amateurs interested in joining AMSAT can receive membership information by writing directly to: Membership Committee, AMSAT, P.O. Box 27, Washington, D.C. 20044.

"Ode to OSCAR"

The following Ode to Oscar was written by Bob Goss at NASA's Goddard Space Laboratories. It should be sung to the tune of "Daisy, Daisy."

[*Continued on page 90*]

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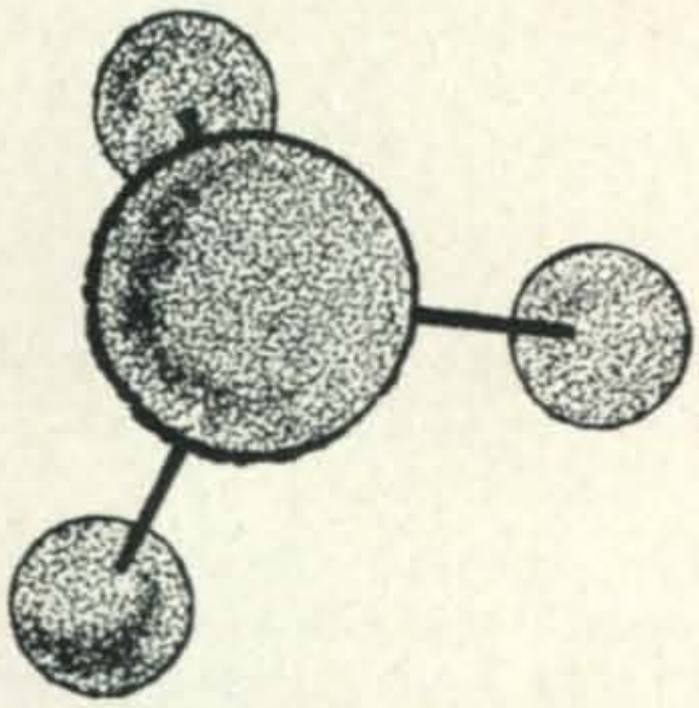
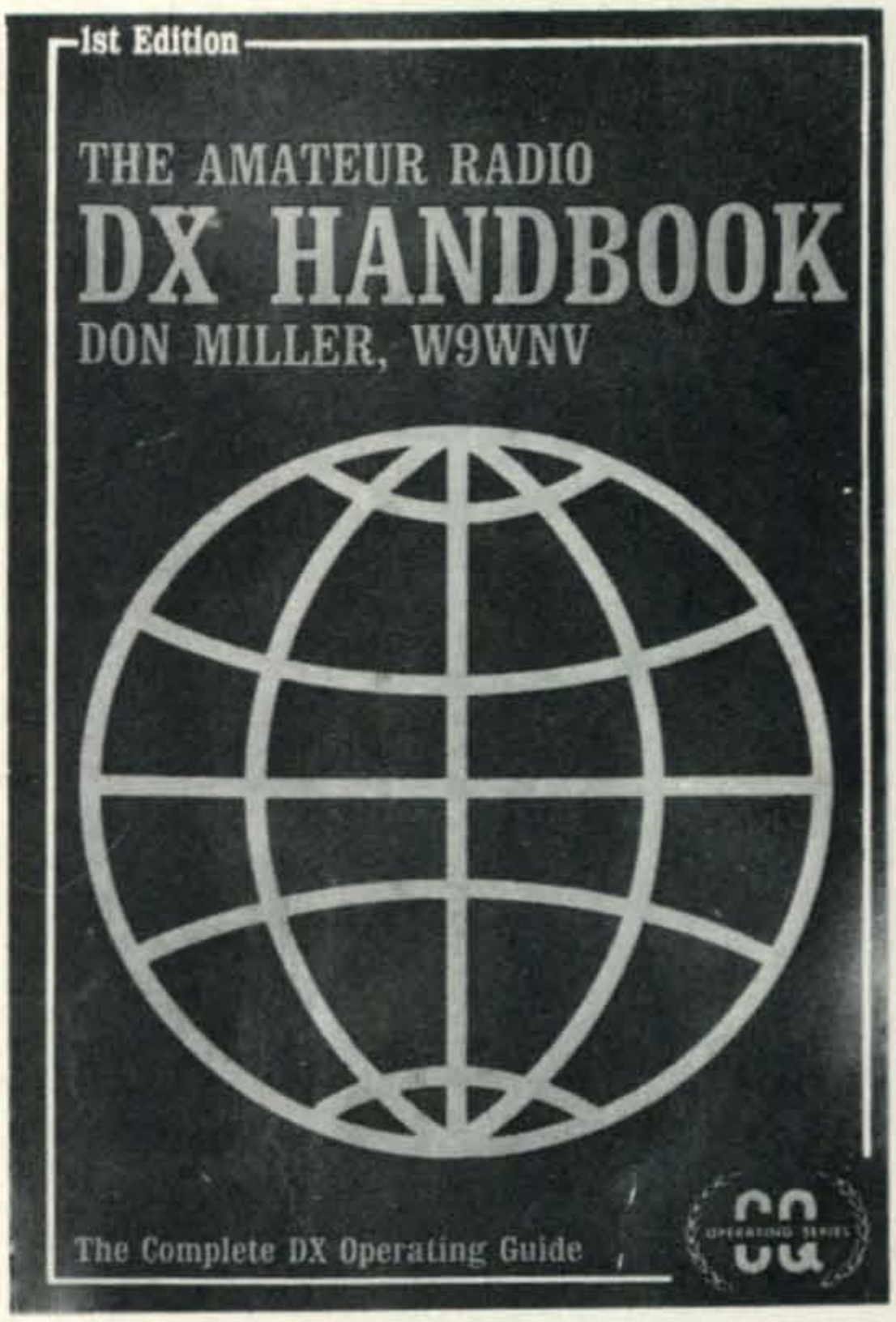


WHAT'S TO KNOW ?



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See page 102 for New Reader Service

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But that's not all. Ham Cat features lightweight, super strength construction with a shake-proof sleeve lock that folds over for garaging. Lightweight precision-wound coils are sealed in an indestructible, white epoxy-fiberglass sleeve with chrome-plated brass fittings.

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Order No. 254	15 meter Ham Cat mobile coil and tip rod.	Suggested Ham Net, **$10.95**
Order No. 253	10 meter Ham Cat mobile coil and tip rod.	Suggested Ham Net, **$ 9.95**

CALIBRATE YOUR OWN D.C. METERS

BY JOSEPH P. FINCUTTER,* K3STU

Part I

With a little ingenuity, less than $50, and good shop practices you can build a calibration system consisting of a Potentiometer, a Volt Box and several Standard Resistors with an overall accuracy of better than ±1.0% and perhaps as good as ±0.5%. In this two part series Part I, presented below, covers the principles of the Potentiometer and Volt Box. The second installment will cover the Standard Resistors, construction of all three units and their use.

IN a recent article[1] I covered the problems associated with the use of voltmeters (v.t.v.m. and v.o.m. types) in making good measurements. I also brought up the subject of the accuracy of these types of meters. Unless the accuracy of the meters is known and the meters used properly, the measurements made are almost meaningless. Even though a manufacturer makes realistic claims for the accuracy and stability of his meters, use and abuse by the owner, even just sitting on the shelf in a changing environment for a period of time, all will be detrimental to the accuracy of the meter. So we should have some convenient method to check the accuracy of our meters. Periodic calibration of our meters will insure better measurements, providing of course that we use the meters properly. And, besides, we should want to know the accuracy of our panel meters on the KW final, an FCC requirement when the input is over 900 watts.

We can get this calibration by obtaining the service from a commercial laboratory, but this is usually costly. So why don't we calibrate our own meters? It is not difficult, and, with a reasonable expenditure of funds for good quality surplus or new components and maybe a fruitful search through our own junk box, we can build several items of calibration equipment which will be two or three orders of magnitude better than our meters. If you are interested in a valuable calibration system for your shack, read on!

*5620 Alta Vista Road, Bethesda, Md. 20034.

[1]Fincutter, J. P., "Voltmeter Circuit Loading," *CQ*, Part 1, Sept. 1967, p. 75; Part II, Oct. 1967, p. 66.

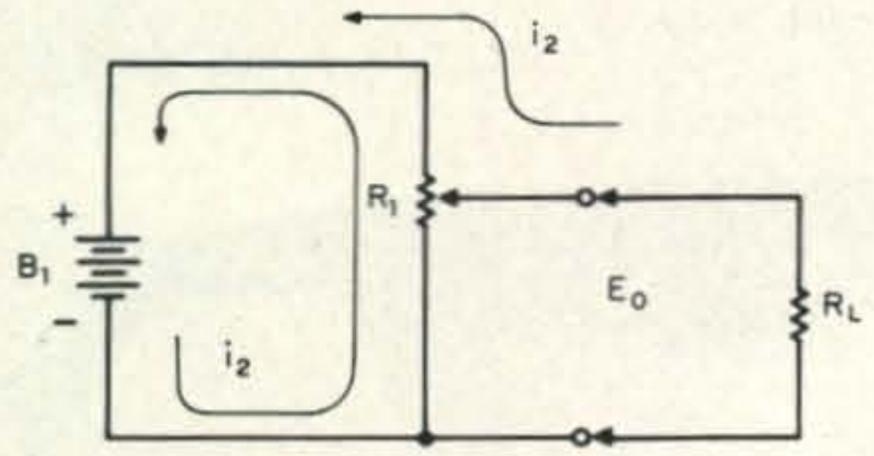

Fig. 1—Schematic presentation of a potentiometer showing the current paths and voltage divider action.

What Is Needed?

In order to calibrate meters we need the following:

1. A voltage measuring device called a Potentiometer, which will be the *heart* of the system.

2. Since the Potentiometer is limited to about a 2 volt maximum measurement, a voltage divider, Volt Box, will be necessary to divide higher voltages down to less than 2 volts.

3. In order to measure current, a Standard Resistor of known value is required so that we can measure the voltage drop across it with the Potentiometer and then compute the cur-

See page 102 for New Reader Service

Shown above is all the equipment needed to check and calibrate your d.c. meters. The box on the left is the carrying case for three Standard Resistors (one of which is shown in front). The Potentiometer/Volt Box is in the center and the Weston Unsaturated Standard Cell is packed in styrofoam in the box on the right.

rent by the use of Ohm's Law.

A complete explanation of the theory, application, some hints on construction, and operation of these items follows.

Theory

A potentiometer is a fundamental electrical instrument used to measure voltage by the comparison of an unknown voltage with a known voltage through the intermediary of a variable *IR* drop.

From the definition above, two factors are important: (1) we must have a stable known voltage as a reference source, and, (2) we must have a constant current through a stable known value of resistance such that points of known *IR* drop can be selected along the length of the resistance. For a better understanding of the word POTENTIOMETER and its application to measurements, let's examine fig. 1.

The supply voltage, E_{B1}, produces a current, i_1, through R_1, and, according to Ohm's Law:

$$E_{R1} = i_1 \times R_1 = E_{B1}$$

and E_0 can be varied from 0 to E_{B1} by adjustment of the sliding arm along the length of R_1. However, several factors are involved:

1. The current through R_1 should be constant.
2. Resistance, R_1, should be stable both electrically and mechanically.
3. The value of R_L should be a sufficiently high value with respect to R_1 to hold i_2 to a very, very low value with respect to i_1.

Replacing R_1 in fig. 1 with a galvanometer and another battery of lower voltage than B_1, we develop fig. 2.

As we move the arm of R_1 from the bottom towards the top, the galvanometer indicates the algebraic sum of i_2 and i_3. (Kirchoff's Laws). When the arm of R_1 is adjusted to a voltage point along R_1 equal to the voltage of B_2 the galvanometer will indicate zero current since i_2 and i_3 will be reduced to zero. So, we could calibrate the various positions of the arm of R_1 in terms of voltage and use the zero indication (null) of the galvanometer to measure the voltage of any battery (B_2) as long as it is a lower voltage than that of B_1. By the same token we could insert an unknown voltage in lieu of battery B_2 and measure it by adjustment of the arm of R_1 until the galvanometer indicated zero current (null).

However, as simple as this seems, there are problems which must be overcome. What happens as B_1 discharges? What specifications do we impose on R_1 and the associated dial mechanism? What about the sensitivity of

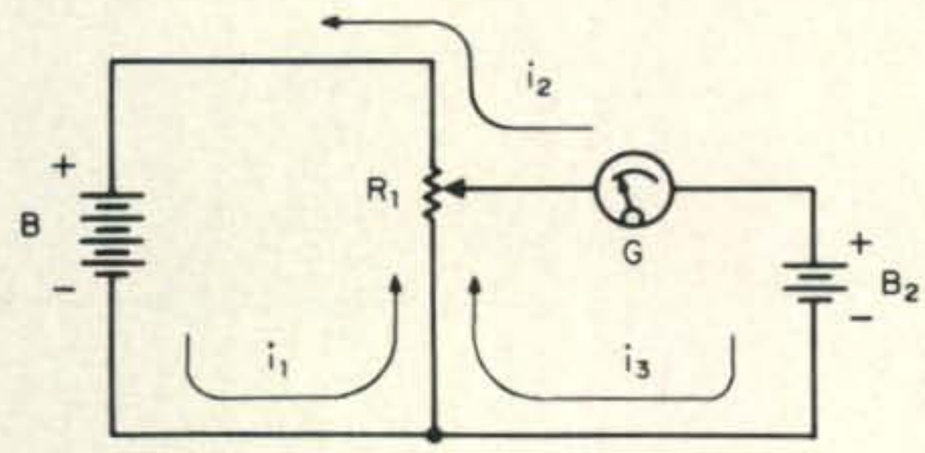

Fig. 2—Addition of a meter and second voltage source to the circuit of fig. 1. The meter indicates the algebraic sum of current i_2 and i_3.

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A close up of the Potentio meter/Volt Box shows the left side with the terminals brought out to five banana jacks. Switch S_2 is a lever type located to the left of the zero center galvanometer. Switch S_3 is directly below S_2 and S_1 is to the left of S_2.

the galvanometer? How do we insure the accuracy of the *IR* drop across R_1? Figure 3 should help us answer some of these questions.

1. B_2, a standard voltage, is provided to accurately establish the *IR* drop across R_1. B_2 is a mercury cell which normally has good voltage stability. However, an unsaturated standard cell could be used if you are fortunate to own one.

2. R_1 should be a slidewire type of resistance. A helical potentiometer with good overall accuracy and a linearity accuracy of at least ±0.1% can be used. In fact 'helipots' with a linearity accuracy of ±0.05% are available on the surplus market at a reasonable price. The turns counter dial for this type of potentiometer would normally have an accuracy of 1 part in 1000 (±0.1%).

3. R_2 is used to adjust the current flow through R_1 and compensates for the discharge of B_1 (within limits however). It should be a wirewound rheostat with a vernier drive which will allow easy adjustment of the current flow through R_1 in the "Standardize" procedure which will be explained later. The value of R_2 would be determined by the voltage of B_1 and the value of R_1.

4. The voltage of B_1 should not be more than 6 volts nor less than 3 volts if the voltage of B_2 (*E*std) is approximately 1.3 volts.

5. A logical value for R_1 would be 1000 ohms, since the turns counter dial could then be read directly in ohms. On this basis, R_2 would be 1000 ohms or greater, dependent upon the voltage of B_1. (Use Ohm's Law to set the current through R_1 to a low level, yet be able to obtain an *IR* drop across R_1 which would be equal to B_2 (Estd).

6. Although it would be ideal to have a sensitive galvanometer (laboratory type) for a null indicating meter, a good zero-center (25-0-25) will suffice for our purposes.

Now let us examine fig. 3 from an operational point of view. Basically we must "Standardize" the *E*std (B_2) voltage to some point along the length of R_1. This is accomplished by:

1. Seting S_2 to the s (Standardize) position.
2. Setting S_1 to the ON position.
3. Setting the arm of R_1 to some arbitrary point, D_1, (dial setting) along R_1, preferably at midrange or above.
4. While intermittently depressing S_3, (until the meter reads 'on scale) adjust R_2 for a zero or null indication on the galvanometer. The current flow is now adjusted to give us a point on R_1 (D_1) equal in potential to *E*std.

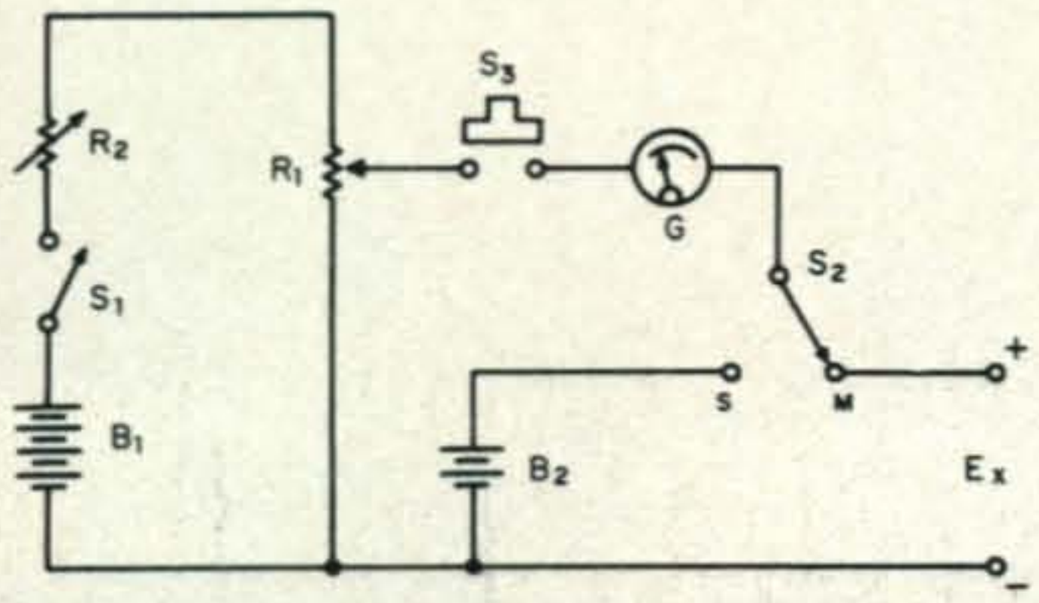

Fig. 3—Circuit of the complete Potentiometer. Details are covered in the text.

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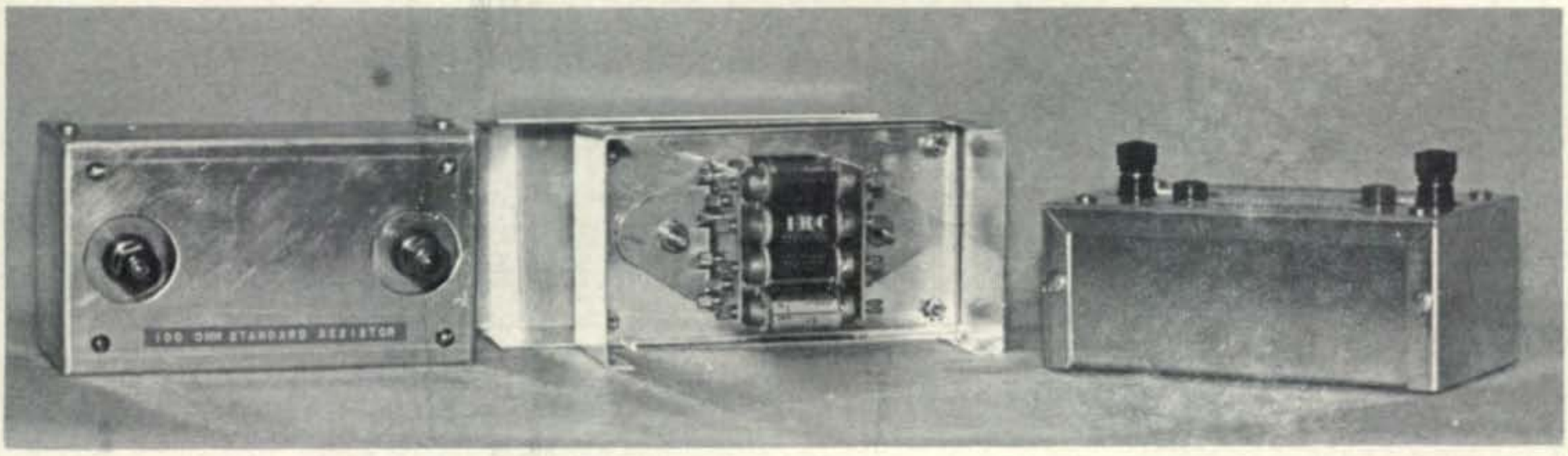

A view of the Standard Resistors shows how the ten 100K resistors are mounted on brackets to form a 10K standard. The box on the right holds a 10 ohm unit. The four terminal connections can be seen.

5. Now set S_2 to M (Measure) and we are ready to measure Ex as long as the value is equal to or less than that of Estd. (It is possible to measure slightly higher values, up to approximately 1½ to 2 times Estd, but the accuracy could be degraded. Larger values of voltage require the use of a voltage divider which will be explained later.)

6. With the unknown voltage connected to the Ex terminals, intermittently depress S_3 (until an on-scale reading is obtained) while adjusting R_1 for a null indication on the meter. When the null is obtained we have a new point, D_2, on R_1. The unknown voltage is now obtained from the following equation:

$$E_x = E_{std} \times R_2/R_1 \qquad (1)$$

But since we used a 1000 ohm helical potentiometer and a turns counter dial we can write Equation (1) as follows:

$$E_x = E_{std} \times D_2/D_1 \qquad (2)$$

where

E_{std} = Reference voltage (Mercury Cell).
D_2 = Dial setting for null with E_x.
D_1 = Dial setting for null with E_{std}.

The accuracy of our measurement is dependent upon the following:

1. Linearity of R_1, $\pm 0.1\%$ is good, but a $\pm 0.05\%$ would be better. The turns counter added to the linearity accuracy and is normally 1 part in 1000 ($\pm 0.1\%$).

2. Constant current through R_1. Recommend the use of a mercury cell (or cells) because of their constant voltage/current characteristic until almost the last moment of usability. In any event a battery with a good, or high, milliampere/hour capacity should be used.

3. Accuracy of Estd. Mercury cells, rated as "Reference Cells" are satisfactory for a very long period of time. Normally there is a very low value of current drawn from these cells and then only for the short period of time required to standardize the potentiometer. At null, no current is drawn.

4. Stability of R_2, S_1, S_2, and S_3. R_2 should be good, both electrically and mechanically, making good contact. Also all soldered joints should be good and the interconnecting wires should be "oversize" for the currents being carried.

From equations (1) and (2), the operational procedures and fig. 3 it is easy to understand that the same unknown voltage, Ex, could be measured by Standardizing at several different points on R_1 (D_1) and then obtaining a new null for each, R_2 (D_2). If we made three measurements we could average the three and it would be safe to say that our averaged measurement of Ex, statistically at least, would be better.

Volt Box (Voltage Divider)

What is meant by "Volt Box?" Well, maybe the phrase "voltage divider" will be more meaningful. We have used them many times

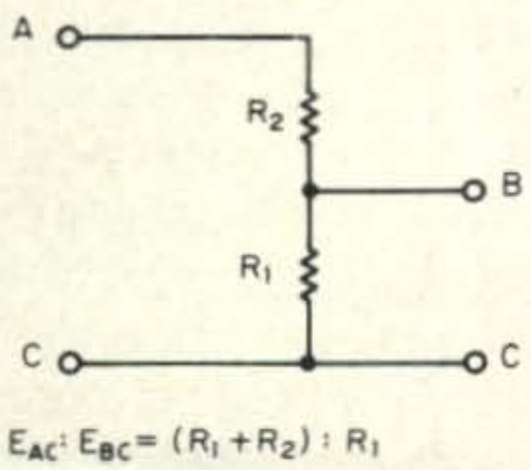

Fig. 4—Basic circuit of the Volt Box, a precision voltage divider.

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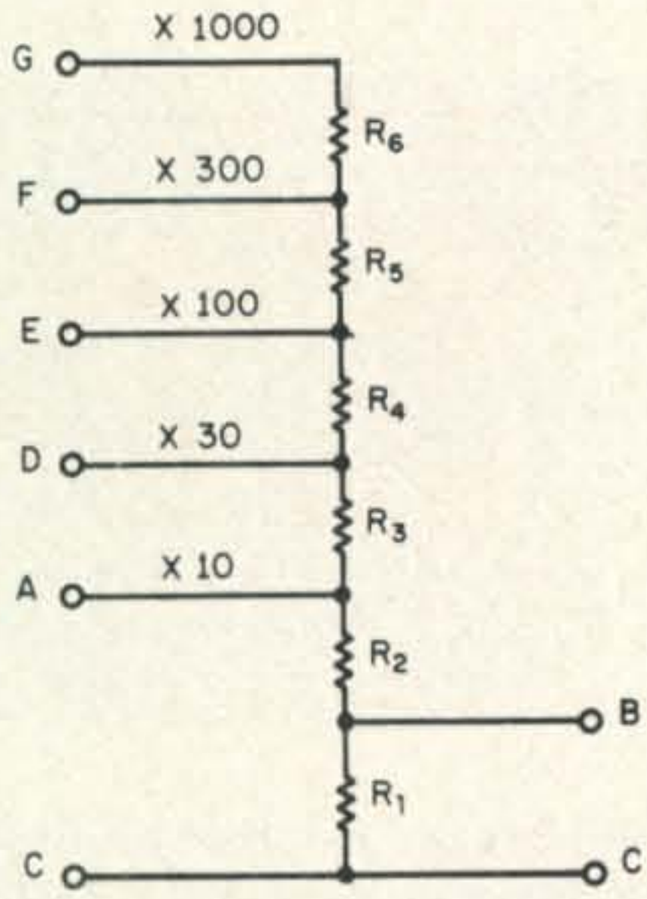

Fig. 5—Circuit of a practical Volt Box. Calculation of the various resistance balues is covered in the text.

in power supply circuits to provide proper voltage for plate and screen and bias circuits. We used the required amplitudes of voltage and current in the circuits to calculate, by means of Ohm's and Kirchoff's Laws, the values of resistance to be used. A "Volt Box" divider is somewhat different in that we are going to use a ratio of resistances, one to another so that within certain limitations we can divide one voltage by some constant. Let us examine fig. 4.

From equation (2) in fig. 4, the ratio of E_{AC} to E_{BC} (*E*in to *E*out) can be chosen to suit your needs. The ratio will determine the values of R_1 and R_2. However, you should consider the loading effect on the measured circuit[1] and choose an "ohms per volt" that best suits your needs. Remember that the resistance between points *A* and *C* will be in parallel with the circuit being measured.

So, let's establish a ratio of 10:1 for E_{AC} to E_{BC}. Then R_1 will be one tenth the value of $R_1 + R_2$. So if we choose a value of 10K ohms for R_1, then $R_1 + R_2$ would be 100K ohms and simple mathematics reveals that R_2 would be 90K ohms. Now the accuracies of R_1 and R_2 are important, but the ratio of the two will determine the division and hence will be a limiting factor on the accuracy of the over-all measurement system. So what is a practical approach to adjustment of the values of R_1 and R_2? The simplest and easiest method would be to purchase the resistors of the value chosen, making sure that we obtain the highest order of accuracy possible, such as $\pm 0.01\%$. This is expensive! Let's reduce the cost. Remember we really are more interested in their ratios rather than in their accuracy. Therefore let's buy a handful of $\pm 1.0\%$ resistors, with several each of the values calculated and a few that are 8 to 15 times greater in value. By using a bridge or some other convenient means of measuring resistance, choose those resistors that are equal to or higher than the nominal value. Then you can take the "much higher" values and parallel them with the nominal values to get the correct values for the ratio you desire. Since we're more interested in ratio than in nominal value, and since your measurement system will be common to all your measurements, any errors (inaccuracies) in your measurements and for all practical purposes can be disregarded.

A divider made of two resistors as in fig. 4 makes this adjustment reasonably simple. You start with R_1 and make R_2 9 times that of R_1. However, if we were to build a Volt Box as in fig. 5 you can see that our adjustment problem for R_3, R_4, R_5 and R_6 becomes more complex because of the need for maintaining the ratios between the resistors. Equation (2) still holds for the circuit in fig. 5. It will only be necessary to make substitutions for the terms within the brackets. For example, let us put the unknown voltage between points *D* and *C* and connect the Potentiometer across points *B* and *C* (and the Potentiometer is *always* connected across points *B* and *C*). Since point *D* is labelled "$\times 30$", we will multiply the reading on the Potentiometer by 30 to give us the unknown voltage, or, we will *divide* the input voltage by 30 to reduce it to a level measurable on the Potentiometer. Therefore the equation is changed to read as follows:

$$30 : 1 = (R_1 + R_2 + R_3) : R_1 \qquad (3)$$

As we proceed to points *E*, *F*, and *G* (to point *C*) for our input circuit we must add the additional resistor to the bracketed term in our equation. Now simple mathematical manipulation will determine the values for each of these resistors and I feel no need to solve the equations here. But you can see that it will be necessary to proceed on a cautious basis with the adjustment of each resistor in the chain so that we can maintain the accuracy of the ratios.

Since the maximum input to the Potentiometer is limited to approximately 2 volts, the

[*Continued on page 91*]

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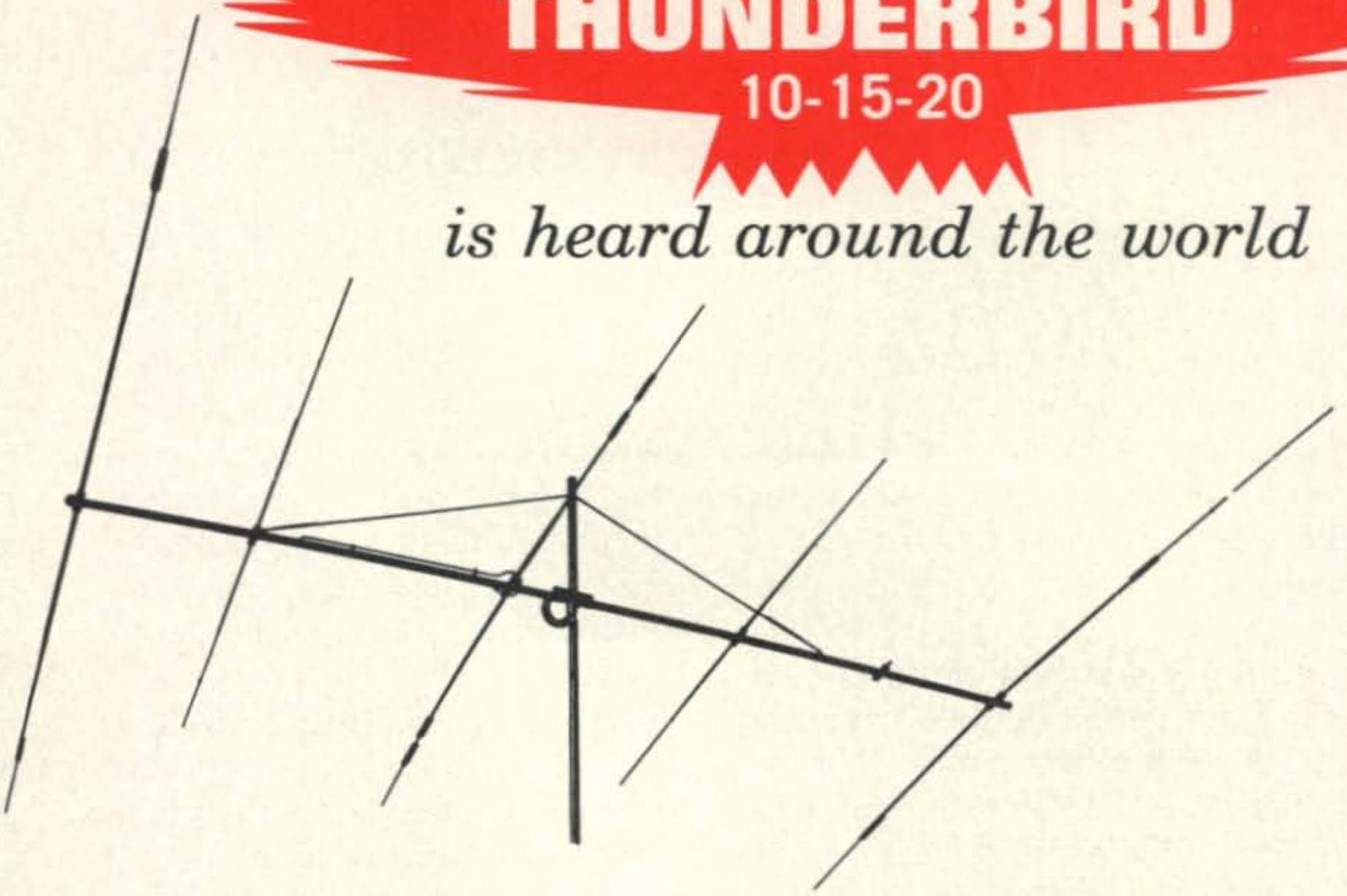

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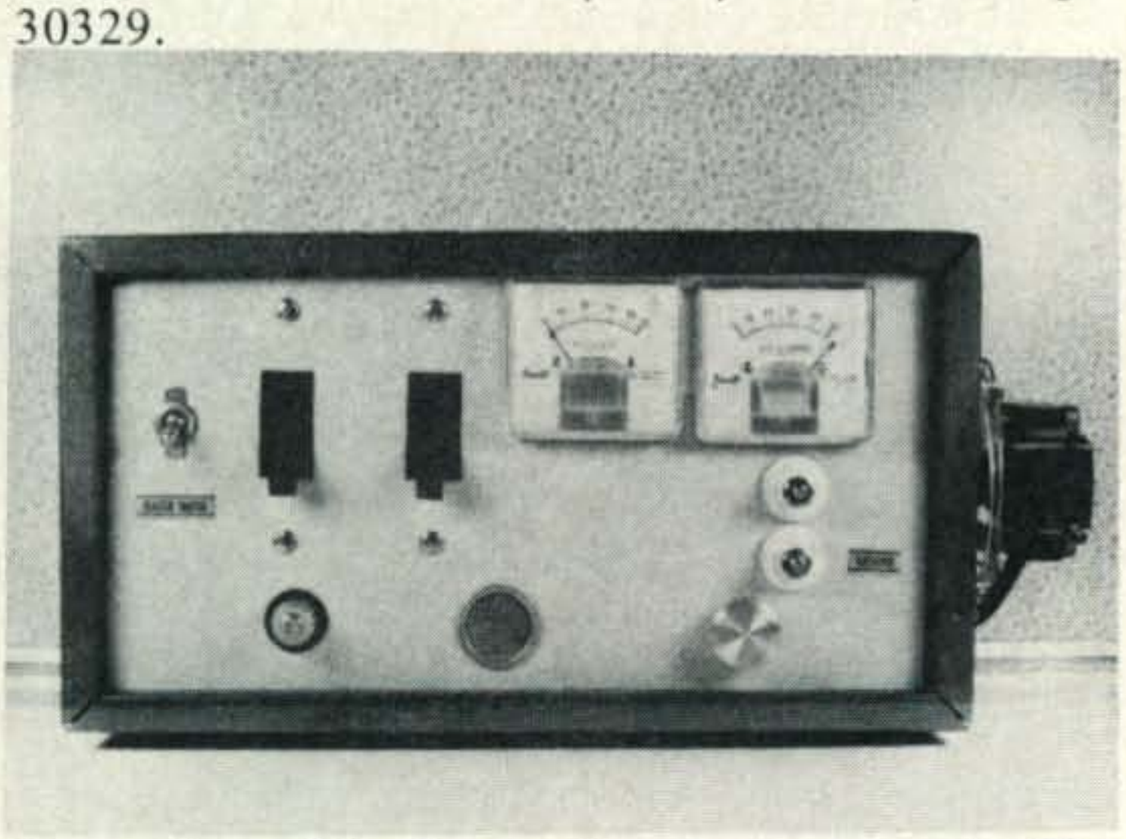
A HIGH CURRENT, LOW VOLTAGE, TRIAC CONTROLLED POWER SUPPLY

BY ROBERT C. ARP,* W5MMI

THE construction of a compact, d.c. power supply that can deliver 24 volts at 40 amperes or 12 volts at 80 amperes, variable, was made feasible by the introduction of the bidirectional triode thyristor. The availability of triacs with an r.m.s. current capability of 15 amperes, and with a voltage rating of 200 volts, made possible the direct control of transformer primaries to vary their secondary output voltage.

It had long been a desire of mine to own such a supply to power the multitude of surplus dynamotors, genemotors, motors, converters, inverters, and vibrator power supplies that I have accumulated over the years. Once constructed, the supply not only fulfilled this need, but also offered the incentive to take advantage of the many 24 v.d.c. surplus bargains still available. Because of it, I now have a.c. voltage at 400 and 800 c.p.s. available. Charging automotive batteries are a snap, and even sirens have found their way on the bench.

*1885 N. Druid Hills Rd., N.E., Atlanta, Georgia 30329.



Front view of the low voltage power supply. The toggle switch to the extreme left is the power On-Off switch. The two heavy duty toggles form S_2, used to switch from 12 volts at 80 amps to 24 volts at 40 amps. The meters indicate current and voltage. The two terminals below the right hand meter provide the output voltage. The knob below the terminals controls the triac to vary the output voltage. The blower can be clearly seen on the right end and one vent, for the triac, is located at the bottom center of the front panel.

The Triac Circuit

Because of the abundance of available material on semiconductor theory, I would only like to point out the characteristics and specifications that will allow the maximum amount of flexibility in choosing circuit substitutions, and in maintaining the triac circuit.

The RCA 40575 triac used in the phase-controlled circuit shown in fig. 1 is designed to block voltages of either polarity, and to conduct current in either of two directions, with positive or negative gate triggering. The maximum r.m.s. value of principal current that can be allowed to flow through its main terminals when the triac is in the on-state is 15 amperes. The current that flows through the main terminals of the triac is also the current that flows through the load. Furthermore, when the triac is in the on-state, the current through the main terminals is limited by the impedance of the transformers, T_1 and T_2, not by the impedance of the triac. The maximum instantaneous value of principal voltage that may be applied to the main terminals, without switching the triac into a conductive state, is 200 volts. The gate power that will switch the triac into a conductive state is between 15 and 80 d.c. milliamperes at voltages between 1 and 2.5 volts d.c.

The diac, which is the triggering device, is also a bidirectional semiconductor, and is able to turn on the triac during alternate half cycles of applied a.c. I have used two different types of diacs; the GE ST-2, and the TI-42. The GE ST-2 device seems able to trigger the triac more reliably when working the output of the supply into capacitive loads. RCA has recently introduced the 1N5411 diac, and Motorola has the MPT-28 and the MPT-32 available.

The RCA 1N1184A diodes were chosen to rectify the low voltage because I anticipated

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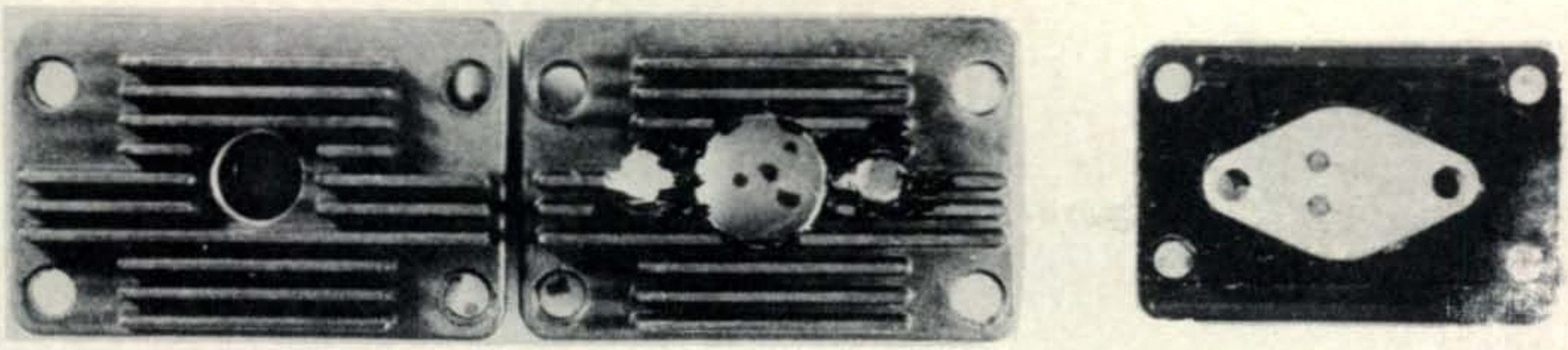


Left is a TO-5 heat sink as purchased from a surplus house. In the center is the same heat sink modiffied for the triac. On the right is the reverse side of the modified sink showing the triac in place.

enough use of the supply to warrant the cost. If, however, corners must be cut, I would recommend trying four of the John Meshna diodes that have at least average forward current rating of 40 amperes, and a peak reverse rating of at least 100 volts.

The operation of the triac circuit can be viewed by assuring an initial condition of zero current through the transformers, when 120 volts a.c./60 c.p.s. is present at the input of the supply, and R_1 equals 100K ohms. The voltage across trigger capacitor, C_2, is a sine wave of 17 volts r.m.s. amplitude, and the voltage across the transformers is zero. At this point the voltage across the diac is also 17 volts a.c., and the principal voltage across the triac is the full 120 volts a.c.

As the resistance of R_1 is decreased towards 65K ohms, the charge on C_2 increases to the breakover voltage, $V(BO)$, of the diac. When this charge equals $V(BO)$, the diac fires, lowering the breakover voltage of the triac and switching it on an initial conduction angle that is much less than 180 degrees. Because the time constant of R_1, C_1 and R_2, C_2 decreases as the resistance of R_1 is decreased, the triac is triggered at larger conduction angles as R_1 approaches zero ohms. When the triac is in on-state, its impedance is very low; therefore, when R_1 equals zero ohms, and the conduction angle of the triac is very close to 180 degrees during each half cycle, almost the entire 120 volts a.c. input is dropped across the relatively high impedance of the transformer primeries.

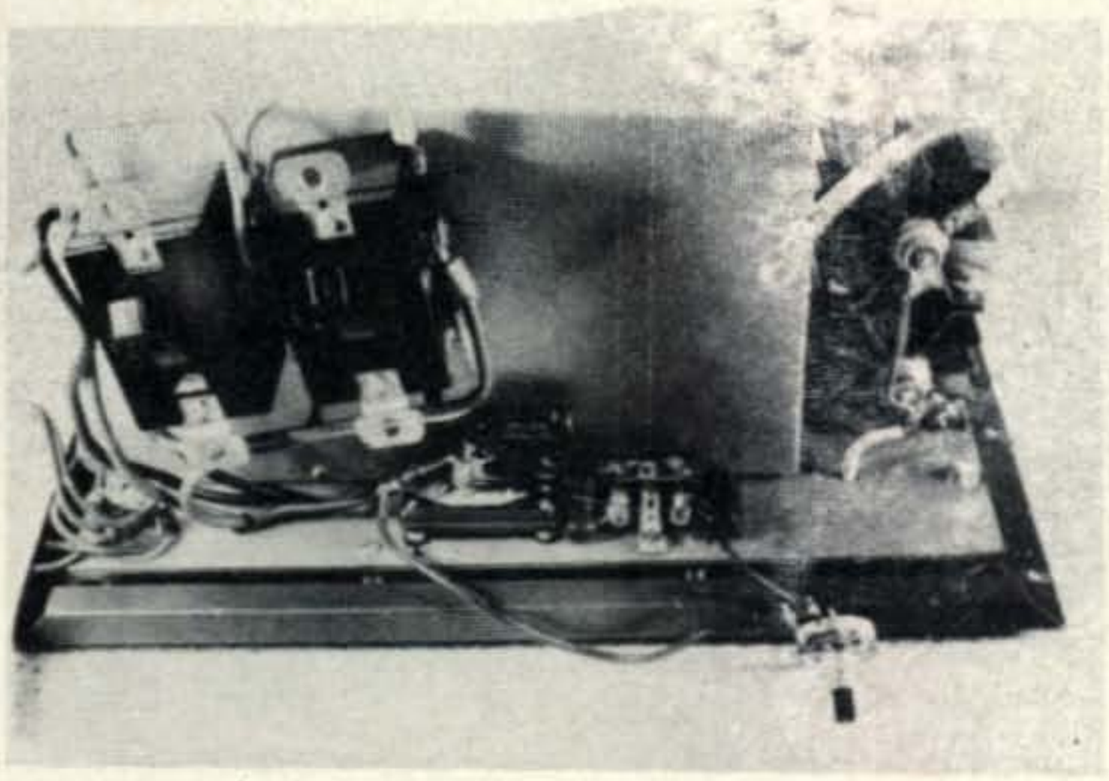
Control over the entire 360 degrees cycle is reliable because the charge on C_2 is partially restored each halfcycle by the larger charge on C_1. This restoration of the charge on C_2 allows the triac to be triggered at smaller conduction angles and assures that all conduction angles will be equal in magnitude.

The RC network, R_3-C_3, reduces the commutation dv/dt to prevent the instantaneous peak voltage that appears across the triac, when it is switched off, from retriggering the triac.

Therefore, by controlling the voltage across the primaries of T_1 and T_2, and by placing their secondaries in parallel or in series, by the use of S_2, the output of the supply may be varied, continuously, from 0-12 volts d.c. or from 0-24 volts d.c.

Construction

The power supply was constructed on a 11½ × 7 inch chassis cut from a Bud PA-1104 rack panel. Eight H.H. Smith #2122 threaded, brass spacers were mounted, two on each side-with countersunk screws-to support the chassis. The holes for the transformers, however, were cut first; then the spacers were mounted and finally the transformers. The 7½ × 7 inch piece of rack panel that was left over makes an excellent heat sink for another project, or, in a larger cabinet, for the triac in this project.



View of the low voltage power supply with the case removed. The two power switches on the left are S_2. The components in the center, in front of the transformers, are for the triac control circuit. The heat sinks on the right hold the four diodes for the bridge rectifier.

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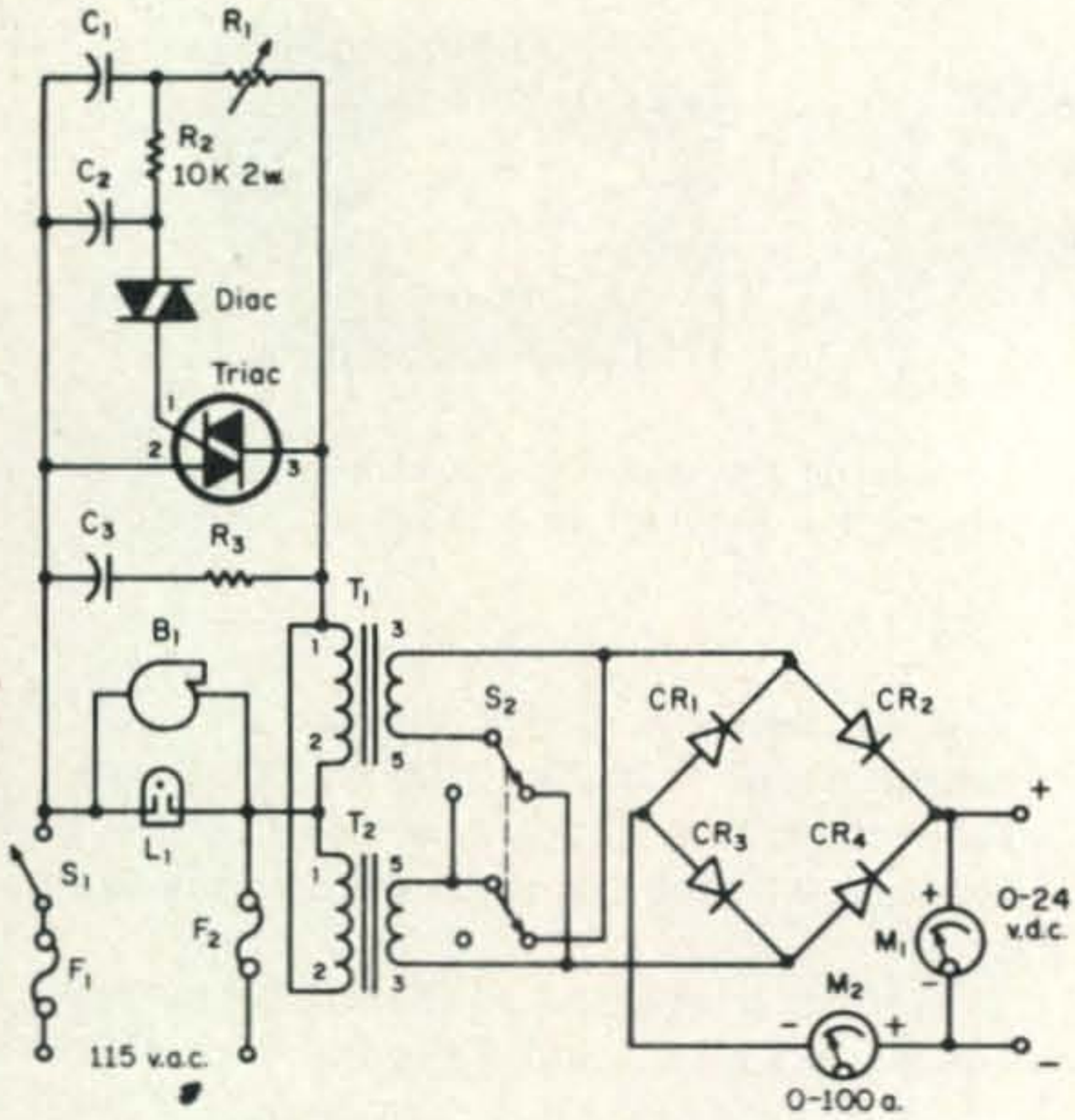

Fig. 1—Circuit of a high current, low voltage, triac controlled power supply. Switch S_2 is special and is described in the text.

BL—Blower, 100 c.f.m., 115 v.a.c.
C_1, C_2—0.1 mf, 200 v.d.c.
C_3—0.22 mf, 200 v.d.c.
CR_1, CR_3—1N1184RA.
CR_2, CR_4—1N1184A.
Diac—GE ST-2.
R_1—100K 1/2 watt linear taper.
S_1—S.p.s.t. 16 amperes at 125 v.
S_2—D.p.d.t. 40 to 80 amperes at 24 v.
T_1, T_2—115 a.c. to 12 volts at 40 amperes.
Triac--RCA 40575.

For the four rectifiers, two 3 inch long heatsinks were cut from Wakefield type 300 extrusion, which is 2 inches square. The actual computed heatsink for each diode was copper, 1/16" thick, 5" square for free air operation up to 149° *F*, or 4" square for forced air operation up to 167° *F*. Because the diodes have an $I_{F(AV)}$ rating of 40 amperes at 302° *F* case temperature, and a rating of 60 amperes at 212° *F* case temperature, and, because the blower blades are 1 inch from the heatsinks, liberties were taken.

Half inch deep holes were drilled into each end of both sinks and were tapped for the 1/4-28 threads of the diodes. One heatsink, containing the 1N1184RA (R indicating reversed connectors) diodes, was mounted directly to the chassis to the right of the two transformers. The other heatsink, containing the 1N1184A diodes, was fastened, with four screws, on top of the 1N1184RA heatsink-separated from it by 4 Wakefield type 103 teflon insulators.

A heatsink made for TO-5 style transistors (John Meshna #107) was modified for the triac. The heatsink, measuring 1 15/16" × 1¼", had eleven long rows of fins on one side and ten short rows of fins on the other. The seven innermost fins, on the side with the eleven long rows, were filed off with a medium size file, leaving this side smooth and flat, with four rows of fins. The center hole of the sink was enlarged to 1/2 inch. The triac was placed in this hole so that the two mounting holes could be marked and drilled. The triac was mounted to the sink, and the sink to the chassis-in front of the transformers-separated from the chassis with four H.H. Smith #2100 brass spacers, and insulated from it with eight GC #6525 fiber washers—one on each side of the chassis for each of four holes.

The maximum amount of current the triac should have to handle would be 7½ amperes for a full 24 v. at a full 40 ampere output. Because the triac has an I_{T}(r.m.s.) rating of 15 amperes at a case temperature of 158° *F*., and because even the largest dynamotor that I have, a GE model SD4889A with 28 v. at 19 amps input, has a no-load starting current of less than 50 amperes, and, also because of the method of forced air cooling the triac, there has been no failure due to excessive heat.

A transistor socket was plugged onto the gate and main terminal #1 of the triac. This socket, a #6 solder lug under one of the nuts securing the triac to its heatsink, and two H.H. Smith #864 terminal strips were used to mount all of the parts in the trigger circuit, except R_1, which was mounted on the front panel of the 7" × 13" × 8" Bud type MD-1960 cabinet, into which all of the above and below was jammed.

The d.p.d.t. switch, S_2, that is used to place the secondaries of T_1 and T_2 in series for 24 volt operation, or in parallel for 12 volt operation, must be able to pass so much current, that I found it easier to mount two switches and wire them in parallel. I was lucky enough to find two large switches in time, but I had planned to use two knife switches on top of the cabinet. To bring the output voltage to the front of the panel, two porcelain thru-panel insulators were used because of the large screws and nuts that can be used with them.

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A 0-50 d.c. ammeter was mounted on the front panel, above the insulators, and to the right of a 0-50 d.c. voltmeter.

The blower was taken apart and reassembled so that it could be mounted on the outside of the right side of the cabinet; the blades fitting part way through a 4¼ square inch hole cut with a saber saw. A 5 inch round speaker grill was placed over a 2¼ round hole cut into the left side of the cabinet.

To cool the triac, a Cinch #41-V screened plug, 1 inch in diameter, was mounted on the front panel directly in line with the triac.

Wiring

The two transformer primaries must be wired so that the secondary voltages are in phase. This can be done easiest before they are mounted by noting the numbers on the transformer taps, and temporarily connecting the transformer primaries in parallel, and their secondaries in series as shown in the schematic when S_2 is in the 24 volt position. While monitoring the secondary voltage, apply power to the primaries. If the voltage of the secondaries is not 24 volts, reverse the wires on one of the primaries.

For all of the wiring between transformer secondaries and switches or rectifiers, #10 solid wire was used. For all wires between the rectifiers and the thru-panel insulators or the ammeter, #8 stranded wire was used.

The diodes, CR_2 and CR_4, in addition to being electrically connected through their common heat sink, are connected by a length of #10 solid wire soldered to the lugs under their cathodes. In the same manner, CR_1 and CR_3 are connected by a length of #10 solid wire soldered to the lugs under their anodes. Reverse diodes were used for CR_1 and CR_3 so that straight wires could be run up from their cathodes to the anodes of CR_2 and CR_4.

For all other wiring, except the power leads, #18 zip cord was used. Two sets of power leads were made from #8 stranded wire. One set, for lower current operation, was made by soldering a number 8 solder lug on each of two ends, and by soldering two 50 amp battery clips on the remaining ends. For high current operation, a set of leads was made as above, but with two 100 amp battery clips on each of two ends.

INDICATION	POSSIBLE CAUSE
Output voltage cannot be lowered from maximum output.	1. Triac shorted in both directions. 2. Wiring error: main terminal #2 shorted to main terminal #1, or to gate.
Output voltage not present over most of the control range, but appears when $R_1=0$.	1. Diac shorted out. 2. Wiring error: diac not included, or wired incorrectly.
Problem above, accompanied by arcing in R_1.	1. C_1 shorted; R_1 probably destroyed but triac probably OK. 2. Wiring error: open main terminal #2 contact; R_1 and triac probably destroyed. 3. Wiring error: main terminal #1 shorted to gate; R_1 probably destroyed.
No voltage across transformer primaries.	1. Diac open. 2. R_1 open. 3. Wiring error: open circuit at R_1, diac, triac gate, or main terminal #1.
Ammeter reads upscale with no load on the output of supply.	1. Ammeter magnet destroyed by a short circuit across the output; fuses probably blown, triac probably OK. 2. Wiring error: short circuit in secondary circuits of supply.
No transformer secondary voltage to diodes, with voltage present at primaries.	1. Transformer primaries not in phase.

Table I—Trouble Shooting Chart.

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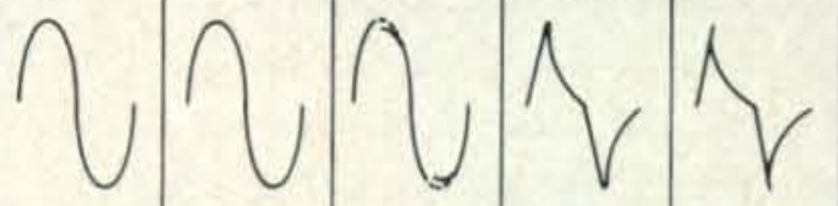
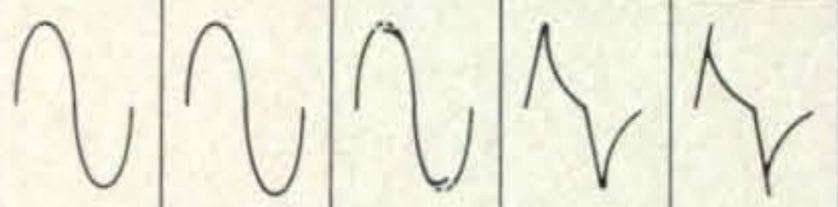
VOLTAGE WAVEFORMS					
R	100K OHMS	65K OHMS	64K OHMS	9K OHMS	0 OHMS
Ec	17 VAC	24 VAC	24 VAC	24 VAC	24 VAC
ED	17 VAC	24 VAC	24 VAC	24 VAC	24 VAC
EL	0 VAC	1.7 VAC	8 VAC	100 VAC	115 VAC
Ep	120 VAC	118.3 VAC	114 VAC	20 VAC	5 VAC
C					
D					
L					
P					

R = Resistance across R_1
C = Trigger capacitor C_2
L = Primaries of T_1 & T_2
D = The Diac
T = The Triac

Table II—Voltage waveforms in the triac control circuit.

Trouble Shooting

After completion of the wiring and testing, one of several problems might appear. The various troubles are listed in Table I with the corresponding causes.

Typical waveforms are shown in Table II and can be of help in locating difficulties.

Operation

In general, select the position of S_2 for 12 volt or 24 volt operation; connect the minus and positive power leads to the output terminals of the supply; then turn on the power switch. This will prevent arcing in S_2 and will reduce the possibility of an accidental short across the output terminals. If the output of the supply is shorted. It will demagnetize the ammeter magnet and blow the fuses in the plug.

Check the load for shorts *before* it is connected to the power leads. If there is any doubt, decrease the output voltage to zero (R_1 equals 100K) before connecting the load. Slowly turn R_1 to increase the output voltage, noting the ammeter reading. If the load is not shorted, rated voltage should show on the voltmeter before a 50 amp reading on the ammeter is reached.

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Have You Mumble-itis?

BY DON F. E. FOX,* WB2OYF

How many times have you heard it? "Sikew–sikew–sikew. Dis is dubbaya bee tree zee un us. Cholly–Murray–Sittle, callin sikew. C'mon, pule-e-e-z"

"Tanks fer de shout, dubbaya bee won ul kay dubbaya. Dis is dubbaya bee tree zee un us. Da hannel here is Dev–Dever, abul, Vaginny, igul. Yur sinnul here is kew-five; vurry gud, yanowaddameen?"

First, before we translate, let me apologise to the real WB3CNS... if there is one... for taking his name, or call, in vain. It was snatched out of thin air as an example of how any call can be clobbered by sloppy enunciation and bad diction. We could have used nearly any other call just as well.

Let's see what "dubbaya be tree" is actually saying and try to find out why it comes out the way it does.

As you have already guessed, "sikew" is really CQ. The "Dubbaya bee tree" is WB3. "Zee un us" is his way of saying CNS. Even his phonetics fall victim. His "C" is supposedly cleared up by "Cholly" for Charlie; a mumbled "um" for Mary, pronounced "Murray"; and an "us" for S, as proved by his "Sittle" for Seattle, leave us nearly as far at sea as we were before his version of

The "c'mn, pul-e-e-e-z" shown he is a close relative of the c.w. operator who stretches out the final K when looking for a reply to a CQ. The balance of the transmission is understandable if you say it without moving your lips at the same time that you hold your jaks completely rigid.

Think we are overdoing our example? Fortuneately, yes. But there are enough hams who abuse the ears of their listeners to justify these few words on the subject of proper enunciation. The sad part is that the worst offenders seldom know that they are doing something wrong. If you get many requests to repeat what you say, better beware. You may be a mumbler.

Of course, hams aren't the only ones on the air who are guilty of sloppy diction. Some of our ex-athletic stars who have had a retread and blossomed out as highly paid network commentators and announcers can't be bothered to speak either the King's English or even good American. Just for fun, listen to the broadcast station announcers who insist on pronouncing the twenty-third letter of the alphabet as "dubbaya" instead of the correct "doublet-you". In the case of some, it's ignorance... or lazy jaws; the rest, sloppy enuncia tion.

Is there anything the average ham can do to improve the quility of his diction? Certainly there is. Practically every public library has excellent books on the subject of proper speech and the training of the speaking voice. For those unable to get to a library, here are a few simple exercises which can do a lot to loosen up the facial muscles and make for better enunciation.

Easiest, and among the most effective lip and tongue exercises is to make yourself speak understandably while biting on a half inch dowel. Say the Gettysburg Address (out loud) slowly, intelligibly, and repeatedly. You'll find yourself using muscles you never knew you had.

Now clench your teeth, without the dowel, and say it all over again, several times. Be sure you are speaking understandably. For variety, open your mouth as far as it will go and try to say it again.

Drop your lower jaw and let it relax...sort of flop around, if possible. Try the Address abain. Of course, you will sound silly, but don't worry; you are giving some lazy muscles a good work-out. There are dozens of other exercises in the books on speech. They are all aimed at getting you to use your facial muscles to best advantage when you speak.

One of the best things you can do to improve your diction is to get a copy of "The Cataract of Ladore" by Robert Southey. Read the entire poem out loud, being careful to enunciate EVERY syllable. Do it again... and again...and again...and again. Deliberately over-enunciate! Bite off consonants! Practically spit out each syllable until you

[*Continued on page 89*]

*10 Amy Ave., Utica, N.Y. 13502.

10-Meter Anomalous Propagation With Australis-OSCAR-5

BY K. J. DOYLE,* WA2QMC

While the majority of Australis OSCAR 5 reception reports were of a relatively predictable nature, some of the more exotic tracking efforts produced unusual results. These "anomalies" open wide new areas for speculation and investigation among amateur space enthusiasts. The article below describes one tracking group's observations.

THE launching of Australis OSCAR 5 on January 23, 1970 signaled the start of a seven week investigation into the strange propagation phenomenon known as antipodal reception. NASTAR, the Nassau Amateur Satellite Tracking Astronomy and Radio society, under the direction of Ken Doyle, WA2QMC and Jesse Wagner, K3GKB/WA-2UYF, successfully tracked nearly one half of OSCAR 5's nearly 600 functional orbits. Approximately one hundred cases of anomalous propagation were recorded on 29.450 mc. While a detailed analysis of these phenomena will take many months to complete, several preliminary findings are presented here.

Antipodal Propagation

Antipodal propagation is the sudden reappearance of a satellites signal when it is at a point approximately at the other end of the earth from the observer.[1] The phenomenon was first reported by W5LFL on the early Sputnik transmitters which operated in the 20 mc and 40 mc regions. Upon further investigation, the authors discovered several other amateurs who had likewise copied strange "ghost" signals from the Sputnik transmitters and had kept accurate logs of these unusual events. These logs are now at NASTAR and will undergo detailed computer analysis along with the antipodal data from Australis OSCAR 5 in a effort to determine if the observed phenomena are similar.

To date, no satisfactory explanation as to the cause of antipodal propagation has been given. One theory states that it is basically a scattering phenomenon with the satellite's signal being radiated in every direction and converging at a point exactly on theother side of the earth. If this were the case, however, one might expect to observe a signal with a very great amount of frequency disperation, that is, the width of the antipodal signal received by the observer should sound rough or fuzzy and be considerably wider than the signals received when the satellite is overhead. The width of the signal should be approximately equal to the maximum Doppler excursion observable on a direct overhead pass since, the observer would "see" all possible satellite velocity vectors.

However, antipodal reception of the OSCAR 5 signal was observed from only two directions, North and South. Signals coming over the North pole were characterized by rapid flutter and varying amounts of frequency dispersion. Doppler shift measurements indicated that the satellite was moving away from us at approximately its maximum orbital velocity. The frequency dispersion varied from 20 to 70 c.p.s. suggesting multipath

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

[1]Soifer, R. "Antipodal Reception of Oscar Signals," *QST*, Nov. 1968, p. 32.

Jesse Wagner, K3GKB/2 checks the Mansanto chart recorder during OSCAR 5 pass.

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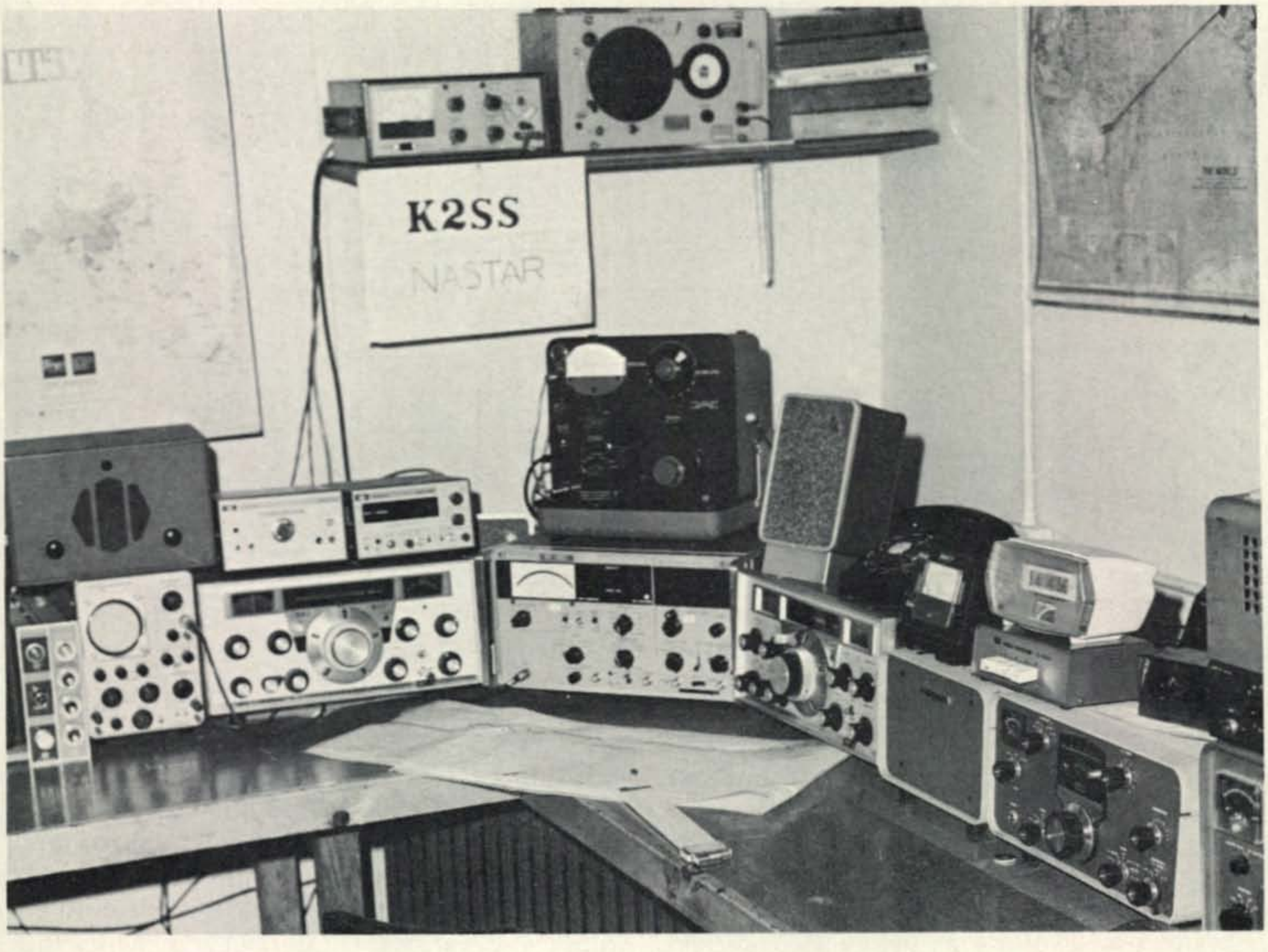

Overall view of NASTAR's 10 m. tracking station.

effects as the satellite's signal passed through the North polar auroral region. Signals were also noted coming from the South simultaneous with those from the North. However, no flutter or frequency dispersion was noted. Signals from other directions were not heard during any of the antipodal anomalies recorded at NASTAR. It is also interesting to note that in every case, antipodal reception was observed during local daylight hours and although an extensive search was made for antipodal signals during nighttime hours, none was observed.[2]

Multipath Propagation

At least one very unusual phenomenon was observed on orbit 381. Australis OSCAR 5 passed to the west of NASTAR and was only a few degrees above the horizon. At AOS (aquisition of signal) the signal was clean with no frequency dispersion or flutter. However, shortly after AOS, flutter began followed a minute later by a small amount of frequency dispersion. The dispersion became progressively worse until one minute to LOS (loss of signal) when two distinct signals appeared, relatively free from frequency dispersion and both below the satellite's true frequency. (The latter point indicates that both signals were moving away from us.) The signals were spaced approximately 100 c.p.s. apart. This suggests the existence of two separate signal paths from the satellite. One

Closeup of business end of 10 m. tracking station.

[2]It should be noted here that term "antipodal" is used only to describe an observed phenomenon. This phenomenon may or may not be the same as that to which the term was originally applied. Comments from other observers are invited.

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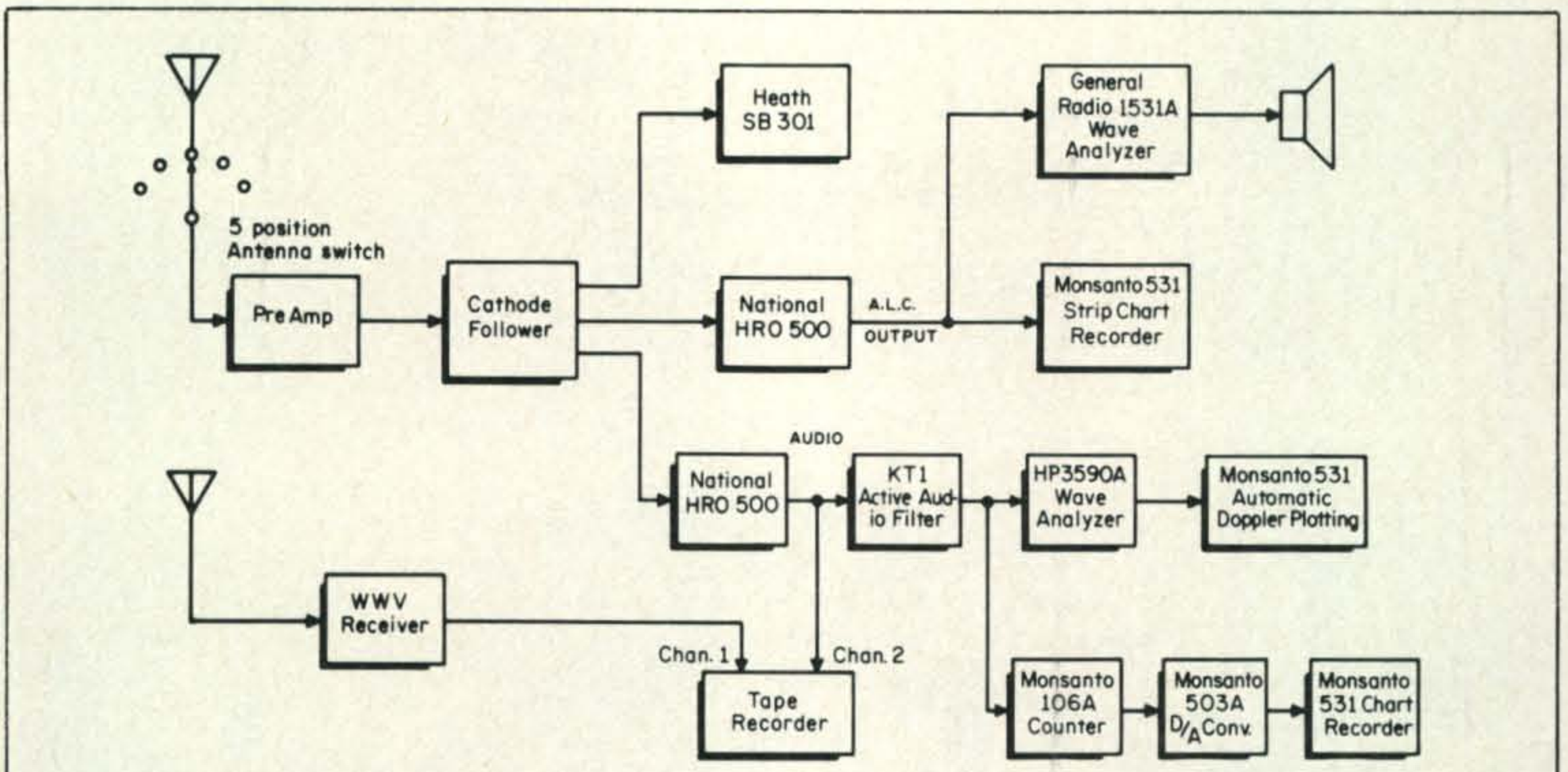
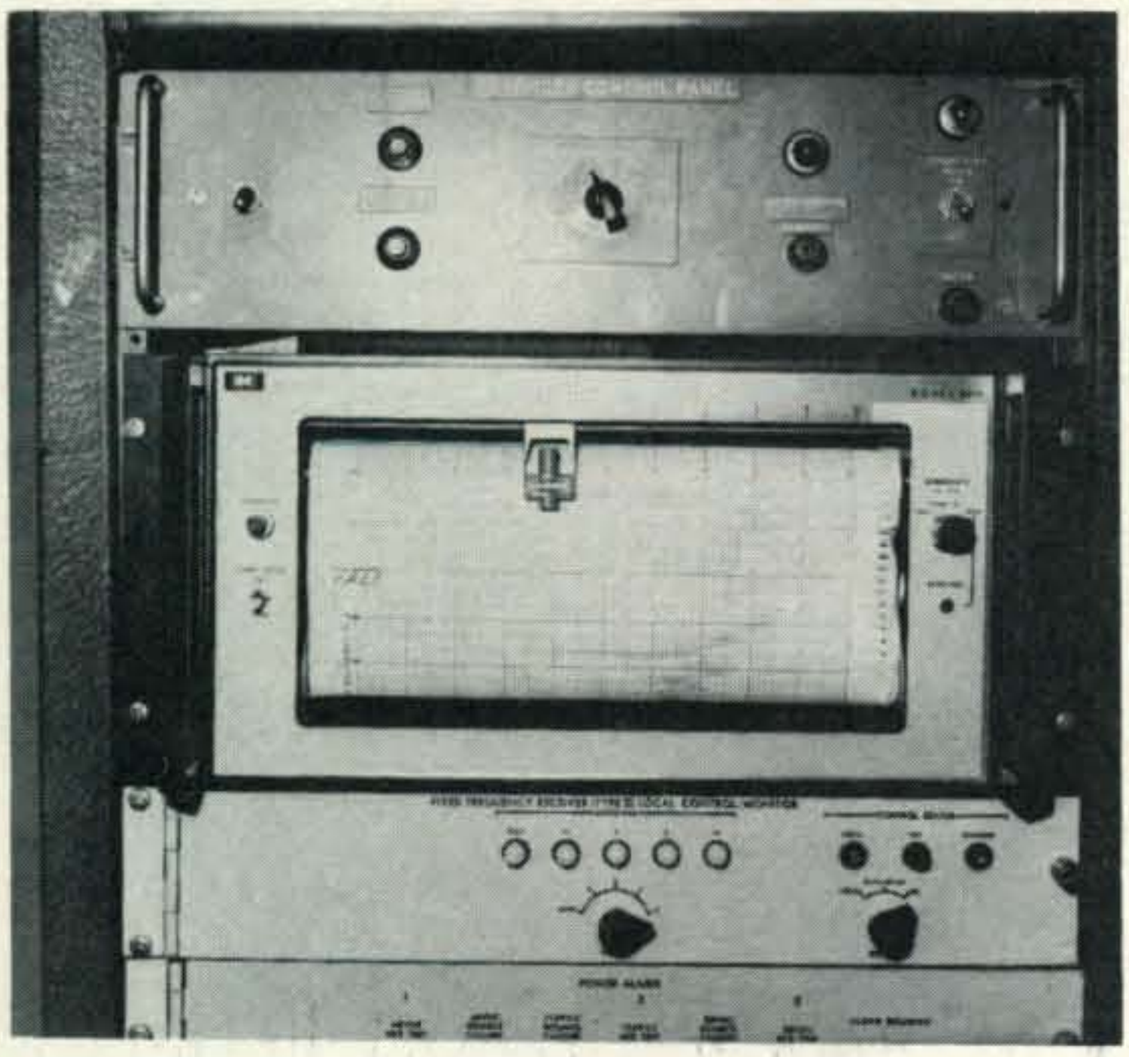


Fig. 1—Block diagram of NASTAR's 10 m. OSCAR 5 satellite tracking and recording installation.

path appears to have been direct while the second apparently followed a somewhat longer path perhaps curved toward the pole.

Other Below The Horizon Phenomenon

Many observations of below the horizon phenomenon were made. These consisted of two distinct types: Pre-AOS and Post-LOS phenomenon. The former occurred between 5 and 25 minutes before real AOS, that is, before the satellite actually comes up over the horizon and the path becomes essentially line of sight. The majority of Pre-AOS anomalies occurred during local daylight hours with signals free from flutter, and frequency dispersion. Some two-meter Pre-AOS anomalies were also noted although they usually occurred a few minutes before real AOS and lasted usually less than a minute.



Closeup of the Monsanto Chart recorder during an OSCAR pass.

The Post-LOS anomalies were more interesting and varied. These occurred when the satellite passed below the radio horizon and only during local daylight hours. The signals are characterized by rapid flutter and varying degrees of frequency dispersion. In general, the frequency dispersion was much greater than that observed on antipodal signals. The degree of severity depended upon the amount of auroral activity, a point which we will discuss more fully later.

Often, the Australis OSCAR 5 signals were readable for periods upward of one hour, measured from the time the satellite crossed above the radio horizon in the south to the time we lost all contact. Approximately 20 minutes of this time represents the time the satellite was above the horizon, while he rest represents a Post-LOS anomaly. This continuously readable signal usually occurred on overhead passes. At other times, the signal would drop out at the expected LOS time and reappear 5 to 12 minutes later, remaining above the noise for periods approaching 40 minutes or longer. During this time, several distinct signal peaks were observed occurring at regular intervals of 6 to 7 minutes. This strongly suggests that the satellite was spinning about its "X" axis, slowly rotating its dipole antenna. If further analysis shows this to be the case, this information should be of

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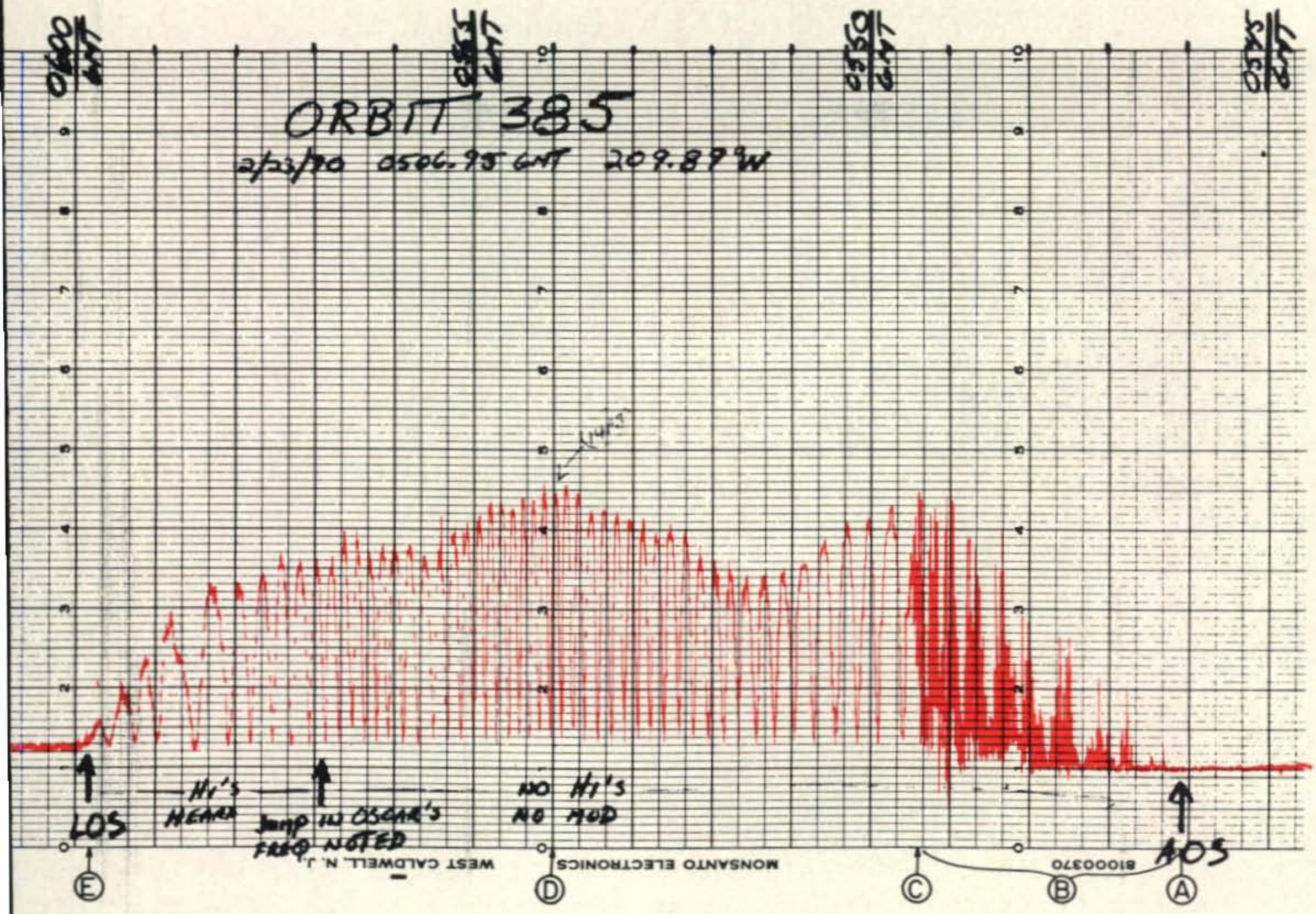

Fig. 2—Typical OSCAR 5 signal-strength-vs-time chart recording. The circled letters indicate: A—Aquisition of signal (AOS) B—Erratic signal flutter caused by auroral activity; C—Sudden end of auroral flutter; D—Time of closest approach (TCA); E—Loss of signal (LOS).

extreme interest to the designers of the Magnetic Attitude Stabilization System (MASS) experiment carried aboard the Australis OSCAR 5 spacecraft.

Auroral Mapping Via Satellite

A review of several hundred chart recordings made of the satellites signal strength reveals a distinct period of auroral flutter during each observed orbit. The flutter is caused by rapid absorption or reflection of the 29 mc OSCAR signal as it penetrates the north polar auroral region. Thus, by watching the severity of auroral flutter, it is possible to map the geographical point on each orbit where the auroral activity begins. During the seven week lifetime of the Australis OSCAR 5 satellite it was noted that auroral activity started at latitudes extending from 60° to below 40°N. On the morning of March 7, 1970, the day of the total solar eclipse observable from the East coast of the United States, WWV's GEO-ALERT bulletin predicted magnetic storm activity. It was noted that auroral fluter on OSCAR's signal began at approximately 17°N latitude! There was probably a fine auroral opening on the v.h.f. bands. NASTAR would like to receive any reports of v.h.f. auroral work during the period extending from January 23 to March 10, 1970. Such data would

Ken Doyle, WA2QMC, plotting the next pass of OSCAR 5.

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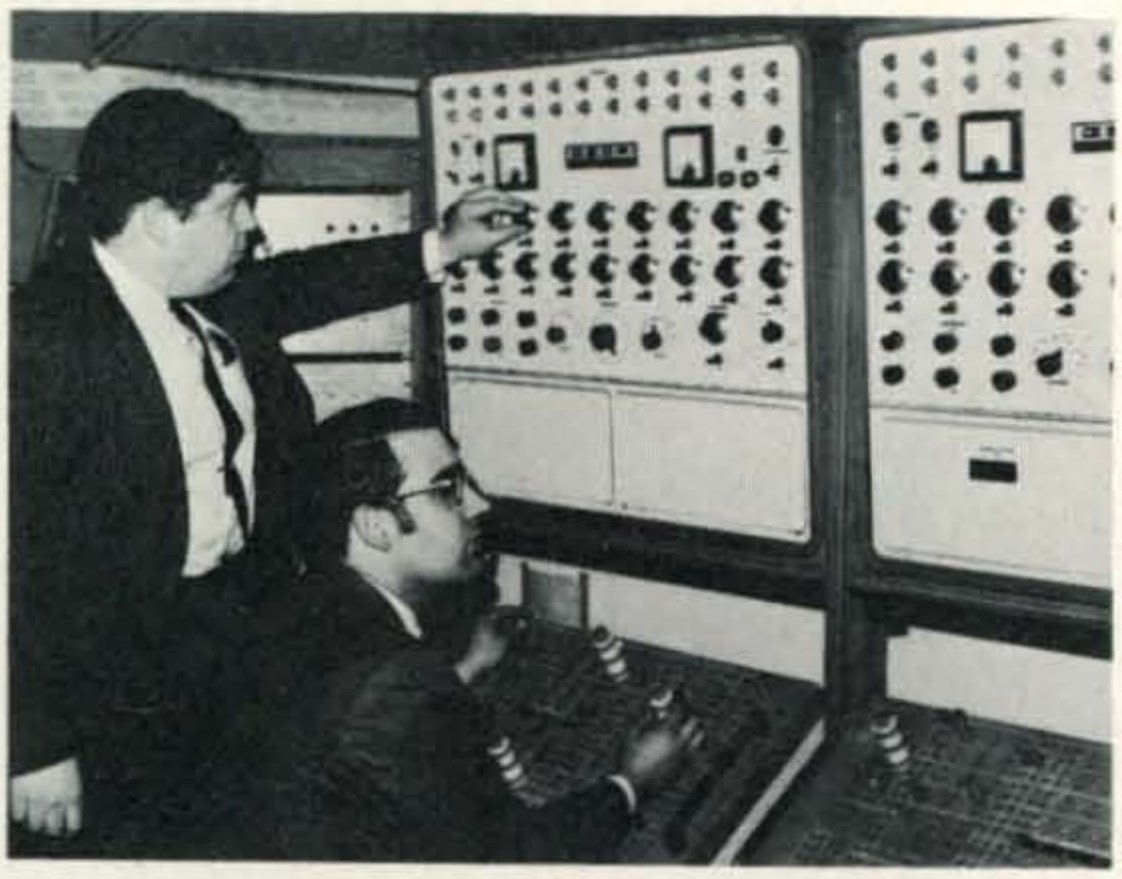


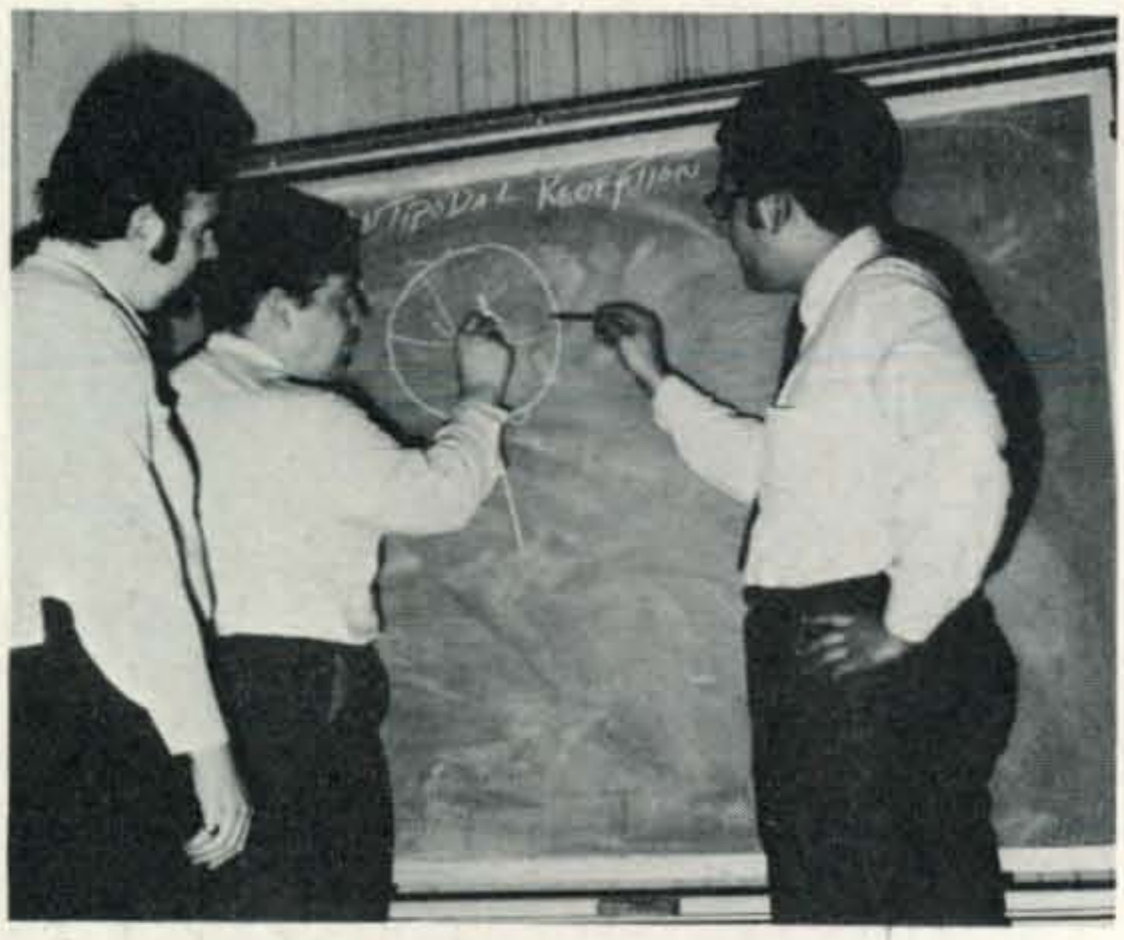
WA2QMC and Jesse Wagner, K3GKB/2 (seated) checking the analog computor real time telemetry reduction.

be very helpful in our analysis of auroral effects.

Station Equipment

To carry out this study and to obtain detailed records of propagation phenomenon, it was realized that it would be necessary to upgrade the already fine facilities at NASTAR with several specialized instruments. After a very careful search of available literature, several manufacturers were contacted and were requested to supply equipment to NASTAR for the duration of the satellite's lifetime. The response was overwhelming. Most manufacturers not only loaned their equipment but donated it to the organization for use on Project Moonray!

A simplified block diagram of the 10 meter OSCAR 5 tracking station at NASTAR is shown in fig. 1. The heart of the system was a pair of National HRO-500's. The a.g.c. output of one of the HRO-500's was used to drive a Monsanto 531A strip chart recorder to provide a permanent reord of OSCAR's signal strength. A General Radio 1531A wave analyzer/active audio filter with a 6 c.p.s. bandswitch was used to identify the satellite signals. This was necessary since the only means of identifying the satellite signal was by a 5 c.p.s. carrier frequency shift during HI identification.



Ken Doyle, WA2QMC (center) explaining to Walter Goldenberg, WN2MHZ and Jesse Wagner, K3GKB/2 (right) the finer points of antipodal reception.

Because of its extreme frequency stability, the second National HRO-500 was used for Doppler measurements. The receiver was tuned to 29.448 mc at a bandwidth of 2.5 kc. The receiver frequency was determined by reading out the heterodyne oscillator, tuneable oscillator and b.f.o. frequency outputs at jacks provided on the HRO-500 with a Monsanto 101B, 50 mc counter. Accuracies of 0.1 c.p.s. were possible. At AOS, the satellite produced a beat note of approximately 2.5 kc which slowly drifted downward as the satellite approached us. The beat note fed through a Kinetic Technology, Inc. tuneable active audio filter model SB53-3 to reduce the overall noise. The signal was then fed into a Hewlett-Packard 3590A/3594A wave analyzer. The HP unit is equipped with a 10 c.p.s. bandwidth filter which automatically tracks an input signal. A built in frequency counter displays the tracked input signal to an accuracy of ± 1 c.p.s. It also provides a d.c. output proportional to the input frequency that was used to drive a second chart recorder for fully automatic Doppler plotting! A backup automatic Doppler recording system was also available that measure frequency rate, df/dt rather than absolute frequency as did the HP unit. This consisted of a Monsanto 106A reversible counter and a Monsanto 503A Digital to Analog converter. The output of the D/A converter was connected to a third chart recorder.

A 4-channel stereo tape recorder was used to record both the satellite signal and WWV time signals for future analysis. However most analysis could take place in real time with the setup described. A Heathkit SB-301 was used for general work.

The antenna farm consisted of a 4-element 10 meter Cushcraft yagi optimized for 29.450 mc atop an 85 foot telephone pole. A specially designed 8 element wire yagi was

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DX

BY JOHN A. ATTAWAY,* K4IIF

THE award's program is taking a breather this month so there isn't any Honor Roll or listings of new certificates issued. The WPX files and S.S.B. DX Award files are in transit to Jerry Hagen, WA6GLD, so these programs are temporarily out-of-service. WAZ cards are still being received at this QTH, but due to major surgery in the family there hasn't been an opportunity to check them out. Hopefully everything will be back on schedule next month.

XW8CS QSLs

It is reported that VE6AO, QSL Manager for XW8CS, has been quite ill and a large backlog of cards has accumulated. He hopes that a group of VE6's will come over this spring and help him get the cards up to date. *(Tnx K4OLQ).*

Info for CQ DX Award Chasers

The following data should help you work some new zones, prefixes, and countries. Of course, past times and frequencies of operation by a DX station are no guarantee of his future habits. Serious DXers wishing the latest information should subscribe to one of the weekly or biweekly DX publications. Those now received by the DX department, with the call of the editor or publisher in parentheses, include *The DXers Magazine* (W4BPD), the *Long Island DX Association Bulletin* (W2GKZ), the *West Coast DX Bulletin* (WA6AUD), *DX-Press* (PAØTO), the *North Eastern DX Association Bulletin* (K1IMP), *DX-MB* (DL3RK), and *Long Skip* (VE3DID).

Activity from the Rarer Zones: Zone 23: JT1KAA, 14052 kc at 0050 GMT, 14015 kc at 0123 GMT, and 140 kc at 0500 GMT; JT1KAF, 14026 kc at 0143 GMT; JT1AL, 14045 kc at 0600 GMT; JT1AM, 14027 kc at 0120 GMT; UA9VH/JT1, 14202 kc at 0100 GMT; UKØYAA, 14020 kc at 0142 GMT; and UAØYT, 14044 kc at 0320 GMT.

Zone 24: BT1PK, 14028 kc at 0100 GMT, QSL to P.O. Box 427, Peking, Peoples Republic of China; VS6DO, 3895 kc at 1330 GMT; VS6DR, 14210 kc at 1630 GMT; and VS6EA, 21300 kc at 1440 GMT.

Zone 34: Su1AM, 14242 kc s.s.b. at 1800 GMT; SU1MA, 14205 kc s.s.b. at 0300-0400 GMT.

New and Rare Prefixes: AX—This special Australian commemorative prefix is in wide use. Everyone should have AX1—AXØ confirmed by the end of 1970.

HG—HG is a VHF prefix in Hungary. However, since 10 meters is considered VHF there many DXers work this prefix. HG2RD has been active near 28510 kc at about 1400 GMT.

HO—Panamanian stations used the HO series, instead of the normal HP, between Feb. 20 and March 14 to commemorate the XI Pan American games.

HT—HT1MG (YN1MG) advises that the HT series is in use in Nicaragua to celebrate the 25th anniversary of the radio club there.

IRØ—The Roman stations are keeping this one busy. Everyone should get it confirmed this year.

JX4—JX4YM is active from Jan Mayen. QSL to LA-bureau.

On the left is Alen Otway, 8P6AH, who operated VP2DAN, and on th right Pat Toppin, 8P6AZ, who operated VP2DAO. Their operation was during the October, 1969 CQ Worldwide DX Phone Contest. *(Photo courtesy VE3DLC).*

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

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One of the hottest prefixes around now is IRØ, marking the 100th anniversary of Rome as the capital of Italy. Tony, IRØIJ, operating, and Tony, IRØJX, are 2 of the chaps keeping things busy. In 1971 they will be I1IJ and I1JX again.

RA1–RAØ, RB5, etc.: The USSR is now assigning calls in this series to its VHF operators. As 10 meters is also considered vhf there many RA's are being worked by DXers on 28 mc.

UK–USSR club stations now use UK prefixes so UK1-UKØ should be in your logs soon.

WE4–WE4SUN was a special one day station during propagation measurements for the solar eclipse March 7. It was operated by the Georgia Southern College Radio Club in cooperation with the college's Dept. of Physics.

YT–YT calls are being assigned to amateurs in YU-land (Yugoslavia).

8QØ–8QAYL counts as 8QØ for WPX.

Rare Countries on S.S.B.: AX9, Cocos-Keeling–AX9KY, 14250 kc at 1330 GMT.

CEØ, Easter Island–CEØAE, 14222 kc at 0300 GMT.

What could be more timely than a photo of Vlad Maymistow, UAØ-YT, of Kyzyl City, Tanna-Tuva in Zone 23. Vlad is handing out more Zone 23 QSO's than anyone else right now and he QSL's *very promptly* via the Bureau. This photo is courtesy of Harvey, W2-MLO, who works Vlad regularly on 20 meter c.w. with a dipole only 14 ft. above the ground.

CR4, Cape Verde Islands–CR4AD, 28639 kc at 1730 GMT.

CT2, Azores Islands–CT2AK, 14240 kc at 2100 GMT.

EA6, Balearic Islands–EA6AR, 28570 kc at 1452 GMT.

EP, Iran–EP2DA, 14235 kc at 1300 GMT.

FB8, Amsterdam & St. Paul–FB8ZZ, 14220 kcc at 0145 GMT.

FB8, Kergulen Islands–FB8XX, low end of 14 mc s.s.b. transceive, 1130 GMT.

FM7, Martinique–FM7WR, 14220 kc at 0145 GMT; & FM7WW, 28637 kc at 2130 GMT.

FP8, St. Pierre and Miquelon Islands–FP8-AP, 3798 kc, 2100 GMT.

FR7, Reunion Island–FR7ZW, 14245 kc at 0445 GMT; & 28600 kc at 1300 GMT.

FY7, French Guiana–FY7YR, 28581 kc at 1500 GMT.

HH9, Haiti–HH9DL, 14218 kc at 0100 GMT.

HV, Vatican–HV3SJ, 28640 kc at 1640 GMT and 3807 kc at 0610 GMT.

TU2, Ivory Coast–TU2CS, 14204 kc at 2200 GMT.

UI8, Uzbek–UI8CD, 14239 kc at 0345 GMT.

UJ8, Tadzik–UJ8AC, 14250 kc at 0440 GMT.

UL7, Kazakh–UL7JA, 14224 kc at 0415 GMT.

VK9, Norfolk Island–VK9NS, 14217 kc at 1245 GMT.

VK9, Christmas Island–AX9XI (VK9XI), 14263 kc at 1250 GMT.

VKØ, Heard Island–VKØHM, 14203 kc, at 0500 GMT.

VP8, Falkland Islands–VP8KD, 28558 at 2120 GMT; and VP8FL, 14218 kc at 0055 GMT.

ZD5, Swaziland–ZD5R, 28520 kc at 1730 GMT.

ZK1, Cook Islands–ZK1AJ, 14315 kc at 1100 GMT.

ZP5, Paraguay–ZP5OI, 14242 kc at 0250 GMT.

3A, Monaco–3A2CQ, 14230 kc at 1220 GMT, & 3A2CC, 14210 kc at 1530 GMT.

3V8, Tunisia–3V8AL, 28650 kc at 1650

9N1, Nepal–9N1MM, 14210 kc at 0220 GMT.

Amateur Radio in Germany

The following information was furnished us by Gerd Schnautz, DJ1QP, DX Editor of

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the German monthly amateur magazine *DL-QTC*.

"The history of ham in Germany could be said to date back to 1919 when the first applications for licenses were submitted. Unfortunately these early applications were turned down because of an 1892 law which made all communications a monopoly of the state. Some radio enthusiasts refused to be discouraged and operated for several years over the 200-450 meter range using callsigns of their own invention. About 1924 these unlicensed operations spread to the short wave bands as well.

"Subsequently several radio clubs were founded, and with a concerted effort succeeded in persuading the government to grant licenses for club stations. The clubs established their own rules to control operating procedures as there were still no formal laws governing amateur operations. In 1933 about 180 individual licenses were granted for the first time by the Nazi government to demonstrate ham radio progress in Germany.

"After the end of World War II many hams again operated without licenses. Those in the US occupation zone had the unofficial support of the US authorities. In 1949 a new amateur radio law became effective in the US and British zones. It was extended to the French zone in 1949, and to the Saar district (9S4) in 1957. In eastern Germany there were no licenses until 1953 when the first DM calls were issued.

"There are about 17,000 licensed hams in western Germany today, most of whom are members of the Deutscher Amateur Radio Club (DARC) through it's 350 affiliated local clubs. Most of the local clubs meet at least once each month.

"The most important DARC function is the QSL service. At each local club meeting the hams deliver their QSLs which are bundled and sent to the DARC QSL Bureau in Munich. The DARC Bureau then forwards them to other QSL Bureaus all over the world. In turn, the DARC Bureau receives all incoming cards, both foreign and domestic, and sorts them by a computer called the Wuppertal QSL Machine. The sorted cards are sent to the various local clubs for distribution at their monthly meetings. Hams who are not members of DARC can also obtain their cards through the Bureau by paying a small service charge.

"The DARC magazine is called *DL-QTC*, and I (DJ1QP) am DX Editor. We have three

George Blanarovicz, ex-OK3BU, is now operating from as VE3BMV. George was a consistent winner of CQ DX contests for OK-land and held every WPX certificate possible. He has set his sights on the VE6TP trophy in this year's WPX contest. Anyone needing a card from George's old calls, OK3BU, and OM3BU can reach him at P.O. Box 292, Don Mills, Ontario.

pages reserved for DX news, including contest results, RTTY, and awards. As the deadline prohibits the publication of up to the minute news in *DL-QTC* we also have a DX news-sheet, *DX-MB*.

"The old German law governing amateur operation allowed only two classes, A and B. In Class A a final tube with up to 20 watts plate dissipation was permitted, while in Class B up to 50 watts was allowed. Since 1963 we have a new law which is much broader and involves three classes, A, B, and C.

"Under the new law, Class A is permitted up to 50 watts plate dissipation, and after one year of creditable operation you can apply for Class B without another examination. Class B operators may run final tubes with up to 150 watts plate dissipation. Class C allows only very restricted operation on 2 meters with low power. No code test is necessary for Class C.

These interesting photos are of the XE-gang during there Dec. 16-18, 1969 DXpedition to XF4. *(Photo's courtesy K4DSN).*

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"The limiting of plate dissipation does away with the necessity for high voltage measurements. Consequently, it is easier for authorities from the Bundespost to make spot checks on amateur operations. The ham is allowed to choose a tube within the limitations of his license and make the best of it. His effectiveness depends on his own ingenuity and ability. There are clever hams who are able to run up to 2 kw PEP with their tubes within the limitations.

"Another paragraph of the new law, which will be of interest to W, K hams with TVI problems, says that in cases of interference the owner of the set receiving the interference must do everything technically and economically justifiable to screen his set. Only after this will the amateur be obliged to attempt a remedy.

"A German amateur must be at least 18 years of age and have no criminal record. He must pass a code test of 12 words per minute for three minutes, a technical examination, and a test of his knowledge of the regulations. He will then be allowed to operate A1, A2, A3, A3J, F1, and F3 in the 80-10 meter bands. There are special RTTY licenses and 160 meter licenses with a low power limit. These require a separate application. Reciprocal licensing agreements are in force with many countries.

"The most famous German DX awards is the WAE (Worked All Europe). It is available in three classes for contacts with the 60 countries on the WAE list. Other interesing awards include the DLD (Deutschland Diplom) for working German districts, and the EU-DX-D (European DX Diplom). The latter is issued on an annual basis and may be won each year. Complete rules and record books for these awards may be obtained from DARC."

QSL Information

AXØKW–Via VK7KJ.
CN8DW–To W6GZI.
CP1GN–c/o W9JT, 343 W. Windsor, Lombard, Ill. 60148.
CR9AK–Via CT1BK.
CWØAA–To W2GHK.
EA6AR–c/o DL7FT.
EL2CB–Via W2CTN.
EL7B–To W3BYY, RD-2, Hanover, Pa. 17331.
EP2DX–Signal Branch Box 1000, APO New York, N.Y. 09205.
ET3REL–W3GBE, 101 Kuethe Dr. Annapolis, Md. 21403.
GC3UML–c/o G3UML, 95 Collinwood Gardens, Clayhall, Ilford, Essex, England.
GC5AGA–Via K4II, 1018 Woodburn Rd., Spartanburg, S.C. 29302.
HK1BQR/4–To WA5UHR, 1510 Lynnview, Houston, Tx. 77055.
HR2GK & HQ2GK–c/o VE1ASJ, Box 51, Saint John, New Brunswick, Canada.
HS1ABO–Via K5QHS.
HS5ABD–Fred Laun (ex-HI8XAL), c/o U.S. Embassy, Bangtok, Thailand.
HT1MG–Mike Swink, P.O. Box 2988, Managua, D.N., Nicaragua.
KH6EDY (Kure Is., Jan., 1961-Dec., 1969)–KH6BZF, 45-601 Luluki Road, Kaneohe, Hawaii 96744.
MP4QBK–W/W/VE to K4MQG, others to MP4BHH.
OJØMI–c/o OH2ER.
OJØMR–Via OH2NB.
PJ9BB–To W2VIA.
PJ9GF–Via WB4GTS.
SVØWI/JY–c/o WA3HUP.
TA1AM–Via K4EPI.
TA1RT–To WA3HUP, 105 June Drive, Camp Hill, Pa.
TA2AE–Via DL7FT.
TA2SC–c/o WA3HUP.
TF5TP–Via DL7FT, 1 Berlin 47, Petunieweg 99, Germany.
TG9UZ–J.H. Carnett, Av. Las Americas 20-30, Zona 13, Guatemala City, Guatemala, C.A.
TI9CI–To TI2CMF.
TJ1AJ–c/o W4FRO.
TJ1AK–Via W4DQS.
TJ1QQ–To W4DQS.
VKØKW–c/o VK7KJ.
VP2AA–Via VE3GMT.
VP2DAJ–To WB4EFE.
VP2GRN–c/o W4YHB.
VP2VI–Via VE3ACD.
VP5CS–Keith D. Collins, RCA MTP, Ascension NCS, Patrick AFB, Fl. 32925.
VP7NF–To VE1ASJ.
VP8KD–c/o K2JXY.
W9FIU/KS4–Via W9FIU.
WE4SUN–To W4DQD, P.O. Box 2067, Ga. Southern Branch, Statesboro, Ga. 30458.
ZA1AB–c/o Radio Dept., Electric Polytechnical School, Tirana, Albania.
ZC4AK–Via WA2CMV.
ZD8DB–c/o WØEZT (Not via WØELT).
ZD9BP–To VE1ASJ.
ZL3AB–c/o W6ZHQ, 1505 Avolencia, Fullerton, Ca. 92632.
ZS2MI–Via ZS6LW.
5R8AS–To W6FQ.
5VZDB–c/o W4SPX.
6W8DY–Via VE4SK.
6W8XX–To F2XX.
6Y5ET–Via WB4EYX, 1730 Woodmere Dr., Jacksonville, Fl. 32210.
8R1U–c/o VE3DLC.
9J2RQ–Via WB2EXS.
9M8FMF–To W1YRC, 30 Rocky Crest Road, Cumberland, R.I. 02864.
9N1RA–c/o K6OE.
9Q5SE–To W4RNC, 8 Wilshire Drive, Asheville, N.C. 28806 (for June 1968-May, 1969 contacts).
9Y4RP–Via WA5MYR.
9Y4US–To K8NSA, 14416 Kennerdown Ave., Maple Heights, Ohio 44137.

73, John, K4IIF

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THE dwards PROGRAM

BY ED HOPPER,* W2GT

THE May, "Story of The Month", about Joe Ripp, WA9SKB after these commercials.

John McCaa, W4HA sent me a lot of statistics which qualified him for a USA-CA-2500 award endorsed All 14 mc A3A and a USA-CA-2000 award endorsed All 14 mc A3A and All Mobile 14 mc A3A.

A USA-CA-2500 award endorsed All 14 mc A3A went to Jack Brenner, WA2AMM and a Mixed 2500 award was earned by Ennis Royer, W3CDG.

A USA-CA-2000 award endorsed All A3A was awarded to Joe Ripp, WA9SKB. Mixed 2000 awards were issued to Jim Perry, K4-WVX (now portable 1 in Mass.) and to Don McCarthy, WA9PRE/WAØZZT.

Harry Okey, Jr. WPE6ETT hit the jack pot with USA-CA-500, 1000, 1500, and 2000 awards endorsed All Phone. Harry is the first s.w.l. from the 6th call area to apply.

Mixed USA-CA-1500 and 1000 awards went to Andy Lovelace, K4BXU, and Alex Ekblad, W2HI (ex-W2KIR).

Darrell Lemonds, WA6CCK won USA-CA-1000 and 500 awards endorsed All 14 mc A3A. Mixed 1000 awards were sent to Ted Lucas, WB2ISX and Clem Duval, K8HWW.

Pedro Marcano, YV7AV won a USA-CA 500 award endorsed All A3A. Matti Vuorela, OH6NH qualified for a USA-CA-500 award endorsed All A-1 and the first award to Finland, although I received the fee and a note back in November 1969 from Armas Hakkanen, OH2NQ who was sending his application, but it has not arrived.

Mixed USA-CA-500 awards went to Wilbur Lewis, KØOJG; Leif Lundin, SMØAJU; and the "M. Pupin" Radio Club, YU1BCD.

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

Joseph T. Ripp, WA9SKB

The County Hunting bug really hit Joe about March of 1969, but an interest in amateur radio goes back to 1920 when, at 13, with the help of one of the early amateurs, some home-brew equipment was built. An unfortunate accident happened to his mother some four years later and this cut short progress in the radio field.

In 1927 Joe was married and shortly there after started a correspondence course but when the big depression hit, this, of necessity, was dropped.

In 1956, appointment as Civil Defense Director for the City and County of Kenosha rekindled an interest in radio. Amateurs were organized and an Emergency Operating Center was planned, and at completion it was one

Home CD and County Hunting set-up at WA9-SKB.

USA-CA HONOR ROLL

2500		1500		500	
W4HA	66	WPE6ETT	128	YV7AV	768
WA2AMM	67	K4BXU	129	KØOJG	769
W3CDG	68	W2HI	130	WA6CCK	770
2000		**1000**		SMØAJU	771
W4HA	93	WA6CCK	190	YU1BCD	772
WA9SKB	94	WB2ISX	191	OH6NH	773
K4WVX	95	WPE6ETT	192	WPE6ETT	774
WA9PRE/WAØZZT	96	K8HWW	193		
WPE6ETT	97	K4BXU	194		
		W2HI	195		

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WCPR-50

of the better communications centers in the state.

In 1961 the City proposed a new police building with an Emergency Operating Center for all City and County Departments for use in *any* emergency. This center, with matching funds from the Federal Government, was completed in the new building basement in 1964.

Upon completion of this and other projects, it was possible (with the help of other local amateurs) to start some evening classes in radio theory. These classes have continued and Joe is proud to be able to announce that his 12 year old grandson received his Novice ticket in August of 1969.

With most of the planning and projects completed, except for updating, Joe now finds a little more time for operating. Most County Hunting is done on week-ends, some free evenings and the short period when home for lunch.

The radio shack is in one bedroom of a mobile home located in one of the local parks. Thus there is no space for a beam, but he is lucky to be able to have a 40 foot tower with a two-meter beam and a TV antenna atop it. A 14AVQ vertical is the antenna for County Hunting and it has done very well.

About the time you read this, Joe should have a Galaxy installed in his car and he hopes to give out some of the Wisconsin and Illinois Counties—his work does take him around these states.

Much enjoyment has been derived from County Hunting and Joe wants to express his thanks for all the help received and in return offers to fone-patch those in need of one to his area. He also wants to help with giving out some needed counties with that rig in his car. He also hopes to meet many of you in Knoxville, Tennessee July 4-5.

Our records show that WA9SKB was issued USA-CA-500 award #753 and 1000 #180 on October 25, 1969, both endorsed All 14 mc A3A Mobile. On November 17, 1969, 1500 #120 was issued for All A3A and on February 13, 1970 USA-CA-2000 #94, endorsed All A3A was sent to Joe.

Awards

WCPR and WACPR AWARDS: The International Amateur Radio Club of Geneva will award Certificates of Achievement to radio amateurs everywhere in recognition of the following achievements in amateur radio communications. *WCPR-50 AWARD* will be issued to any radio amateur who submits evidence of 2-way communication with another amateur radio station in each of 50 CPR Zones. Stickers are available for 60, 70, 75, 80 and 85 Zones. *WACPR AWARD* will be issued to any amateur radio operator who submits evidence of 2-way radio communication with one radio amateur in each of the 90 CPR Zones. All contacts must be made on or after April 1, 1968.

Endorsements will be given for Phone, CW, 2 × SSB, RTTY and Mixed Modes. A special endorsement will be given if all contacts are made by a Mobile station.

DO NOT SEND CARDS with application. A simple statement appended to your list of claimed Zones and witnessed by an officer of your local radio club or by two other amateurs certifying that they have seen the cards will suffice. I.A.R.C. reserves the right to ask that cards be submitted (Actually GCR). Contacts made and verified during IARC CPR Contest will not require cards. Contacts may be made by the same operator from any number of stations and/or locations, the award is given to the operator. Certificates will be issued free to blind persons. Others send U.S. $1.00 or 10 IRCs with application. For stickers please include s.a.s.e. or 3 IRCs. Apply to Custodian: Harry L. Whiting, W2-JXH, 20 Pocono Place, Holiday City, Tom's River, N.J. 08753, U.S.A.

Kim-Chi Award: This award is available again for working 5 HL9 stations. GCR Rule list applies, bonus Korean stamps. Yes, available to amateurs and s.w.l.s, send list, 10 IRCs or U.S. $1.00 to new custodian, William A. French, W2SRQ, RFD 2, Priest Road, Geneva, N.Y. 14456. *(There is no time limit).*

Lion's Head Radio Club Award: This award issued by the LHRC, P.O. Box 1167, Capetown, South Africa for contacts with club members. The call ZS1AB which was that of the, well known, late Barney Joel, is now assigned to the LHRC and Max Adler, ZS1ACD is the custodian of the station, so

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contacts with ZS1ACD can claim 2 contacts toward the award. I believe only 5 contacts are required for those in Zone 38 and 3 for others. Send application and 5 IRCs to LHRC to address above. Those in N. and S. America can obtain their QSL for ZS1ACD QSOs by sending QSL and s.a.s.e. to Ray L. Fansler, WA9UET, RR 3, Fairfield, Illinois 62837.

The Okinawa Award: Sponsored by the Okinawa Amateur Radio Club, is issued to both amateurs and s.w.l.s for proof of the following QSOs or reception of KR6/8 stations: 25 (for KR6/8); 10 (for BV, CR9, DU, HL/HM, JA/KA, KG6, VS6 and W/K); 5 for all others. The award is free and the QSLs do not have to be sent, however a standard GCR list must accompany the application to OARC, APO, San Francisco, California 96331, U.S.A.

Worked Afghanistan Radio Award: Available to all amateurs for working the necessary YA stations: YAs must work 6, other Asian stations must work 4, stations in Europe and Africa work 3 and all others must work 2 different YA stations. At least two bands must be used—for example one on 21 mc and the others on 14 mc. The QSLs must be submitted with application and 10 IRCs or U.S. $1.00. As soon as the application is checked, the award and QSLs will be returned air mail, if registered air mail is desired, send 2 extra IRCs. Contacts dated 1 January 1966 or later are OK. The award can be worked every year (with different stations). Apply to: Mr. Wolfgang Renner, P.O. Box 279, Kabul, Afghanistan.

Tokyo Fighting DX Club Award: Actually called **The Trans Pacific Award** will be issued to all amateurs or s.w.l.s who work (or hear) 10 countries facing the Pacific and Islands in it and contain Asia, N. America, Oceania and S. America (like HC, OA, W, VE, UAØ, HM, VK, KH6, BY, ZL, BV). Send GCR list and 6 IRCs to Shinshichi Shimizu, JA1QGC, T.P.A. Chairman, 2-6-6 Tairamachi Meguro-Ku, 152, Japan.

Notes

Thanks for the hard work by Abe Daniels, WA7EGL, an *Idaho County Award* should be available again and soon and probably in three classes. Also through Abe's hard work, a most beautiful QSL card has been prepared and are free of charge to Idaho hams through the courtesy of The Idaho State Commerce and Developement Department, Capitol Building, Boise, Idaho.

Kimchi Award

Although the 1969 CW County Hunter Contest got little publicity due to a change of sponsors, plus other complications, it appears that 302 counties in 48 states were active. Space does not permit listing all the winners, but among the high scorers were: K1ZFQ, WA2UJM, K4BAI/4, WA4FFW, WB4-KVE, K4OWE, KØQIX/M5, WA8APY/8, WA8USU, and glad that KZ5II and VE1AE joined in. CW County Hunters are invited and welcome to check into the CW CH NET. It meets on 14070 at 2000 GMT on Saturdays and on 7055 at 1600 GMT on Sundays and 0100 GMT on Thursdays. Also during our warmer months it meets on 14070 at 1400 GMT on Saturdays. News of special CW mobile trips is given on the Nets. Also such information and other data of interest to CW County Hunters is found in the *CW CH Newsletter* published by James E. Hoffman, K1ZFQ, 42 Gresham St., Milford, Conn. Cost is $1.50 per year.

In order to get the QSL you need, try using the County Hunter Reply QSL cards. *You* list *all* the data on the card and put a stamp and your address on the card or send along a self-addressed stamped envelope. Thus the other fellow just need to check it against his log and sign it and drop it in the mail box. Such QSL cards are printed and sold by John J. Brenner, WA2AMM, 162 Meisel Ave., Springfield, N.J. 07081. The cost is 500 cards for $3.50 postpaid, add 25¢ if you are west of the Mississippi River.

I'm sure Lee Hopson, WAØLIW was *surprised* and pleased to get that beautiful Plaque sent by Bertha, WA4BMC and Bud, K4AUL. Lee while operating mobile gave Bertha her #3079, Pitkin County and gave Bud his #3079, San Juan County.

Thanks to Henry Gepke, WA7HFG for sending a POD 26 to JA1ERB (who stopped in the middle of a contest to ask me to thank "GEP"), also a POD 26 to 9J2XZ as well as one to OH2NQ.

Thanks to Bill Sinkankas, WØHAO for sending along a POD 26 to SM7BUG.

[*Continued on page 92*]

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Apr. 1–	Dec. 31	Beam the Americas
May	2-3	OZ-CCA DX Contest
May	10	USSR Phone Contest
May	9-11	Georgia QSO Party
May	16-17	YL Inter. SSBers Party
May	16-17	World Telecomm. Contest
May	16-17	Michigan QSO Party
June	5-8	CHC/FHC/HTH QSO Party
June	13-14	ARRL VHF QSO Party
June	14-20	Massachusetts Radio Week
June	27-28	ARRL Field Day
June	28	WAB VHF Phone Contest
July	25-26	County Hunters C.W. Party

Beam the Americas

Starts: 0000 GMT Wednesday, April 1
Ends: 2400 GMT Thursday, Dec. 31

This activity has been organized by the "Partners of Alliance" to further friendly relationships between the Americas, and to encourage participation in the Partners program.

United States stations must contact 25 different stations in Central and/or South America. And conversely Central and South Americans must also work 25 U.S. stations.

All contacts must be of a 10 minute or more duration and any legal mode or frequencies may be used.

A certificate will be awarded for the first 25 reported, with endorsements for each additional group of 25 different stations, and may be submitted at any time.

There are special awards to the single operators in the U.S., Central and South America who submit a certified record of the greatest number of contacts made during the contest period, and must be received before April 1, 1971.

Your log must show the beginning and ending times of each contact, and also include a signed certification that all entries are true and accurate.

All entries go to: Ernest L. Bracy, W1BFA, P.O. Box 88, Readfield, Maine 04355.

OZ-CCA DX C.W. Contest

Starts: 1200 GMT Saturday, May 2
Ends: 2400 GMT Sunday, May 3

This is the 19th running of this contest by the E.D.R. of Denmark. It's a world wide type contest, with operation on all bands, 3.5 thru 28 mc. Both single and multi-operator stations are permitted.

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

Scoring: Each completed QSO is worth 3 points, however contacts with OX, OY and OZ stations count double or 6 points. Your multiplier is determined by the number of countries worked on each band. Call areas of W/K, VE/VO, PY, LU, VK and ZL will be considered as multipliers. Final score, total QSO points times the sum of the multiplier from all bands.

Awards: Certificates to the highest scorer in each country and above call areas.

Include a summary sheet with your log and a signed declaration that all rules and regulations have been observed. Include an IRC for a list of the results.

Mailing deadline is June 15th and logs go to: E.D.R. Contest Committee, P.O. Box 335, Aalborg, Denmark.

Georgia QSO Party

Starts: 2000 GMT Saturday, May 9
Ends: 0200 GMT Monday, May 11

This is the ninth annual Party sponsored by the Columbus A.R.C. The same station may be worked on each band and mode for QSO points.

Exchange: QSO nr., RS/RST and QTH. County for Georgia; state, province or country for others. (Ga. to Ga. contacts permitted)

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

Frequencies: c.w.–1810, 3590, 7060, 14060, 21060, 28060. s.s.b.–3975, 7260, 14290, 21410, 28600. Novice–3725, 7175, 21110.

Awards: Certificates to the top scorers in each state, province, country and Georgia county, 2nd and 3rd place awards where warranted. There are also plaques to the leading Georgia station, out-of-state entry, Georgia club with highest aggregate score, and portable or mobile entry from a station operating outside his home county.

Make up your log in the usual sequence and include a summary sheet and a signed declara-

*14 Sherwood Road, Stamford, Conn. 06905.

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tion that all rules are observed.

Mailing deadline is June 8th. Mail logs to: Columbus A.R.C. Att: John T. Laney III, K4-BAI, 1905 Iris Drive, Columbus, Georgia 31906. Include a large s.a.s.e. for results.

YL Int. SSBers QSO Party

Starts: 0000 GMT Saturday, May 16
Ends: 2400 GMT Sunday, May 17

The scoring is a bit complicated in this one, so hope you took my advice and wrote to WØ-GNX for rules and log information.

There are three categories, both phone and c.w. may be used, and non-members are invited to participate.

Categories: 1. DX/WK teams, composed of a DX station and a W/K station. The sum of their combined scores is the team score. 2. YL/OM teams, composed of related pairs, wife/husband, sister/brother and etc. Operation must be from the same QTH but with each one's call. 3. Single operator, non-members will use this category as well as members.

Exchange: RS/RST, SSB nr., state, province, or country, and partner's call if a team station. (non-members send "no number")

Points: Contacts between members; 4 points on 10, 15 & 20, 6 points on 40 & 80. Member to non-members, 2 points on 10, 15 & 20, 3 points on 40 & 80. Contacts between non-members have no point value.

Multiplier: Sum of different prefixes, countries, states, VE provinces, *CQ* Zones and DX/WK and YL/OM teams when both stations are worked. (KH6 and KL7 count both as country and state)

Final Score: Total QSO points times the sum of the multipliers. The same station may be worked on different bands and modes for QSO points but *not* for additional multipliers.

Frequencies: C.W.–3565, 7065, 14070, 21070, 28070. Phone–3973, 7273, 14332, 21373, 28673. (Look for DX on 3773, 7090 and 14332)

Awards: Certificates to the first 3 places in the many different categories and sections. There are also 4 Trophies and 8 Plaques to the world leaders in the different categories.

Logs: Must show date/time in GMT and the information listed under exchange. You must also show a rest period of 6 continuous hours in each 24 hour period. To qualify for an award each operator must show a minimum of 6 hours of operating time, in each mode if score is combined.

Submit logs no later than June 30th to: Woody Bennett, WØGNX, 8939 East 31st Street, Kansas City, Missouri 64129.

Results WAEDC 1969 C.W. Contest

United States					
W1BPW	**157560**	**K4BAI**	**54102**	**K8DHT**	**38087**
WA1FHU	**98348**	W4HOS	20473	K8BCK	35217
W1DTY	**53515**	K4ZA	19264	**W8AYS***	**11968**
W1TW*	**15990**	WB4IOJ	12848	WA8VBY	10038
W1WMH	135	W4TKN	11270	K8RCT	7524
WB2CKS	**111384**	W4RAE	4675	WA8VRB	3904
WA2HLH*	**42427**	W4KFC	910	W8DSO	1386
W2DKM	23142	W4KMS	135	**W9VNE**	**73800**
W2MYK	21696	**W5JAW**	**92272**	**OH1XO/W9***	**6720**
W2CKR	2232	**K5YAA**	**59540**	W9QWM	6080
WB2AYD	1836	**W5GZR***	**17865**	K9WMV	2346
W2MLO	275	K4RIN/5	6697	WB9ANW	1349
W2NCG	200	W5KGJ	6400	**WAØKDI***	**12584**
W2YAM	160	W5OJZ	936	**No. America**	
W3GM	**150240**	WA5SOG	153	**KL7MF**	**8363**
K3HTZ	53784	**K6AHV**	**54320**	**VE1EK/1**	**2870**
W3CRE	11440	WA6IVN	27448	**VE3AIA**	**9405**
W3ARK	5408	WB6OLR	8646	VE3EEW	3784
W3MDO*	**4386**	**W6JPH***	**4495**	VE4ZX	1584
WA3DMH	2862	K6SDR	3080	**VE6ARG**	**4598**
W3QOR	1566	K6MG	2925	VE6ADK	1020
W3UT	748	W6DGH	1155	VE6AKP	1408
W3LMZ	84	W6CLM	960	**KZ5II**	**6084**
K4DSN*	**59920**	W6GBY	105	**HP1BR**	**1302**
		K7WWR*	**6960**		

BOLD denotes certificate winners. (*) winners using less than 200 watts.

World Telecomm. Contest

C.W.–0000 to 2400 GMT Saturday, May 16
Phone–0000 to 2400 GMT Sunday, May 17

This is a new contest sponsored by the Brazilian Ministry of Communications, and will be held on this date or the first week-end after the 17th of May each year.

The object of the contest is to make the highest possible number of contacts in the different I.T.U. zones to commemorate "Telecommunications Day" May 17th.

Operation is limited to single operator, all band, 10 thru 160 meters.

Exchange: RS/RST plus your I.T.U. zone.

Points: As follows:

	10/15/20	40	80/160
1. Same country	0	0	0
2. Other countries same Zone	1	1	1
3. Other Zones same continent	2	3	4
4. Other continents	3	5	9

Final score: Total QSO points multiplied by number of different I.T.U. Zones worked.

Awards: Diplomas to the three highest scorers in each country, and each call area in countries with large returns.

Gold, silver and bronze medals to the three highest scoring stations in the world, both on c.w. and phone.

And the imposing I.T.U. Trophy to the country with the highest score. The score being determined by the mathematical average of scores of the top 10 contestants of that country. The Trophy will be held by the national assocciation of that country, affiliated with the I.A.R.U. It will remain in their possession for one year and permanently retired if won 3 times within a 5 year period. (If less than 10 logs are received from one country, the average from logs submitted will be used as the score.)

C.W. and Phone are separate contests. Your log should show in this order: date/ time in GMT, station, number sent/received, band, continent,

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zone multiplier, points. A summary sheet with your name and address in BLOCK LETTERS, scoring and other essential information is also requested.

Mailing deadline is June 30th to the Ministry of Communications, Amateur Radio Section, Rua Miguel Couto 105–21 andar, Rio de Janeiro, ZC-26, Guanabara, Brazil.

Note: Let me emphasize, the I.T.U. (CPR) Zone list is *not* to be confused with the *CQ* Zones, we have 40 zones, CPR has 90. The Country list and Zone map is much too elaborate and involved to be covered in this Column. The CPR list may be obtained from the I.T.U. in Geneva, or a large s.a.s.e. to *CQ* will get you a temporary copy.

Michigan QSO Party

Starts: 2100 GMT Saturday, May 16
Ends: 2100 GMT Sunday, May 17

This is the 3rd annual QSO party sponsored by the Central Michigan A.R.C.

The same station may be worked on each band and mode for QSO points.

Exchange: RS/RST plus a three digit QSO number starting with 001 for the first contact, and QTH. County for Mich.; state, province or country for all others.

Scoring: One point per QSO. Mich. stations multiply total by state, provinces and countries worked. Out-of-state use Mich. counties for their multiplier. (max. of 83) Mich. may work in-state stations for points and multiplier.

Frequencies: C.W.–3560, 7060, 14060, 21060, 28060. Phone–3925, 7260, 14290, 21360, 28560, 50400, 52525, 144500, 144694. Check 21 mc at 1600 and 1900 GMT, and 28 mc at 1700 and 2000 GMT.

Awards: Certificates to top stations in each state, province and country, and in each Michigan county. There are two Trophies, one for the top station in Michigan and the other for the out-of-state leader.

Mailing deadline is June 30th to: Central Michigan A.R.C., P.O. Box 73, Lansing, Mich. 48901.

CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, June 5
Ends: 0600 GMT Monday, June 8

This one has a lot going so read rules carefully. I highly recommend that you write K6BX for rules sheet. (Include s.a.s.e.)

Exchange: CHCers and FHCers: QSO nr., RS/RST, name, CHC/FHC nr., State, county. (DX use Laan, Dok, province and etc.) Non-members (HTHers) same above less membership nr.

Points: CHCers: CHC to CHC 1 point, CHC to HTH 2 points, CHC to Novice 3 points. YL and FH contacts add 1 point. (If QSO is DX out of own country, double above points.)

HTHers, FHCers, SWL: HTH to CHC 3 points, YL and b/p CHCers 5 points. FHC contacts one additional point. HTH to HTH no value.

Same station may be worked on different bands and modes for QSO points, s.s.b. and a.m. are considered different modes.

Multiplier: Sum of different continents, countries, VE provinces, US states. (Own state counts, KH and KL count as both state and country.)

Final Score: Total QSO points times the sum of the multiplier.

Frequencies: C.W.–3575, 7070, 14075, 21075, 21090, 28090. Phone–3943, 3960, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620, 28690, 50.35. DX; 3770, 3775, 3790, 7070, 7090. Novice: 3710, 7160, 21140.

Awards: 1st, 2nd and 3rd place certificates for world, continents, countries, states, and provinces. Plus many Trophies for the many categories.

It is again recommended that you contact K6BX, for official forms so that you can get the most credits for your efforts.

Mailing deadline July 6th to: Clif Evans, K6BX, 3212 Mesa Verde Road, Bonita, Calif. 92002. Include s.a.s.e. when requesting forms.

Editor's Notes

I still have not officially heard from Box 88 regarding May's USSR contest activities. However I was reliably informed that there will be no c.w. contest this year, but it will be replaced by a phone only contest on May 10th. Still no rules but perhaps I will get them in time to at least tell you how to score your logs.

If your organization is planning any contest activity in July or August you better get the information to me in a hurry. Remember, I must have the announcement at least 3 months before the date of the contest.

We are making good progress on the October Phone contest results and should have them in the next issue.

73 for now, Frank, W1WY

"The shack is pretty damp but it doesn't bother me."

See page 102 for New Reader Service

VHF TODAY

BY ALLEN KATZ,* K2UYH

THE development of transistors with gain on 1296 mc and above has stirred quite a flurry of interest. Most of this interest, however, has been concentrated on low noise transistor preamplifiers.[1,2,3] Many fellows are missing a good thing by not looking into transistorized mixers also. The big advantage of transistor mixers is not their low noise figure (NF) which is not that much better than a good diode mixer, but their conversion gain.

As we have pointed out on several past occasions, the NF of your receiving system does not just depend on the NF of the first stage, but also depends on the gain of the first stage and the NF of following stages. The overall NF of two stages in cascade turns out to be:[4]

$$NF = NF_1 + (NF_2 - 1)/G_1$$

Usually the gain of the first stage (G_1) is great enough that the noise contributed by the second stage is insignificant and the overall noise figure is approximately that of the first stage. But when the first stage is a diode mixer with a conversion "loss" rather than a gain, the NF of the second stage suddenly becomes very important. For example, the best NF you can obtain from a diode mixer is about 6 db. If such a mixer has a conversion loss of only 1 db and is run into a good communications receiver (NF about 3 db), the overall NF will be almost *9 db*. The above calculation shows why I have seen a lot of 1296 crystal mixers and have yet to see one (Schottky diodes included) with a measured NF much less than 9 db. On the other hand, the overall NF of a transistor mixer with the same 6 db NF feeding into the same communications receiver would be about 6 db.

1296 mc Transistor Mixer Design

Norm, WA9HUV knows first hand about the advantages of a transistorized mixer on 1296 Mc.[5] He has used one on this band for more than a year and has contributed the design shown in Figure 1. With this mixer, he is able to get the same NF performance with only one stage of amplification as was previously obtained with two stages of amplification and a diode mixer. This reduction in stages of amplification is a real savings; not as good a transistor is needed for mixing as for amplification.

[5]World Above 50 Mc, *QST*, Feb., 1970.

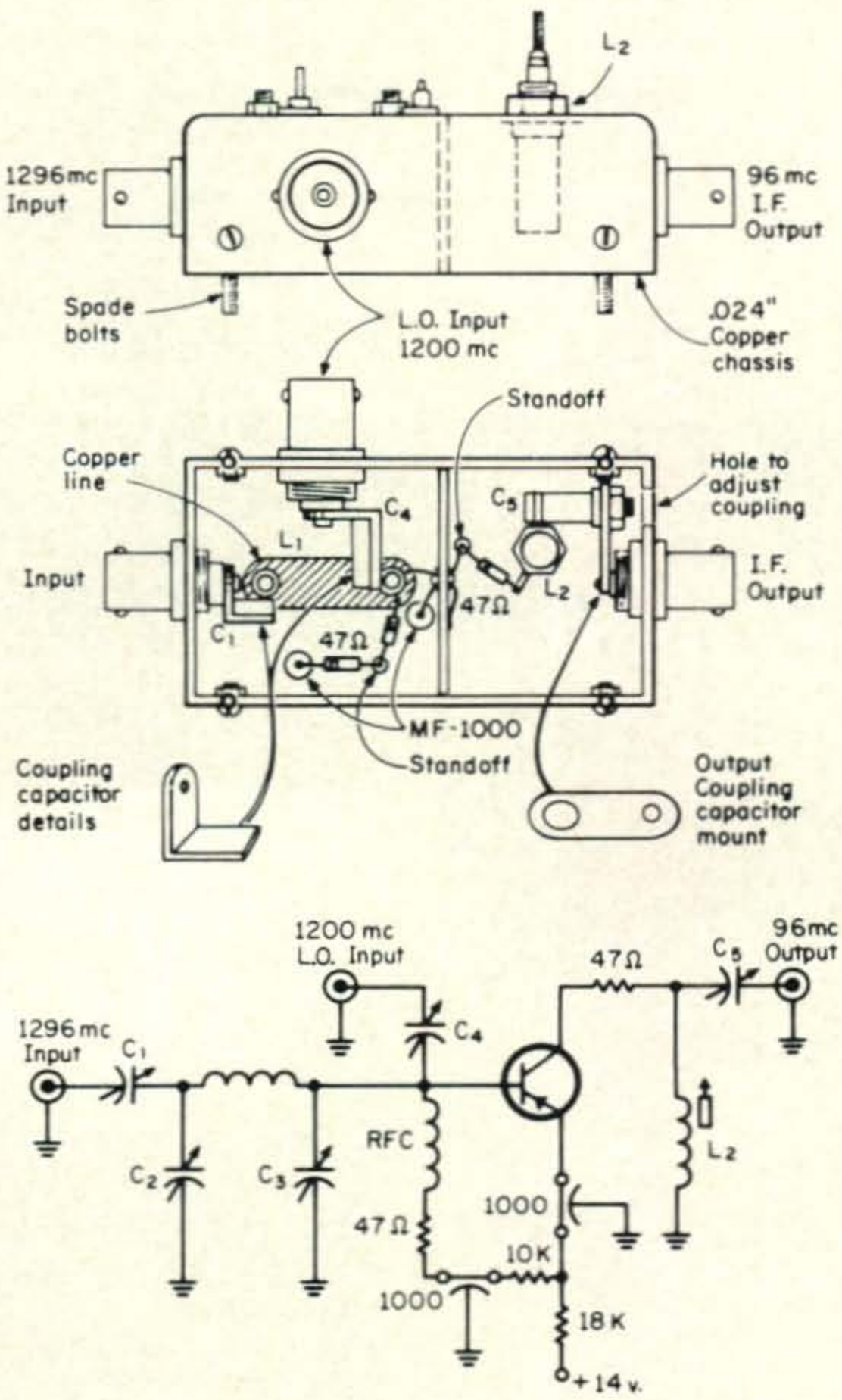

Fig. 1—Details for WA9HUV's 1296 mc transistor mixer.
C_1, C_4—Copper flap, see pictorial drawing.
C_2, C_3, C_5—0.5-5.0 mmf variable.
L_1—1 1/8" × 3/8" copper strap.
L_2—6 t. #24 space wound on 1/4" coil form.

*66 Skytop Road, Cedar Grove, N.J. 07009.

[1]Katz, "A 1296 Mc Preamplifier—That Works", *QST*, Nov., 1967.
[2]Vilardi, "A Two-Stage Transistor Preamplifier for 1296 Mc", *QST*, Dec., 1968.
[3]VHF Today, *CQ*, Dec. 1968 and Jan., 1969.
[4]VHF Today, *CQ*, Aug., 1968.

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The mixer uses a relatively inexpensive transistor, the Motorola MM5043 and mechanically is probably easier to construct than any of the crystal mixer designs around. The input circuit is similar to those used in 1296 Mc amplifier designs. A copper strap approximately 1⅛" long × 3/8" wide (depending on lead length) is hung between two piston trimmers. Input and local oscillator injection is accomplished by means of two adjustable copper flaps. The output circuit is pretty much conventional except for the standoff at the collector and 47 ohm decoupling resistor. Output coupling is provided by means of another piston trimmer mounted on a copper support. Norm notes that the mixer may become unstable if undercoupled. The transistor is mounted in a hole cut in the top of the chassis and held in place by the shield-partition. The 10 and 18 K resistors not shown in the pictorial view of Figure 1 are mounted on the topside of the chassis. The mixer as shown is designed for an i.f. frequency of 96 mc, but should be easily moved to 144 mc by changing the frequency of the LO from 1200 mc to 1152 mc and taking a turn off the collector coil.

Even though transistors which give a significant gain on 2300 mc are not available to amateurs (yet), an approach similar to that of Norm's (using a transistor which will work as an amplifier on 1296 mc but not 2300 mc) will produce a working mixer on 2300. More on this in the future.

73, Allen Katz, K2UYH

See page 102 for New Reader Service

Propagation

BY GEORGE JACOBS'* W3ASK

DURING May, optimum frequencies for long distance propagation are expected to be somewhat lower during most of the daylight hours, and somewhat higher during the late afternoon, early and nighttime hours, than they were during the winter months. These are normal, seasonal changes brought about by the sun rising higher in the northern sky. Static levels also increase noticeably during May, and signals may be somewhat weaker on DX openings during the daylight hours. 15 meters is expected to be the optimum band for DX propagation during much of the late morning and afternoon hours, while this honor should go to 20 meters during the early evening hours, through the hours of darkness and until a few hours after sunrise.

This month's column contains Short Skip Propagation Charts for the period May 15-July 15, as well as Charts centered on Alaska and Hawaii. The Short Skip Charts contain forecasts for one-hop openings between distances of 50 and 2300 miles. For specific times of DX openings, refer to the DX Propagation Charts which appear in last month's column.

For a forecast of general day-to-day propagation conditions expected during May, see the "Last Minute Forecast" appeared at the beginning of this column.

VHF Ionospheric Openings

May is generally a good month for v.h.f. ionospheric openings. A sharp seasonal increase in sporadic-E ionizations is expected during the month, which should result in some fairly frequent 6 meter short skip openings over a range of 1000 to 1400 miles. During periods of wide spread ionization, 2-hop 6 meter openings may occassionally be possible up to distance of approximately 2300 miles. An occasional 2 meter short skip opening, between approximately 1200 to 1400 miles, may also be possible during periods of intense sporadic-E ionization. Short skip 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 take place at other times as well. Refer to "VHF Ionospheric Propagation," appearing in the November 1969 issue of *CQ* (page 37), for a do-it-yourself method for predicting

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for May 1, through June 15, 1970

	Days	Forecast Rating & Quality (2)	(1)	(4)	(3)
Above Normal: May 8, 14-15, 18, 20. June-4, 11-12, 14.		B	B-C	A	A-B
Normal: May 4-7, 9-13, 16-17, 19, 21, 24-29. June 1-3, 5-10, 13, 15.		C	D	A-B	B
Below Normal: May 1, 3, 22-23, 30-31. June—none.		D	E	B-C	C-D
Disturbed: May 2.		E	E	C-D	D-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 forecat is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following 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 Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

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

6—These Propagation Charts are valid through basic propagation, data published monthly by the July 15, 1970. These Charts are prepared from Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

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v.h.f. sporadic-E short skip openings.

Some fairly good meteor-scatter openings, of short duration should be possible on the v.h.f. bands during the Eta Aquarids meteor shower which is expected to take place May 2-7. Eta Aquarids, a major meteor shower, should peak in intensity during the evening hours of May 5, with an expected hourly meteor count of 20.

There are good possibilities for some 6 meter trans-equatorial (TE) scatter openings during the month. TE openings are most likely to occur between 8 and 11 P.M., local standard time, at the path mid-point on long north-south paths which cross the geo-magnetic equator at approximately a right angle. TE openings favor locations in the southern areas of the USA, but an occassional opening should be possible into the central and northern areas during May.

Auroral activity is generally at a low level during May, but some displays may occur this month during periods of below normal or disturbed ionospheric 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 reflection or scatter from ionized patches produced by the auroral display. Check the "Last Minute Forecast" at the beginning of this column for those periods in May that are expected to be below normal or disturbed.

Sun Spot Cycle

A monthly mean sun spot number of 130 is reported by the Swiss Federal Solar Observatory for February, 1970. This results in a smoothed sun spot number of 107, centered on August, 1969. The present sun spot cycle appears to have reached a plateau in its decline from maximum activity. The smoothed sun spot numbers for the 5-month period between April and August, 1969, remains practically constant between 106 and 107.

A smoothed sun spot number of 95 is forecast for May, 1970. ■

CQ Short-Skip Propagation Chart

May 15—July 15, 1970
Local Standard Time At Path Midpoint
(24-Hour Time System

Distance From Transmitter (Miles)

Band (Meters) / *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 (1-2) 09-13 (2-3) 13-17 (1-2) 17-21 (2) 21-07 (1)	07-09 (2-0) 09-13 (3-0) 13-17 (2-0) 17-21 (2-1) 21-07 (1-0)
15	*Nil*	06-09 (0-2) 09-13 (0-3) 13-17 (0-2) 17-19 (0-3) 19-23 (0-2) 23-06 (0-1)	06-09 (2) 09-13 (3) 13-17 (2-4) 17-19 (3-4) 19-21 (2-3) 21-23 (2) 23-06 (1)	06-09 (2-1) 09-13 (3-2) 13-15 (4-3) 15-19 (4) 19-21 (3-2) 21-23 (2) 23-06 (1-0)
20	09-12 (0-1) 12-18 (0-2) 18-00 (0-1)	06-09 (0-2) 09-12 (1-3) 12-18 (2-4) 18-20 (1-3) 20-00 (1-2) 00-06 (0-1)	06-09 (2-3) 09-12 (3-4) 12-18 (4) 18-20 (3-4) 20-22 (2-4) 22-00 (2-3) 00-06 (1-2)	06-09 (3) 09-15 (4-3) 15-22 (4) 22-00 (3-4) 00-02 (2-3) 02-06 (2)
40	06-08 (1-2) 08-11 (2-4) 11-19 (3-4) 19-21 (2-3) 21-00 (1-2) 00-06 (0-1)	06-08 (2-4) 08-09 (4-3) 09-15 (4-2) 15-17 (4-3) 17-19 (4) 19-21 (3-4) 21-00 (2-3) 00-06 (1-3)	07-09 (4-3) 09-15 (2-1) 15-17 (3-1) 17-19 (4-2) 19-21 (4) 21-02 (3-4) 02-07 (3)	07-09 (3-1) 09-17 (1-0) 17-19 (2-1) 19-21 (4-3) 21-02 (4) 02-05 (3-4) 05-07 (3)
80	07-10 (4) 10-18 (4-3) 18-22 (4) 22-07 (3-4)	07-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-05 (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) 22-05 (4) 05-07 (3-2)	07-08 (1-0) 08-18 (0) 18-20 (1-0) 20-22 (3-2) 22-03 (4-3) 03-05 (4-2) 05-07 (2-1)
160	05-08 (4-1) 08-09 (3-0) 09-18 (2-0) 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*	19-20 (1) 20-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	20-22 (1) 22-02 (2) 02-06 (3) 06-08 (2) 08-10 (1) 10-14 (2) 14-16 (1)	07-11 (1)
Central USA	*Nil*	18-21 (1) 21-23 (2) 23-01 (1) 01-04 (2) 04-05 (1)	02-08 (3) 08-14 (2) 14-22 (1) 22-02 (2)	07-12 (1)
Western USA	*Nil*	18-20 (1) 20-23 (2) 23-02 (1) 02-05 (2) 05-06 (1)	02-04 (3) 04-08 (4) 08-14 (3) 14-18 (4) 18-20 (3) 20-02 (2)	07-09 (1) 09-14 (2) 14-16 (1) 12-15 (1)*

†To convert from the GMT times shown in the Chart to local standard times in Alaska *subtract* 8 hours in the Pacific Time Zone; 9 hours in the Yukon Time Zone and 10 hours in the Alaskan Time Zone. To convert from GMT to local standard time in other areas of the USA, *subtract* 5 hours in the EST Zone; 6 hours in the CST Zone; 7 hours in the MST Zone and 8 hours in the PST Zone. For example, when it is 18 GMT it is 10 A.M. in San Francisco and 1 P.M. or 13 hours in Washington, D.C.

*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.

[*Continued on page 92*]

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Compiled by Tom Kneitel, WB2AAI, this contains 192 pages of conversion articles, covering almost every piece of surplus gear worth the effort to convert to ham use. $3.00

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Ken Grayson has loaded this book with schematics for currently popular pieces of conversion gear, making it invaluable to amateurs as a guide to surplus gear. $2.50

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Q AND A

BY WILFRED M. SCHERER,*
W2AEF

Portable Antenna with SB-34 Transceiver

QUESTION: I travel by commercial airline a great deal in my work. I wish to be able to operate portable to ease the long, empty weekends in a motel. My SBE-34 can do anything but handle an s.w.r. over 2:1. This is difficult to obtain with the antennas I've tried, unless an antenna-matching coupler is used. These usually are too large to add to my luggage. An antenna is needed that can be hung, perhaps by tape or otherwise, in a motel room and that has an s.w.r. less than 2:1. Is there any such antenna that will provide true portable operation?

ANSWER: The only suggestion we have in respect to a portable antenna to meet the situation is the DPZ Vacationeer Antenna. Unfortunately, however the original manufacturer passed away, so this is not still in production, as far as we know.

A sketch of the antenna is shown at fig. 1 in case you'd like to rig up something similar. This antenna also was described in *CQ*, August 1963, page 29.

It is a 6-foot collapsible job that clamps on a window. Separate interchangeable loading coils are used at the base for 20, 15 and 10 meters. Attached to the clamp is a wire that serves as a counterpoise. It is cut to the required length that makes the whole system equivalent to a half wave. The coax feed is attached between the base of the loading coil and the bracket as is done with mobile whips. The s.w.r. depends on the length of the counterpoise and on just how it is positioned. You can use a small reflectometer type s.w.r. bridge (little enough to carry around) to make the necessary adjustment for an s.w.r. under 1.5:1.

As far as a motel room goes, the antenna probably would have to protrude out of a rear window or from a railing. You also should consider a room at as high an elevation above street level, as possible, perhaps even a *hotel* room.

*Technical Director, *CQ*.

TVI With DX-100 on C.W.

QUESTION: I have a DX-100 with which there are problems with key clicks and harmonics (t.v.i.). There were some standard modifications sent to all known owners of this rig. The one I have is second hand and only the loading modification was made. Will the "Improved keying for the DX-100" modification help clear up my problem?

ANSWER: We do not have any data on the above-mentioned modification, so cannot comment thereon, except to say that it must have been worked out as far as minimizing key clicks. As for t.v.i. when using c.w., suggest you look up an article published in *CQ*, March 1961, page 36 under the title of "The Heath DX-100B, 1961 Version." This includes data on eliminating t.v.i. on c.w. along with information on stabilizing the p.a. and reducing harmonics from the exciter stages. The improved stability also may help the key-click situation.

Navy RAO-7 Receiver

QUESTION: Enclosed are some photos of a receiver given to me. It is quite old, but is one of the most stable I have ever had. There had been name plates on it but they were removed. It is of National Radio manufacture and it resembles the NC240C & D, except for some of the controls on the panel. Can you identify it for me so that I may obtain schematics or other data?

ANSWER: The receiver in question is the Model RAO-7 made for the U.S. Navy. A schematic may be found in the *Surplus Schematics Handbook*, published by *CQ*. Other data will be found in *CQ*, August, 1956, p. 46, under the title "More Bandspread on National Military Receivers". Adding a product detector will be found in QST, May, 1964.

51J Receiver Improvements

QUESTION: Have you any data on improvements or modifications for the Collins R-388 51J receivers.

ANSWER: Articles on the above subject are as follows:

"A Single-Tube Product Detector," Capt. P. Lee, *CQ*, Apr. 1961, p. 50.

"Further Improvements for the 51J," Capt.

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P. Lee, *CQ*, Apr. 1968, p. 68.

"More on Updated Improvements for the 51J Receivers," W. Scherer, *CQ*, Dec. 1968, p. 64.

"Restoring the Collins 51J PTO," W. Orr, *Ham Radio*, Dec. 1969, p. 36:

HR-10B Receiver Malfunction

QUESTION: My Heathkit HR-10B receiver works fine on 80 and 40, but does not function on 20, 15, and 10. Any ideas on how to get it working?

ANSWER: The following steps should lead you to a solution for getting the HR-10B working properly:

1—Make sure the local oscillator is functioning. To check this, listen for its signal on another receiver. For 20 meters the oscillator frequency (as heard on the other receiver) should be 15, 681-16, 031 kc, for 15 it should be 11, 340-11, 590 kc and for 10 meters 14, 840-15, 690 kc. If you don't have another receiver for checking this, measure the oscillator r.f. voltage at pin 9 of V_{2B} or at pin 8 (here it will read much lower than at pin 9).

A meter with an r.f. probe will be needed for these measurements. You can also use a v.o.m. with about 47,000 ohms (or an r.f. choke at the prod end of the hot lead for the v.o.m. to see if any d.c. bias voltage appears at pin 9 which should be developed when the tube is oscillating.

2—If oscillator failure is indicated, try another tube at V_2 (6EA8).

3—Re-check the r.f. front-end elignment, particularly at the oscillator inductors.

4—Make sure connections between the bandswitch and other components are well soldered.

5—Check d.c. voltages on V_2 (particularly V_{2B}) as indicated on the schematic. Do this with the bandswitch set at the various positions.

6—Follow step 5, at the r.f. stage.

V.F.O. for C.E. 20A

QUESTION: How about a good v.f.o. for use with the C.E. 20A s.s.b. exciter? How about something like the Lake Shore Bandhopper V.F.O.?

ANSWER: A good basic v.f.o. design for a solid-state v.f.o. was described by G.D. Hanchet, W2YM, in QST December 1966, page 11. This does a good job and is very stable. It may be set up for various frequencies, but if you wish to use one basic range, the necessary frequency range (outside of the basic

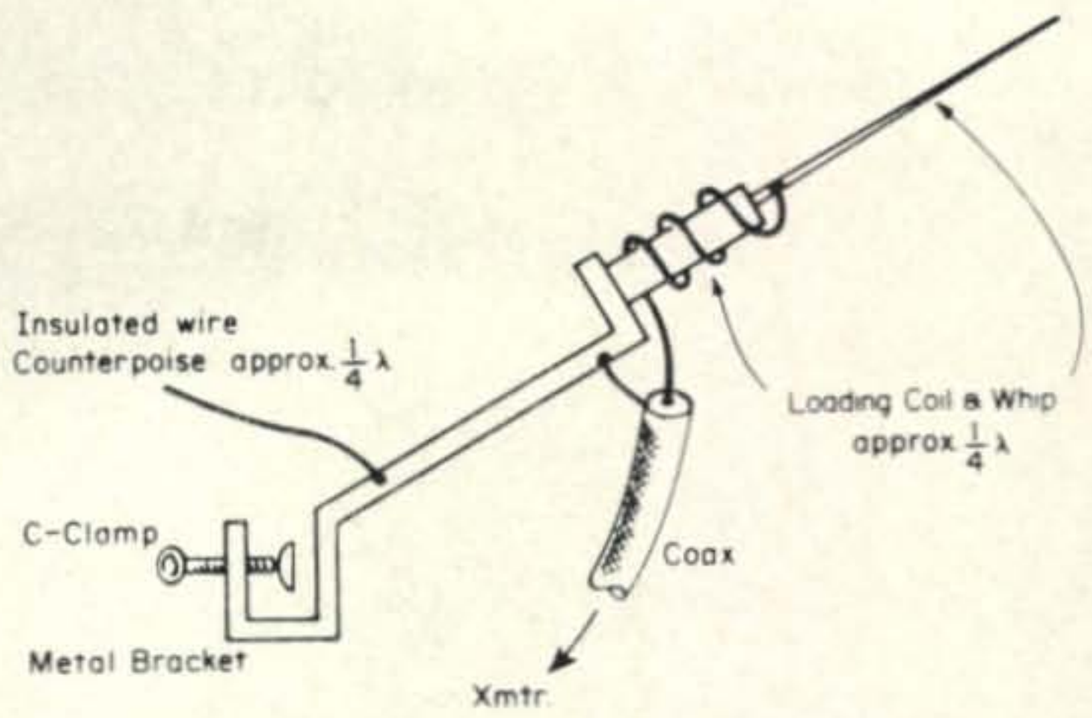

Fig. 1—Vacationeer portable antenna for mounting on window frame. If frame is metal, insulate bracket with wood blocks. Counterpoise and coax should be at right angles to each other.

one) required for the different bands to be used in conjunction with the 20A may be had by premixing with crystals as in the Bandhopper v.f.o.

Smoking Valiant

QUESTION: I put up an 80-meter dipole for use with a Johnson Viking transmitter. Apparently the dipole was mismatched, and unaware of the high s.w.r. presented, I operated the rig under these conditions. It is now drawing excessive plate current and reverse grid current. Now, after changing bad clamper, final and bias tubes, the p.a. will not dip properly and sometimes smoke comes from the area of the tank coil when the B-plus is on.

I referred to a book on fixing transmitters. It told me that I had parasitic oscillations or self oscillations, whatever that is. Anyway, it said my screen bypass capacitor was shot, but this was just a bum steer. What do you suggest?

ANSWER: In respect to the problem with the "smoking valiant," here are some suggestions toward a solution:

1—Make sure the insulation on the wires to the p.a. bandswitch has not broken down; arcing may be occurring at this point.

2—Make sure the bandswitch contacts are in good shape and not burned.

3—Check p.a. tune and loading variable capacitors and make sure they have not arced across plates and caused a short.

4—Check plate-blocking capacitor.

5—Make sure there is proper bias on p.a. tubes.

6—Make sure there is adequate grid drive.

7—Make sure the parasitic suppressors are okay.

[*Continued on page 89*]

A GREAT BUY FROM ARROW —

DELUXE SWAN *Cygnet*

MODEL 270 . . . 5 BANDS . . . 260 WATTS

The new Cygnet line is our latest development, and promises to become tremendously popular. Being self-contained with AC and DC power supply and loudspeaker, it is designed for easy portability, ideal for vacation or business trips, field day, or mobile operation. At the same time it provides all the necessary power and versatility for a complete home station. The 508 external VFO or 510X crystal oscillator will plug directly into the deluxe Cygnet 270, as will the VX-2 Vox unit or FP-1 Phone Patch. And, if you feel the need for more power, the Cygnet Linear provides a 5 times increase to better than 1200 watts. The Cygnet line comes with the same high quality and reliability that is traditional with all Swan products. And with the famous Swan customer service, if and when required.

THE LITTLE GIANT DELUXE CYGNET TRANSCEIVER MODEL 270

260 watts P.E.P. input on 10 through 80 meters.
A complete amateur radio station including 117 volt and 12 volt DC power supply and loudspeaker in one package with a handle. Has 100KC crystal calibrator, Dial Set, A.F. Gain, R.F. Gain, AGC, ALC, S-meter, sideband selection, all the features required for home station operation with enough power to work the world. Yet, the Cygnet is small and light enough for mobile or portable operation; an ideal traveling companion on business or vacation trips. **$525**

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Standard version of Deluxe 270. Same power and circuitry, without some of the Deluxe features. Still a magnificent talking machine. **$435**

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212 Digby 9-4411

525 Jericho Tpke., Mineola, N.Y.
516 Pioneer 2-2290

225 Rte. 46, Totowa, N.J.
201 256 8555

900 Rte. 110, Farmingdale, N.Y.
516 MYrtle 4-6822

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

ONE more blow for sense and logic has been struck! Another electronic manufacturer has found that utility can be served, goodwill reaped, and even some money be made by selling old equipment rather than smashing it! This great forward step has been taken by the Alden Electronic & Impulse Recording Equipment Company Incorporated, of Westboro, Massachusetts, builder of standard commercial/government facsimile recorders.

Not that everyone who hankers to learn more about FAX will be able to rush out and buy an Alden 9244T recorder for $1.98, but at least Alden has started a move toward allowing their old sets to be put to use rather than destroyed, and soon serious but relatively impecunious facsimile experimenters may be able to obtain some used Alden sets.

Alden and Muirhead have long been the dominant manufacturers of commercial grade communications facsimile equipment. Stewart Warner, Xerox, Times Facsimile (Westrex/LitCom) have also been in the field, but have not rivalled Alden or the British-owned Muirhead Company. Fairchild has worked at Fax sporadically, and some small companies have built sets to specifications for the Associated Press, United Press International, Western Union or the military.

The big two have generally leased their sets, with the government, the largest customer, by far. After a big Alden or Muirhead unit was removed from service it was scrapped.

I have long heard that both companies had had thoughts about selling some used gear, but until recently neither company would even answer its mail on that subject. Now however, Alden has started to sell Fax gear removed from service, and the trend seems to be for more sales in the future.

Right now obsolescent Alden units are still not cheap. Prices range from $150 for an as-is/where-is 9137EA set, capable of running at 60, 90, or 120 r.p.m., to $3,789 for a 9244T 120/ 240 r.p.m. set for copying weather photo satellites, complete with solid-state demodulator and other electronics. (A discount of three percent is offered for cash with order.)

The cheapest, and thus most attractive set to amateurs, the 9137, is roughly comparable with the familiar TXC-1 and RD-92A military fax sets in basic specifications. The TXC-1 is a WW II design, capable of turning 30/60 r.p.m. It has the same feed rate of 96 lines per inch as the 9137. The RD-92A is a post-war, receive-only update of the TXC-1 in rack mount form, capable, in some versions, of 90/120 r.p.m. operation. All three (9137, TXC-1, RD-92) will run at standard communication transmission rates, and are close enough to the commonly-used line spacing to give at least usable results off the air.

What is on the air of course is copy from three major sources: satellite cloud-cover photos, government weather maps, and Wire Service news photos.

Alden decided to sell its surplus Fax machines after the U.S. Weather Bureau ordered leasing of a large number of Alden 9271 automatic recorders for its Forecast Office Facsimile Network. Existing USWB installations of 9137 and 9244 recorders were no longer needed. Some of the older sets were already factory reconditioned to like-new shape when the weather bureau decision was made, indicating that Alden would have a big loss if it merely junked the older equipment.

After the go-ahead to surplus-out the old

The Alden 9137 Weather Map Recorder.

*5716 N. King's Highway, Alexandria, Virginia 22303.

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sets was made the Federal Aviation Agency got wind of the plan and bought up the first 44 units available. That both limited the numbers and propped up the prices, but in the future, according to John Hines at Alden, there will be steady numbers of surplus sets available at prices commensurate with the length of service and condition, down, probably, to the $100 range.

The cheapest sets that will be coming along are the 9137 units, with 6 to 12 years of service on them. In inoperative condition, but apparently able to be repaired, these can be bought in the area of $150, which is not far above the surplus price of the RD-92A. Anyone interested in such a set should contact Mr. Hines at Westboro, Massachusetts, 01581, to see where a unit might be available. Since these sets weigh upwards of 550 pounds, economy dictates finding one being taken out of service locally.

If you got next to the people who service these Alden units you could probably get an idea whether an inoperative 9137 was a good buy or not. Maybe it had blown a fuse—or maybe the entire electronics pack went up in smoke. It would be well to check, and also get a copy of the service manual.

Fully-operational 9137 sets are being offered at $750, with a 90 day warranty. Later models of the 9137, with electric (rather than mechanical) speed change, are listed at $1,000 with 90 day guaranty and $2,500 factory-rebuilt like-new.

A more modern set, the 9217, is offered with 90 day warranty for $1,400 each. Both the 9137 and 9217 have tube-type electronics, and 60/120 or 60/90/120 r.p.m. speeds. They use standard 18 inch-wide recording paper of the electrolytic type in continuous rolls. Internal clocks in the sets can be programmed for semi-automatic operation.

For those who want to work the satellites, and have a lot of money (though less than the new price) can get a 9244 set for 120/240 r.p.m. at $2,900 factory rebuilt, with new-set guarantee, vacuum-tube electronics. A solid-state version, 9244T, as mentioned above, goes for $3,789, New.

Parts, one should realize, are not cheap for specialized gear like facsimile sets. The TL-19 holddown strap is not bad at 50¢, but the WE-19 wireless helix, used to make the recording, with a 1,000 hour life expectancy, runs $15.00. The 9137WB-1-104 endless loop printing electrode (*life: 1,000 hours*) costs $14. A six-roll carton of Alfax electrolytic

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Back Issues

Back issues of *CQ* are available from our Circulation Department. Issues in the current year sell for face value (.75) and all others in stock are one dollar each, postpaid. If the issue is no longer in stock, photo copies of specific articles are available at one dollar each. Preferably, the entire issue will be sent.

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recording paper costs $45.00.

Probably the chief interest in the more expensive surplus Fax Sets would be among scientists who want to copy the satellites. The Alden units are not precisely matched to the Nimbus and ESSA transmissions, but are so closely similar that reasonably good results may be obtained. The satellites transmit 75 lines per inch, and their images would appear to be shortened if received on a 96 line per inch recorder. Also, the 120 r.p.m. units may be used, giving two images per pass, each containing half the transmitted lines, thus degrading resolution to some degree. Alden suggests that 120 r.p.m. machines might be converted electrically to run at 240 r.p.m. They say "the motor amplifier precision drive may be able to handle the added speed if the motor" is changed to run at twice the designed speed, at the same current as the original motor (about 50 watts)

"This cannot be considered a highly-recommended mode for the reception of these pictures, but it has been done and some amateurs are using the equipment this way." Alden's John Hines told me.

The satellite transmissions are on several frequencies in the 136 mc area, including 135.6, 137.5, 137.62, and 136.95.

The older point-to-point transmissions are found throughout the high-frequency bands. The news services guard their frequency rather closely, but government FAX channels throughout the world may be found in U.S. Navy publication HO-118A. ■

Scratchi [*from page 12*]

seever, doing a little fiddling, and there are the signal! So, fixing up a key out of ice tongs what having handles (courtesy Ye Old Mountain Gift Shoppe) and sending a few fast vee's. The old fist sounding pretty good on ice tongs.

Getting reseever working to in just a cupple minutes. So, that's what I call a good job. No problems, no trubbles. All got to do now is making signs and getting both reseever and xmitter to eggshibishun hall. You thinking if I calling this feller and telling him I needing a truck to transporting my one transistor reseever and xmiting he buleeving me?

Respectively yours,
Hashafisti Scratchi

P.S. Forget hole thing. Just discovered I can't get'em out the door of the shack. Oh well, guess I'll try to get a WAS QRP. At leest I can say "mi rig hr homebrew wat u hv?" **H.S.**

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Announcements [from page 14]

Ottawa, Illinois

The Starved Rock Radio Club will hold their Annual SRRC Hamfest at the La Salle County 4-H Home and Picnic Area Southwest of Ottawa, Illinois on June 7, 1970. This all-day affair suggests advance registration until May 29 at $1.50 or at the gate at $2.00. Free coffee and doughnuts from 10.00 to 10:30 A.M.C.D.S.T. Food available and ample parking provided. For a full day of activities, follow big, YELLOW HAMFEST signs on Route 71 from South end of Illinois River bridge at Ottawa, Illinois. For further details, including data on available motels and/or camp facilities write W9MKS, RFD #1, Oglesby, Illinois, 61348.

Hazel Park, Michigan

The Hazel Park Amateur Radio Club will hold its 4th annual Swap and Shop on May 17, 1970, 10 A.M. to 4 P.M., at the Hazel Park H.S., Hazel Park, Michigan.

Free parking for 1000 cars, door prizes, main prizes, snack bar. Come for the day. For further details contact Jack Field Sr., WA8WVE, 1444 East Evelyn, Hazel Park, Michigan 48030, phone 313-LI 4-7162.

Pittsburgh, Pennsylvania

The 16th annual Breeze Shooters Hamfest will be held at White Swan Park near Pittsburgh, Pennsylvania on May 17. This is the la gest nonprofit amateur radio event in the Western Pennsylvania area attracting over 1200 amateurs annualy. For more information contact J. L. Burnett, K3IXB, 608 Charlotte Drive, Pittsburgh, Pa. 15236.

Amateur Radio at AFCEA—1970

On-the-air amateur radio facilities will be provided by the US Navy's Washington voice in the amateur radio fraternity, K4NAA, operating daily from the Sheraton Park Hotel in Washington, D.C. during the three days of the Armed Forces Communication and Electronics Association Convention in June. AFCEA convention delegates with amateur radio licenses are invited to take advantage of the Navy's ham radio station to contact friends during the convention on June 2, 3 and 4.

The K4NAA fixed portable station will be operational from 0900 to 2200 EDST with two available positions for c.w., s.s.b. and RTTY on the 10, 15, 20, 40 and 80 meter bands.

A specially designed QSL card has been prepared to acknowledge contacts with licensed amateurs throughout the world who are invited to make contact during the AFCEA convention.

The Navy and AFCEA invite all amateur radio enthusiasts to visit K4NAA on June 2, 3 and 4.

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Letters [*from page 8*]

ternity in general and Mr. Gardiner, W1FE, in particular know that I agree with the latter's point of view (OUR READERS SAY, January '70) concerning high speed c.w. and the Extra class exam. Going several steps further, I have petitioned the FCC, RM-1522, to eliminate the c.w. requirement from the Extra exam. The initial 13 w.p.m. General class test should suffice in this rapidly aging mode of communication. Support is requested.

A. R. Gargano, W2EHB
Blackwood, N. J.

Helping Hand

Editor, *CQ:*

The STI Amateur Radio Clug (WB9ADF) has undertaken a "Helping Hand" project to assist hams or would-be hams in solving their technical problems.

We wish to extend this service to hams in all parts of the world, and particularly to those who are just getting started in ham radio or who are isolated from help.

As a technical pool from which to draw solutions, the members are students working toward the Associate Degree in Electronic Engineering Technology, and are hams themselves for the most part, with a highly trained staff of instructors to back them up.

If you feel this project is of a worthy nature, we would appreciate it if you would mention it in a feature issue. Inquiries and problems should be addressed to:

STI Amateur Radio Club WB9ADF
Sams Technical Institute
Interstate Industrial Park
Fort Wayne, Indiana 46808

Thank you.

Jeffrey Stineburg, WA9TOJ
Trustee, STI ARC
Fort Wayne, Indiana

Japanese Radio Row

Editor, *CQ:*

Having just visited Tokyo, I can agree that the Akihabara area is indeed a fascinating place. However, I found the displayed price on small parts to be comparable to U.S. prices. They would negotiate of course, but that would be rather time-consuming and not really worth while. The larger articles, such as radios, TVs and tape recorders, were priced considerably under U.S. prices. Nevertheless, I found the prices on those same articles to be even lower in Hong Kong. Shopping is much easier in Hong Kong. The exchange rate is quite simple and easy to compute in your head so you know exactly where you stand as you are buying. I will go to Hong Kong every chance I get, but I never expect to waste my time by going to Tokyo again.

One word of warning. Be sure not to have a hotel send laundry out for you in Tokyo. I stayed at the Imperial Hotel where a nice suite costs less than $40.00, but the laundry which I sent out cost me $67.00!

Charles Campbell, W4IHG
Bangkok, Thailand

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Q&A [*from page 81*]

8–Check neut. of p.a. and driver stage.

9–Make sure the r.f. chokes L_{11} and L_{12} are okay. L_{11} might have burned up.

10–Check operation on all bands. A clue may be found if the adverse condition exists on only one or two bands.

11–Reverse grid current and high plate current often is an indication of an inter-element short in a tube. Try different p.a. tubes one at a time.

All these suggestions are not necessarily directly related to the problem, but they should be followed as a routine procedure.

Frequency Instability with Swan 350

QUESTION: I have a Swan 350 that has developed trouble on the 10 and 15 meter bands. The incoming signals sound very warbly intermittently and I am told my signal also warbles and is distorted. I thought maybe it was my 10-15 meter beam, but checks with another antenna did not bear this out. Got any hints as to the cause or a remedy?

ANSWER: Similar troubles that others have had were due to dirty v.f.o.-switch contacts. Suggest you give these a going over with a contact cleaner, such as Spray-Kleen by General Cement Co. Tuning capacitor wipers also may be dirty. Outside of this you would have to track down a defective component (capacitor or inductor) in the v.f.o. or even try new transistors. Also make sure there are no loose or otherwise poor connections, particularly at the bandswitch.

As for distortion on transmit, check bias and make sure this is set for correct p.a. resting current. T.V. sweep tubes often deteriorate after use, so a new set of p.a. tubes may be needed.

10 Meter Oscar 5 Prop. [*from page 64*]

used for overhead passes. The array was tiltable to ±45° from zenith and was very effective in filling in antenna pattern nulls experienced with the 4-element yagi on overhead passes. Other antennas used were a 10 meter reference dipole, and two long wire antennas, one 400 feet long and another 600 feet long, both aligned in different directions. All antennas terminated in a 5-position coaxial switch. A preamp and cathode follower established the front end noise figure and distributed the signal to each of the receivers. This was done to prevent any interaction between the receivers. The entire station was run on a highly regulated a.c. line to prevent any line variations.

OSCAR Bounce

Even though the satellite has now stopped transmitting, NASTAR has proposed using the satellite as a passive reflector to establish communications between distant stations. tests are currently being run at prescheduled times which should be announced via regular AMSAT bulletins from W1AW NASTAR will be using a 1 kw homebrew transmitter into the antenna system already described. The receiving system will be augmented with the new Hewlett packard 3721A Correlator which can detect signals buried in noise by 40 db or more. The results of these tests will be published in the first available issue of *CQ*. ■

Acknowledgements

The authors wish to extend their thanks to Walter Goldenberg, WN2MHZ and Jim Moore W2IJM for their fine photographic work as well as Ed McGinley, WN2LDF who assembled many of the antennas used in tracking OSCAR 5. We also want to thank all of the manufacturers who so graceously donated their equipment to NASTAR. ■

Have You Mumble-itis [*from page 59*]

become syllable-conscious. Take it slow, at first, and do a thorough job on EACH word. When it says "thundering" don't say "thunnering". Get ALL the letters into each word hat belong there.

Don't fret about sounding peculiar when you later get on the air. You won't. You'll automatically slip back to the way you spoke before . . . but you won't be quite so bad.

Do these exercises over again the next day, and the next, etc. If you are among the mumblers you've got a life-long habit to correct and that will take more than a few minutes practice. Remember that it will take many sessions of exaggerated pronounciation to get in the new habit of speaking distinctly and understandably on the air.

The best rig and mike in the world can't put out a better sound than you put in. Excep for the c.w. and RTTY crowd, ham radio consists in getting a thought to somebody else by way of intelligently combined sounds. The better these individual sounds are produced by the transmitting amateur himself, the better chance his electronic equipment has of relaying his thoughts to his listener. Water can't rise above its source nor can a transmitter put out better diction than is

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put in. To be understood, speak understandably.

So, sebenty-trees an' anks fer lissenin'. Dis is dubbaya bee tu owe wy uff, odd yankee feller, pullin' da big switch fer now. G'nite. ■

Late Oscar News [*from page 45*]

Oscar, Oscar, give me your answer, do
I'm unwilling to share my ride with you
You'd probably block my vision
Or cause a space collision
So I'll be damned, if I'll be crammed
On a vehicle built for two.
Tyros, Tyros, here's my reply to you
I'm ap-proved by N-A-S-A- HQ
So don't be unkind or bossy
With this hitch-hiking Aussie
And I'll look neat—in the rumble seat
Of a vehicle built for two
Delta, Delta, here's all I have to say
If he bumps me, there will be hell to pay
Six solids we cannot prevent
This ham adds to our torment
We never thought that we'd get caught
On a vehicle built for two.
Tyros, Tyros, not a thing can go wrong
Be a hero—let Oscar tag along
And be a content precursor
It could have been much worser
We could, you see, have carried three
On this vehicle built for two.

Triac Power Supply [*from page 58*]

When operating into inductive loads, the output voltage of the supply will increase as much as 40% of the no-load voltmeter reading. The voltage, therefore should be reduced to about 70% of the desired output voltage before connecting the load; then, with the load connected, R_1 should be adjusted so that the rated voltage is indicated on the voltmeter.

Obtaining the Parts

The lamp socket (part #68-4), the heat sink for the triac (part #107), and the two 12 volt at 40 ampere transformers (part #T-48) were purchased, before anything else, from John Meshna, Jr. at 19 Allerton Street, Lynn, Mass. 01904. The cost of each item was 4/$1.00, 5/$1.00, and $7.00 each, respectively.

The blower (part #273-220) was purchased from Radio Shack for $4.95; the fused plug (part #270-1249) for $0.59.

All other parts are available from local dealers, or, from local junk boxes. ■

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Calibrate Your Own D.C. Meters [*from page 52*]

ratios you establish must take this limitation into consideration. Again, the input resistance of the Volt Box must be considered from the standpoint of each point because there will be "circuit loading" effects on the voltage being measured. You cannot design this out of the Volt Box, but you can design and build a good Volt Box using the principles outlined above. But, you must know how to use it properly.

A second installment will cover the Standard Resistor, construction and application of all three of the units.

(To be continued)

A No Compromise 5 Band 2 Element Quad [*from page 18*]

wires together. Use a small insulator on each driven element. Run the wires through the ends, wrap them around, solder and bend the wires toward each other and trim them to where the ends are about 1/4" from each other. Refer to 5 and the photo for the method of attaching the 72 ohm twin lead o the driven elements.

I painted the finished hub with zinc napthenate, a clear liquid which prevents rot.

Results

This quad has given me excellent results, working such places as Australia, Chile and the Antarctic on 10, 15 and 20 meters. It seems to have a front to back ratio of about 25 db. I have built other quads but I have seen no other two element quad that would out perform it.

If you have an antenna tuner such as a "matchbox" or a "transmatch" you can use open wire line to feed all five antennas. I tried this with 300 ohm television open wire line and it was surprising how much this improved reception and transmission on even as low a frequency as 10 meters. Checking theoretical feed line losses per 100 feed of feed line on 10 meters, the 72 ohm twin load loses about 1.5 db while the 300 ohm line loses only about 0.15 db plus the 4 to 1 s.w.r. loss of about 0.15 db additional making a total of only 0.3 db per 100 feet compared with 1.5 db when using 72 ohm line ■

Propagation [*from page 78*]

HAWAII

Openings Given In Hawaiian Standard Time†

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

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT. For example, when it is noon or 12 hours in Honolulu, it is 5 P.M. or 17 hours local time in NYC and 2 P.M. or 14 hours local time in Los Angeles.

USA-CA [*from page 71*]

The new call and QTH of Don McCarthy, ex-WA9PRE is WAØZZT, 4334 W. Nevada Place, Denver, Colorado 80219.

A note from "J.D." Delancy, K1ZAT to say that anyone needing mobile reply cards signed by him for his cross-country trip last October should send them to: J. Delancy, FR 041 36 7158, 6900 SS Box 15, APO, N.Y. 09101. He hopes to be active as DL5JD.

With the new fone allocations due to incentive licensing, our part of the 14 mc band is sure crowded these days—there have been some complaints of our Independent CH Net Mobiles moving atop some fone-patching from hospital ships near Viet Nam on 14345 —although I am under the impression that all of the Armed Services have their own frequencies outside the ham bands for such fone-patches, it is almost impossible to try to explain this to a mother or sweetheart or wife who is talking to one of *OUR* injured men *or* women.

One other note of caution, I have heard that a well known mobileer has received a citation from the FCC—I have NO details as yet but must assume it has something to do with not identifying oneself. No more room. How was your month? 73, Ed., W2GT.

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A MUST FOR EVERY DXER

DX AWARDS LOG

This fabulous book sells for $3.95 anywhere in the U.S. and is available for immediate delivery from the CQ Technical Library. However, with any subscription to CQ you can obtain a copy of the *DX Awards Log* for just $1.50 (a $2.45 savings). To obtain your DX Log at the discount price it must accompany a subscription order to CQ, but that order can be for renewals or extensions as well as for new subscriptions.

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See page 102 for New Reader Service

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00**. No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

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Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.**

WANTED: July, 1967 and Jan., 1968 issues of 73 Magazine. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L. I., N. Y. 11050.

FOR SALE: Hallicrafter HT-19 250W. CW transmitter, no tvi, 20 cents per watt. W9HBP, 6032, N. Oxford, Indpls., Ind. 46220.

FREE QSL's are available from a few sources. Does anyone know who these are? Dick, W2FGL, 19 Mango Lane, Liverpool, N. Y. 13088.

WANTED TO BUY: 5-Band Transceiver, AC & DC Supplies. K0YJZ, 10015 West 9th Street, Wichita, Kansas. 67212.

HAMMARLUND SP600/JX14, Perfect both electrically, physically. s/n 9640. Cert. $275. WA6YQS (916) 489-8659.

SWEEP SIGNAL GENERATOR, UHF T. V. range, Flat within 1DB, Philco number G8002, Cost $289.50. New condition, $75.00. Glen Richie, 643 Diamond Road, Salem, Va. 24153.

FOR SALE: Heath Sixer & Mobile Supply, Mint, $50.00. Want: Electronic Keyer-mint. J. K. Evans, K4BIR, 1646 Sigmon Road N.W., Roanoke, Virginia. 24017.

FOR SALE: SR-150 xcvr, AC and DC power supplies, mobile rack, and mike. perfect; $325/offer. WB6WJR, 3090-26th Avenue, S. F., Ca. 94132.

NO MORE HAM RADIO BY 1980? Could be, unless we do something now. Rush ideas to WA1GFJ, 160 Elm St., North Haven, Ct. 06473. 247-4243.

SALE: HAMMARLUND HQ110 Receiver, matching SPKR, Manual, Mint condx., $125.00. FOB, Richard Beatie, 1904 114 Avenue, Tampa, Florida. 33612.

SALE OR TRADE: Retina Mark IV camera f 2.8 lense. Completely reconditioned by Kodak. Has EK serial number. $140.00 cash or trade stereo tape recorder. A. H. Davis, 1508 Gawain Borger, Texas. 79007.

SELL: Large selection oil & electrolytic caps. 6MFD @ 600V 40 cents; 10MFD @ 1000V 1.90. Free list. Ken Maas, Burlington, Wisconsin. 53105.

FOR SALE: Nearly new Eimac 3-400Z, Eimac socket, chimney, Rotron fan. $34.00 Postpaid via air P. P. W. R. Stangel, K6JB, P. O. Box 372 Lakeport, California. 95453.

WANTED: Old Crosley model X or XJ battery receiver. Also Vol. 1, 2 and 3 Rider's manuals. W7KE, 1109 S. 2nd St., Hamilton, Mont. 59840.

SELL OR TRADE: Complete in new binders. Postpaid. 67, 68, 69 CQ $8 each. 68, 69 QST $6 each. All 5, $30. W9HNG, 921 Walnut Street, Decatur, Indiana. 46733.

TRIGGER ELECTRONICS, cashed our check but have never sent the 3 crystals ordered July 3rd., 1969. Perry, WN8AXU.

CANADIANS: Complete amateur equipment service by fully equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta, Canada.

SALE: Hallicrafter SX140 receiver, $60, R-47 speaker, $7.50, Joystick antenna & 4RF tuner, $29.50. F. Strickhausen, WA0NLR, 715 Tyler, number 36, Topeka, Kansas. 66603.

BURBANK HAMFEST: 10AM-10PM Saturday, May 9th. Live displays of the latest ham gear and hour-long talks by top experts on several facets of ham radio. Hamfest held at W6LS.

LICENSING COURSES: The LERC Amateur Radio Club regularly conducts free ham courses which are open to all. Write to: 2814 Empire Ave., Burbank, California. 91504.

SELL: T-150A, $65, Globe Chief Deluxe, $30, NC-140, $90, Eico 324 Sig. Gen., $30, 6-meter converter, $15. G. Strickland, WA4WMG, Rt. 4, Louisburg, North Carolina. 27549.

SWAN 500-117 XC power supply.. $350. Bandit 2000B modidi d to 2000C, $200.. Drake MN-4 matching network, $40. Heath phone patch, $10, Knight Grid Dipper, $5. W1AW Balun, $5, Ham-M rotor used 3 months with control box, $85. 200' RG8U, $10. Walter Wiaduck, W9ZWH, 4926 Hawthorne, Hillside, Illinois. 60162.

HELP: Anyone who worked WN3BMF March or April 1955 please confirm QSO. Old records lost. Tony Casciato, VA-176, FPO New York. 09501.

HAMS INTERESTED In Superb 1 watt Solid State SSB/CW/FSK exciter write for details. E. Jeltrup, 27A Lincoln Pl., Ossining, N. Y. 10562.

See page 102 for New Reader Service

SELL: clean SWAN 400, built in crystal calibrator and side band selector, matching AC supply, 406 VFO, $295.00. D. B. Whittemore, 36 Masterton Road, Bronxville, New York. 10708. Telephone: (914) 337-1059.

DRAKE 2B, 2AC, 2BQ, $165. Heath DX60B, Novice Crystals, $65. Johnson Low Pass Filter, $8.50. R. A. Sullivan, 4423 N. 17th Street, Arlington, Virginia. 22207.

SALE: Harvey-Wells Ham Band receiver. Two meter transmitter, XTAL/VFO: $15. W4VRO, Ray Crawford, 7120 Kingsbury Circle, Tampa, Florida. 33610.

WANTED: Transceiver, or Receiver Xmtr Accessories. Also Linear-2000 etc. Cash if Reasonable. F. E. Coble, 251 Collier Avenue, Nashville, Tennessee. 37211.

JOHNSON VIKING II, Manual, PTT, audio circuit modified. $70.00. RME 69 rcvr made 1939, manual $25.00. WA2FFZ. 186 West Avenue, Pitman, New Jersey. 08071.

FOR SALE: HX-10 "Marauder," vfb condition, $150; 304TLs @ $30, 100THs @ $10, APX-6s, new w/tubes, $25. Ship express collect. K5AEU, Box 146, Leland, Mississippi. 38756.

HQ 170 AC RECEIVER, HX 30 TRANSMITTER, Gonset 500 watt Linear. All excellent condition for 6 meters AM-CW. SSB with manuals as a unit only. $550.00 for all. WA4AUF. J. P. Luke, 215 Shea Street, Portsmouth, Virginia. 23701.

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88 Mh uncased Toroids 5/$1.50, 255A relay's, $2.30, relay sockets 80 cents each, PP48. E. W. Evans, K4OEN, 220 Mimosa Lane, Paducah, Kentucky. 42001.

TRADE: Collins 2 Kc mechanical filter, model F455N20. WANT: 2 Meter FM gear, Farmer, 3113 No. Columbia Street, Plainview, Texas. 79072.

WANTED: Lake Shore Bandhopper VFO 2 Meter SSB Tran. Rec. Ruben Horn, W9NES, Rt. 1, Box 271, Marinette, Wisconsin. 54143.

FOR SALE ART-13 xmtr, all pwr supplies plugs & cables, some spares. $100. Deliver 150 miles. Bud, K2GFL, 226 Edgemont Dr., Syracuse, NY. 13214

ON DISABILITY PENSION NEED SSB xmtr for 40 m. Must be bargin or in need of repairs. Box 335, Nampa, Idaho. 83651.

NEW Regenay TMR-8H 148-174 MC. Crystal control and a 1 year warranty. In box. Have never been used. $129.00 postpaid. Ken, P. O. Box 141, Jenison, Michigan. 49428.

HW-32A $95. HB Power Supply $25. P&H LC-400C 800 Watt linear $95. K5YZQ. Tom Hoflich, 1629 So. Keeler, Bartlesville, Ok. 74003.

FOR SALE: EICO753 x cur, 751 AC Supply, and 717 Keyer. WAC, WAS, DXCC 120 with this rig. Make offer. WA5JWU, M. Carroll, 1836 S. Woodhaven, Baton Rouge, La. 70815.

WANTED to borrow: a manual for Heath Chippewa KL-1 Linear Amplifier. Will take good care and return. Samuel Warnock, K8NLM, 1109 Graystone Drive, Dayton, Ohio. 45427.

SELL: HQ-110 RCVR $100.00, EXC CONDX--Minolta ALS 35mm Camera $45.00, Perfect--K4OZQ, R. Hagan, 2058 Woodmeadow Circle, Birmingham, Alabama. 35216.

FREQUENCY METER, TS-174/U, 20-250 Mc. with modulation, Regulated A.C. power supply. Like new. $125.00. Glen Richie, 643 Diamond Road, Salem, Virginia. 24153.

TRADE: New ORD DK-1 Keyer for Autronic or TO Keyer. C. Kresge, W4NXE, 2525 North 10th Street, Number 904, Arlington, Va. 22201.

HAVE TO TRADE All or Part 2 LEICA 35MM, assorted Lens, Etc. Also 16MM Bell & Howell Movie Camera Magazine Loading, 3 lens Turret for CW TX. Col. E. Arnold, W6AT, 606 Buckeye St., Vacaville, California. 95688.

FOR SALE: Hallicrafters SX-115 in near mint condx., $300.00 or best offer. WANT: 500 cycle filter for Collins S-Line rcvr. R. F. Lozen, WB2-ERE, 625 Adeline Drive, Webster, N.Y. 14580.

WANTED: TR-44 Rotator with Control, in good condition. Will pay reasonable price. W1APU, Dover-Foxcroft, Maine. 04426.

FM Xmitter: FOR SALE, G.E. 4ET6B6, 50W, 6m, 12VDC inc. new MOT mike. Have 2 avail. @ $30.00 each or best. Sase for schem. S. Lipoff, K3KLQ, 621 S. Maple Oak Park, Ill. 60304.

WANTED: To contact anyone collecting tapes of Historic Radio Broadcasts, old programs, or other similar. Frank Gilmore, K0JPJ, 1258 E. Cherokee, Springfield, Missouri. 65804.

SELL: HW-16 Key manual, $85. Mint condition. Bert O'Connor, 16 Smithshire, Andover, Massachusetts. 01810.

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RTTY gear for sale. List issued monthly. 88 or 44 Mhy torroids, uncased, five for $2.50 postpaid. Elliott Buchanan and Associates, Inc., 1067 Mandana Blvd., Oakland, California. 94610.

NOVICE CRYSTALS: 40-15M $1.33, 80M $1.83. Free flyer. Nat Stinnette Electronics, Umatilla, Florida. 32784.

RUBBER ADDRESS STAMPS, $2.00. Signature $3.50. Free catalog. Jackson's, Box 443F, Franklin Park, Illinois. 60131.

TELETYPE equipment and parts. New and used. We stock just about any Teletype item. Write for more details. RTTY Electronics, P. O. Box 655, El Cerrito, California. 94530.

New-WB2EYZ SOLID STATE SPEECH PROCESSOR (QST Nov. 69). Exclusive SOFT CLIPPING in high quality limiter circuit. INTELLIGIBILITY improved 3db to 10db. DOUBLES output meter reading. MODULATION UNIFORM even when whispering. Order today. $79. SPEECH PROCESSOR - WB2EYZ, 2154 57th St., Brooklyn, New York. 11204.

COLLINS AND MOTOROLA For Sale: Collins 62S-1. Like new, $450.00. Motorola HT series H23DCN–1034A, wide band and 2 channel in universal case with crystals, nicad battery and all accessories. Like new, $275.00. Will not ship. Call Jack, WA9AHZ home 445-0311 or bus. 445-0364.

FOR SALE: HW-32, $60, Will pay shipping; TA-33, $50; AR-22, $10; Tel: 324-1227, WA6HYI, 17024 Faysmith, Torrance, California. 90504.

SPECIAL as long as our stock lasts: Brand new Hammarlund HQ-215 Mark II receivers, $295.00. Write for best prices on other new and reconditioned amateur equipment. HENRY RADIO COMPANY, Butler, Missouri.

WORLD RADIO's used gear has trial - guarantee! Clegg Interceptor - $199.95; 22'er - $139.95; KWM2A - $749.95; Swan 250C - $249.95; 350 - $289.95; 500C - $379.95; NCX3 - $159.95; HW22 - $79.95; DX60 - $49.95; HT40 - $49.95; HT44 - $149.95; SX101 - $159.95; HQ110A - $139.95; 2A - $159.95; HRO50 - $129.95. Free "Blue - book" list for more. 3415 West Broadway, Council Bluffs, Iowa. 51501.

DRAKE TR-3, AC-3 Power Supply, matching Heathkit SWR and Phone Patch, Collins SM-1 mike, (All above items contained in console unit--picture of station sent upon request), 1000' coax, 20' telescoping pole, Topaz DC-300X1 Power Supply, Webster Bandspanner--Complete package with manuals--$595. WA7BTK, Sittner Hall Annex, College Place, Washington. 99324. (509) 525-0950. All Exclnt Condx, one owner.

FOR SALE: Johnson Viking II (Provision for 10 Crystals). Also VFO for same,--Globe DSB-100. WA6HCH, Larry Plummer, Box 502, LaThrop, California. 95330.

PHOTOGRAPHY: Will trade Pentax Takumar 200 mm f3.5 lens and/or Polaroid deluxe model camera w/close-up and portrait lens for Ham Gear. Charles Simmons, Box 552, Plattsburgh, N. Y. 12901.

WILL BUY 1800 ft. of No. 28 DCC Wire and dozen binding posts of 1920's vintage -- W6AKM, 1289 Glen Eyrie Ave., San Jose, Ca. 95125.

FM GEAR - Trade: Motorola T-41 deck with x-tals for T-43 deck. Scope Heath SB-610 Mint cond.- $50. Ken Norton, WB4HKZ, 5 Bridgeport Drive, Greenville, S. C., 29607.

COLLINS MECHANICAL FILTER (FOR 75A4), 1.5 KHZ $20, 3.1 KHZ $12. KOBHM, Gary Yantis, 10809 Johnson Drive, Shawnee, Ks. 66203.

FOR SALE: ELMAC AF-67, PMR-7, M-1070 w/ cabling. Also EICO 753 w/solid state VFO and all manuals. Will deliver in S. West Mo. K0HQW, T. Isaacson, St. Rt. 1, Box 833E, Branson, Mo. 65616.

SELL: Knight T-150A xmtr. 150 watts, cw/am, 80 thru 6 meters, vfo/crystal. Vy gud condx, great cw xmtr. Will sell for $80 or best offer. Includes manual. WA9PQM, 1101 West Ridge Road, Hobart, Indiana. 46342.

WANTED: Operating manual, Alignment instructions for KG-636 Knight DC-Lab Scope. Dual-Trace Pre-amp. for above. WN5INU, Richard Lehmann, P. O. Box 1171, Bay City, Texas. 77414.

WANTED: Drake 2NT or other CW XMTR. Tom Dornback, K9MKX, 19 W. 167 21st Place, Lombard, Illinois. 60148.

MOBILE HI-BAND FM 10 Watt transceiver $15. 30 Watt, $25. Will not ship. John Wasiewicz, W2DQC, 229 Sarles Ln., Pleasantville, New York, (914) 769-9331.

REPAIR AND REBUILD small and medium antique transmitting tubes; also other vacuum work. Sam Diaz, P. O. Box 245, Pine Grove Mills, Pennsylvania. 16868.

SELL: Johnson Viking II, Heath Twoer, Lafayette HE45B. Write Chester Ludlam, 2309 Bullington, Wichita Falls, Texas. 76301.

MOTOROLA 41V Utility base 2 meter Rig 110V AC on 146.76 Meg, $85.00. Two Dumont TV Monitors, Model VM-8 and Electron Corp. Camera, highest bid. K5VYY, 3728 Wilkie Way, Ft. Worth, Texas. 76133.

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SELL: HT-46 SSB transmitter mint condx, $225. John Rogus, 58 Fremont Street, Meriden, Connecticut. 06450.

HAM TRANSFORMERS Rewound, Jess, W4CLJ. 411 Gunby Avenue, Orlando, Florida. 32801.

NOVICES: DX-60, Hr10, and Eico 722 Vfo all ppd ur Qth for $130. WA9WSX, RR 2, Ladoga, Indiana. 47954.

KONIKA AUTO SE CAMERA: Cost $130.00. Absolutely brand new. Swap for receiver or ? Fred Martin, 202 Kenny Street, Fayetteville, New York. 13066.

HAMMARLUND HQ-110 rcvr vry good condx. with speaker 160 to 6 meters, $95 or best offer. WA3JBN, 316 Donnell Road, Lower Burrell, Pennsylvania. 15066.

CLEANING UP SURPLUS CRYSTALS I have. 16 cents each. SASE for list. Also HQ-110 with speaker, $95. WA3JBN, 316 Donnell Road, Lower Burrell, Pennsylvania. 15068.

WANTED: Johnson 250 watt Matchboxes in good condition. State price. Douglas Kahle, K6OE, P. O. Box 507, Pacific Grove, California. 93950.

WANTED: Loan or Xerox copy of schematic for a Morrow Model number MB560 Xmtr. Chan Shippy, WA0YAK, Colome, So. Dak. 57528.

FOR SALE: 2 Prop Pitch motors, $25 each. PE 103 Dynamotor, $25. Pick up here. W8YLV, 2928 Dartmouth, Midland, Mich. 48640.

SELL: All Band Transceiver, SR150, AC and DC power supplies with mobile mount, $395. Also HT-37 and SX101A, $375 for both or $200 apiece. All the equipment is in excellent condition and on the air. K. P. Duquette, K2HDU, 7 Johnson Avenue, Plattsburgh, New York. 561-7403.

WANTED: Receiver for 160 meters. Must work. Surplus OK. Anything considered. WA2FGF, Ken, Totten, 11 Myrtle Avenue, Demarest, N. J. 07627.

RTTY INFORMATION for the Amateur interested in RTTY. F. DeMotte, P. O. Box 6047, Daytona Beach, Florida. 32022.

THE BEDFAST CLUB is always in need of used US or foreign stamps to sell for funds. No quantity too large. A. Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England.

SELL OR TRADE, APECO Copy Machine & Supplies, $25; Good typewriter, $25, GR Coax Line Stretcher, $25; TS-186D Freq. Meter 100-10,000 MHz, $95, list VHF/UHF. W4API, Box 4095, Arlington, Virginia. 22204.

WANTED: Any information on Codamite 201A Morse/Baudot Generator and address of Codamite Corporation. L. Van Heuveln, WA0NUX, Box 622, Salem, South Dakota. 57058.

SELL: HW-16 mint cond, $85. Will ship. Bert O'Connor, 16 Smithshire, Andover, Mass. 01810.

WANTED: Manual for Johnson Desk Kilowatt Trans. Pay reasonable price. W. J. Slater, COLOMBO, Dept. of State, Washn. DC, 20521.

WANTED: Accessories for Galaxy V. P. Wiegert, 625 Van Duzer Street, Staten Island, New York. 10304.

WANTED: 75A1-A2, A3, or A4, must be in A1 condition. State condition, price, etc., in first letter. Elmer Stedman. Burr, Nebraska. 68324.

SELL: Heath DX40-Needs work. Two 4CX250B's. Brand new. Best offer. K2STV, 30 Eleanor Lane, Plainview, New York. 11803.

WANT: DR-30 Receiver, Collins 399C-1. SELL: 75S3, $395. HW32, $80. SB610, $68. HO-13, $62. NC 190, $150. SB 200, $190. Lampkin 205A, $180. Linar System 350 DC s/for Collins, Drake. $80. TH4 Beam, used. $50. Drake AC3, $60. Frank Baker, W8FLT, Box 546, McComb, Ohio. 45858.

WANTED: Trade HW32A for HW22A. Need four Leg Self-supporting tower. Sell DB22 Preselector, $6.00, Tube checker, $12.00. W2UGM, 66 Columbus Avenue, Closter, New Jersey. 07624.

FOR SALE: EICO 753 Tri-Bander 20-40-80, SSB; AM, CW, Factory wired. 200 W. Input, 752 Mobile DC Power Supply. $150 takes both. Anyone have a Grebe CR9 for sale? W2ADC, Box 201, Elmont, New York. 11003.

FOR SALE: HALLICRAFTER HT-32A transmitter, mint, original owner. First $200.00 takes. R. Cherrill, W3HQO, 1405 New Rodgers Rd., Apt. M-12, Bristol, Pa. 19007.

SWAN 240 with a Heath HP13 DC 12v and HP23 AC supply, $200.00. Walt Kenyon, WA11344, 1695 North Point St., San Francisco, Ca. 94123.

WANTED: 2 Meter and 6 Meter Converters for NC300 RECX. W1KGU, 294 Summer Street, Brockton, Massachusetts. 02402.

FOR SALE OR TRADE: Henry 2K-3, HT 32B Excellent, HA6, P-26 Power Supply Hallicrafters SR42A W/HA26 VFO like new, Gonset 2 Meter Linear. HQ 180 Rcvr. Very Good, 75A4 Excellent. NEED: KWM 2 or 2A, R-390A or 51S receiver. D. W. Langston, W5BBV, 3808 Gingerbread Rd., Alexandria, La. 71301.

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SELL: Collins 75A-2 w/2.1 kc Mech, Prod. Det., Spkr & Manual, $200; National NC-173 w/Spkr & manual, $50. K8VQP, 15746 Bradner, Plymouth, Michigan. 48170.

REGULATED SUPPLY, Dressen-Barnes 22-106, 300V, 150MA, SASE details, $10 F.O.B., W6PZV, 3175 Val Verde Ave., Long Beach, Ca. 90808.

W-10-U Award: Work ten university club stations. Send $1.00 and the QSL's to Georgia Southern College Radio Club Secretary, W4DQD. L. Price, P. O. Box 2067, Ga. Southern College, Statesboro, Georgia. 30459.

FOR SALE: 1 pair Johnson Personal Messenger 1½ W. CB units complete w/carrying cases, extra xtals & auto adapter. Exc. cond. $150. J. C. Miller, W0IXB, 1735 N. 11th St., Neb. City, Neb. 68410.

HEATH 2mtr lunch box. With 12 vdc. $50.00. HE45B 6mtr, $50.00. WA5CMC, 2309 Bullington, Wichita Falls, Texas. 76301.

I'M STILL LOOKING for a Beckman 785(A) DCU, new or used. All letters answered. W4FUI, Box 260, Rte. 2, Candler, North Car. 28715.

TS-118/AP VHF-UHF Bird wattmeter and dummy load. 0-500w., in 3 ranges complete with 3 thermocouples. $65 FOB D. Tkach, 14938 S. Dixie Hwy. Monroe, Michigan. 48161.

ARTIFICIAL LINE UNIT Complete, $15.00. C. B. Goodman, 5826 S. Western Avenue, Chicago, Illinois. 60636.

WANTED: NBFM Adapter for Collins 75A3. 3Kc Filter for 51J4 Collins Rcv'r. Pay top price. WA2FYE, M. Paulson, North Salem, N. Y. 10560.

SELL: LaFayette HA-225 Comm. RX Vy gud cdx, $90. Ike, WB4LAL, Rt. 7, Florence, Al. 35630.

SELL: CQ & QST magazines from 47 for two dollars per year plus postage. Single copies 25 cents, plus postage. Erv Rasmussen, W6YPM, 164 Lowell, Redwood City, California. 94062.

1500 WATT PEP, 80-10 Mtr Final with Variac Control Power Supply, 100 watt drive needed. Excellent condx with Schematics. R. Mendelson, W2OKO, 27 Somerset Place, Murray Hill, New Jersey. 07974.

B. T. I. LK-2000, Absolutely Like New. Late s/n 1924; factory cartons, manuals. Cert. $695. WA6YQS, Telephone (916) 489-8659.

VOX WANTED FOR SWAN-350. K4NNK, Gary Altman, School of Biology, Georgia Tech, Atlanta, Georgia. 30332.

SELL-TRADE: Lowrance Fish-Lo-K-Tor; 4KW diesel generator; Atlas 10" metal lathe; Antique Colt Six gun; Swan 175 W/ac pwr; 2KW GE constant voltage xformer. Want KWM-I. E. E. Hampshire. R1, Camdenton, Mo. 65020.

JOHNSON VIKING II TRANSMITTER and matching VFO. Excel. cond. Sacrifice $75. Ph. (918) 437-6679 or write; WN5AER, 12110 E. 24th Pl., Tulsa, Oklahoma. 74129.

HAM CALL LICENSE PLATES for Collectors. Very rare KP6AQ to highest bidder. KP6AQ, 949 Havensport, Cincinnati, Ohio. 45240. Only KP6 Plates around!

SELL: LA400C Linear Amp 800W Pep, $75. HW-30, $35 plus shipping. WB2V2W, 10 Scott St., Massapequa Park, New York. 11762.

SWAP: Collins 30L-1 for 75S-3. Collins Crystal Pak for 75S-1. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Massachusetts. 01056.

WANTED: Schematic for SWR Coupler 914A that works with an old Jones Micro-Match 262 Indicator. K6VOI, Bob Carlson, 1309 East Elgenia Ave., West Covina, California. 91790.

KWM-2 number 12225, PM-2 $775; 75S-3, number 13619, $400; HT-44, PS-150, $265; SX-117, $200; HT-32A, $225; HT-33A, $300. All mint. Don Burns, 4410 Reading Rd., Dayton, Oh. 45420.

FOR SALE: Rackcabinets with doors, 76" x 22" x 22" over 6. of 19" panel space! $30 each. HQ-145C like new, $165. No shipping. W4JSC, Box 15013, Tampa, Fla. 33556. Telephone: (813) 920-5094.

AMECO TX-86 and PS-3 pwr supply, 80 thru 6 mtrs, 90 w. CW and AM, excellent novice or tech rig, $50. K4ZLE, 60 Fike Dr., Havelock, North Carolina. 28532.

FOR SALE: SR-400 w/matching power, mike and dust cover. $625.00. WB2DCH, Box 266, Salt Point, New York. 12578.

FOR SALE: KWM-2 with A.C. Supply 516F-2, $765.00. 30L-1, $345.00. All in mint condition. John Sypek, 311 Montgomery Street, Chicopee Falls, Massachusetts. 01020.

SALE: Gonset II - 2 meter equip - 117V -122DC- with Gonset VFO (with Stabe of audio), plus 15-20 xtals. Best offer! W2ASI, 15 Kensington Oval, New Rochelle, New York. 10805. (914) NE3-7077.

FOR SALE: ESSCO TU designed by ESSCO for KWM-2 transmit and receive RTTY. No modifications to KWM-2 required. First Check for $185 gets. J. Brink, POB 3734, Fayetteville, North Carolina. 28305.

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VIBROPLEX Key; "Original" $20. WANTED: Stereo Receiver. Bob, W0YVA/4, 4423 N. 17th Street, Arlington, Va. 22207. (703) 524-2398.

FOR SALE: POWERMAKER CONVERTS 12-V D.C. to 115-V 60-Cycle A.C. At 300 Watts. Fully transistorized. Like new, $50.00. W5AQN, P. O. Box 1316, Rockport, Texas. 78382.

HEATHKIT HD-10 KEYER: Very good condition, with instruction manual. $35.00. Contact: WA5-GYK, Byron Young, Jr., 1910 Red Bluff, number 19, Pasadena, Texas. 77502.

SELLING OUT: Mint Collins S-Line. 32S3, 75S-3B, 30L-1, 312B4, 516F2. First $1495.00. WA3H-MQ, Paul S. Abbott, 301 Blacksmith Road, Camphill, Pennsylvania. 17011.

WANTED: Early issues of QST, before 1923, to complete file. Also CQ, RADIO. Sell: Pr. new 304-TL's- $35. W9CO, Box 37, Lincoln, Il. 62656.

NEW HT-46 SSB-CW Xmtr--Has never been used. $225, W6GGT, 1925 Bidwell Way, Sacramento, California. 95818.

Collins 32S-3, Serial number 11363 in mint condition, $450.00. Joe Aguiar, WA1JLS, 45 Williamsburgh Drive, Orange, Connecticut. 06477. Telephone: 795-3071.

FOR SALE: Newtronics Cliff Dweller, 75 meter antenna, $40.00. Swantenna (Manual model) $30. Pick up deals only. W8IIT, 281 Jenny Lane, Dayton, Ohio. 45459.

WANTED: Johnson KW Matchbox 250-30-3 with directional coupler and CLIFF-Dweller 40 and 75 meter dipole beam. George Clark; 1741 La Coronilla Dr., Santa Barbara, Ca. 93105. (805) 966-2126.

FOR SALE: TX62, 2 mtr. converter, HQ110A, Lafayette VFO, 6 mtr preamp. $230. Charles Doley, WA2EUS.

FOR SALE: Drake 2B rcvr, good cond. $150, J. L. Slagle, Rt. 3, Box 14, Fort Collins, Colorado. 80521.

FOR SALE: New 3" Rect. Burlington MA meters. 5-- Oto 300; 4--0 to 150; 2--0 to 50; 1--0 to 25. W6OFD, 619 14th Street, Modesto, Ca. 95354.

BERKELEY 7160 FREQ COUNTER, $200. 1556 Counter with 1450 Printer. $200. SASE for info. W9TKR, 505 So. Elmwood, Waukegan, Il. 60085.

SB-300, SSB, CW & AM Filters. Like new-speaker, $200.00. W6TRU, 5226 Vickie Drive, San Diego, California. 92109.

CANADIANS SB34 Xcvr. $289 or best offer. VE3BBN, 226 Wellington Street E. Aurora, Ontario, Canada.

FOR SALE: SB 401, Excellent, $260.00. SB 301 Perfect, $250.00. Edmund C. Casey, W8DWJ, 500 Norway Avenue, Cincinnati, Ohio. 45229.

WANTED: Old Battery Operated Radios of the early 1920's. Need not be in working condition. State your price. K0SVJ, David T. McKenzie, 1200 West Euclid, Indianola, Iowa. 50125.

WANTED: 70' or 80' Crank up- fold over Heavy duty tower. WA1AWX, 101 Bob Hill Road, Ridgefield, Connecticut. 06877.

WILL SELL 4-1000A for $60.00, 3RP1, $13.00. All tubes Brand New. Everett C. Bollin, WA3DVO, 3511 Essex Road, Baltimore, Maryland. 21207.

FOR SALE: DX60 with some novice Xtals, $50. Johnson Match Box, 300W Max., $50. HT444SX-117 Both $425.00 SB200 Linear 185. All items in very gud condition and very clean. You pay shipping. Write WB2NDS, 16 Fane Court, Brooklyn, New York. 11229.

YOUR antique receiving, transmitting tubes rebuilt, working condition: $12. Replicas, $15. Postage extra. Sam Diaz, Pine Grove Mills, Pa. 16868.

FIELD DAY/Portable Rig - 40 meter CW transceiver; See CQ, June, 1968, page 61. This is the actual one built by W6BLZ. For the article, $40. Electronic Fish Callers for fishermen, $4.00. Write for details. J. R. Shank, 21 Terrace Lane, Elizabethtown, Pennsylvania. 17022.

HEATH SB-100, 200, 300, 400. Swan 240 & 12v. p.s. 3 kw plate Xformer. Estate sale. C. Wyman, 4453 Via Pinzon, Palos Verdes Estates, California. 90274.

WANTED: OBSOLETE TUBES-DeForest Marconi. Fleming Telefunken Welsh Weagant Moorehead. W9LGH, 610 Monroe Avenue, River Forest, Illinois. 60305.

WANTED TO BUY: Johnson 6N2 Thunderbolt VHF linear amplifier. Robert Dixon, W8ERD, 311 E. Kelso Road, Columbus, Ohio. 43202.

SWAN 350 with calibrator and AC Supply. Factory updated and aligned. Al Condx. $334. Roof Tower and 10/15 Meter Beam, $50. A. Bockelman, WB2RZF, 2617 Hewlett Ave., Merrick, NY. 11566

SWAN 350 - Cal. & AC Supply, Full 10M coverage. Mini-Products Vertical 6 thru 20M, no radials req'd $25.00. Many other pieces, all vfb condx. A. Bockelman, WB2RZF, 2617 Hewlett Avenue, Merrick, New York. 11566.

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TOUCHTONE DIAL equivalent from Denmark. Ten button, convertible to all twelve in a minute with data included. Beige, except green while they last. 12VDC required for oscillator operation. $15.00 postpaid USA. J. O'Brien, WA6-UGY, 6606-5th Street, Rio Linda, Ca. 95673.

MINIATURE LICENSE PLATE! Your call embossed in raised letters on 7" x 2½" steel plate. $1.00 postpaid. Yale Packaging Company, Yale, Michigan. 48097.

VHF NBFM TRANSCEIVER solid state modules. 25 Watt transmitter, including multiplier, six channel oscillator, phase modulator, FET front end, crystal filter I.F., discriminator, audio amplifier. 8 to 12 VDC. Request specifications and low price, brand new. H. D. Sylten, 1651 NE 56th Court, Fort Lauderdale, Florida. 33308.

DRAKE R-4 $210, Tom McGuire, 1521-2 H St., Davis, California. 95616.

SELL: HEATH APACHE, TA-33 JR BEAM, Clean Condx, WA8SNF, Barberton, Ohio.

FOR SALE: DX100 Xmitter, HOWARD 436A RCVR, all $70.00. Good for 10 meters or novice. W9EBH, Aledo, Illinois. 61231.

TRADE: My complete Collins S-Line for light plane. 30*S-1 75S-3 and 120' Crank up tower, Never used. Jim Lundy, WA5BMM, Deming, New Mexico. 88030.

SALE: Ranger I, $69.00. HW100 and AC power supply. New $275. Eddie Hathaway, 4803 Russell Street, Richmond, Virginia. 23222.

WANTED: Heathkit HW-16. Robert L. Ammons, Route number 1, Rowlesburg, W. Va. 26425.

ROCHESTER, N. Y. is again Hamfest, VHF meet and flea market headquarters for largest event in northeast, Saturday, May 16, 1970. Full day of dual programming covering all phases of amateur radio. See Announcements column for more information.

WIRELESS SHOP: New and reconditioned equipment. Write, call or stop for free estimate. 1305 Tennessee, Vallejo, California. (707) 643-2797.

NOVICES: Need for general ticket? Complete recorded audio-visual theory instruction. Easy, no electronic background necessary. Write for free information. Amateur License, Box 6015, Norfolk, Virginia. 23508.

TELETYPE PICTURES FOR SALE: Vol 1 $1.00. Vol 2 with larger pictures and new innovations $2. Audio and perforated tapes available. W9DGV, 2210-30th. St. Rock Island, Illinois. 61201.

WANT: DR-30; DR-50; DT-20. Must be in normal operating condition, clean. Your best price. W5-QCS, Ed Parsons, 1438 Adkins, RD. Houston, Texas. 77055.

FOR SALE: HQ170, noise silencer, good condition, $125. Wiseheart, 111 Calumet Avenue, San Anselmo, California. 94960.

NCX-3, HP-13, mic., $150.00. E. Rolek, 1166 Ridge Road, E., Rochester, N. Y. 14621.

HW12A plus HP23 Supply, $95, Johnson Fone Patch, $14, Heath 100 KC Xtal Cal., $9, Ameco SWR Bridge and Indicator, $18. All perfect. Will ship postpaid for cert. check or money order. K2QHT, Glamore Court, Smithtown, New York. 11787. Telephone: (516) 265-6479.

FOR SALE: "Simpson" 260, roll-top case, good condition, $40. Eico number 315 signal generator, $33. Heath kit GR-91, Short-wave, $20. David Nolt, R.D. 1, Paradise, Pennsylvania. 17562.

SOMERSET COUNTY HAMFEST The 5th SCARC Annual Hamfest will be held Sunday June 7 at the CASEBEER Grove 4 miles north of Somerset, Pa. on US Route 219. Registration starts noon. Rain or Shine-- FREE tables INdoors for swap-shop. Write K3YVS, 718 Division Street, Berlin, Pennsylvania. 15530.

CIRCUITS for 32 electronic projects, R. F., audio and gadgetry, complete plans, $1.00. P. M. Electronics, Inc. Box 46204, Seattle, Washington. 98146. Dealer inquiries invited.

FOR SALE: Carter Dynamotors unused 12 Volt In @ 14 Amp Output 720 Volt DC @ .125 Amps. $2.00 each plus postage. Roache, W1KUP, Canterbury, Connecticut. 06331.

MANUALS: TS-173/UR, TS-174/U, R-274/FRR, $5.50 each; R-390/URR, R-390A/URR, $6.50 each. Many others. List 20 cents. W3IHD, 4905 Roanne Drive, Washington, DC. 20021.

GET YOUR "FIRST!" Memorize, study: "1970 Tests-Answers" for FCC First and Second Class License. -plus- "Self-Study Ability Test." Proven. $5.00. Command, Box 26348-H, San Francisco, California. 94126.

FOR SALE: Model 26 Teletype machine; cover and table in excellent condition, $45.00. Must be picked up. Stoner RT-1 Converter, $45.00. R. W. Carter, K6DW, 1853 Euclid Avenue, Camarillo, California. 93010.

1,000 PERSONALIZED NAME AND ADDRESS LABELS, SIZE 2"x¾", $1.00. BUCKWALTER ENTERPRISES, 120 *Deerfield Blvd., Hampton,* Virginia. 23366.

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WANT: Used 3 element tri bander - thunderbird or jr., TA-33 or Jr. LaVern Smith, 3104 Catherwood, Indianapolis, Indiana. 46226.

SALE: Valiant I and HT-40 F/W XMTRS; SX-111 RCVR. Make offer, all gud condx. WA2APG, 27 Hearle, Pequannock, N. J. 07440.

SALE: Hard bound volumes "Flying Magazine" 1958-1962. "AOPA-PILOT" 1961 and 1962. $6.00 /Vol. Dr. B. W. Dukett, 2523 Durwood Road, Little Rock, Arkansas. 72207.

"ARMED FORCES DAY Certificate will be sent to every station worked by WA9DZL, Wisconsin Air National Guard, 128th Air Refueling Group during operation May 16, 1970. Look for us on SSB, 40, 20, 15, and 10 SSB."

WANTED: Single band beam HF antennas in any condition. Bill Costello, W3BQN, Route 2, Box 192-B, Annapolis, Md. 21401. (301) 757-2637.

WANTED: Antique transmitter and receiver tubes made before 1925, also UV-204 with spherical bulb. W9LGH, 610 Monroe Ave. River Forest, Illinois. 60305.

FOR SALE: Clean late Swan 350 W/Calibrator-VOX- C. W. Sidetone plus 117XC A.C. Supply and 410 External VFO $450.00. J. Huisman, 653 W. 27th Holland, Michigan. 49423.

WANTED TO TRADE: All construction plans and courses ADV. in POP ELECTRONICS. Don Brittons, Howards, Etc. 1 for 1 trade. Joe Wegner, P. O. Box 262, Glendale, California. 91209.

SELL: HEATH APACHE TX1- 150 W. AM- 180W. CW; Plus Gonset 6-10-15 meter converter. Both $85. J. B. Blake, WA6DSY, 1143 S. Shasta St., West Covina, California. 91790.

WANTED: Missing issues of Ham radio Magazine. Please state available issues, price, and condition in reply. W4GHV, 538 E. Samford Avenue, Auburn, Alabama. 36830.

EARLY RADIO books, magazines, catalogues, QSLs, keys, crystals or holders, before 1925, wanted. Buy or swap. K8IKO, Box 222, Worthington, Ohio. 43085.

SUPER NOVICE STATION: Ranger 1, HQ110C, 80, 15, 40 meter dipoles, coax, antenna relay, etc. $250. Jim Hadlock, K7JRE/1, 215 Herrick Road, Newton, Massachusetts. 02159.

WANTED: Manual for General Electronic Dist. Co. New York Model 200 Signal Generator. A. M. 'Gus' Goings, WA4CPL, P. O. Box 1195, Tavares, Florida. 32778.

FOR SALE: INSTRUCTOGRAPH, wind up model, W/Manual, 10 tapes. $10.00 FOB, W6PZV, 3175 Val Verde, Long Beach, Ca. 90808.

MULTI-ELMAC AF-60; KNIGHT T-60 W/Heath VF-I; Blaupunkt AM, FM, Marine 12 vt. Mobile. Need Ham-M Control, 8 cond. Wire, 6 & 2 Yagi. (213-869-7525) Downey, Calif. 90242. WB6HEZ.

20M. BEAM FOR SALE: HyGain 203BA (3 EL YAGI) with instructions and new end caps- pick up- Best offer over $30. WB6KXI. (213) 349-8492.

WANTED: Manual for Hammarlund HQ-120 Receiver. J. Alley, W1DMD, 298 Taunton St., Lakeville, Massachusetts. 02346.

WANTED: Lettine VFO W/P.S. State condition and price. K7VIN, 2612 E. Sandra Terrace, Phoenix, Arizona. 85032.

WANTED: 160 M. coils for C. E. 100V/200V. Willing to pay outrageous price or consider buying xmtr w/coils. LA0AD c/o Amoco, Tananger, Norway.

WORKED SOUTH AMERICA CERTIFICATE: Work all 13 countries. Send $1 and confirmation to HC1TH, Box 583, Quito, Ecuador, S. America.

WANTED: Gonset Comm IV 2 meter Transceiver. State condition, case color, single or dual tuning knob, serial number and lowest cash price. Chas. Simmons, Box 552, Plattsburgh, N. Y. 12901.

Shawnee Amateur Radio Association (SARA), Hamfest, August 2, 1970. Herrin City Park, Herrin, Illinois. For details write: Bill Johnson, W9ERI, 502 W. Kennicott, Carbondale, Illinois. 62901.

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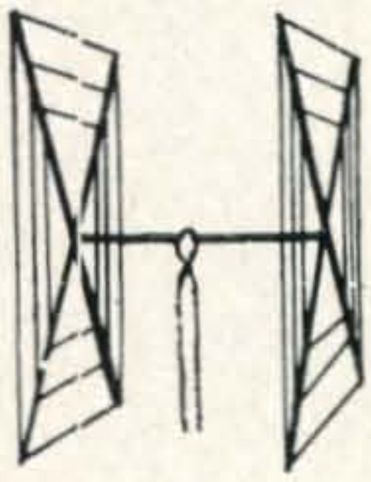

W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy 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
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Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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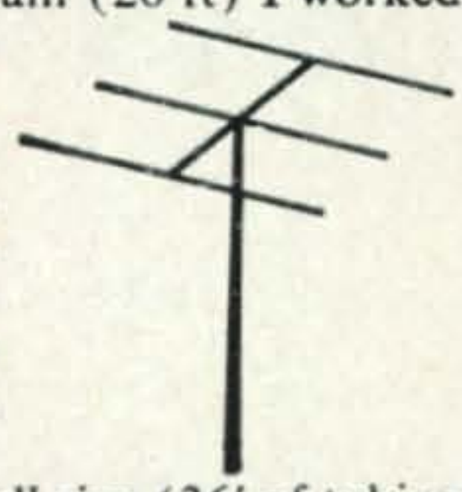

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*20' boom

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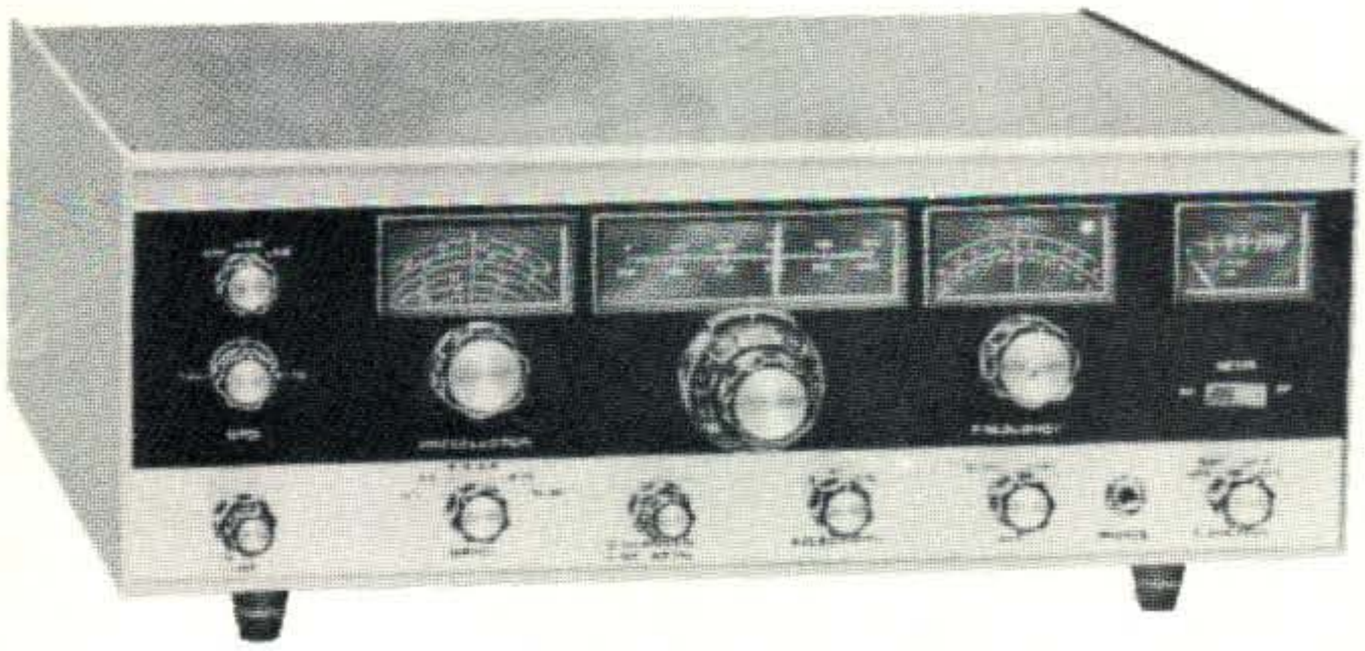

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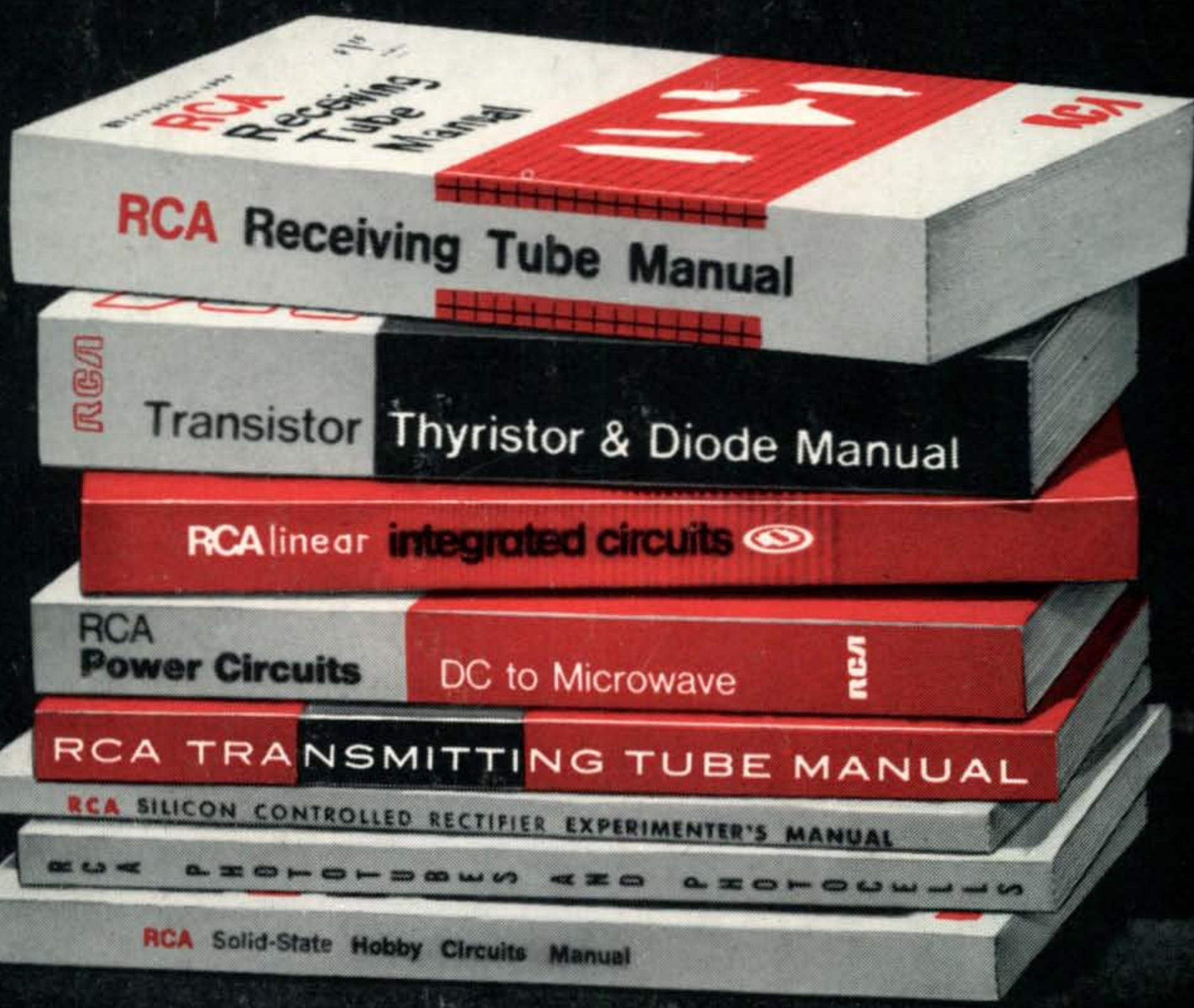

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