June 1969
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CQ

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Lunar Module Communications

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The Radio Amateur's Journal

NEW Heathkit® SB-500 2-Meter Transverter

Put Your Heathkit® SB-Series Rig On "2" For Only $179.95*

• Provides complete 2-meter capability for SB-101, SB-110A, HW-100 and the SB-301/401 combination • USB, LSB & CW operation • 144 to 148 MHz coverage • 130 watts PEP input . . . 50 watts PEP output • Highly sensitive receiver • Fast, easy tuning • No cable switching • Handsome SB-Series styling

Now, in answer to many requests, Heath has a fast, low cost way to put you on two meters . . . without having to buy a whole new rig. If you own an SB-101, SB-110A, HW-100 or the SB-301/401 combo, you're almost there. Here are the details on how to get on "2" — the SB-500 way.

Here's How It Works. In the receive mode, the SB-500 takes an incoming 2-meter signal and heterodynes it to either 6 or 10 meters, where the low band gear handles it in the usual way. On transmit, a 28 or 50 MHz driver output is heterodyned to 2-meters, amplified and coupled to the output.

Here's What It Delivers. When used with any of the gear above, the SB-500 2-Meter Transverter gives you complete 2-meter SSB or CW transceive operation from 144 to 148 MHz. A pair of inexpensive 6146's in a push-pull AB_1 circuit deliver a husky 50 watts output into a 50 ohm nonreactive load. Final plate voltages are derived from the driving unit, but all other operating voltages come from a built-in power supply — no extra supply to buy. Receiver sensitivity is 0.2 uV for a 10 dB S+N/N ratio . . . that means solid copy QSO's. A front panel on-off switch places the SB-500 into operation or allows the low band gear to operate straight through to an antenna or drive a linear . . . a combination of complete rear apron jacks and internal relay switching eliminates troublesome cable changing. Reliable relay-controlled T/R switching too. Tuning is fast and easy, and a built-in meter monitors either final plate current or relative power. ALC voltage is supplied to the driver to aid in preventing over-driving and distorted signals. A built-in 1 MHz crystal calibrator is also included.

Solid, Stable Construction. The sensitive receiver and oscillator go together on well planned circuit boards. To insure stability and make adjustment more exact, the transmitter and power supply components are ruggedly chassis mounted. The SB-500 comes complete with all interconnecting cables too. Start enjoying the QRM-free world of 2-meters today . . . with the new Heathkit SB-500 . . . another hot one from the hams at Heath.

Kit SB-500, 19 lbs.....**$179.95***

SB-500 SPECIFICATIONS — RECEIVER: Sensitivity: 0.2 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **Spurious Response:** All are below 0.1 microvolt equivalent signal input, except at 145.310 MHz (50 MHz IF only). **Antenna Input Impedance:** 50 ohm unbalanced. **TRANSMITTER: DC Power Input:** 130 watts PEP. **Power Output:** 50 watts (50% duty cycle). **Output Impedance:** 50 ohm with less than 2:1 SWR. **GENERAL: Frequency Range:** Any 2 MHz segment between 144 & 148 MHz into 50 MHz or 28 MHz tuned IF. **Mode of Operation:** SSB or CW only. **Power Requirements:** (1) 120/240 VAC, 50/60 Hz at 82 watts (internal). (2) 700 to 800 VDC at 200 mA (from driving unit). **Fuse:** ¾ ampere slow-blow for 120 VAC (formerly 3AG); ½ ampere slow-blow for 240 VAC. **Front Panel Controls:** Meter-calibrate switch, final tuning, off-on (function) switch, preselector, final loading, driver tuning. **Chassis Controls:** Relative power adjust & bias adjust. **Rear Apron Connectors:** RF output, ALC, linear relay, relay, drive, power plug, low f receiver, low f antenna, fuseholder. **Tube Complement:** 6CB6 transmitter mixer, 6CB6 crystal calibrator, 6DS4 receiver RF amplifier, 6DS4 receiver mixer, 12GN7 transmitter RF amplifier, (2) 6146 final amplifiers, (types 6146A or 6146B may be directly substituted), 7059 heterodyne oscillator-amplifier, 8156 RF driver, 0A2 voltage regulator. **Diode Complement:** 5 silicon diodes, 750 mA, 500 PIV; 3 in power supply, 2 in ALC. 1 Germanium diode, IN191: REL PWR. **Cabinet Dimensions:** 12¼" W x 6⅝" H x 13" D. **Overall Dimensions:** 12¼" W x 7-15/16" H x 14" D including knobs and feet. **Net Weight:** 14½ lbs.

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

ver·sa·til·i·ty (vur'se-til'e-ti), n., the quality or state of being versatile; specifically, a) competence in many things. b) ability to move freely in any direction.

the definitive ham rig . . . Heathkit SB-101 Transceiver with SB-640 External LMO and SB-200 KW Linear

Versatility has real meaning when you operate with this Heathkit trio. With the SB-640 & SB-101 combination you have *five* frequency control options . . . external variable control of transmitting frequency . . . internal or external variable control of transceiving frequency . . . or crystal control of *transmitting* or *transceiving* frequency . . . almost enough versatility to put you in two places at the same time. In operation, whether you are a DX hound, net control, contest operator, or just a guy who likes a lot of action, you'll appreciate being able to move freely anywhere. And with the SB-200 KW Linear you'll be heard anywhere.

Order the SB-101 for the best value in SSB transceivers. Front panel selection of upper or lower sideband; SSB or CW filters; PTT or VOX control; plus built-in CW sidetone; built-in 100 kHz calibrator; 1 kHz dial calibration; true linear tuning; fixed or mobile operation.

Order the SB-640 for the most versatile use of your SB-101. It's like adding a second receiver; provides external frequency control by LMO or either one of two crystals; features same calibration and smooth dial mechanism as SB-101; powered by SB-101.

Order the SB-200 for maximum power output at lowest cost. 1200 watts PEP, 1000 watts CW; drives with 100 watts; built-in SWR meter, antenna relay, solid-state power supply; ALC; shielded, fan-cooled amplifier compartment; pre-tuned cathode input; circuit breaker protected; 120/240 VAC.

Kit SB-101, transceiver, 23 lbs.	**$370.00**
Assembled SBW-101, transceiver, 23 lbs.	**$540.00**
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SBA-100-1, mobile mounting bracket, 6 lbs.	**$14.95**
Kit HP-13, Mobile power supply, 7 lbs.	**$64.95**
Kit HP-23A, Fixed-station power supply, 19 lbs.	**$49.95**
Kit SB-640, external LMO, 9 lbs.	**$99.00**
Kit SB-200, KW linear amplifier, 41 lbs.	**$220.00**

Compare the Specifications

PARTIAL SB-101 SPECIFICATIONS — RECEIVER SECTION: Sensitivity: Less than 1 microvolt for 15 db signal-plus-noise to noise ratio for SSB operation. **SSB Selectivity:** 2.1 kHz minimum of 6 db down, 5 kHz maximum of 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. **Spurious response:** Image and IF rejection better than 50 db. **TRANSMITTER SECTION: DC power input: SSB:** 180 watts P.E.P. continuous voice. **CW:** 170 watts — 50% duty cycle. **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 c- keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker in CW mode. Approx. 1000 Hz tone. **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 stability:** Less than 100 Hz per hour after 20 minutes warm-up. **Dial accuracy — "resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Cabinet dimensions:** 14 7/8" W x 6 5/8" H x 13 5/8" D.

SB-640 SPECIFICATIONS — Frequency output, LMO: 5 to 5.5 MHz. **Frequency output, crystal:** 4.975 to 5.525 MHz. **Frequency stability:** Less than 100 Hz per hour after 20 minutes warmup from normal ambient conditions. Less than 100 Hz for ±10% line voltage variations. **Visual dial accuracy:** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 Hz. **Front panel controls:** Main (LMO) Tuning dial; LMO/XTAL switch; Crystal Selector switch — XTAL 1/XTAL 2. **Panel light:** ON when transmitting or transceiving frequency is controlled by External LMO. **Rear apron facilities:** Connector to SB-101. Frequency Adjust trimmers XTAL 1 and XTAL 2. **Power requirements (from SB-101 Transceiver):** 150 VDC at 5 ma. 12.6 VAC at 450 ma. **Dimensions:** 6 5/8" H. (plus feet) x 10" W. x 11 3/8" D. (including knobs).

SB-200 SPECIFICATIONS — Band coverage: 80, 40, 20, 15 & 10 meters. **Maximum power input:** 1200 watts P.E.P. SSB, 1000 watts CW. **Driving power required:** 100 watts. **Duty cycle:** SSB, continuous voice modulation; CW, 50% (key down time not to exceed 5 min.). **Third order distortion:** 30 db or better at 1000 watts P.E.P. **Output impedance:** 50 to 75 ohm unbalanced; variable pi-output circuit. SWR not to exceed 2:1. **Input impedance:** 52 ohm unbalanced; broad-band pretuned input circuit requires no tuning. **Meter functions:** 0-100 ma grid current, 0-1000 ma plate current, 0-1000 relative power, 1:1 to 3:1 SWR, 1500 to 3000 volts high voltage. **Front panel controls:** Load; Tune; Band; Relative Power Sensitivity; Meter Switch, Grid-Plate-Rel. Power-SWR-HV; and Power Switch, on/off. **Tube complement:** Two 572B/T-160-L (in parallel). **Power requirements:** 120 volts AC @ 16 amperes (max.), 240 volts AC @ 8 amperes (max.). **Cabinet size:** 14 7/8" W x 6 5/8" H x 13 5/8" D. **Net weight:** 35 lbs.

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See page 110 for New Reader Service

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You're really operating 'First Class' with our 500C. It combines all the features you require to have a complete SSB-AM-CW transceiver with performance, quality, and reliability second to none.

The P.E.P. input rating is conservatively rated at 520 watts, but actually, with the pair of 6LQ6 blast rated tetrodes in the final amplifier stage, peak input exceeds 570 watts before flat-topping. With this kind of power, S-9 signal reports from the far corners of the world are commonplace. Audio quality of the 500C is definitely superior to most other transceivers on the market today. This is due to the high frequency crystal lattice filter used in the 500C that is made especially for us by C-F Networks. This filter provides excellent channel separation, combined with the smooth, natural voice quality for which the Swan 500C is so well known. Velvet smooth dual ratio tuning is achieved with our custom machined planetary drive, machine tooled to extremely close tolerances. Refinements of the Swan VFO have resulted in superior mechanical and thermal stability and more precise dial calibration. For the CW operator, the 500C includes a built-in sidetone monitor, and by installing the SWAN VOX accessory, you will also have break in CW operation.

The Swan 500C is a deluxe transceiver with proven reliability and performance, yet is priced substantially less than competitive gear. See it at your Swan dealer soon.

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Model 14-117 ..... $130

THE SWAN *Cygnet*

5 BANDS—260 WATT SSB TRANSCEIVER WITH BUILT IN AC-DC SUPPLY AND LOUDSPEAKER

It's a complete radio station in a lightweight, easy-to-carry package, that even includes the microphone, and yet costs only $395. Just connect a power source and an antenna, and you're on the air. Plenty of power to work the world with a strong, clear signal on phone or CW, and with excellent receiver sensitivity second to none.

The Swan Cygnet has been an instant success since we first introduced it in February. Experienced hams find it ideal for taking along on business trips or vacations since it can be operated from a motel room, boat, car, or practically anywhere. Newly licensed hams find that the Cygnet provides a complete amateur radio station at a minimum investment.

If you're one of those practical people who knows that the back of the airplane gets there the same time as the front . . . you, too, will like our Swan Cygnet.

See it, and try it at your Swan dealer soon.

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CQ The Radio Amateur's Journal

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DEPARTMENTS

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

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ZERO BIAS

At a recent convention, a newly licensed amateur came up to me and asked if I thought he should "waste $6 on joining the ARRL." He was clearly disappointed when I told him that, far from being a waste, his $6 League membership would be one of the more worthwhile investments he could make at this point in his amateur career. He obviously expected me to support the notion that the ARRL was not worthy of his membership. But I don't, and never have thought that way.

Make no mistake about it, I don't approve of the attitudes and tactics of the League in many important areas: their handling of the Incentive Licensing proposal, the pompous attitude of the DXCC committee, the ultra-conservative approach to such things as amateur satellites, and the terrible inertia frequently exhibited by League policy. Our disapproval, however, should not be construed to be total rejection of the value of a league-like organization. Moreover, we feel that it is essential to the future usefulness of ARRL to have young people join and begin to assume an active political role in League policy.

Scanning the lists of SCM's and Directors quickly gives the impression that both groups are composed of older and more established amateurs than the typical newcomer can easily relate with. It's difficult to see how things could be any other way since something like a league directorship demands large expenditures of time and effort, not to mention money, all of which are beyond the capability of a young man in his late teens or early twenties. In fact, even the very campaign literature distributed by candidates for directorships stresses the stable, long-term, established nature of the man. Youthful and fresh attitudes are most often detriments rather than assets to a league office-seeker, probably because the voting-majority is also composed of similar established, comfortable individuals. Thus the perpetuation of the conservative, middle-income, middle-age approach to league policy.

Maybe – just maybe – it's about time for a restructuring of ARRL to include some *working* provision for the participation of young people in policy determination. These young people are the ones who will be forced to live with the form of amateur radio that is being shaped now by an ultra-conservative ARRL. To suggest that they be given a major role in shaping their own future is therefore not too far afield.

Presently, the channels through which *any* amateur can make his thoughts known to ARRL headquarters are through sixteen ARRL Directors, all good men, but all unable to completely disassociate their own voting habits and opinions from those of their constituents. A man, no matter how impartial he tries to be cannot vote **without** some partiality, and a 40-year-old man, no matter how hard he tries, cannot think in the same terms as an 18-year-old.

It is our opinion that a new intermediate body should be established within ARRL which would lie between the ARRL member and the Divisional Director. We propose that the number of members of this body should bear relation to the number of League members to be represented and that such members be charged with the responsibility to *direct* the Divisional Directors on how they are to vote on issues which will ultimately affect the individual amateur in any way. We further propose that the only requirement for eligibility in this body be ARRL membership with no regard to age or length and continuity of membership, and that election to the body be by petition signed by 100 or so ARRL members.

We feel that in the improbable event that such a system was ever to be adopted, the young people of our hobby would finally have achieved the fair degree of representation which they are currently denied.

On Cover

Our cover this month takes on an outer space aire once again by depicting the landing on the Moon's surface of the Lunar Module and the first careful steps by man on a heavenly body other than Earth. The photo, supplied through the courtesy of Grumman Aircraft Engineering Corp. shows a full-size mock-up of the LM, and two fully suited-up "astronauts" on the detailed mock moon-scape at the company's Bethpage, L.I., N.Y plant. A sequel to March *CQ*'s "Voice of Apollo-8" article by K4DSN, this time describing the LM's communications system, begins on page 56.

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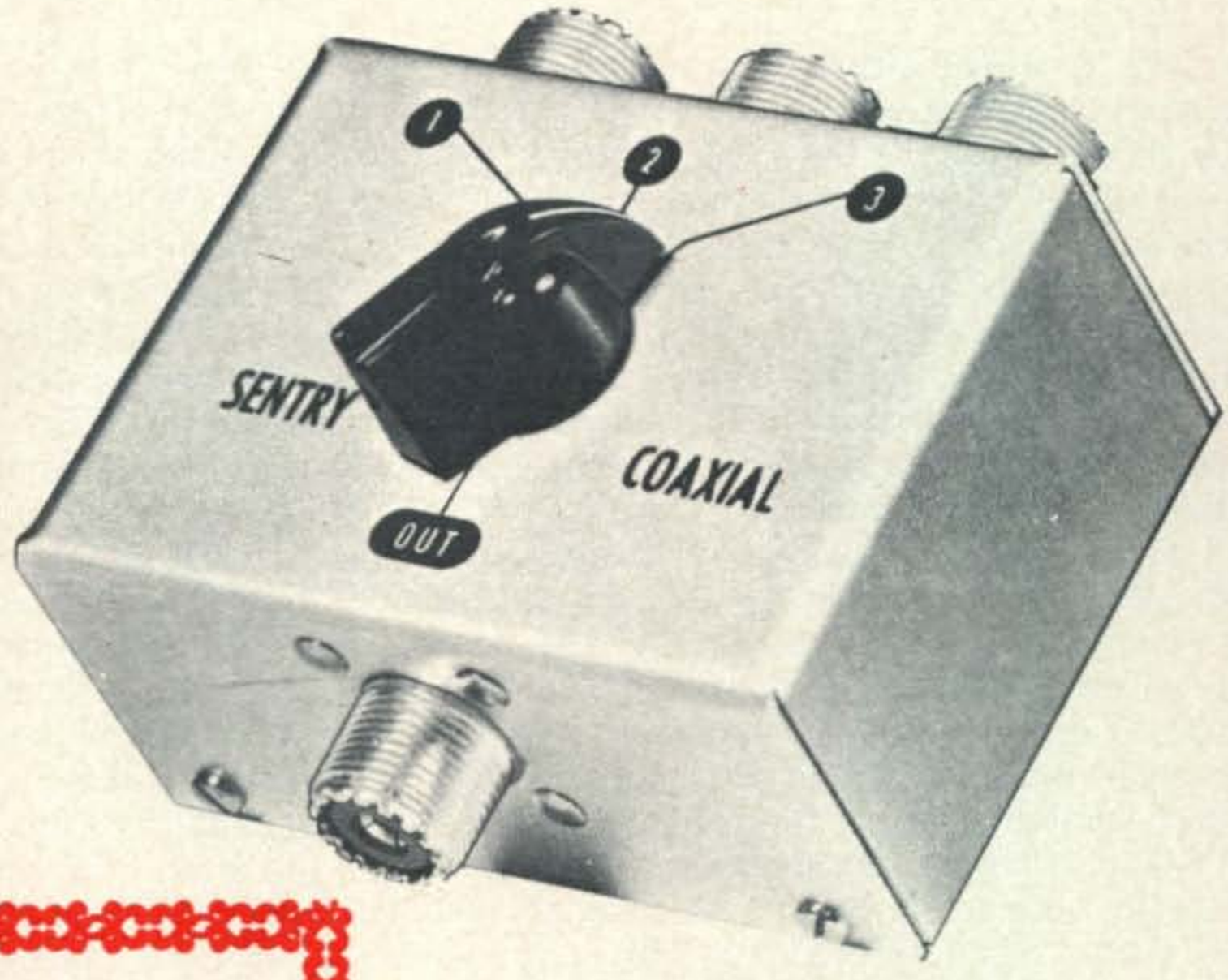

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OUR READERS SAY

Philippine Operating Permitted

Editor, *CQ:*

It is regrettable that copies of the *CQ* Magazine, January 1969 issue, arrived in Manila almost three months late, so that I secured my copy about the latter part of March.

The letter of W. P. Lauson, K7MZC, entitled "Philippine Operating," as published in the "Our Readers Say" page of that issue, brought me no little surprise and dismay. Mr. Lauson claimed that he had been stationed in the Philippines for several months and up to the time of his writing had not obtained permission to operate.

We would like to pass on to you the information that since 1964, the Radio Control Office of the Department of Public Works and Communications, Republic of the Philippines, has been granting special permits to U.S. citizens with valid FCC licenses. Among those who were granted permits to operate in the Philippines since then were:

DU Special Call	*Name*	*Home Call*
W6FHM/DU1	Herman Brunemeier	W6FMH
W4BIC/DU1	E. K. Shinn	W4BIC
KH6AED/DU1	Sam Lewbel	KH6AED
DX1AAV	Lawrence Eisler	W4AAV
DX1LNY	B. J. Smith	K8LNY
DX1HMI	Frank R. Smith	W8HMI
DU1ZAA	William J. Hunt	K2IRT
DU1ZAB	Gary D. Elliott	W7UXP
DU1ZAC	Robert K. Kula	K3MOV
DU1ZAE	Halbert T. Cupps	W4JNR
DU1ZAF	Alex T. Quarmyne	9G1TV
DU1ZAG	Byran Y. Ike	WB6KRW
DU1ZAH	Lyman L. Frazer	W4SUS
DU1ZAI	G. T. Mitchel	KG6APJ
DU1ZAJ	Wallace F. Music	W7UUO
DU1ZAN	John Lowell Alline	W1GL
DU1ZAW	William R. Long	W3EIV
DU8ZAD	T. K. Baxter	W3MOV

All applications to operate ham radio stations in the Philippines either of foreign or Filipino nationals, have to be recommended for approval by the Philippine Amateur Radio Service, Inc. (PARS) of which the undersigned is the President. We are enclosing a copy of our Articles of Incorporation and the By-Laws for your file.

As of this writing, we have not come across any communication from Mr. Lauzon applying for a permit to operate an amateur radio station in the Philippines. Furthermore, we do not have in our records a person who is "Filipino by birth and now a U.S. citizen" who had been granted permission to operate in the country. We have, however, received an application two weeks ago from Capt. Salvador R. Tesoro, WB6LVR,

See page 110 for New Reader Service

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- 180 watts input

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Model TC-6

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Amateur Net

FEATURES

- All switching between VHF and normal low-frequency operation of the exciter and receiver is accomplished by the function switch on the front panel.
- When used with any Drake exciter, no additional power supply is needed. However, the converters may be powered by an AC-3 or AC-4 power supply when used with other exciters.
- The low level drive required is obtainable from almost any exciter covering 20 meters or from the TR-6 (with TC-2).
- Oscillator injection may be obtained from the Drake VHF receiving converters.
- Transmitting AGC prevents flat-topping and increases talk power.
- Metering is provided for both final amplifier plate current and relative output power.
- Built-in antenna relay.
- Provision for controlling linear amplifier and/or external coax relay.
- Matches Drake 4-Line in appearance.

TC-2 SPECIFICATIONS

Frequency Coverage: 143.9-148 MHz.
Frequency Coverage with TR-6 and SC-2: 143.9-144.5 MHz and 144.9-145.5 MHz.
Modes of Operation: SSB, CW, AM, RTTY; determined by exciter.
Average Distortion Products: The odd order are better than 25 dB below PEP.
Input Power: 180 watts on CW or RTTY. 180 watts PEP on SSB and AM.
Output Impedance: Nominal 52 ohms with adjustable output network (SWR less than 2:1).
Injection Required: 0.25 V. at 130 and 131 MHz (from SC-2).
Excitation Required: 0.25 V. at 13.9-18.0 MHz.
4 Tubes, 4 Transistors, 5 Diodes.
Size: 5½" high, 11⅝" deep, 7⅝" wide. **Weight** — 9 lbs.

TC-6 SPECIFICATIONS

Frequency Coverage: 49.5-54 MHz.
Modes of Operation: SSB, CW, AM, and RTTY; determined by exciter.
Average Distortion Products: The odd order are at least 35 dB below PEP.
Input Power: 300 watts on CW or RTTY. 300 watts PEP on SSB and AM.
Output Impedance: Nominal 52 ohms with adjustable Pi-L network (SWR less than 2:1).
Injection Required: 0.25 V. at 36.0 and 36.5 MHz (from SC-6).
Excitation Required: 0.25 V. at 13.5-17.5 MHz.
6 Tubes, 1 Transistor, 4 Diodes.
Size: 5½" high, 11⅝" deep, 7⅝" wide, **Weight:** 9 lbs.

At your distributors, or write: Dept. 269
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USAF, assigned at Camp John Hay Air Force Base in Baguio City, but his permit has not been issued yet. He is a Filipino by birth and now a U.S. Citizen with permanent residence in Chicago, Illinois.

It will certainly be of great interest to all *CQ* readers to know that the reciprocal agreement between the Unithe States of America and the Republic of the Philippines, which was initiated by PARS, has already been signed by U.S. Ambassador G. Mennen Williams. We expect the Philippine Secretary of Foreign Affairs to ratify this very soon.

Lastly, we hope that you will publish this letter in your magazine for the benefit and guidance of all concerned.

Emilio M. Assistores
Asst. Dir. of Civil Aviation &
Asst. to the Undersecretary for
Transportation and Communications
Manila, Philippines

Editor, *CQ:*

Readers of *CQ* have traditionally been treated to a look at "the other side of the coin" on important matters such as incentive licensing, DXpeditions, etc. It has always been a pleasure to note that when your opinions do not agree with those of ARRL, you have presented your arguments to the readers, and the readers presumably make up their minds on the particular subject after seeing both sides of the situation. This is as it should be, however, it places a resonsibility on you to present facts in an honest manner.

I feel you have neglected this responsibility in the February '69 edition. I refer you to "De Extra", page 69. The status of the change of grades of licenses is grossly misrepresented. To illustrate my point, let's take a representative group of 1,000 amateurs and divide them up according to the percentages quoted by K4IIF.

Class of License	No. of Amateurs per Thousand Holding This Class License		Number Change	Percentage Change
	1965	1968		
Novice	62	56	− 6	− 9.7%
Technician	224	218	− 6	− 2.7%
Conditional	154	136	−18	−11.7%
General	395	405	+10	+ 2.5%
Advanced	150	158	+ 8	+ 5.3%
Extra	16	26	+10	+62.5%

If we consider Conditional and General as basically the same class of license, since they share the same privileges, then the figures become even more in favor of the higher class license. Even without this stipulation, however, Advanced is increasing at twice the percentage of General, and Extra is increasing at 25 times the percentage rate of General. This certainly looks like a landslide to me! Due to the fact that Advanced class licenses were not issued to new applicants until late in 1967, this increase took place over only one year of the three year period in question, and it is reasonable to assume that there will be a much larger increase in this percentage in future three year periods.

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Since this letter will probably come to the attention of Mr. Attaway, I would like to make clear that this is not intended as a "Vicious Attack", but only as a request to present the facts in a true light. The percentages he quotes relate to the total of all licensed amateurs, not to the individual class of license, and are therefore irrelevant and present a distorted picture.

I would appreciate further correspondence from you or Mr. Attaway on this matter.

H. Hans Brakob, KG6AQI/WAØPQF
FPO San Francisco 96630

The following is a reply from DX Editor John A. Attaway, K4IIF.

De Extra's statistical analysis was made by a neutral party, not even interested in amateur radio, who has a Ph.D. from a major West Coast university. He warned us that there would be those who would make the case for a '62% increase', but that it was totally invalid statistically as the starting point represented such a small percentage of all the U.S. hams. For example, suppose we had a Super Duper class license, but only one ham had it. Then if 2 other hams became super-dupers, it could be hailed as a 200% increase and therefore a landslide by the standards of Mr. Brakob. However, 3 hams out of 260,000 are almost as meaningless as the number who are amateur extra's. For further comment see De Extra on page 64 of the May, 1969 issue of *CQ*."

John, K4IIF

Ham Repeaters

Editor, *CQ:*

It's about time, an article on Ham Repeaters ...Page 46 of the April 1969 issue...

I am a new 3 year subscriber and one of the many hams interested in the latest ham fad, two meter repeater communications. At last we old timers have something new and up to now the leading amateur publications have ignored the subject completely as tho it did not exist.

Now, Mr. Editor, please follow up with articles on the repeater and mobile units and how they are set up and operated. A list of the many repeaters already in operation Nationwide would also be interesting.

Wilbur T. Golson, W5CD
Baton Rouge, La. 70806

We Stand Corrected

Editor, *CQ:*

It appears that there is a small error in the power supply article on page 36, April *CQ*.

Resistor R_1 has a value of 2.7 k on the schematic. It appears to me that for a good design R_1 should have a value of about 470 ohms. The reason for this is that the zener diode regulated supply for the base of transistor C_1 should be as "stiff" as practical for best regulation. The 1N964 has a nominal current of 9.5 ma. with a max. of 24 ma. Under worst conditions–high line voltage and no load on the power supply with a 470 ohm R_1, the zener current would be approximately 12.5 ma., well within its 400 mw. rating. With low line voltage and full output load

[*Continued on page 95*]

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Announcements

Correction

RE: Photo on p. 71 in Dec. '68 *CQ*. The call sign of DARC president Karl Schulthesis should be DL1QK.

Tacoma, Washington

The 1969 Washington State Hamfest will be held July 12 & 13 at the Sportsmen's Chateau, 16409 Canyon Road East in Tacoma. There will be two days of activities for hams and their families. Camping and trailer space available on the grounds.

Preregistration prize will be an HW-12A transceiver kit. Grand prize will be a Swan 350C transceiver. Many other door prizes. Registration is $5 in advance and $5.50 at the gate.

For motel or camping reservations, registration applications or information, contact Hamfest Chairman Merl Chavis, W7IKG, 5640 S. Yakima St., Tacoma, Washington.

Chatham, Ill.

The Wuad-Co. Amateur Radio Club will sponsor the 12th Annual Hamfest of the "Breakfast Club" on July 19 and 20 at Terry Park, 3/4 mile east of Palmyra. All other groups are invited to meet at the hamfest, giving prior notice to the hamfest committee. There will be dancing and movies Saturday night. Bring your own basket lunch. Sandwiches and soft drinks available on the grounds.

Mobile talk-in on 3873 kc. from noon Saturday to 11:00 A.M. Sunday. Games, contests, golfing and fishing. Bring your swap gear. Camping facilities open from Friday afternoon to Monday morning. Pre-registration until July 7 is $1.00; $1.50 at the gate.

Write: "Hamfest" c/o Quad-Co. ARC, Box 323, Chatham, Ill. 62629

Passaic, N.J.

The Knight Raiders VHF Club, Inc. will hold its Third Annual Hamfest on Saturday July 19. Between 500 and 600 hams from the metropolitan area are expected to attend this affair which will be held at Garret Mountain Reservation, West Paterson, N.J. For more information contact: Jack D. Wilk, K2KDQ, P.O. Box 1054, Passaic, N.J.

Radio on Radio

"QSO with W2CFP," a new series of broadcasts featuring news and views on amateur radio is now being heard each Saturday in the Central

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SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

You would think that it being easy to forecasting weather these days. After all, scientists having weather saddlites all over the sky, getting pictures of weather all over the world. How hard it be to knowing what the weather are going to be at one little old spot on earth?

Hon. Ed., it not that I minding minor differences. Likesay forecast is for "clear and temperature in 80's"—I not minding it when it a bit cloudy and temperature in 70's. Or, likesay if forecast for "cool and 30% chance of rain"—I not minding it when it a bit cloudy and temperature in the 70's. Anybuddy can be wrong a little bit.

But Hokendoke Hackensaki!! did things get goofed up last week. I never forgetting it, on acct. I coming within an inch of not being able to breathing . . . but I getting ahead of my story.

Scratchi needing new antenna for some speshul experimental work I doing. I making deel with local tellyfone company and getting a used 50 foots tellyfone pole. They making reel slicky self-supporting antenna roost, as you knowing, Hon. Ed.

Next, I calling weather bureau to getting forecast for weekend. They coming back with "clear and temperature in mid-80's." Real nice pole-putting-up weather. So, I notifying several local amchoors we having a pole-raising and cacktus jooce party that Saturday.

When along come Saturday, it looking like forecasters are being rite, as it reel peechy weather. Local amchoors showing up brite and early, and we starting to dig hole. Needing a 15 foots hole, then we planning to digging a trench leeding to hole, so we can just sort of sliding pole into hole. Kind of a hole with a side door, of you knowing what I meening.

Hole digging working out reel well. Ground is kinda soft from resent rains, so old Arizona clay coming up nice and easy. By noon we

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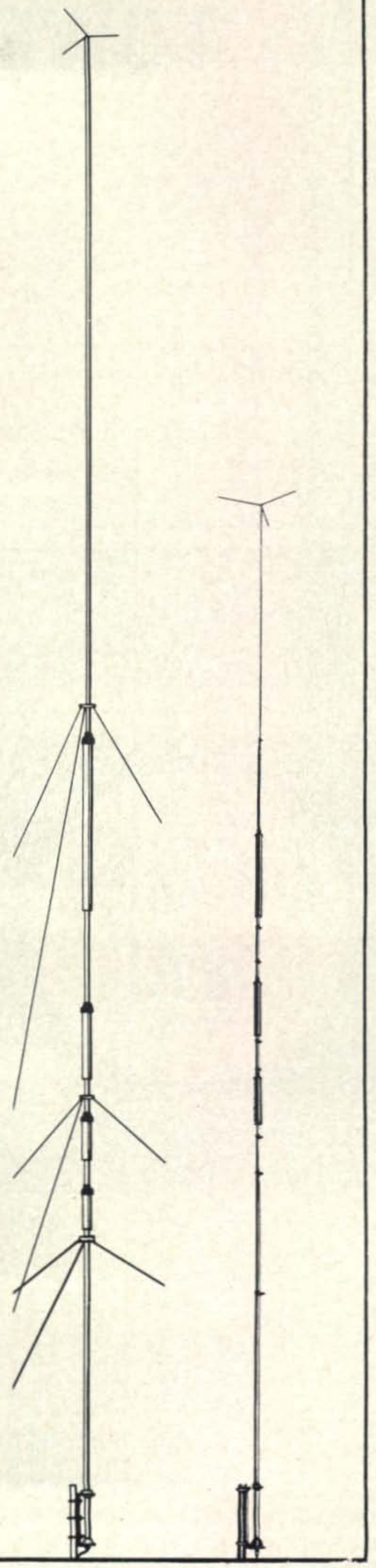
If you can't swing a beam, maybe you should swing with one of these.



These are the trap verticals that go along on just about every DX-pedition. It's because they're the best antennas under the sun for hams that are short on swinging room or cash.

The 14AVQ (10 thru 40 meters) and the 18AVQ (10 thru 80 meters) from Hy-Gain are the ONLY high efficiency-high Q trap verticals made.

Others claim to have an advantage in uniform mediocrity across all bands which is the result of low Q-high loss traps.

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Get down to the best distributor under the sun (he stocks all Hy-Gain products) and get swinging on the 14AVQ or 18AVQ.

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FOR THE MOST ADVANCED ANTENNAS UNDER THE SUN

See page 110 for New Reader Service

having hole at rite depth, and the other fellers who digging trench are almost finished. So, we calling lunch hault, to partaking of some of XYL-to-be's cucumber, peanut butter and jelly sandwiches, washed down with cacktus jooce.

By time finishing lunch, it no longer "clear." In fackly, it "overcast with showers any minute" kind of weather. We pole-putter-uppers thinking things over and desiding to go ahead anyway. If it rains, ground will be slippery and pole going in better.

Sure enuf, just as we finishing side-hole trench and rolling tellyfone pole over to it, rain are reely coming down—a reel Arizona gully washer. We huffing and puffing and pushing for abouts ten minutes, and getting pole up in air cupple of feets. All this time rain are coming down harder and harder until we sloshing around in at least a foots of mud.

Suddenly sky are cleering, rain are stopping, sun are coming out, and wind are starting. Hon. Ed., you never seeing wind like this. I meen, it reely blowing—like sixty-eleven miles per hour. It blowing so hard it picking up the mud on the ground and blowing it over everything. While this happening, that Arizona sun are shining britely and temperture going up to high-80's.

So there we are, pushing up on pole—looking like flag-raisers at Iwo Jima—and wind are plastering us with mud, and Arizona sun are baking it on us as fast as it hitting us. You not buleeving this, Hon. Ed., but in no time at all none of us can moving. Mud is caked so hard we can't moving a muscle. All of us are mud statchews. Hands in air, pushing up pole, but just statchews.

We might being there yet except for good old Hon. Brother Itchi. He thinking we could be having problem, so he coming out to helping us. When he seeing our predickament, he quick-like getting hammer, and knocking mud off all of us.

So, next time you hear about Arizona weather, keep in mind it can be changeable. And don't ever buleeve weather forecasters when they say "clear, temperature in mid-80's." I still have tellyfone pole at 30 degree angle sticking in ground. Hole is filled up and packed tite with baked mud.

Oh, if you printing this, don't using my reel name, or Feenix Chamber of Commerce getting reel mad at me, and maybe not renewing my subscripshun to Arizona Highways Magazine.

Respectively yours
Hashafisti Scratchi

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A TWO CHANNEL CONVERTER FOR APOLLO RECEPTION

BY FRANK JONES,* W6AJF

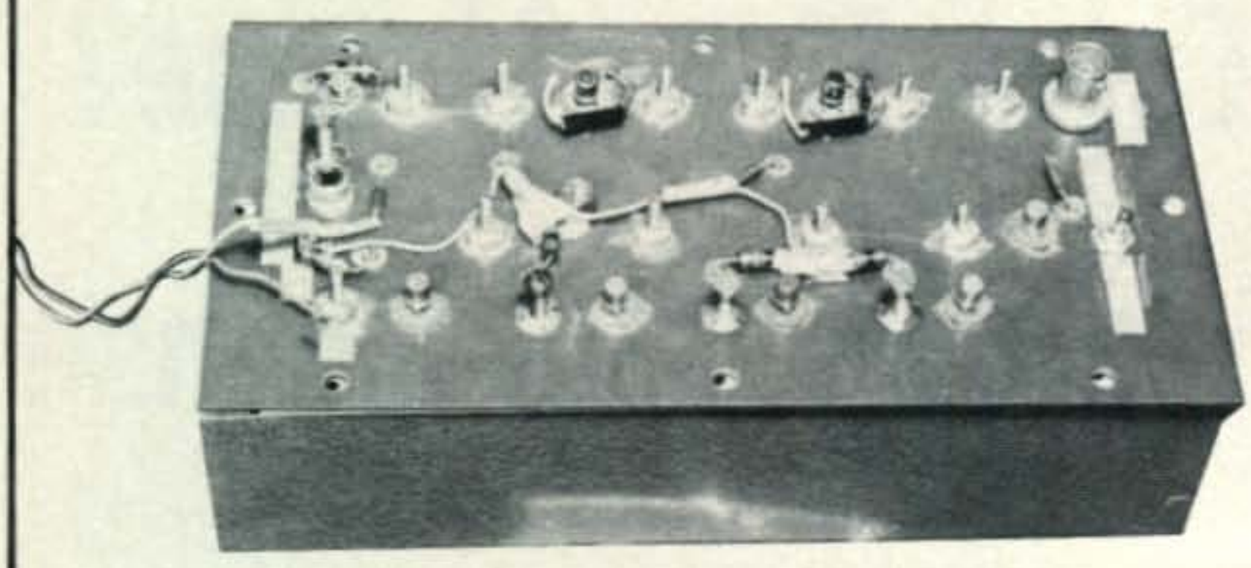
THE two channel v.h.f. converter illustrated here was built up to monitor the expected frequencies that would be used by the astronauts on their trip to the moon. These would be voice channels and might be fairly weak signals coming back to earth. Probably a beam antenna would be needed though possibly a horizontal 20 inch dipole would be good enough for reception part of the time. To make up for possible antenna deficiency, the converter was designed for high gain and low noise figure. The N.F. measured at values between 2 and 3 db, which is very low indeed, at the desired frequencies of 296.8 and 259.7 mc. The remarkable Union Carbide UC734 f.e.t. (field effect transistors) at the present price of less than $2 apiece seem to be the best transistors for the r.f. and mixer stages. Probably the Texas Instrument 2N5245 or TIS88 would be comparable, at a little lower cost. The socket connections would be different and the neutralizing coil *L*m probably would have less turns.

*850 Donner Avenue, Sonoma, Calif. 95476.

Circuit Descriptions

Two r.f. stages were used to get enough gain to permit the use of an f.e.t. as a mixer with the low cross-modulation advantages. Perfect inductive r.f. neutralization of the input to output capacitance cannot be obtained at both r.f. frequencies since there is nearly 40 mc spread involved. The neutralization is good enough to permit good gain at both frequencies when the r.f. circuits are properly tuned and the antenna is near 50 ohms impedance. The mixer output is in the 21 mc band which is covered by any amateur band radio receiver when used as the i.f. system with this converter.

The crystal controlled oscillator chain finally was designed with surplus crystals of 7650 and 7800 kc. These are multiplied 36 times to get the 275.4 and 280.8 mc frequencies needed to heterodyne the desired r.f. signals into the 21 mc band between 21.0 and 21.5 mc. With the particular crystals and untuned crystal oscillator shown in the circuit diagram, the multipliers wound up close to 275.4 and 280.0 mc. One crystal output



Top view of the two channel Apollo converter mounted in its chassis enclosure. The oscillator chain is in the foreground with the channel selector switch at the right, just below the antenna connector.

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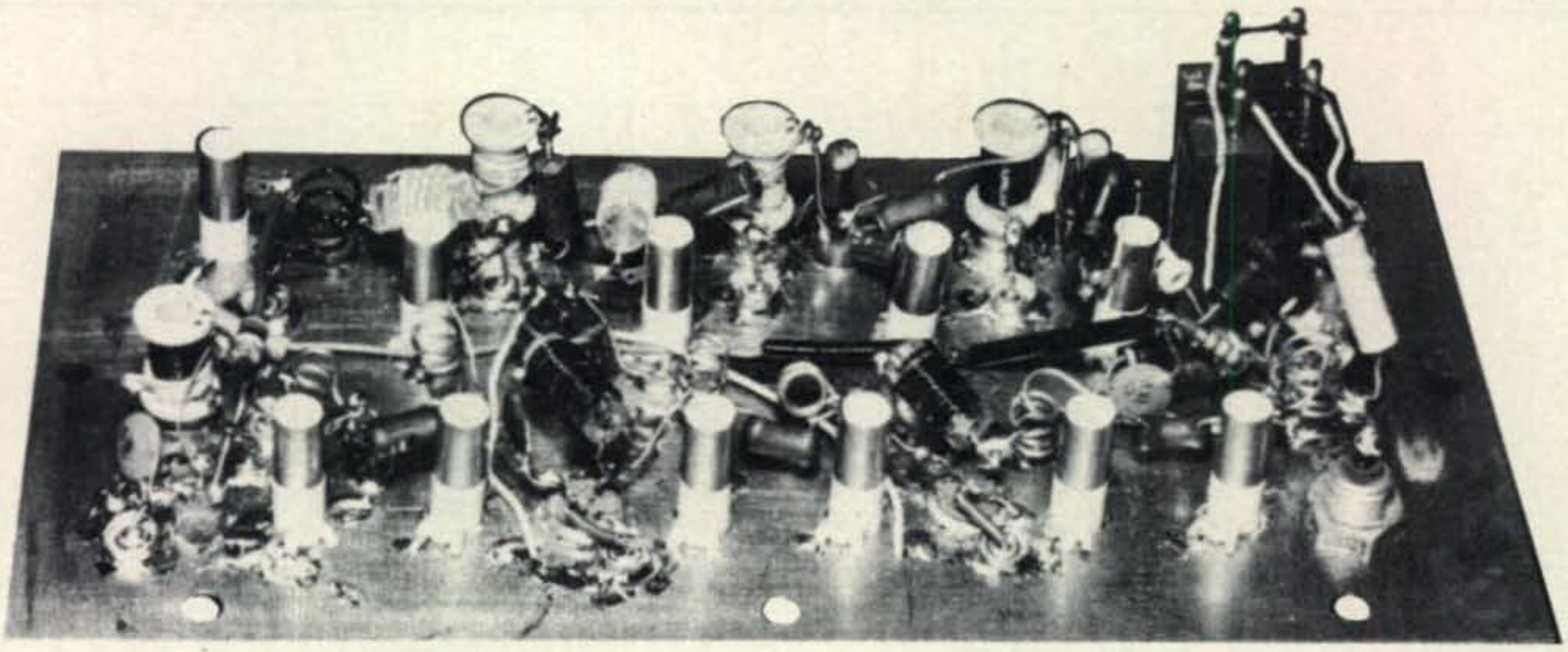

Bottom view of the two channel Apollo converter shows the r.f. strip in the foreground and the crystal oscillator chain in the rear. The harmonic trap adjustments are in the center of the board. The crystals and the selector switch are in the right side.

halfway between the 296.8 and 259.7 mc would do, if the i.f. receiver would tune in the range of around 18.5 mc. The 21 mc band is close to this range, so that the two crystals are close enough to operate in the doubler and tripler stages without retuning.

Overtone crystals could be used but these would cost more than the savings in coils and other small parts. One advantage of overtone crystals in the 30 to 40 mc range is that there are less oscillator chain spurious signals responses than when starting with 7 to 8 mc crystals. F.e.t. units in the r.f. and mixer circuits, and moderately good *Q* in the multipliers help to reduce spurious signal responses. The series tuned trap circuits in each frequency multiplier probably help emphasize the desired frequency in each stage. These circuits increase the stage output considerably when tuned to the collector frequency by providing a low impedance path from base to emitter. Some adjustments, particularly at higher capacity settings, will tend to cause spurious oscillation, so care must be taken to adjusting these traps properly.

The frequency multiplier stages are all biased at zero voltage until r.f. drive is applied. This means practically no collector current until r.f. drive is present (or undesired parasitic oscillation is present).

The transistors used here were unmarked, mixed 2N706, 2N708 or 2N709 NPN units which can be used in this frequency range. The 2N706 units seemed to have slightly higher output capacitance which may mean a turn more or less in each slug coil form to hit the desired frequency. Nearly any silicon NPN low priced transistors can be used in this oscillator chain providing the f_T is above 400 mc. The output voltage is more than enough to produce good mixer operation with an f.e.t. These require several times as much oscillator injection voltage as would a v.h.f. bipolar transistor. However, the f.e.t. mixer is fairly free of cross-modulation problems.

The r.f. circuits were overcoupled tuned circuits, in an attempt to double-peak the response curves near 297 and 260 mc. Flat response in the middle was not wanted so the *LC* ratios and 1½ mmf coupling capacitors are values which are supposed to produce double peaking effects. It is hard to arrive at this condition in actual practice since the input and output resistances of the UC734 f.e.t.s are not accurately known in this 200 to 300 mc range. Regeneration in the two stages of r.f. amplification also affects the double peaking response. The final effect is suitable for reception of either r.f. channel by only switching to the proper crystal and-tuning the i.f. receiver to the correct spot.

Bipolar transistors of equally good noise figure in this range for r.f. and mixer stages are cheaper but are apt to have bad cross-modulation from any strong signals in this broad band r.f. converter. The f.e.t.s are certainly much better. The f.e.t.s have less gain in r.f. and mixer service but have as good a noise figure.

If the sensitivity of the i.f. receiver is very good at 21 mc down below one microvolt, one r.f. stage in the converter could be elim-

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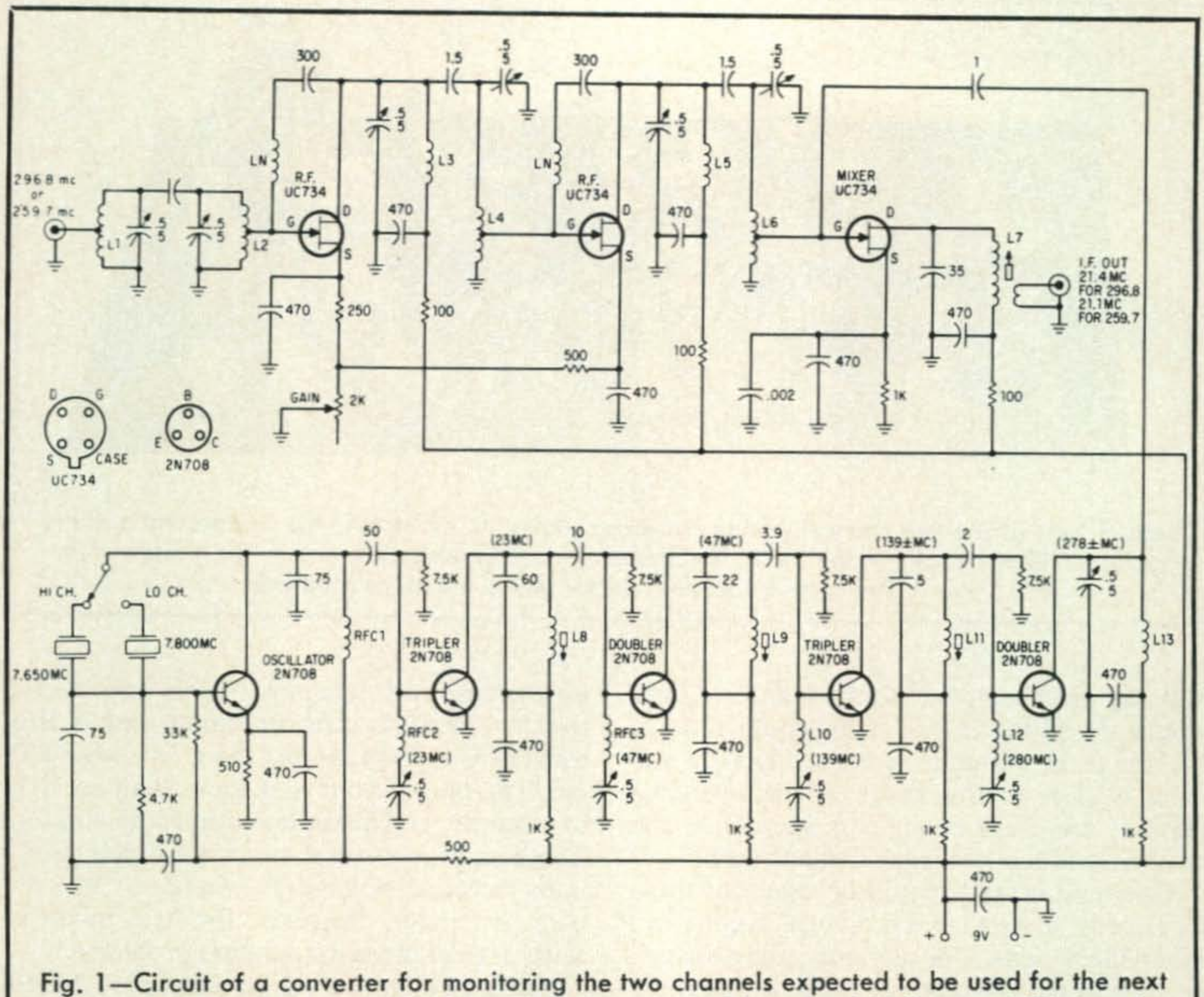

Fig. 1—Circuit of a converter for monitoring the two channels expected to be used for the next moon shot, 296.8 mc and 259.7 mc. The r.f. output is 21 mc for 259.7 mc and 21.4 mc for 296.8 mc. All resistors are 1/2 watt; all capacitors are in mmf.

L_1, L_2, L_4, L_6—4t #20 3/8" long, 1/4" dia., center tapped.
L_3, L_5—4t #20 3/8" long, 1/4" dia.
L_7—21t #28 e., 3/8" long, 1/4" dia. on brass slug tuned form. Secondary 2½ turns on cold end.
L_8—16t #24 e., 3/8" long, 1/4" dia. on brass slug tuned form.
L_9—11t #20 e., 7/16" long, 1/4" dia. on brass slug tuned form.
L_{10}—9t #24 C., 1/4" long, 1/4" dia.
L_{11}—5t #26 e., 1/4" long, 1/4" dia. on brass slug tuned form.
L_{12}—5t #20 e., 1/4" long, 1/4" dia.
L_{13}—3t #20 e., 1/2" long, 1/4" dia.
Ln—10t #22 e., 3/8" long, 1/4" dia.
RFC_1—1/4 mh.
RFC_2—12 μh.
RFC_3—3 μh.

inated without too much sacrifice in n.f. and image rejection. When a converter has only one r.f. stage, the problem of r.f. oscillation is usually absent. A suggestion would be to leave space for the first r.f. stage for addition at a later date. Put the coax input over at the first transisor socket hole and substitute L_1 for L_2, omitting L_2 and Ln *etc.* The writer usually tackles two r.f. stages in all converters and winds up with stable operation. However, if one is tackling the construction of a v.h.f. converter for the first time, a single r.f. stage may present enough problems without compounding it with two stages.

The r.f. coils were wound with some bare number 20 wire which was available. Number 18 or 16 would make a more rigid coil since these are self-supporting, no coil forms. They were wound over a 3/16 and a 1/4 inch diameter drill as a winding form and turns spaced out to the desired winding length. The neutralizing coils Ln and trap coils L_{10} and L_{12} were wound on pieces of poly rod or tubing, 1/4 inch in diameter. The coil turns on Ln were cemented in place,

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coil length varied, only after getting the stages neutralized as well as possible. The other series trap coils were small solenoid, fairly good *Q*, coils of 12 and 3 or 3.3 microhenrys inductance. These could be wound using a coil calculator, but r.f. chokes were available which had a measured *Q* of between 45 and 60, so they were used.

The oscillator chain uses collector slug tuned coils which have 6-32 brass tuning screws. These do not have a wide tuning range so some spacing, winding length, may be needed before these coils are cemented with poly coil dope. If ferrite slug forms are used these coils should have about 15% less coil turns in the same winding length.

The oscillator chain of transistors actually put out a little more r.f. than needed for best noise figure operation. Decoupling resistors of 1000 ohms in place of the usual 100 ohm values were used to reduce the output. Another way of adjusting the output for best results is to use short pieces of insulated hook-up wire twisted together one or more twits in place of the fixed one mmf capacitor shown in the circuit diagram. This capacitor connects from the last frequency multiplier to the gate of the mixer transistor. An f.e.t. mixer, if over driven, is subject to cross modulation and becomes excessively noisy. Too little oscillator injection drops the mixer gain and overall sensitivity very fast, so that should be avoided also. F.e.t. mixers require just about the right amount of oscillator injection for results comparable to an ordinary bipolar transistor. This means about two to five times as much oscillation injection voltage for the f.e.t. mixer for really good operation.

Any transistor mixer needs a low impedance path from gate to ground and source to ground at the output frequency. The tapped gate coil connects directly to ground resulting in a very low impedance at 21 mc. The source bypass, a 470 mmf small feed through bypass capacitor was a little shy on capacity at 21 mc so a .002 mf (2000 mmf) disc condenser was shunted across it. These small solder-in feedthru condensers are especially effective in the 100 to 400 mc range and if memory serves me correctly, are manufactured by Allen-Bradley. If these are not available, small disc ceramic capacitors with short leads may be used as bypasses. Either 500 or 1000 mmf values are suitable. The copper plated bakelite or epoxy board makes a fine ground system and is easily soldered to with a 25 watt soldering iron.

Construction

The converter was built on a 4 × 8 inch copper plated board with the copper side down so as to make a shielding enclosure with a 4 × 8 × 2 inch aluminum chassis. The transistor sockets, if used, can be epoxied in place in this board. If the transistor sockets are not used be sure to insulate the cases of the 2N706, *etc.*, as these shells are connected to the collectors internally. The UC734 transistors have four leads with one lead connected to the metal shell and this can be grounded. In case the transistors are soldered into the circuit, use a heat clamp radiator such as a pair of long nosed pliers clamped on each wire between the transistor and the soldering joint. Small light weight metal clamps are sold by radio dealers and these clamps snap onto the leads while soldering, thus freeing a hand for other service.

Alignment

The oscillator chain alignment really requires an r.f. voltmeter in the 1 to 5 volt range. If one isn't available, a diode, such as a1N100, may be hooked up with a couple of capacitors and resistors as an r.f. head for use with an ordinary d.c. voltmeter.

As each frequency multiplier is tuned up, its series trap circuit should also be tuned for maximum output into the base of the next transistor. Start with minimum capacity in each .5 to 5 mmf capacitor and adjust the screw inwards slowly to the first good peak of output of the multiplier stage. Too much capacity in this series trap circuit may result in self oscillation in the multiplier stage, not controlled by the crystal oscillator. Considerable care is needed to avoid this condition, so always start with minimum capacity in these series tuned trap circuits which are connected from base to emitter in each multiplier stage.

The problem of circuit alignment may be complicated by lack of a suitable signal generator in the 250 to 300 mc range. The writer used the second harmonic of a two meter signal generator. The harmonics are about 1/50 the output of the fundamental, so the attenuator on the signal generator will only show relative output. The rate of attenuation may also be considerably different at these higher frequencies. However, the harmonics do provide a signal for aligning the

[*Continued on page 104*]

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THE POP BOTTLE VERTICAL

BY LARRY W. STRAIN,* WAØEMS

It would be a very unusual ham who would not be interested in an antenna that could be built from scratch in less than a half hour, that is excellent for DX, shows an s.w.r. of unity over half the band and costs less than ten dollars. Sound like a dream? It is, but it can be built.

The antenna has been around for quite a while and is probably one of the simplest ever. There seems to be, however, a shortage of specific dope for exact construction. For those who wouldn't care to spend time figuring just what is needed let's build the Pop Bottle Vertical.

Antenna Construction

The list of materials required is shown in Table I and is specific as well as self-explanatory. Type 6061T6 aluminum was selected on the advice of a metallurgist and has proven to be very satisfactory. It is tough enough to withstand high winds without breaking and can survive most accidents like being dropped off a roof, stepped on (lightly) and so on.

The aluminum tubes are sized for convenient telescoping. Sometimes the 7/8" tube binds inside the 1" tube and steel wool has to be used to smooth any irregularities.

Figure 1 shows how the tubes are assembled initially. A hacksaw is used to cut a notch the width of the blade for one inch into one end of the 1" and the 7/8" tubes. (See fig. 2.) The use of a vise is recommended in order to assure that cuts are even and straight. The compression hose clamps, when placed as in fig. 3, will hold the pipes firmly in place after tightening and provide a convenient adjustment for tuning as described later.

After preparing the top sections as above, the bottom of the 1" tube is cut two ways (fig. 4) and flared with long nose pliers to fit over the mouth of a pop bottle.

Guy Lines

Before the antenna is mounted on the pop bottle the guy lines must be prepared from the nylon line listed in Table I. Cut the nylon line into three 40′ lengths and three 7½′ lengths. Tie a one inch loop 15 feet from one end of each 40′ cord and attach the end of a 7½′ cord to the loop with a square knot.

The shorter end of each 40′ cord is tied just above the clamp on the 7/8" tube and the free end of each 7½′ cord above the top clamp on the one inch tube.

*4912 N. Wheeling, Kansas City, Mo. 64119.

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We are now ready to put up the antenna so drink the pop out of the bottle and set the bottle 2/3 of the way into the ground. The base of the antenna will sit on this so it should be located at least 15′ away from any metal object, further if possible. Drive stakes into the ground fifteen feet out from the bottle, spaced 120° apart.

Slide the 3/4″ tube out 10 feet 6 inches and tighten the clamp on the 7/8″ tube. Then slide the 7/8″ tube out 10 feet and tighten the top clamp on the one inch tube. With luck it will not be necessary to readjust these.

Erecting the Antenna

If another person is handy, there is no problem erecting the antenna. One person simply holds it up while the other ties the guy cords. With only one person, the vertical must be laid with the top clamp on a line between two of the stakes and the ends of two cords tied to them. The vertical is then raised until it leans out away from these stakes and is self supporting while the third line is fastened to the remaining stake. Adjust the guys so that the pipe is absolutely vertical. It only takes a few minutes but is very important to the operation of the antenna. The base should be beside the pop bottle when finished, with all guys snug but not overly tight. When the flare is lifted and fitted over the neck of the bottle the extra tightening will be sufficient to prevent excess sway. The finished results should appear as shown in fig. 5.

Feed and Ground System

The ground rod, at least 4′ long, must not be much over one inch from the side of the bottle and should be driven in until the top is even with the top of the flare on the antenna base.

RG-8/U coax is preferred for connection as this type of vertical will give almost exactly 50 ohms impedance. However, RG-11 can be used but special adjustment must be made as will be explained later. Of course RG-58 or 59 can be used if the power is under 250 watts.

The outside insulation of the coax must be removed for 6 inches and the shield peeled off to one side for the same distance. The shield fastens to the ground rod and the center conductor goes under the base clamp on the antenna. Tape the place where the shield and center conductor separate to prevent water from leaking into the coax. The antenna should be ready to go for 40 meters

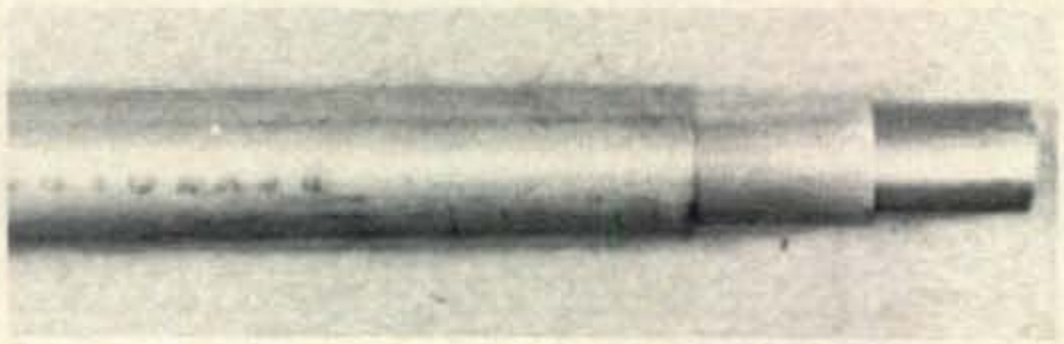

Fig. 1—The tubing for the vertical antenna nests neatly with barely enough clearance to permit adjustment.

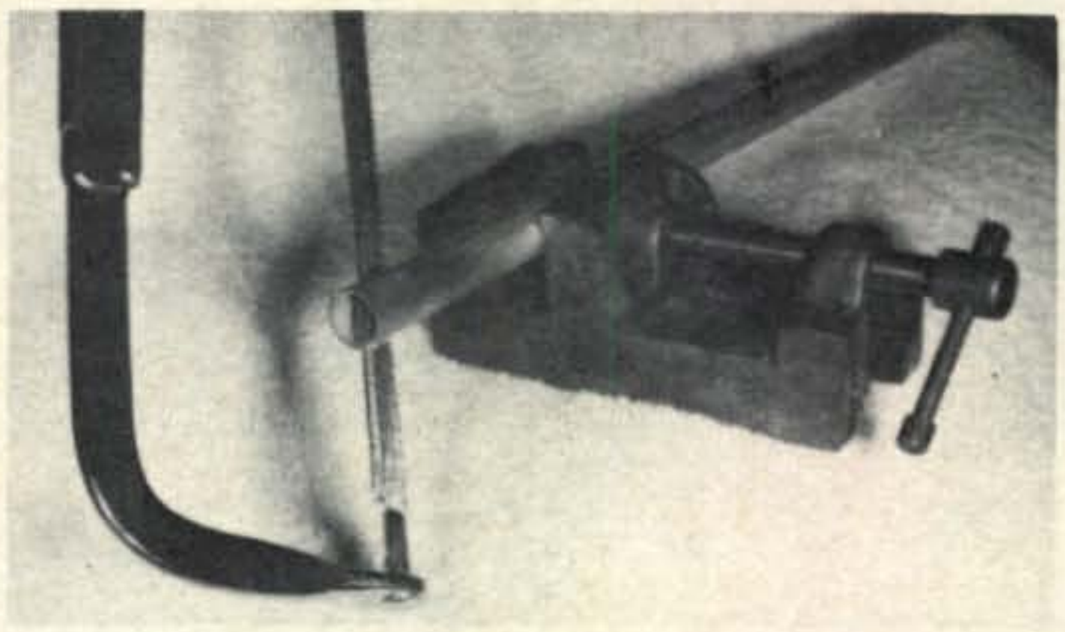

Fig. 2—Slotting one end of the 7/8″ and 1″ o.d. tubes will permit hose clamps to set the interlocking tubes. A fine tooth blade on the hacksaw permits smooth cuts. Slanting back slightly when starting the cut and then squaring off at the end is recommended.

Fig. 3—Clamps are placed in position and tightened just enough to prevent their slipping off but not enough to close the slots.

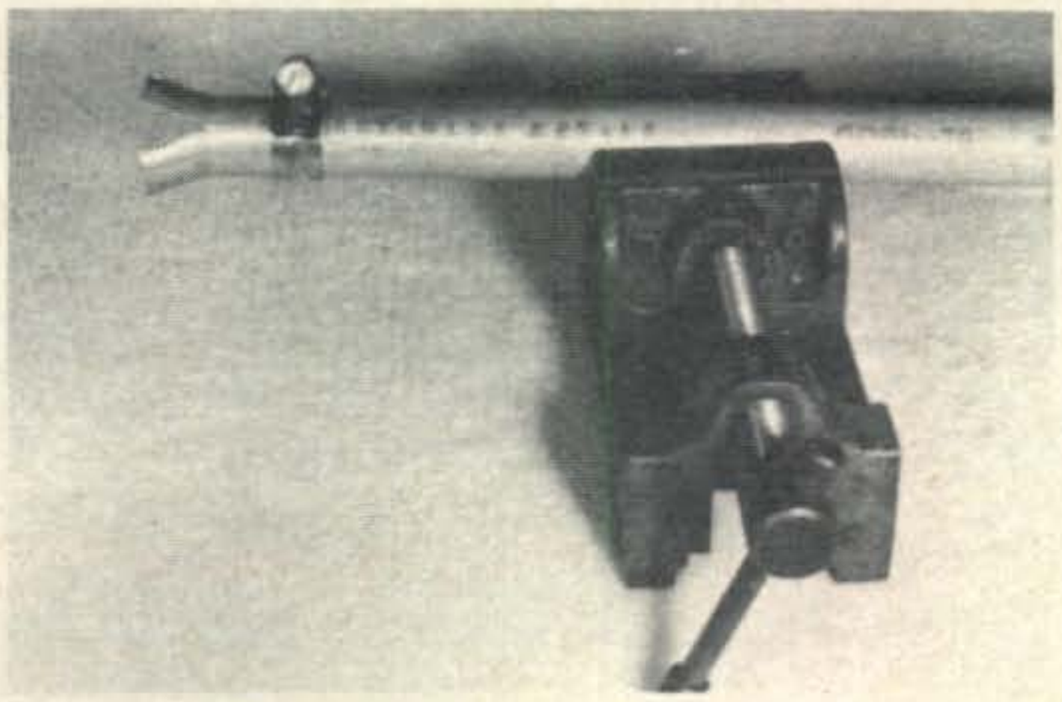

Fig. 4—With the bottom clamp in place the end of the 1″ tube is flared so that it will rest on the top of the pop bottle. Two hacksaw cuts dividing the end into four quarters will permit easy flaring.

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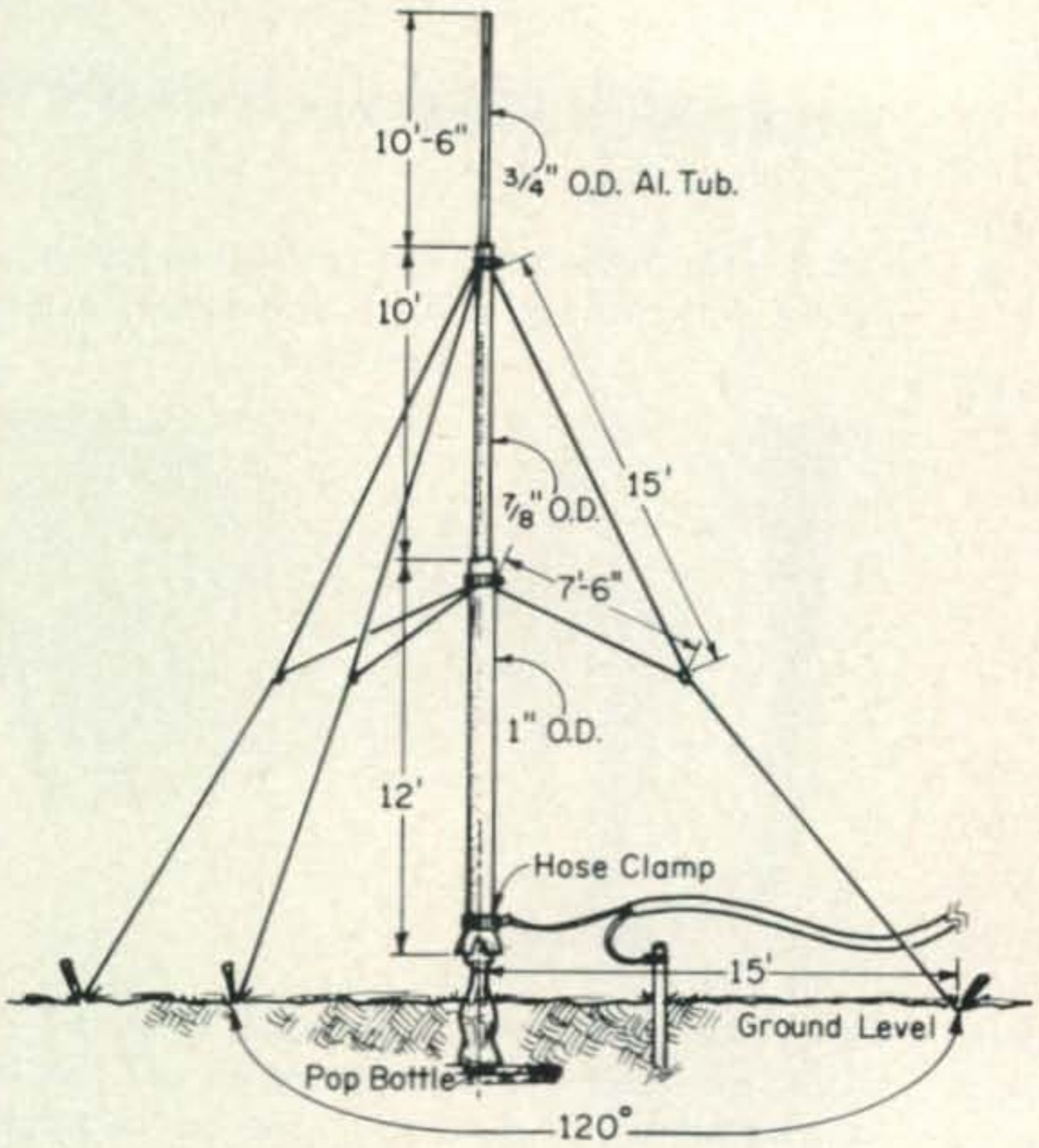

1-12 foot length .058" aluminum tubing, 1" outside diameter.
1-12 foot length .035" aluminum tubing 7/8" outside diameter.
1-12 foot length .035" aluminum tubing 3/4" outside diameter.
3-#16 screw type hose clamps (1/2" i.d. hose).
1-4 foot (or longer) copperweld ground rod with clamp top.
150' nylon seine twine, 100 lbs. test.
1-Bottle of pop, flavor optional.

Table 1—Bill of materials needed for construction of the vertical antenna.

Fig. 5—Dimensions and construction of the Pop Bottle Verticle, ideal for operation on 40 and 15 meters. With a loading coil operation can be extended to 80 meters.

and 15 meters.

Unless there is some metal object in the area the resonance will be 7.2 mc with the measurements given and the s.w.r. will be unity within 50 kc up and 75 kc down.

If the resonance is desired on another frequency the length can be adjusted by loosening the clamp at the top of the 1 inch tube and sliding the 7/8" tube in or out as needed. A 6' step ladder will give access to this clamp but an 8' ladder is safer.

If the s.w.r. is higher than desired or if 72 ohm coax is used the clamp at the antenna's base can be loosened and slipped up the antenna, which raises the impedance of the point of connection. Sometimes it is necessary to adjust the antenna length in addition.

Addition of 1/4 wavelength wire radials will improve performance and burying the coax between the antenna and the house will help protect it from lawnmowers.

Increased Frequency Range

The antenna, as described, will work on 40 and 15 meters making it an excellent antenna for the Novice. Addition of an air inductor in series with the center coax lead will permit operation on 80 meters. The air core coil has 18 turns of #14 wound with a 2" i.d., 3" long. (Air-Dux 1606T or equiv.)

The antenna has worked admirably on 80 through 6 meters but slight loss in performance is experienced if radials are left attached unless separate ones are cut for each band.

The antenna loaded up on 6 meters with about a 1.7:1 s.w.r. Less than one turn of the loading coil was needed in series with the coax line and good signal reports were received from several local stations. It would seem that the antenna was acting as a 7/4 wavelength antenna and, as such, could be expected to load to a certain extent.

On 10 and 20 meters similar results were experienced, however, evidence of a reactive load was noticed in that lead length became critical and shortening or lengthening of the coax line required changing the tap to reduce s.w.r. to tolerable levels. I am certain that this reactance could be tuned out quite readily with a matching network. ■

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SIMULTANEOUS TRANSMITTER AND RECEIVER OPERATION

BY JOHN J. SCHULTZ,* W2EEY/1

Explored below are some of the considerations involved in achieving interference-free operation when it is desired to have a receiver remain functioning while a transmitter is being used or to have several transmit/receive functions take place locally and simultaneously.

THERE are many situations that arise when one might wish to have a second receiver remain operative with full gain while a transmission is taking place on a different frequency. Examples might be the monitoring of a net frequency, time-signal frequency or an emergency calling frequency. In some cases, cross-band operation might be involved. Also, there are many cases when it is desired to have a number of transmitters and receivers operate simultaneously on different frequencies such as in some emergency communication setups and during contests using club stations.

The potential for cross-interference in such installations is tremendous when all the equipment is co-located and operating within the same general portion of the frequency spectrum. It is possible, however, to achieve satisfactory operation, even when a number of receivers and transmitters are operating simultaneously within a relatively close frequency spacing of each other. Military installations, for instance, have often been faced with this problem. Large land based or naval craft communications complexes are often required to operate a number of high powered (to 10 kw) high frequency transmitters simultaneously while receiving operations in the high frequency range are also going on in the same area. Particularly in the naval case, these operations must also go on under the restraint of very close antenna spacing due to the size of a ship and the locations on it which permit the placement of antennas. With good engineering, it is normally possible to operate high power transmitters and modern sensitive receivers simultaneouly with as little as a 5% difference in operating frequency. Thus, it would be possible, for instance, to have two high power stations operating simultaneously at both ends of the 80 meter c.w. band from the same location.

The procedures used when setting up a station with multiple transmitter and receiver operations do not involve so much the application of any new techniques so much as they involve strict observance of well known interference reduction techniques. Many of the techniques. are the same as those necessary to prevent TVI problems while others do not come into play in the TVI situation.

This article discusses some of the techniques used to allow simultaneous transmitter and receiver operation either with wide frequency separation or even, in many cases, in different portions of the same amateur band. The application of one simple technique may allow interference-free usage of a receiver on a different band than that which is used for transmitting. In other more complex situations, where it is desired to operate a number of receivers and transmitters simultaneously, a good deal of advanced planning is necessary to achieve a proper installation. One simply can't bring a bunch of transmitters and receivers together of unknown

*40 Rossie Street, Mystic, Conn. 06355.

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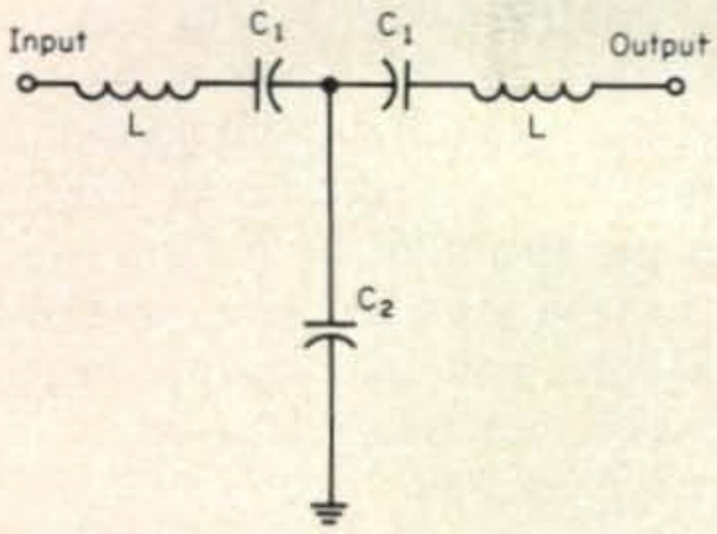
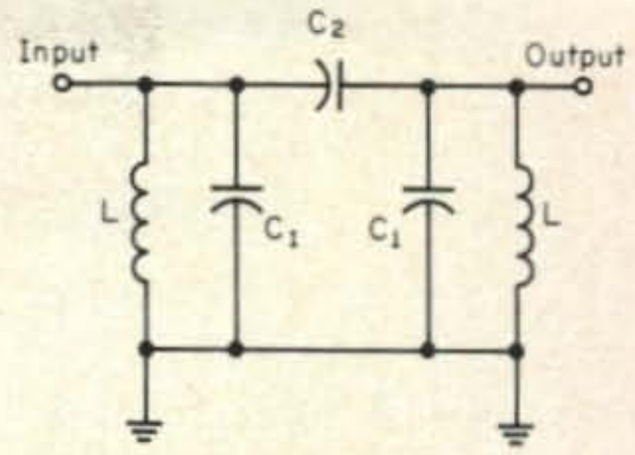


$$L = \frac{R}{2\pi\ (f_2 - f_1)}$$

$$C_1 = \frac{f_2 - f_1}{2\pi\ (f_1)^2\ R}$$

$$C_2 = \frac{1}{\pi\ (f_2 - f_1)\ R}$$



$$L = \frac{(f_2 - f_1)\ R}{2\pi\ f_1\ f_2}$$

$$C_1 = \frac{f_1}{2\pi\ f_2\ (f_2 - f_1)\ R}$$

$$C_2 = \frac{f_1 + f_2}{4\pi\ f_1\ f_2\ R}$$

Fig. 1—Two forms of bandpass filters which may be used for either transmitter or recevier filtering. F_2 (in c.p.s.) is the upper cut-off frequency, F_1 being the lower cut-off frequency. R is the transmission line impedance.

characteristics and expect to quickly setup a workable situation.

Equipment Characteristics

Proper equipment characteristics are the most basic factor in acheiving a satisfactory simultaneous transmitting / receiving installation. One must be certain that radiated energy from a transmitter is only at the desired frequency and only flows *via* the transmitter output line. The receiver must only accept r.f. energy *via* its input terminals at the frequency to which it is tuned.

As regards the transmitter, this is *almost* the same situation as is required for successful TVI-free operation. Enclosure shielding, line filtering and output low-pass filtering are all necessary. The "almost" qualifies the situation because the harmonics of concern are usually of much lower order than those which would cause TVI. For instance, if one were operating on 20 meters and receiving on 10 meters, probably a 60 db reduction in the 2nd harmonic output of the transmitter would be desirable. A low pass filter would have to be used with a cutoff frequency just slightly higher than 20 meters in frequency. In practice, however, it is generally better to use a bandpass filter on the output of the 20 meter transmitter. The bandpass filter involves only a few more components but insures that any spurious responses at the output of the transmitter generated on frequencies lower than 20 meters will also be supressed. A suitable filter design is shown in fig. 1. Several sections can be grouped in series for even higher out-of-band attenuation characteristics if desired. The construction of such a filter is the same as a low-pass filter and in a multiple section filter, individual sections should be shielded from each other.

The requirement for shielding of the transmitter may also be more severe since the operating receiver may be located next to the transmitter, rather than being a distant TV receiver. A receiver tuned to the operating frequency of the transmitter and fed with a coaxial line, at the end of which are a few twines of wire, can be used as a "probe" to check the shielding integrity of the transmitter enclosure and the coaxial line connections to the output filters, antenna switching networks, *etc.*, for unusual "hot spots."

Various spurious responses from a transmitter which might not cause any TVI pro-

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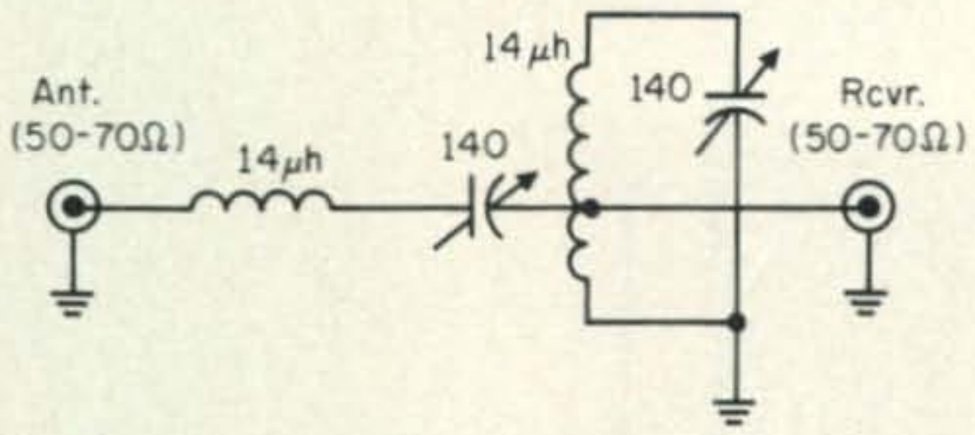

Fig. 2—A series-parallel filter for use with a receiver. Filter values are for use on 80 meters and can be scaled down for other bands. The coil tap is 1/3 up from ground.

blem often can ruin a simultaneous transmitting/receiving installation. These include not only odd-frequency oscillation or mixer products which find their way to the output but also intermodulation distortion products in linear amplifiers. If receiving operations outside the transmitting band are desired, the use of a bandpass filter on the transmitter output will reduce out-of-band outputs. If, however, simultaneous in-band operation is desired, a bandpass filter designed to cut off at the low and high frequency edge of the band will not reduce the in-band spurious signals generated due to intermodulation distortion. An IMD of −20 db for third order products will not effect intelligibility too severly and can be accepted as a just passable situation for a single transmitter / receiver installation. If however, the third-order products are only −20 db, higher order products are probably not reduced much more and such a transmitter operating on s.s.b. could cause havoc if a receiving possibility were desired at the other end of the same band. High power linear amplifiers are usually the worst IMD producers with multiple-tube linears using TV tubes being at the head of the list. The bottom of the list would be occupied by single-tube linears using tube types especially designed for s.s.b. service.

Preferably, a linear hould have an IMD for third order products of −40 db or even more for simultaneous in-band transmit/receive operations.

Receiver Operation

Unlike the TVI situation, simultaneous transmitter/receiver operation requires that the same measures applied to the transmitter also can be used with a receiver. One must insure that pickup only takes place *via* the antenna input and at the desired frequency. One way to check a receiver with a transmitter operating is to simply short its antenna terminals. Pickup that occurs must be entering due to lack of shielding, power line pickup, control wire pickup, *etc.* If such pickup takes place, it must be eliminated first by the use of r.f. chokes and bypass capacitors. Once a receiver is "clean" in this respect, the problem of pickup *via* antenna circuit can be tackled. There are several aspects to the antenna pickup problem and almost any practical situation will dictate some compromises.

If we suppose that the antenna situation has been modified as best as possible (as will be described later) and the transmitter is filtered properly, overload of the receiver must now be reduced to an acceptable level. The degree of off-frequency voltage which a receiver can tolerate before it becomes desensitized or is overloaded to the point where the r.f. stage(s) actually generate spurious products, depends upon the receiver design. Some receivers can accept a volt or more of r.f. energy across their antenna terminals 5-10% removed in frequency from the frequency to which the receiver is tuned and operate normally. With other receivers, the maximum level may be only a few hundred millivolts. The level of off-frequency voltage tolerable depends upon the front-end selectivity and dynamic range of the receiver. Modifying the r.f. amplifier in a receiver can be complicated, but a number of things can be done to improve the selectivity of the front-end (not the i.f.).

The front-end selectivity of many receivers is not very great (30-40 db) and it doesn't take too much off-frequency r.f. voltage to exceed the dynamic range of the input r.f. amplifier. Few receivers are designed specifically for simultaneous transmit/receive operation. One of the easiest ways to improve the front-end selectivity is simply to use a bandpass filter, the same as that for a transmitter (fig. 1) but made of smaller components. As in the transmitter case, it must be constructed in a shielded enclosure and used with coaxial line. For inband transmit/receive operation, a tunable filter is needed such as shown in fig. 2. The series circuit is used to accept only the desired frequency while the parallel circuit peaks at the undesired frequency. The receiver "S" meter can be used for adjustment of the filter when receiving a desired station. A number of filters may be used together in a difficult situation to obtain the desired off-frequency voltage level at the receiver antenna terminals.

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Grounding

The question of grounding and ground loops is one for which no one has developed any universally applicable procedures. If common grounding between transmitters and receivers in multiple installation is unavoidable, it should be done as directly and as shortly as possible. If common grounding can be avoided, it generally will be better. Figure 3 hows some examples. The common control cable wiring and grounding may not cause any problem but the use of two ground dependent antennas, one for transmitting and one for receiving, is almost bound to do so. At least one antenna should be a balanced, ground-independent type, and in a larger installation they all should be so (including the use of baluns where appropriate).

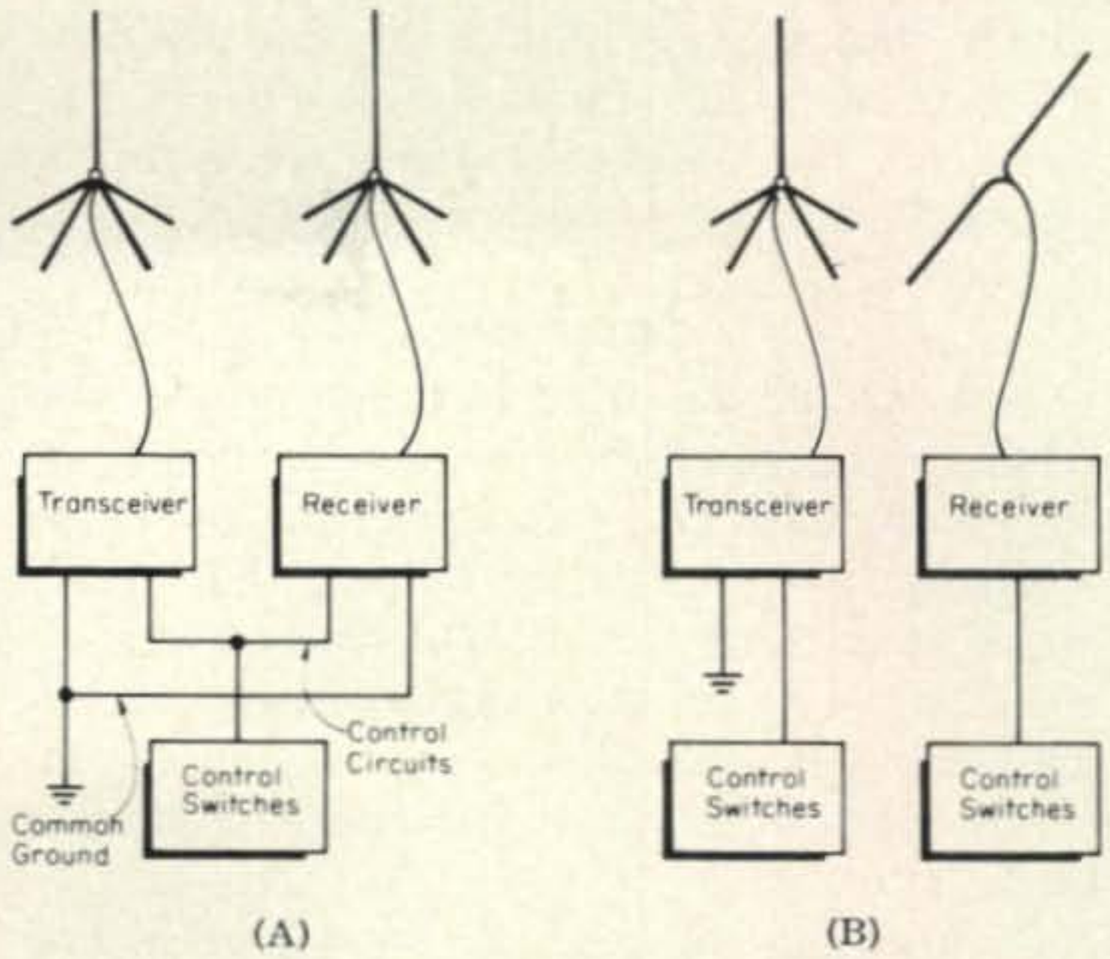

Fig. 3—The separation of common ground and control circuits as well as the use of different antenna polarizations (B) can often produce major reductions in interference during simultaneous transmit/receive operations as compared to when many common interconnections exist (A).

Antenna Separation and Orientation

One of the most classic but still most useful ways to prevent mutual transmitter/antenna interference is to seperate the antennas for each as far as possible. If one has the space, the maximum seperation necessary, in feet, should be 10,000/F(mc). This is based on the situation of two dipoles oriented towards each other to produce less than a volt across one when the other is fed with a 100 watt transmitter.

At v.h.f. frequencies, such a separation may be possible but generally, at lower frequencies, it will not be possible. Also, at v.h.f. frequencies, if antennas cannot be horizontally separated but are stacked, they should be at least separated by a wavelength. At lower frequencies, to reduce the coupling between antennas, maximum advantage should be taken of the pattern nulls that various antennas exhibit and the effects of polorization. Aside from simple verticle antennas, almost any horizontal antenna exhibits nulls in the horizontal plane of up to 30 db off the ends of dipoles and as much off the backside of 3 element beams. For some applications where antenna polarization is not important, the simple expedient of making the receiving antenna polarization different than that of a nearby transmitting antenna will considerably reduce the transmitter to receiver antenna coupling.

"Shadowing" can also sometimes be used to advantage in antenna placement by having some large structure or building separate a transmitting and receiving antenna. Where transmission or reception in distinct directions is desired simultaneously, one can even make use of a wire screen to isolate antennas.

Constructional Considerations

Although one may adequately shield transmitting and receiving equipment, use adequate filters, provide antenna separation, *etc.*, in cases of interference during simultaneous transmitting/receiver operation may occur. Tracking down the cause of such interference usually leads to some arcing or bonding problem. The author encountered one case, for instance, where a transmitter sounded fine over the air and yet produced such a noise in a nearby receiver tuned more than 20% from the transmitter frequency that reception was impossible even with very good separation between the transmitting and receiving antennas. The cause of the problem was finally found to be a corona action between the cooling fins on the p.a. tube in the transmitter. Other noise sources, particularly with high power transmitters, may develop due to arcing in antenna systems, poor coaxial cable connections, ground connections or even in metal structures excited by proximity to a high r.f. field (guy wire joints, turnbuckles, *etc.*). The "arcing" that may occur may be so small as to be invisible to the eye yet constitute a very potent noise generator.

The use of a portable transistor broadcast receiver held over various parts of the transmission line or antenna system will some-

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times indicate the source of the problem. Nearby metal structures should also be surveyed if the antenna system seems to be "clean."

Summary

This article has tried to touch upon some of the highlights to be considered when dealing with multiple transmitter/receiver installation. As was noted before, the "hardware" needed to prevent interference in such installation is not new and so most of the article has dealt with the application of the hardware rather than its construction or circuitry.

Transmitter to receiver interference has mainly been considered although, in some cases, receiver to receiver interference can also take place. The same general techniques are applicable, however, to such a situation, treating one or both receivers as the offending transmitter.

If one were planning for the use of a large number of transmitters and receivers in one location on different bands as well as portions of the same band, a careful plan should be drawn up for the transmitter and receiver filtering requirements, antenna placement, *etc.* Individual pieces of equipment should be checked before hand for proper shielding and lack of spurious outputs. Individual transmitters should be matched properly to the transmission line and antennas with which they are used. Excessive s.w.r. on a transmission line does not necessarily indicate a radiation problem but low s.w.r. at least insures that such radiation is not present to cause interference. Finally, one should follow a systematic plan for testing the installation. Receivers should be turned on one by one and tested for proper operation over their frequency range. The same should be done with each transmitter. If any case of interference is found, it should be rigorously tracked down and corrected before proceeding with the use of any more equipment.

Many amateurs have probably avoided the use of receiving and transmitting equipment simultaneously. Certainly, not all transmitting and receiving equipment can be used simultaneously but with some care in installation, one can enjoy a far broader scope of simultaneous equipment operation than is imagined. ■

A CURRENT SENSITIVE PILOT LIGHT

BY EDMUND HOOD,* W1USM

As equipment service engineer in the biochemistry labs of Brandeis University, I am often called upon to solve rather unorthodox problems. Recently I had the challenge of producing a device to indicate the current flow through a 1000 watt heater. The device had to be able to take a beating such as an ammeter could never survive. I thought of placing a lamp in series with the heater, but any lamp which took a current high enough would drop the voltage available to the heater much more than could be tolerated. It was suggested to place a 1 ohm resistor in series with the heater and detect the voltage drop through a solid-state amplifier. This resistor, a quick calculation proved, would dissipate nearly 80 watts.

The solution proved to be both simple and dirty. The junk drawer yielded a filament

[*Continued on page 100*]

*12 Winthrop Street, Waltham, Mass. 02154.

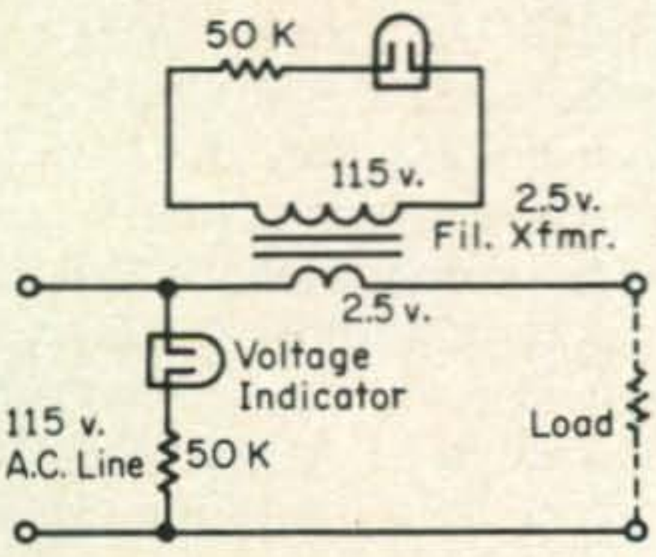

Fig. 1—Transformer winding in series with the load acts as primary and steps up the voltage to a value adequate for a neon bulb. The neon bulb then acts as a current indicator.

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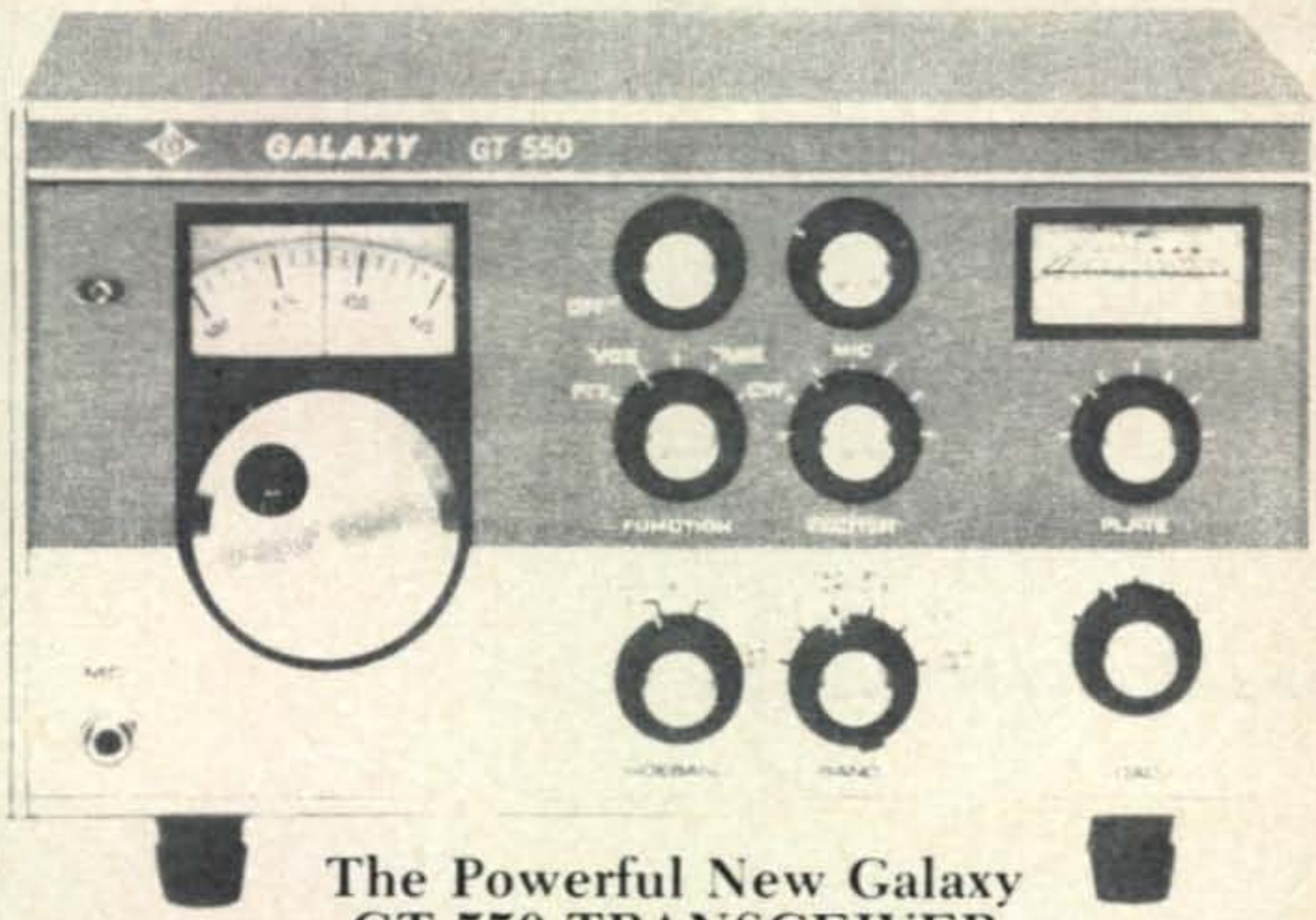

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AN IMPROVED 7360 CONVERTER FOR 14 AND 21 MC

BY R. JAYARAMAN,* VU2JN

DESCRIBED below is a compact two-band converter for 14 and 21 mc. The converter features a toroidal antenna coil, a Q multiplier and a monitoring arrangement that really works. Power is borrowed from the communication receiver, and the power consumption is kept at a minimum by using just three tubes—a 7360 as the mixer, an ECC81/12AT7 as Q-Multiplier, and a 0A2 as the voltage regulator.

The article on a 7360 mixer that appeared in the *CQ*, October 1966, issue provided the starting point for the writer's experiments.[1] It was found that a toroidal input coil will provide quite sharp selectivity without the necessity of making the coupling to the mixer light and thus sacrificing signal strength. The toroidal coil also ensures freedom from stray pickup which can impair the performance of the 7360. The toroid used is a small ferrite ring of 1/2" diameter, suitable for use up to 30 mc. The proper turns required for the primary, secondary and the feedback winding were arrived at by trial and error so as to optimize the performance.

Additional selectivity is obtained by the use of a Q multiplier which enables the signal to be boosted up to 20 db by regeneration. Near the point of oscillation, the antenna circuit becomes highly selective and the input tuning becomes quite critical. Image rejection is excellent, even with a multiband antenna.

Going through several articles on 7360 mixers, the writer found that one important point has been overlooked by all writers, a good way of monitoring the transmitted signal on c.w., a.m. and s.s.b. Even with the writer's 150 watt transmitter, the 7360 was getting overloaded, in spite of the antenna terminals being shorted in the transmit position. The effect was not very noticeable on c.w., but gave rise to distorted audio on phone.

The writer tried cutting off the screen supply, but that did not work. Then the writer tried strapping the cathode line to the monitoring level control which is inserted in the cathode line of the gain-controlled stages of the receiver. The result was that the 7360 was getting completely blocked by the high cathode bias of 30 to 50 volts required by the receiver. If the monitor control was advanced too far, the result was again distorted output due to the 7360 working too near cutoff and the receiver getting under-biased!

Finally the writer solved the problem by clamping the cathode bias of the 7360 in the monitoring position at 6.2 volts by a 6.2 volt one watt zener diode. With a well-shielded transmitter and T/R switch, a 4.7 volt zener may be used. When it conducts, the zener may introduce some noise which, however, is of no consequence in monitoring. Also the Q multiplier is biased to cutoff in the transmit position. Now there is no overloading of the 7360 and distortion-free monitoring of phone signals is possible.

The writer has wired the converter on a

*Assistant Professor, College of Engineering, Trivandrum 16, India.

[1]Schuler, C., "An All-Band 7360 Converter," *CQ*, October 1966, p. 57.

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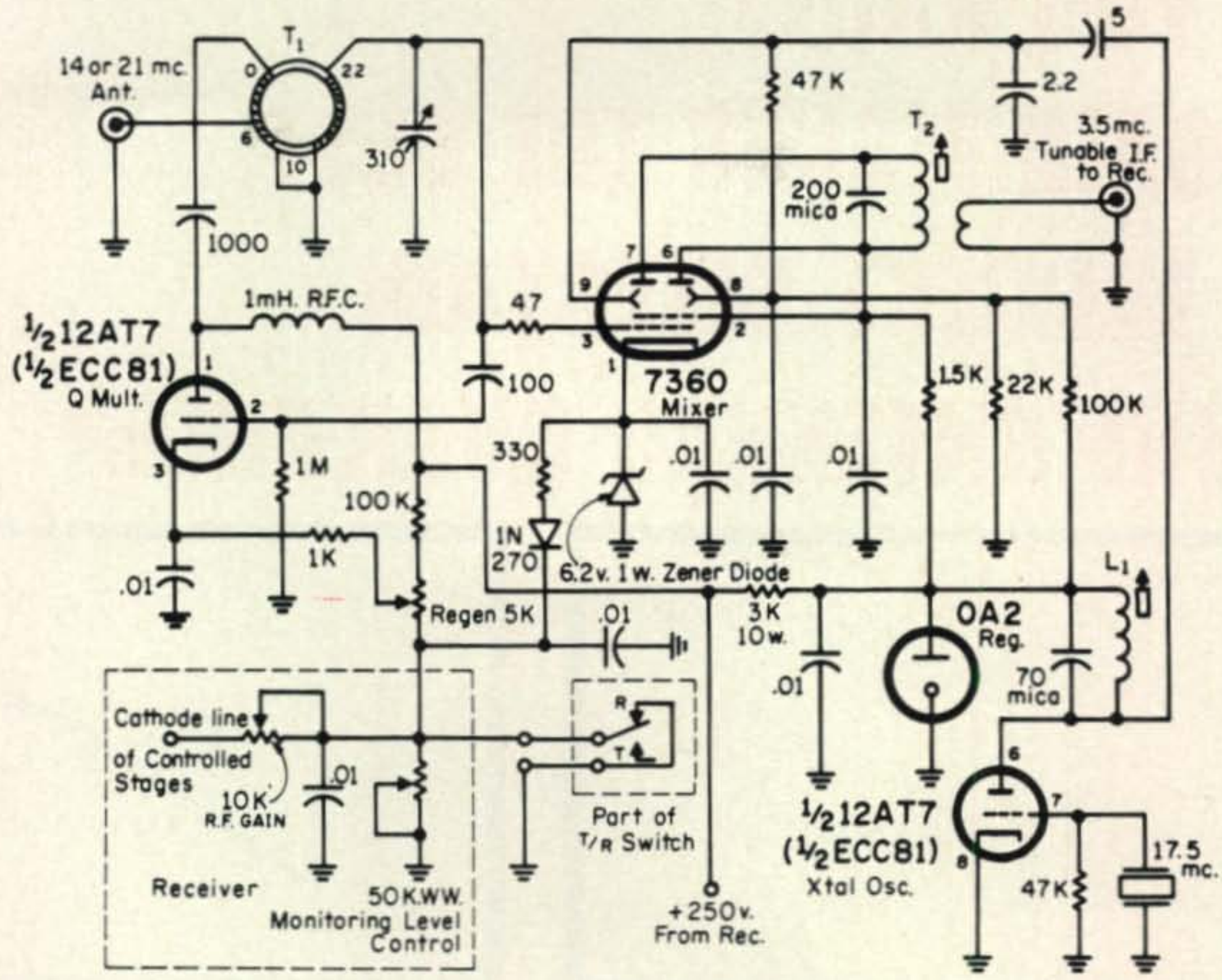


Fig. 1—Circuit of an improved 7360 converter for 14 and 21 mc. All resistors are 1/2 watt except where otherwise noted. All capacitors with values less than one are in mf. Capacitor values one or more are in mmf and all are ceramic except where noted.

CR_1—6.2 volt 1 watt zener diode. Motorola 1N3828.

L_1—1.2 μh. J. W. Miller 4403 0.9 to 1.6 μh, or equiv. The use of a 70 mmf trimmer across L_1 will assure the ability to tune 17.5 mc.

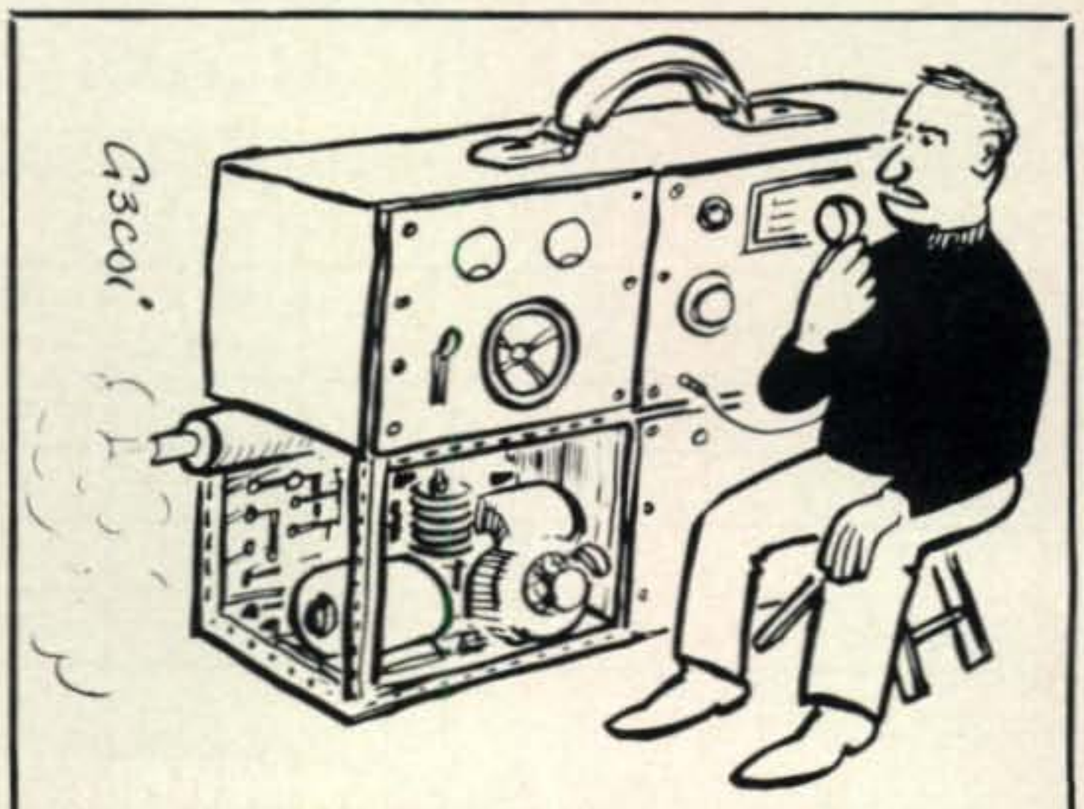
T_1—22t #26 e. wire continuously wound on a toroid form 1/2" o.r., 5/16" i.d. (form material should be good up to 30 mc) with taps at 6 and 10 turns.

T_2—Suitable antenna coil connected in reverse. J. W. Miller B-320-A antenna coil or equiv.

small 8" × 6" × 2" steel chassis. Wiring the converter is not at all critical. Even a Novice can attempt this project, assured of success and satisfaction. The one precaution to be observed is to keep the 7360 away from power transformers and to provide a shield (preferably a μ metal shield) over the 7360.

The writer has no intention of restating the well-known advantages of the 7360 mixer. However it is appropriate to stress one point here: the full benefits of the 7360 converter are realized only when the second mixer is also a 7360. When listening to signals on 14 and 21 mc, the noise that the writer hears in the receiver is mostly due to the 6SA7 mixer in his "good-old" communication receiver. To cut down the noise, the r.f. gain of the receiver is left near minimum, and signals are peaked to the extent necessary by means of the Q multiplier.

The converter is a worthwhile project for a ham possessing any receiver other than the costliest super-duper post-war models! For the small amount of labor involved, the project gives immense satisfaction by way of much improved reception of signals. ■



"... Just testing a new portable rig here ..."

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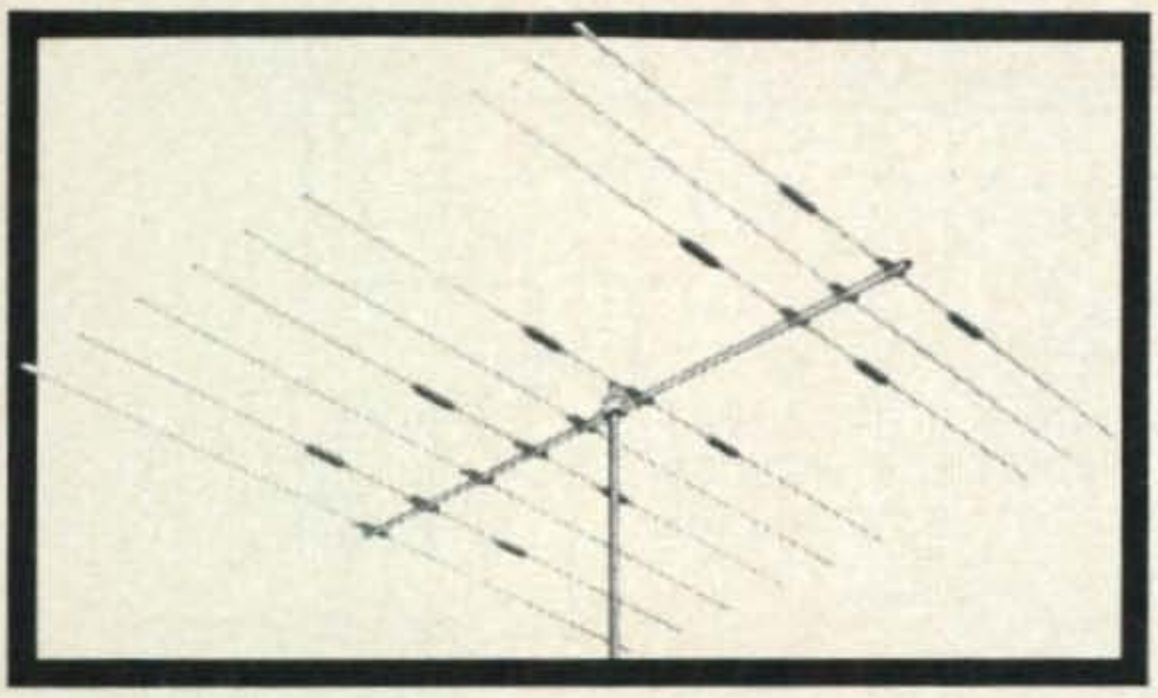

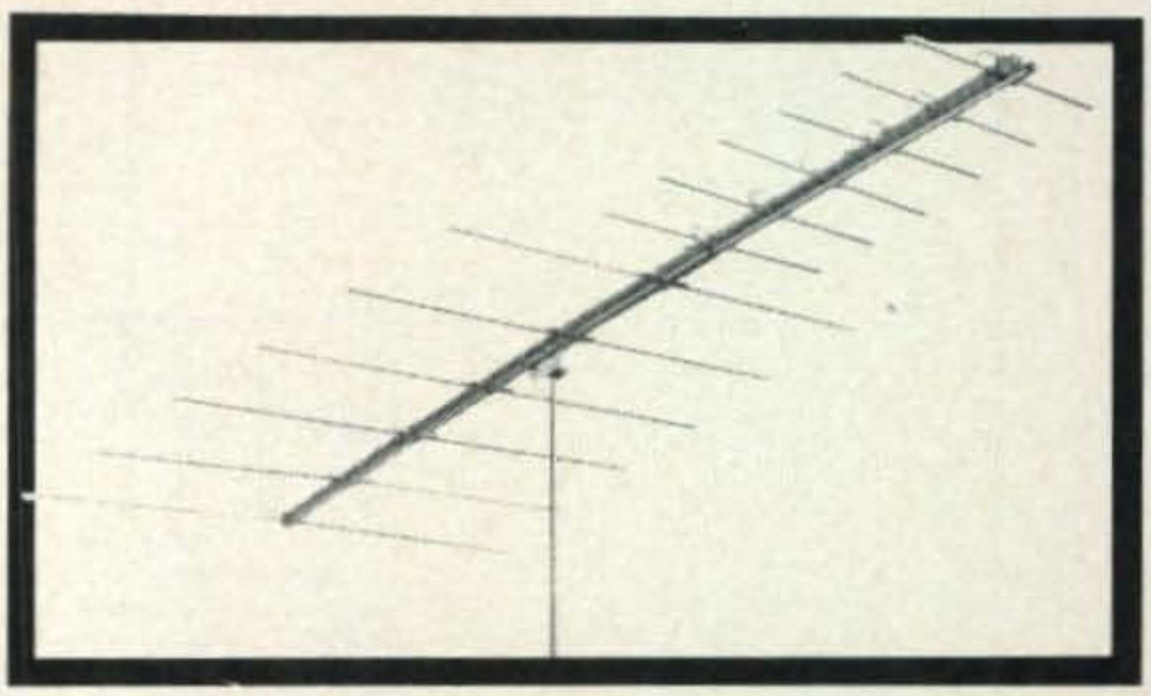

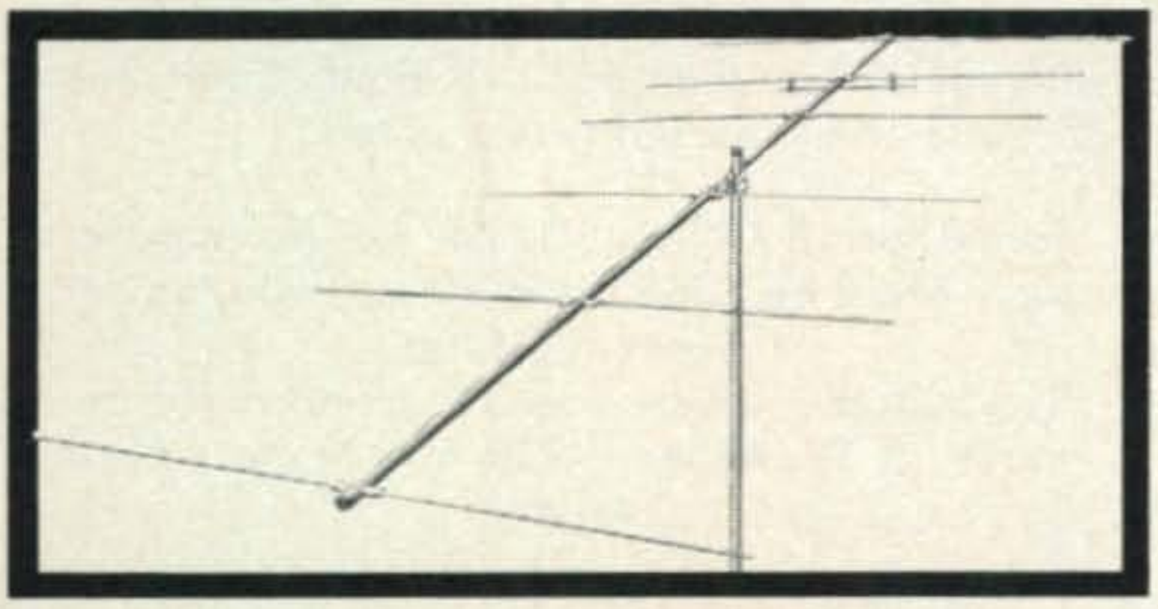

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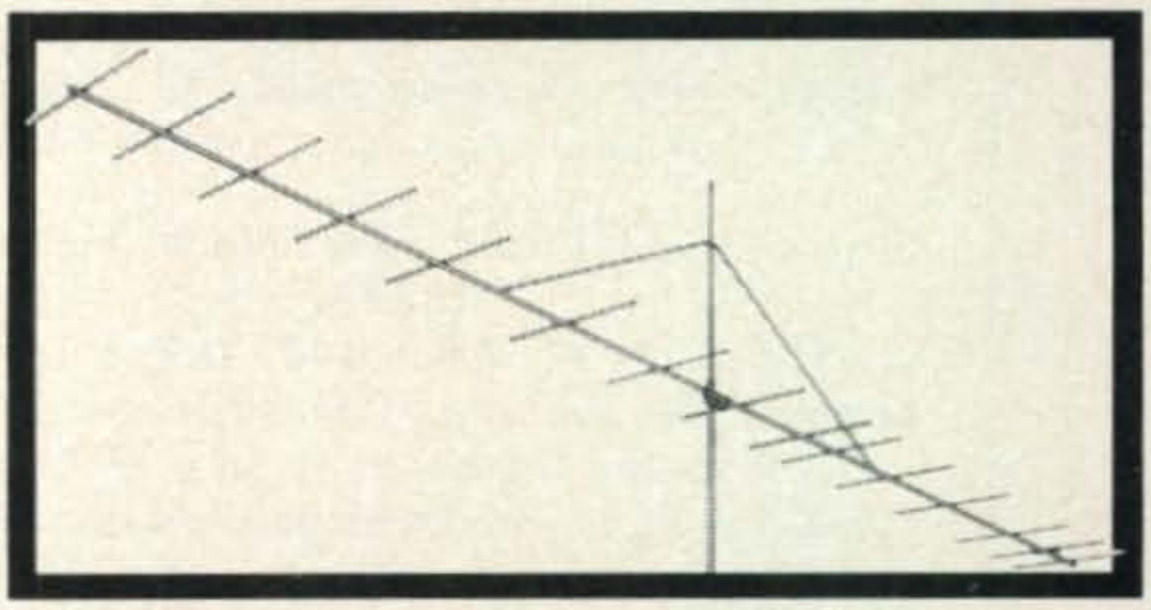

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Hy-Gain 6 Meter Beams — All Take 1 KW Max. Power Input. VSWR At Resonance 1.5:1 or Better.

Model	Elements	db Gain	F/B Ratio	Boom Length	Turn Radius
63B	3	10	20-25db	8'	6'
64B	4	12.7	20-25db	12'	8'
66B	6	15	20-25db	24'	12'6"
611B	11	19	20-25db	47'	24'2"

Hy-Gain 2 Meter Beams — All Take 1 KW Max. Power Input.

Model	Elements	db Gain	F/B Ratio	Boom Length	Turn Radius
23	3	9	20	3'	4'
28	8	14.5	25-30	14'	7'6"
215	15	17.8	20-30	28'	14'

FOR THE MOST ADVANCED ANTENNAS UNDER THE SUN

See page 110 for New Reader Service

Hy-Gain's maximum performance beams put your signal where the action is. Not just by accident, but as the rewarding result of years of experimentation and computerized research in the most modern antenna and RF laboratory as well as exhaustive field testing.

Strategically staggered, optimum spaced elements along the boom are referenced solely to increased field strength intensity and pattern control, thus delivering tremendous increase in directional gain not attainable with close spaced beams or optimum spaced beams using linearity as the sole reference.

Exclusive Hy-Gain Beta Match — All Hy-Gain VHF Beams feature a special VHF Beta Match configuration. The unique pre-tuned Beta Match permits maximum gain and front-to-back ratio with a nominal 50 ohm feed point impedance without de-tuning any of the parasitic elements. An optimum transfer of energy thus results without sacrifice in gain or pattern control.

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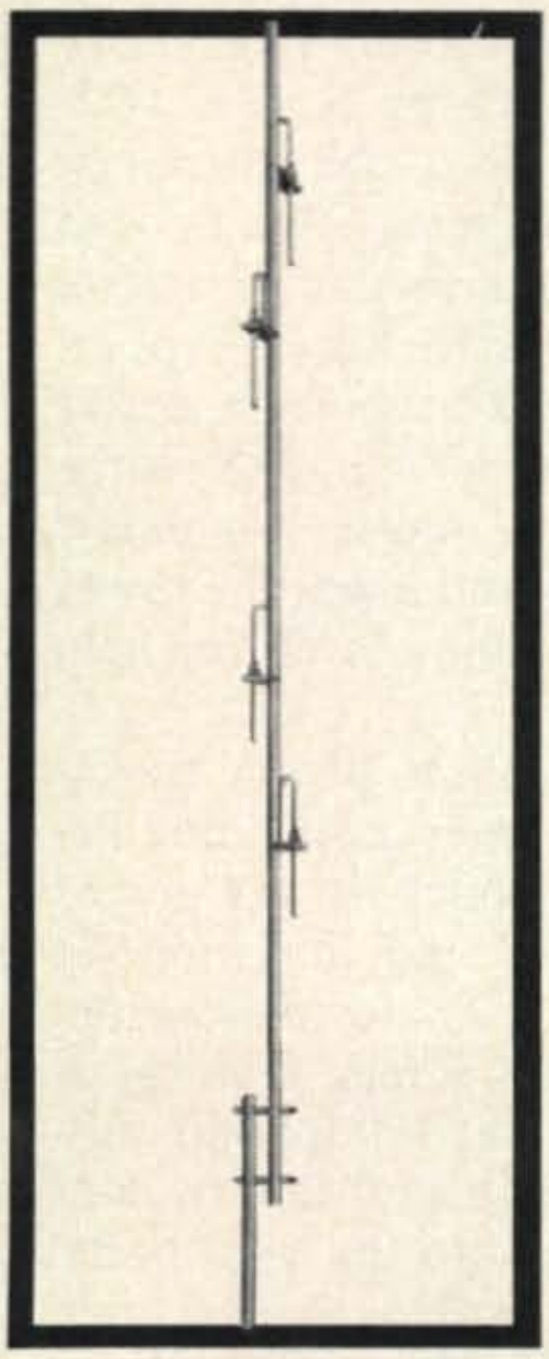

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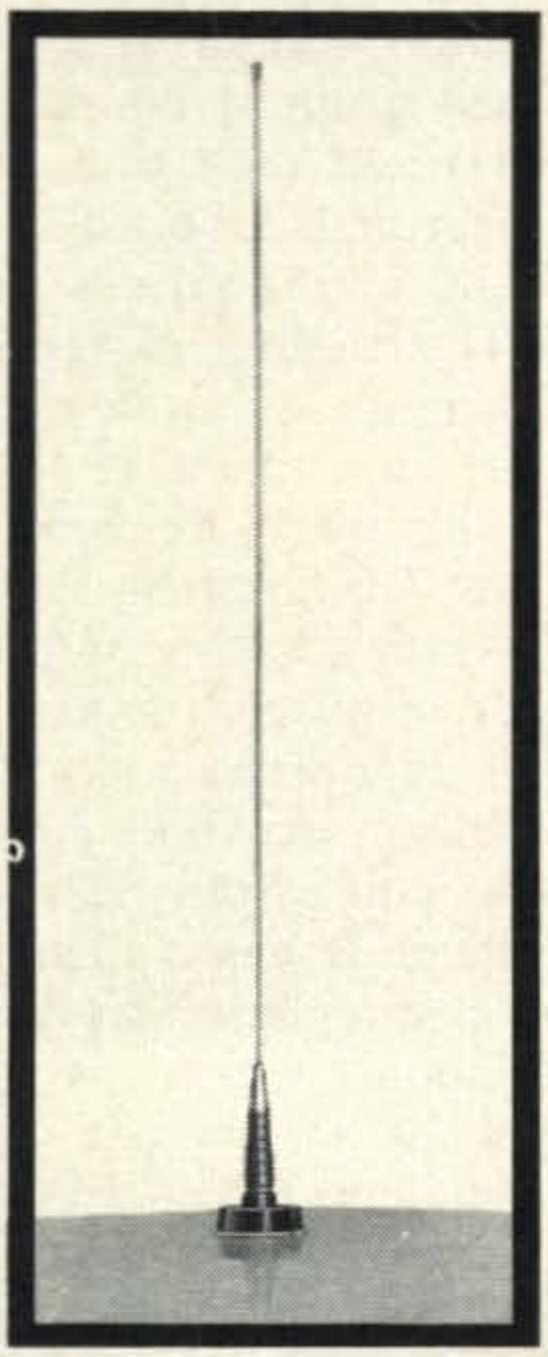

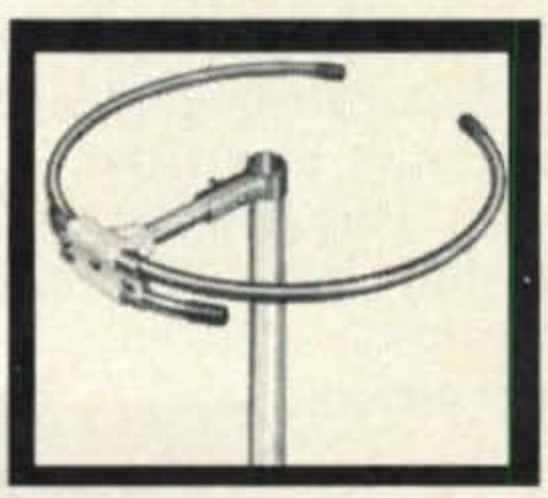

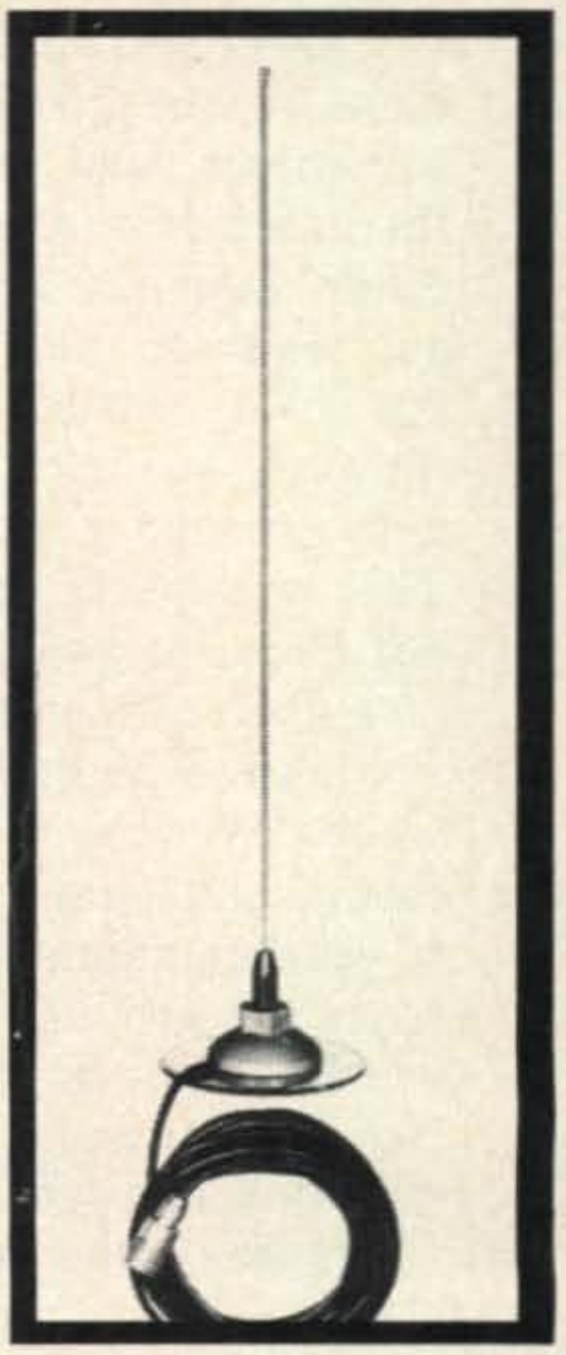

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CRG150 — Vertically polarized omni-directional 55" whip with photographically etched copper base matching coil. Exclusive "Claw" mounting device easily installs in any hole 3/8" to 3/4".

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MAG150 — Alnico magnet base allows quick installation. Can be removed just as easily when parking in uncertain places. No need to scrape paint...the MAG150 is capacitively grounded. Superb performance from so versatile an antenna.

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BUILD YOUR OWN TILT-OVER TOWER

OR . . . What to do if you can't get 8 friends to help you out on a Saturday morning.

BY C. P. CABELL,* WA7EMM

BEAMS and towers are great to have, but there is one problem, things do go wrong sometimes, and somebody has to work on the antenna or the rotor, or maybe haul up other antennas and attach them. When we got ready to put up a tower last summer, the XYL insisted that it be some sort of a tilt-over, so that the old man could do his work on the ground, or pretty close to it. This was great with the OM, since he was not about to go climbing up around the top of a 40 foot tower anyhow.

Figure 1 shows the down position of our setup. We can get to the antenna easily from a stepladder. We should have been able to get the antenna to within half-boom length from the ground, but forgot about the row of evergreens in the way. This gives us point No. 1—figure out carefully what the thing will look like when the tower is down.

Figure 2 shows the general layout. The tower rotates at a point eleven feet above the ground. It's supported by a 1¼" galvanized pipe that goes into the house 10 feet and is bolted to the joists. The bottom end of the pipe is in four feet of concrete. The height of eleven feet to the tilt-over point is really not quite enough, it would be better to have about 15 to 17 feet but one works with what one has. This makes it possible for one lazy man to raise and lower the tower without having to have a big search for help from all his friends.

Figure 3 shows the main lifting mechanism. A 1600 pound boat hoist, double-locking, from Sears Roebuck is the major item. It costs about $15, and it is *double-locking*, in either the up or down position. Double locking is a vital safety feature. A 3/16" galvanized cable, a 750 pound pulley, and a 1/2 inch eyebolt in 4 feet of concrete (to hold the pulley) are the vital parts. The eyebolt is the weak link. I used an open type, and it started to open up under load. Se be sure to get a *closed* eyebolt.

*Registered Professional Engineer, 79 Newcomer Road, Richland, Washington 99352.

Fig. 1—Tower in the down position. The final height above ground depends on the antenna.

Fig. 2—In the down position the tower is nearly parallel to the roof eaves. The 1¼" support pipe extends 10' into the house and is bolted to the joists. The bottom of the pipe is 4' into concrete.

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Figure 4 shows the tilt-over mechanism itself. The tower tilts over the horizontal section of the 1¼" supporting pipe. Three muffler clamps are placed around this pipe. Then, another short section of 1¼" pipe is set above it, and the muffler clamps are bolted to the upper short section of pipe.

Now, how to get the upper section of pipe connected to the tower? Perhaps we could just drill holes in the tower legs and bolt the upper pipe to them, but the tower is in maximum stress at this point, and putting holes in it might very well break the tower in two. It's most discouraging when this happens!

We bolted the upper pipe to 1" support pipes to reinforce the tower legs. (See fig. 5). Then we clamped the 1" support pipes (3 feet long) to the tower legs, using husky U clamps from Lafayette (only known source). Figure 6 shows how the 1" reinforcing pipes are attached to the tower. Also, note that all wiring comes out through the main 1¼" pipe, and this makes a very neat installation.

A sketch of the anchor and cabling arrangement is shown in fig. 7. The cable, as shown, wraps around each leg at the base and is secured at the end by a closed type of hook with a safety catch (as illustrated). The method of securing the cable to the hook is shown in detail (B). The hook passes through the thimble to prevent chafing and the wire is secured, as indicated, by three clamps with the U-bolts bearing on the free or dead end.

The 1¼" support pipe, three tower legs and the eyebolt with bend to increase holding) are shown set in 3′ × 3′ × 4′ of concrete. The pulley fitting through the eyebolt must be closed with a metal plate that can be removed.

Safety Points

In fig. 8, the tower is shown in the up position. Note the safety bar bolted to the bottom of the tower. The point here is that when you get the tower into the up position, you would prefer that the tower *not* keep right on going, and fall over on its backside. The safety bar will hit against the main vertical support to prevent that. Along the same line of safety, the following points should be observed:

A. Before releasing the bolts at the bottom of the legs, attach a temporary safety cable from the eyebolt to the tower to keep it from falling over before you want it to move.

B. In addition to the main hoist cable,

Fig. 3—A 1600 pound double locking boat hoist from Sears Roebuck does the job, along with 3/16" galvanized cable, a 750 lb. pulley, and a 1/2" eyebolt in 4 feet of concrete.

attach a safety cable to the bottom of the tower, and attach it firmly to the eyebolt or leg of the tower, for safety, in case the hoist should slip.

C. Always use thimbles where the cable goes around small objects.

D. Use three cable clamps. Be sure the screw end presses against the live side of the cable (the side where the load is.)

E. Keep small children, pets, and people out from under the tower at all times when it is in the up position.

Fig. 4—The tilt-over mechanism is based on 3 muffler clamps which rotate around the horizontal part of the 1¼" pipe. These are attached to another piece of 1¼" pipe. This latter piece is attached to 1" reinforcing pipes (see fig. 6) attached to the tower.

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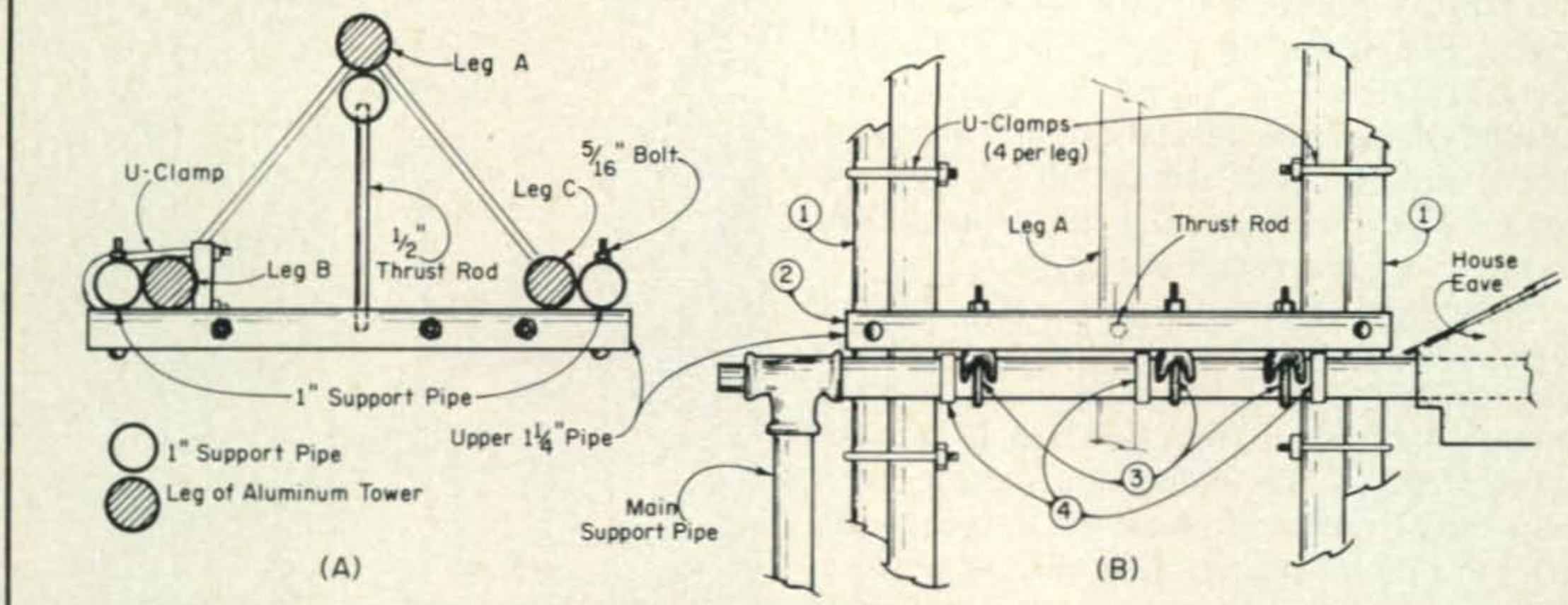

Fig. 5—Rotating mechanism described in the text. (A) Top view of the tower shows the location of the three steel reinforcing pipes and the 1/2" steel thrust rod that wedge fits into holes in the 1" and 1¼" steel pipe to enable leg A of the tower to support its share of the load. All steel 1" support pipes are held to the tower legs by four heavy duty U clamps. (B) Side view of the tilt-over fulcrum. The 1" steel support pipes (1) are bolted to the 1¼" upper pipe (2) which is held to the horizontal main support by three muffler clamps (3). These clamps are made up loosely and rotate around the horizontal main support pipe. Hose clamps (4) keep the muffler clamps from sliding on the 1¼" pipe. The heavy duty muffler clamps are available from Western Auto Co. or any similar supply outfit.

Loading Diagram

To make this a safe, operable setup, you have to do some figuring. Now, I believe that radio amateurs can easily handle simple structural problems, so figs. 9 and 10 show how it is done. The idea is to *avoid* breaking the tower in two at the tilt point. We do this by *not* exceeding the allowable "moment of restraint."

Figure 9 shows a loading diagram for a 40-foot Midway aluminum tower. The same general approach can be used with the Rohn #25 or the Spire tower. I don't think that this tilt-over approach would be practical for a tower much over 40 feet, maybe 48,

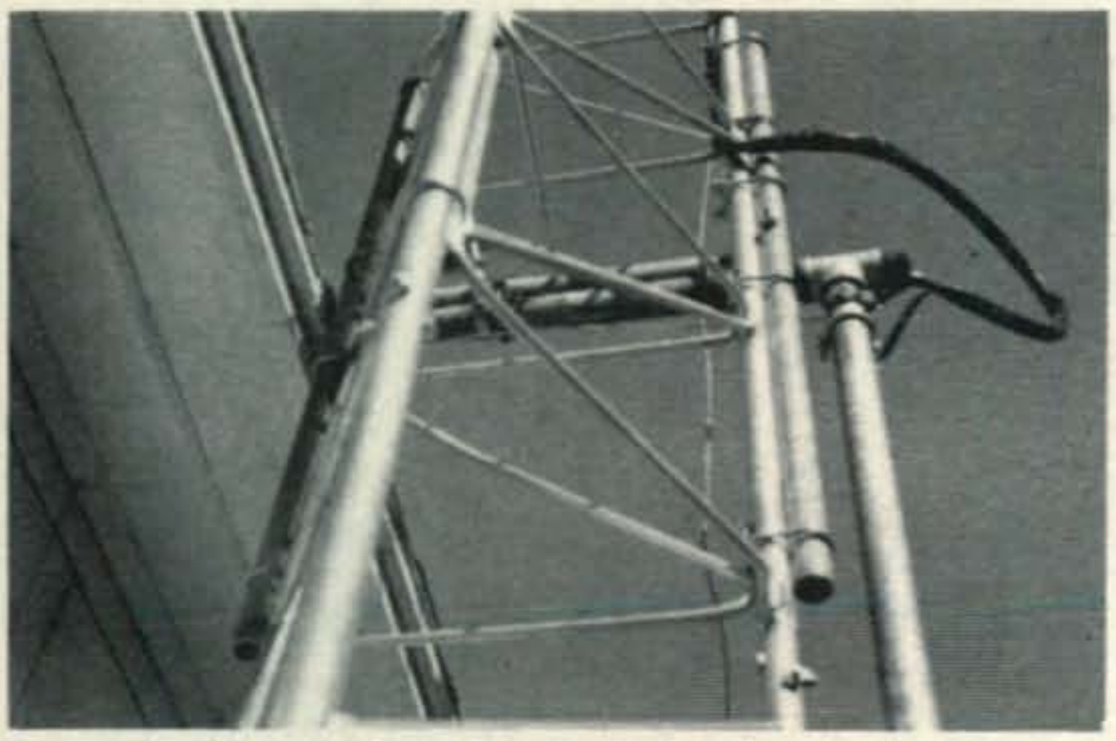

Fig. 6—How the 1" reinforcing pipes are attached to the tower. Also note that all wiring runs from the house through the 1¼" pipe, and through a tee at the top.

but that would probably be the limit.

Let's begin on the left side. Assume the tower weighs 2 pounds per foot. (Four pounds a foot for a Rohn #25.) Total weight on the left side is 11 feet times 2 pounds a foot, or 22 pounds. Assume the weight is concentrated at the midpoint, or 5.5 feet out. So, the "moment" down is 120 foot pounds. (5.5 × 22).

Now, let's go to the right side. We have 29 feet of tower, equal to 58 pounds. The midpoint is 14.5 feet, so the "moment" from the tower is 841 foot pounds. (14.5 × 58). The Alliance rotor and the mast and post weigh a total of 20 pounds. This is located 30 feet from the tilt-over point, so the moment from these pieces is 600 foot pounds. For the TA-33 beam, the weight is 40 pounds, the distance is 31 feet, and the moment is 1240 foot pounds. This gives a grand total of 2681 foot pounds, which is OK for the tower model we have. (You will have to check with your tower manufacture if you have any questions on the allowable moment of restraint.) This same setup, with the Rohn #25, shows 3520 foot pounds, which is OK for the Rohn #25 (Moment of restraint of 4210 foot pounds is allowable by the Rohn Company). Remember we are not allowed to exceed the moment of restraint.

You can see from the diagram of fig. 9 that if the height at the tilt-over point were

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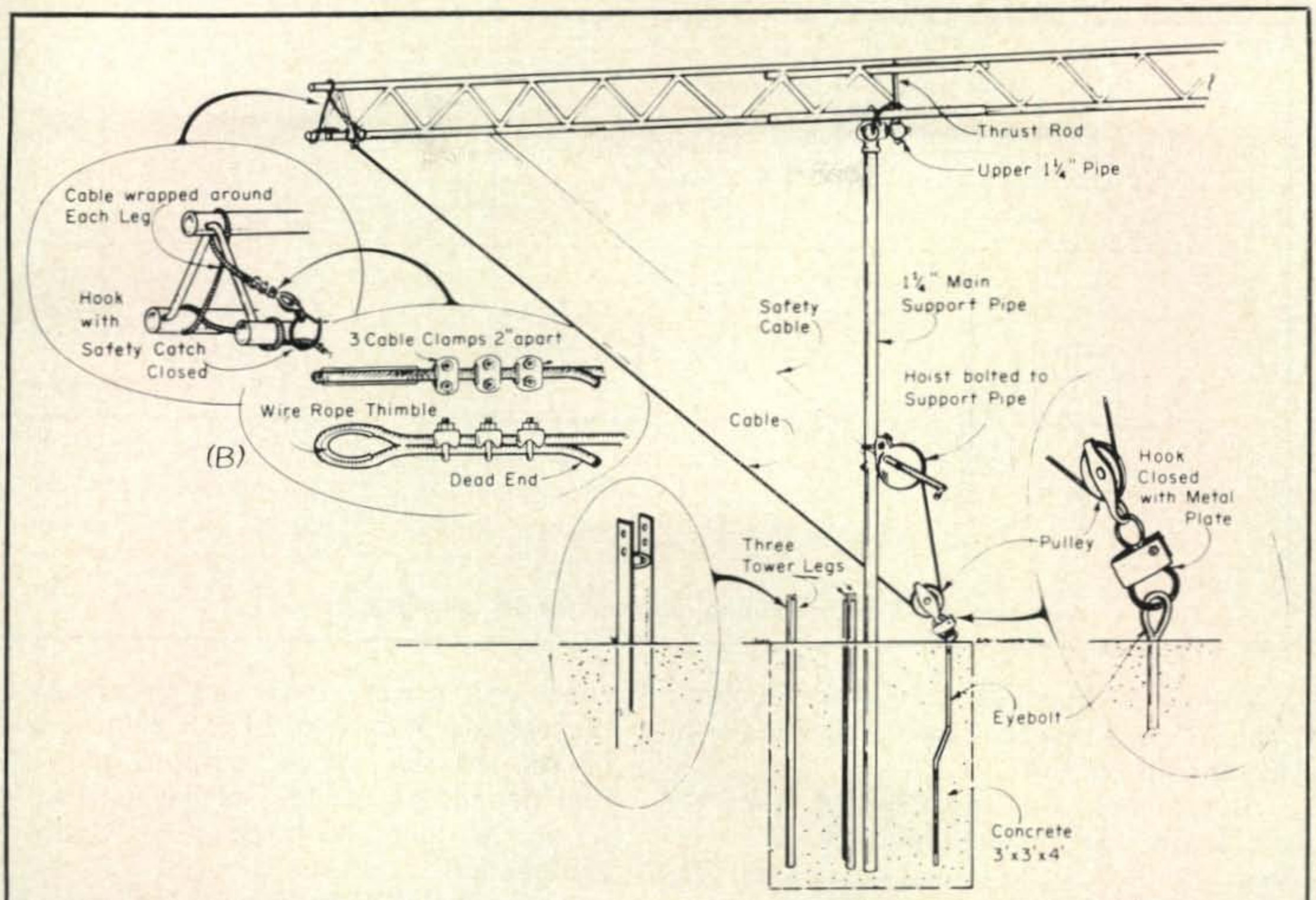

Fig 7(A)—Layout for the cable, hoist and concrete anchor described in the text. (B) Method of attaching the cable to the thimble and clamping the dead end.

increased, the loading would go down. Also, if the weight of the antenna and rotor and mast were increased, the loading would go up.

One way to check out what your tower will do is to refer to the manufacturer's ratings on wind loading. Use the following figures, for the wind velocities shown in Table I.

(These figures are based on the so-called conventional formula used by antenna manufacturers for normal antenna installations by amateurs).

The allowable moment of restraint of your tower can be estimated by multiplying the allowed *unguyed* length of your tower times the appropriate pounds per square foot, shown in Table I, times the antenna area. For example, say your tower manufacturer gives you six square feet of antenna, at 100 miles an hour, for a tower of 30 feet *unguyed* length.

At 100 miles an hour we have 30 pounds per square foot. The 30 pounds per square foot times 6 square feet is 180 pounds. The

m.p.h.	lbs. per sq. ft. of ant
60	11
70	15
80	20
90	25
100	30

Table I—Wind load versus wind velocity.

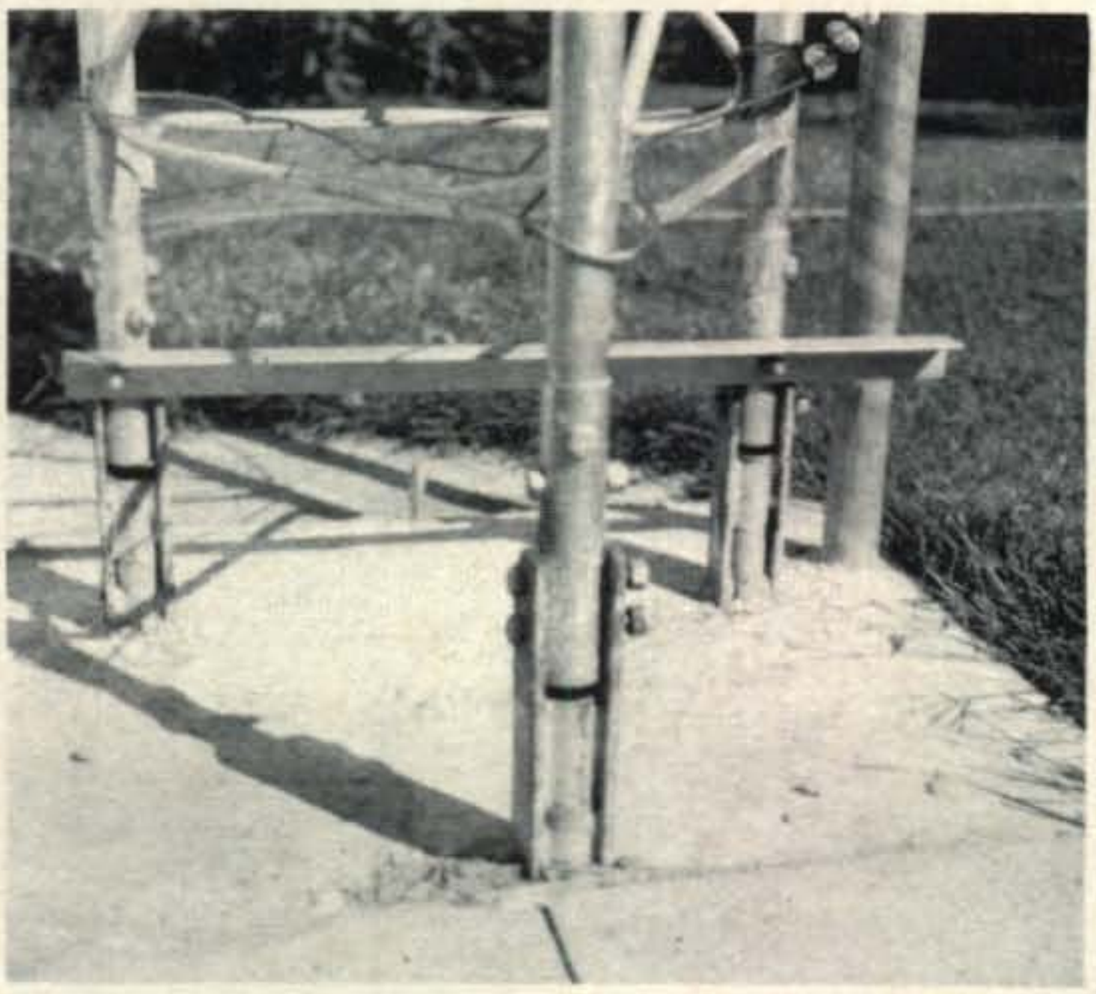

Fig. 8—Tower in the up position. Note the safety bar bolted to the bottom of the tower to keep the tower from falling over backwards.

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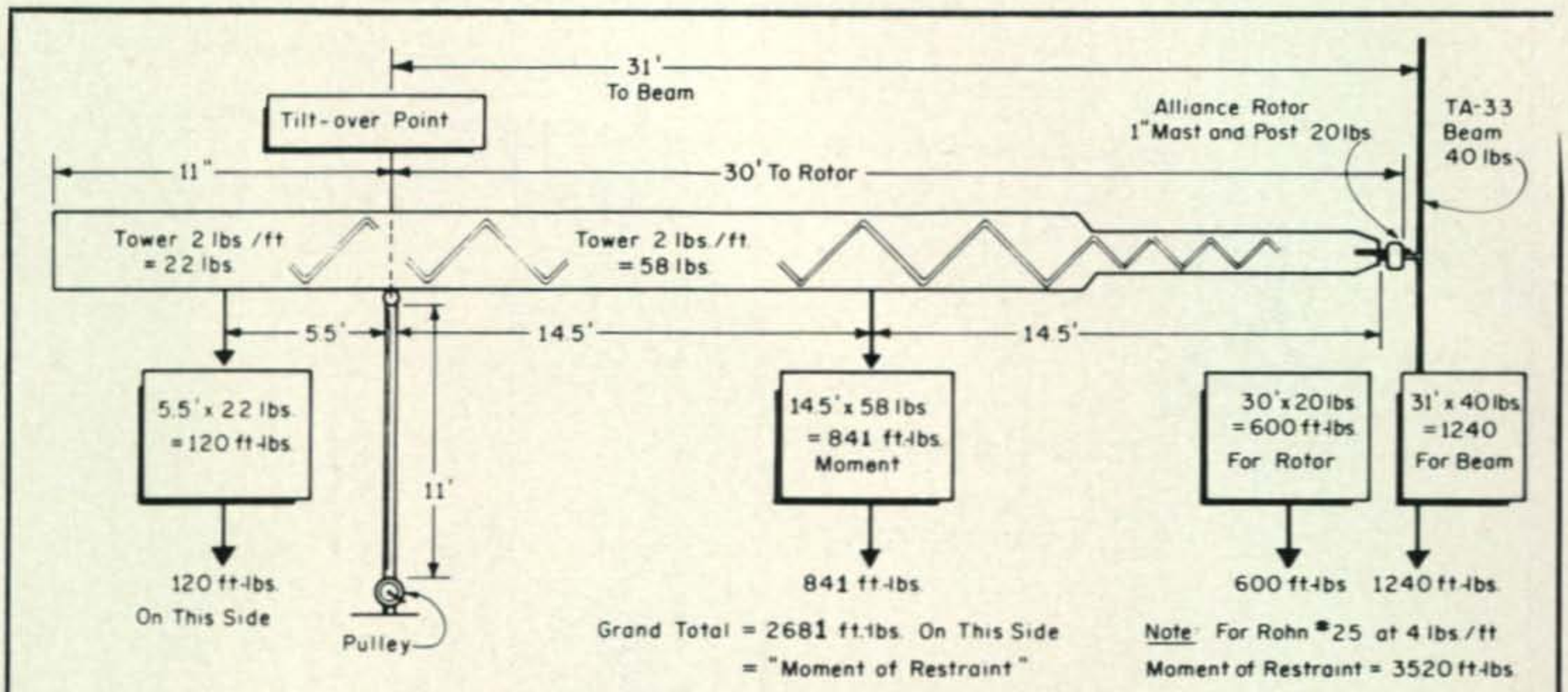

Fig. 9—Typical loading diagram for 40' aluminum tower.

180 pounds times 30 is 5400 foot pounds. This is conservative, since it ignores wind loading on the tower itself.

But suppose the manufacturer gives you six square feet of antenna at 70 miles per hour, for 30 feet of unguyed length. The 70 miles an hour produces a loading of 15 pounds per square foot, so the allowable moment of restraint is about 2700 foot pounds. This would work out with the sketch we showed in fig. 9.

Cable Loading

Figure 10 shows how we compute the cable loading. We have 2681 foot pounds *down* on the right side, which has the same effect as if it were 2681 foot pounds *up* on the left side. We have 120 foot pounds down on the left side. So we need to add 2561 foot pounds on the left side to balance the set up. Assuming we hook up a cable to the extreme left hand side, we need 233 pounds *down* on the cable to balance the setup. But we are at an angle with the pull. It takes almost 1.5 times as much pull, say 350 pounds, in the cable to get the 233 pounds we need. This is why one must have a hoist or winch; one man can't pull that much.

"Now," we ask, "how big a cable?" Better use a 10 × safety factor for hoisting work; Table II is based on the 10 times safety factor. This shows that a 3/16" galvanized stranded cable will do very nicely. Table II also gives you the story of screw eyes and eyebolts—don't go below a 1/2" eyebolt, firmly embedded in four feet of concrete. ■

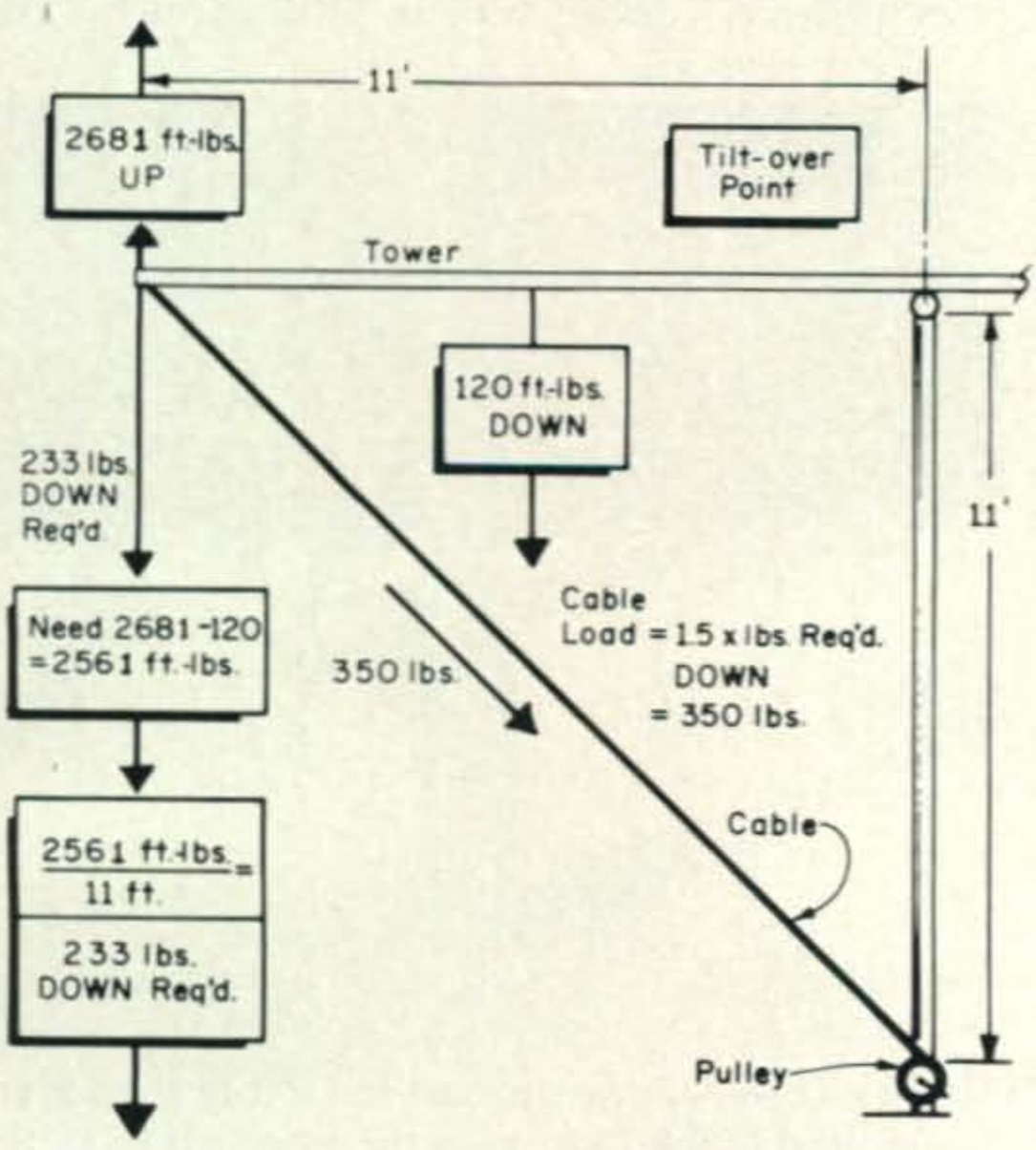

Fig. 10—Cable loading diagram.

Wire and Cable	Pounds
1/8" single strand galvanized	100
1/8" stranded galvanized	225
5/32" stranded galvanized	290
3/16" stranded galvanized	425
1/4" stranded galvanized (H.S.)	470
1/4" stranded galvanized (E.H.S.)	660
Bolts	
1/4" screw eye, open	100
3/8" screw eye, open	170
1/2" closed eyebolt	1100
3/4" closed eyebolt	1800

Table II—Allowable loads for hoisting with a safety factor of 10, and data on screw-eyes.

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WHAT'S A FORTUNE COOKIE?

OPERATION NIMBUS PROVIDES UNEXPECTED ODYSSEY

BY JOHN B. TUKE,* GM3BST

Pausing to reflect his hectic trip to the U.S. last year[1], John Tuke a regular contributor of Space Communications articles to CQ, gives his impressions of this almost unbelievable opportunity made possible by the General Electric Company.

THIS story has very little to do with Amateur Radio, at least not in he usual meaning of the word. But if by "Amateur Radio" one means being interested in radio for its own sake, and the results you get by fiddling about endlessly with bits and pieces, then there is a definite connection with "Amateur" Radio, if only a little with Radio Amateurs.

The exciting bit really started about half past seven one morning in April this year. I'm not usually even awake at that time, but this particular morning I awoke to hear someone hammering at the front door fit to burst it in, so I struggled sleepily up to find the postman waiting to hand me a telegram from the U.S.A. Now up 'till that moment my contact with the U.S. had been limited to some correspondence with NASA and General Electric about my copying pictures from the weather satellites. In fact, just a few weeks earlier a most pleasant gentleman by the name of Bob Jones from General Electric had come up from London to see my satellite rig. He told me they were the makers of the Nimbus satellite and they were interested in the results I was getting. But at half past seven on that April morning I could not think of anyone who was likely to send me a cable. It was a long one too, over 200 words, and as I read it through I could not really make out whether I really had wakened up, or whether this was some sort of a dream. The telegram was from General Electric in Philadelphia and it invited my wife and myself to come to the U.S. for two weeks, all expenses paid, to see some of the space program, and also quite a bit of the country itself, and finally to see the Nimbus 3 satellite launched. Further on in this cable there was a detailed itinerary, starting on May 5th from Prestwick Airport here in Scotland, going via New York, Philadelphia, Washington, Miami, Los Angeles, Vandenberg, San Francisco and ending back in Prestwick two weeks later. Some cable!

After I'd read this lot over twice just to help it sink in a bit more, I went back to our bedroom where my wife Margaret was still

John and Margret Tuke

*Torbank, McMasters Road, Stranraer, Scotland.

[1]GM3BST Rides Nimbus Fame to U.S., CQ. July 1968, p. 54.

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pretty well asleep. I asked, "Would you like to go to America?" This at first only resulted in a sleepy grunt, but I guess the impact got home about 250 milliseconds later for she sat up in bed and said, "*What*?" So I said again, "Would you like to go to America?" Before she had a chance to reply to that, I continued, "We've received an invitation from General Electric to go for a fortnight –they're paying for it all too–and we're to see just about all round the country, *and* see Nimbus 3 launched into the bargain so, do we go, or don't we?" This time the pause was about 60 milliseconds (give or take a nanosecond or two) and the reply very much to the point, "Of course we go and I shall need a whole lot of new clothes."

And that's really how it all started. Very shortly after breakfast that morning, further cables arrived from G.E. with more details, and ending, "And we do hope you will come." Who ever seriously thought of saying no anyway?

Departure Preparations

If, like me, you have been in a quiet government job for about 28 years, sudden invitations to another part of the globe are not an everyday affair. We both suddenly realized that the departure date was just eighteen days away. The first hurdle was getting time off work but fortunately the department fixed this up once they knew what it was all about. I don't have a very clear memory of what went on during that eighteen days; it seemed to be one continuous confusion of filling in forms, running all over the place to get people to sign bits of paper, passports, vaccinations, etc. etc. Seems you can't just turn up at Prestwick Airport and say, "I'd like to go to New York this afternoon", and then just step on the plane. Eventually it all straightened out. Everything just seemed to click into place at last and we were in GM3CEA's car heading for the airport. Somewhat in that eighteen days we had not only completed all the formalities but managed to make two short films for television companies as a result of the publicity our trip had attracted. As we made our way to the airport, I was looking forward to the trip; I thought it would be a nice rest. If only I'd known!

The Flight

At a quarter to five P.M. on May 5th, our Pan-American DC-8 became airborne from Prestwick and for all practical purposes we were already in the U.S. We had our first glimpse of what meals were going to be like for the next couple of weeks, when dinner was served. How any Americans who come to the U.K. manage to avoid starvation I just don't know. You folks certainly know how to make a meal. Apart from the wonderful meal, our immediate impressions were how efficient everything was and how friendly all the people were. Neither Margaret nor myself had been up in a big jet before so that was quite an experience in itself. Once you're up, you would hardly know you were moving and you can get on with the serious work of admiring the hostesses and enjoying the food. You can take it from me that both are superb! Because my work is connected with Civil Aviation (ground services) I had arranged for a cockpit pass as I thought a look at how the other half of flying lives and works would be both interesting and helpful in my work. We were about half way across the Atlantic when I went up on the flight deck and met Captain Glaser and his crew. I don't know for sure whether they are representative of all the Pan Am crews–but if so then I guess that airline has the friendliest and nicest crews you could find. I was invited to make myself at home on the flight deck and some of the intricacies of modern flying and navigation were explained. They made it all so very simple–almost made me feel I could finish the trip flying the thing myself–but that's just part of he friendliness because after a short while watching these men at work you realize you are watching highly skilled people doing a highly skilled job in the best way possible, with relaxed efficiency. Not all the talk on the flight deck was about actual flying; I found that the crew used the weather pictures from satellites, just the same as those I received and that they were of considerable use to them. It was interesting to see from an aircraft the weather patterns which so far I'd only seen from the satellite pictures, cold fronts and warm fronts, they look different somehow when you see them as the real thing, yet it was not difficult to correlate them with each other.

New York

Six hours after leaving Prestwick we were approaching New York. The weather was quite clear as we flew down the coast and I tried to pick out landmarks from the map, without much success I'm afraid. Then we

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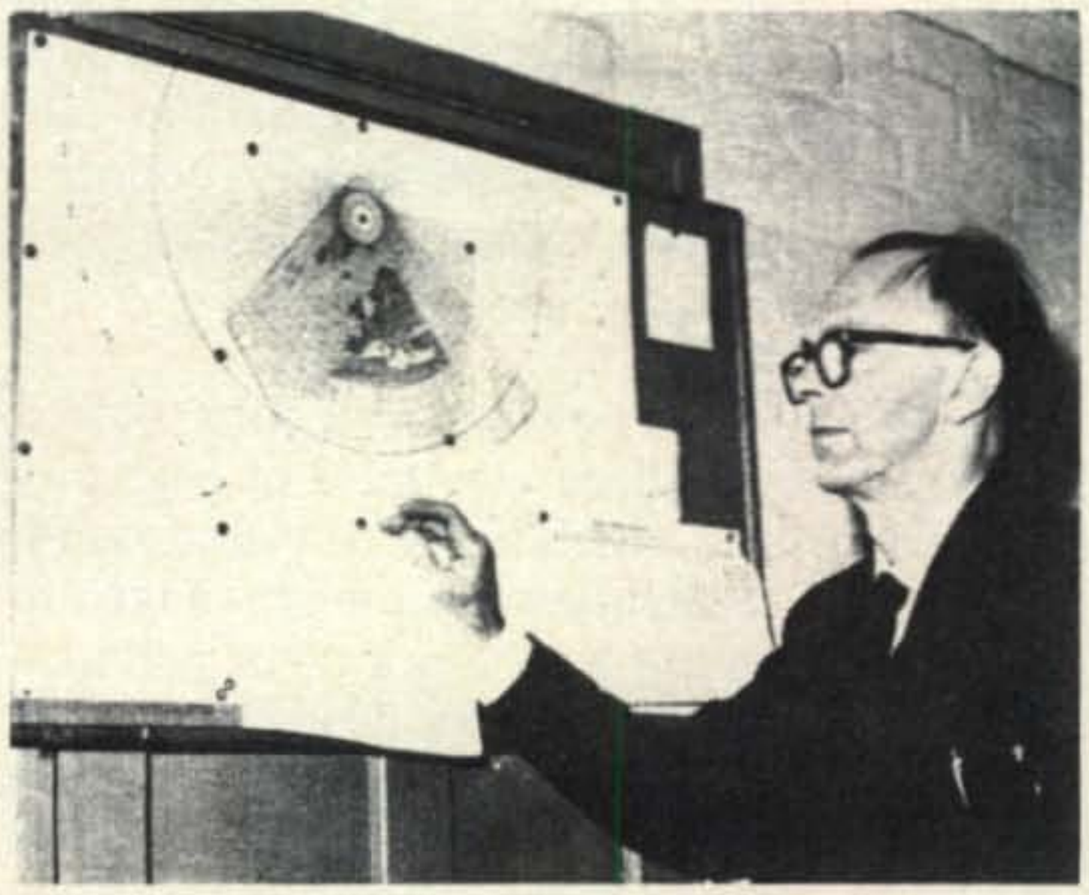
were down, and the first part of the journey was over– but the trip was just beginning.

It was a queer feeling to find yourselves in a "foreign" country for the first time. We collected our luggage and followed the various signs leading to customs. We'd been told that we would be met at the airport–that a Mr. Ray Forbes would be looking after us all the time we were in the States. But how does one recognize Ray Forbes out of all the hundreds of people who are travellers at Kennedy Airport? We consoled ourselves with the thought that he would probably have been sent a photograph of us, but as we came th the customs barrier and were looking up at the balcony above at all the folk waiting to meet people off the aircraft, the problem resolved itself. There were three people standing together in one place. and they were looking at us very intently and talking, then waving and we knew straight away that there was Ray. We even guessed that the couple with him were Mark Silverman and his wife Linda. We'd never met any of them but we'd written and had letters from them and we just knew. You just can't be mistaken about nice people.

In a few moments (after being passed by a most pleasant customs official) we were making the introductions and then being whisked off in a wagon (at least three times the size of my car at home) into New York City. First impressions are often just a tumble of visions and sounds one after the other until you don't know whether you're coming or going, and this was no exception. We sped to the Americana Hotel, went up to our room on the 32nd floor, down again a few minutes later to another huge meal, and finally at nearly midnight American time (but five in the morning by our own personal clock time!) we were off to bed. But, tired though we were we couldn't resist sitting at our room window and watching New York at night. I guess we sat there the best part of an hour just watching–we'd been told that it is as busy at three in the morning as it is at three in the afternoon–but we were too tired to stay awake long enough to find out.

In aviation magazines at home, I'd read articles about how the change of local time can effect you when you travel rapidly from one country to another. Never having done this myself, it had, up to this moment been an interesting but academic point. But about five thirty in the morning New York time Margaret and I were wide awake with our



John B. Tuke at the plotting board. John was recently featured on CBS-TV's program "21st Century."

English stomachs shouting for breakfast! Just before we had come to bed Ray had said in that friendly manner which we were soon to know so well, "If there's anything you want John and Margaret, just dial room service, it's open 24 hours here and they'll see you right." At five thirty in the morning we did just that. To the cheerful voice that asked me what I'd like, I explained that I was from the U.K., and could I possibly get a pot of TEA? (Anyone who's ever been to Britian will know that we live on tea like you folks live on coffee.) Much to my surprise I was told that I could certainly get tea, but no, they didn't have biscuits but I could have some cookies. So we settled for tea and cookies. A few minutes later this was brought to our room together with (and this fairly tickled Margaret) a single beautiful rose in a glass. We got out of bed and once again sat by the window and watched New York at quarter to six on a Sunday morning and marvelled at it all, and wondered if the American people ever went to bed.

That first real day in New York was spent sightseeing. Ray took us to see both St. Stephens and St. Patricks cathedrals and then that afternoon we went up the Empire State Building. Before we had properly recovered from being up there we found ourselves in the "Top of the Sixes" restaurant for our evening meal–which was terrific. Maybe the English know how to make tea just that bit better than you folks do, but what the Americans don't know about food just couldn't be worth knowing! That evening we had got a bit more adjusted to the time change and were able to enjoy it all to the full. We were

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already getting to know Ray better—he'd been in the U.K. during the '39-'45 war and it was interesting just listening to him talk about his experiences over in our country. It's a pity we hadn't known him then.

The Tour

On Monday, May sixth, our tour started in real earnest. There was a lot of publicity attached to our visit and there were newspaper and TV interviews but we managed to get in a visit to the New York planetarium. I never thought I'd meet the director of such an interesting place, but we did and though we only spent a short hour there it was most interesting. That afternoon my wife went to see the United Nations building while Ray and I did some more publicity interviews.

I have not yet told you that we have two children in Canada. Of course they (both girls) are grown up and married and right from the time we'd known about the tour of the U.S., Margaret had been saying to me, "Now we'll just have to see the kids"—and I'd been agreeing with her. So while all the arrangements were being made by G.E. about our tickets I'd mentioned to them that when the tour was over we'd like to return to the U.K. via Toronto—and they agreed. However, no detailed arrangements had been made and Ray kept on saying, "No problem" everytime I mentioned the subject so I'd decided just to let it ride for a bit. So, on the morning of Tuesday 7th as we sped by train from New York to Philadelphia we were not particularly thinking about our youngsters but instead we were comparing train travel in the U.S. to that in the U.K. So when we drew in at Philadelphia and travelled up the escalator into the main part of the station you can guess that 'surprise' is hardly the right word to use for what we felt when we saw our two daughters, one complete with husband and baby, waiting there for us. G.E. had done it again; they'd flown the whole crowd of them down from Toronto to stay with us for a couple of days. What can you say to people who do things like that? Thank you just simply doesn't express it properly.

Philadelphia, or rather just a bit away from it at Valley Forge, is where G.E. has their space technology center and after we'd all had lunch my son-in-law and I were given a conducted tour of the Nimbus project. This time we left the ladies behind, all doting on the baby of course; in fact it seems later that the majority of the office staff did no work that afternoon but just played with my grandson! What we saw on the Nimbus project made it clear why these spacecraft cost so much. You should see the tests that have to be made and all the complications of making them. I'd been getting pictures from Nimbus 2 for almost two years at that time; I almost looked upon it as a personal friend and to be able to see one of these spacecraft close up was really something. This was the first bit of the technical part of the trip and it wasn't more than a few moments before I realized that what I know about space technology could be written on a postage stamp and yet everyone was so friendly. They just couldn't do enough.

The next day, to say we "saw round the city of Philadelphia" would only be a small part of the story. We met the Mayor and were presented with a replica of the famous Liberty Bell. After that, one of the official guides "showed us around"—and oh boy, did we see round? I doubt if there is one square inch of the city that we missed. If you want to know how Philadelphia came into being and all its history and everything it does, then you arrange for an official guide, and you'll learn just *everything*.

Washington

It would be very hard to say, in retrospect, which was THE DAY of the journey; so many different things happened on each, and each was special in its own way. But it isn't just an ordinary day when in the morning you attend a reception at Congress, and then in the afternoon you meet the Vice-President of the United States himself! But that's what happened to us the next day in Washington. We'd been to the reception in the morning and were talking to congressmen concerned with the space program. I found they were really interested to know just how I'd benefited from the satellite pictures. To them I represented some one other than the official users, the ordinary person who really was reaping benefit from the American space program. It was all pretty good. We'd gone out to the N.A.S.A. station at Goddard after that and were just about to start a look round when we were rushed back into Washington to meet Vice President Humphrey. While we were waiting, I was almost getting cold feet—what does one say to a Vice President? I was quite sure he couldn't be one little bit interested in me and my Nimbus pictures and

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equipment—and then we went into his office and the next fifteen minutes passed in one of the most pleasent meetings I have ever experienced. I forgot all about what I thought I should say, we just all seemed to be having a friendly chat. I looked over at Margaret once or twice and I could see she was thrilled to bits-and I wasn't exactly finding it dull either and when Mr. Humphrey gave each of us a memento of the visit, well that really made our day.

Have you ever eaten Fortune Cookies? Well just in case you haven't, let me put you right. That night we went to dinner at "Trader Vic's" where, if you don't already know. I'll tell you they serve the most wonderful Polynesian food. It was my first introduction to this type of meal and I'm prepared to eat in the South Sea Islands from now on if that's what it's like. It was after the main part of the meal was over that they handed round some small triangual shaped pastries—and they were quite tasty too. I'd put back a couple of these when the charming lady in the party sitting next to me said "And what fortune did you have?" I was a bit puzzled about this as we hadn't been talking about soothsayers or anything like that, but I guess I made some sort of vague reply because she went on, "You take one of the cookies and break it open and inside you'll find a piece of paper with your fortune written on it." With that she went on to demonsrate. As nonchalantly as I could manage I did the same to find a slip of paper saying something about having a prosperous future—but what was on the two I had already swallowed, I'll never know!

Goddard

In the past I'd written quite often to the various officials at Goddard Space Flight Center, but it was very much better to meet them. They've got some "rig" there, I wouldn't mind some of their equipment for my back garden. I've said before that all I know about space could be written on a postage stamp—and these boys were the real gen men. I'd thought maybe they'd be nice and polite, but obviously they'd not want to spend too much time talking to me about technical topics. But I was wrong, quite wrong. They were really interested and when I asked questions about technical points which were puzzling me, they told me the answers, and not like a learned teacher to an ignorant kid but as one enthusiast to another. Here at home practically everyone thinks I am some sort of a nut—because I really am enthusiastic about space communications, and I get up at all hours of the night to get satellite signals and pictures. I was proud to find that though technically it was obvious I could never compete with these men, that there was one thing we did have in common, genuine enthusiasm and belief in the space program. If that means being some sort of a nut, then I'll continue that way.

Cape Kennedy

Ray had been telling us all the way along that we'd find everything quite different in Florida as our next call was at the Kennedy Space Center. Certainly we stayed in a lovely motel and the weather was warm—though not as warm as I'd been expecting the way Ray had been talking. In fact, on the Sunday when we had a "day off" and we all went down to the beach, I was cold. But it's a lovely place all the same. That particular Sunday it was Mothers Day, and on behalf of our absent children I decided to treat Margaret to something she had always wanted—a helicopter ride! That's a queer Mothers Day present but Ray and I organized it on the quiet, and then took Margaret along and she was delighted. Any other amateurs wives have a helicopter ride for a Mothers Day present? Maybe I'm not the only nut in the family!

Seeing round Cape Kennedy the next day was terrific. It would not be difficult to write a few pages just about that place itself. Obviously the main attraction is the Saturn Five —no doubt its construction shed is the biggest building in the world—they even used to get their own weather inside it until they fixed up air conditioning. And the Saturn V itself—it is just magnificent. We were right up beside it—it's colossal. What a sight it must be to see that "bird" go. Once again we found everyone so enthusiastic, it was infectious really and we felt we wanted to see it fly there and then. Although we spent a whole day there and were given a full tour, one could go every day for a long time and then not see everything, but unfortunately we had to leave and make our way to Los Angeles as the day was drawing near for the launch of Nimbus 3 at Vandenberg.

Another trip in a big jet took us from Melbourne in Florida straight to Los Angeles—more meals on board and another loveely trip. During a couple of days in Los Angeles

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The satellite weather station of the author.

we had a tour round all the famous places. It was these little "on the side" tours that highlighted the dream quality of he whole journey. We'd heard of places like Beverly Hills—but never thought we'd ever really see them. And all because of satellites and an interest in radio!

We left Los Angeles to go to Lompoc for the launch at Vandenberg. Compared to all the wonderful places we'd stayed Lompoc was quite small, but Margaret and I fell quite in love with the place. What we like about it was the really lovely weather—not too hot, not to cold and plenty of sunshine. The setting of the town between the hills and the sea is just perfect. If anyone ever leaves us a fortune we're going to settle in Lompoc! While waiting for the night of the launch of Nimbus 3, we managed to see quite a bit of that part of California, and the more we saw of it, the more we liked it. We both thought that as far as American steak went, we'd seen everything, but no. One evening we went to a place called "The Far Western," in Guadeloupe. By this time I'd got used to eating as much steak at one sitting as I would eat at home in a week so I was able to do justice to the very best one I've ever tasted in my life—and I reckon I'll not taste another like it until I go back to Guadeloupe and the Far Western again. To this day, if I say to Margaret, "Remember the Far Western?" we both feel hungry!

There was an interesting technical visit while we were at Vandenberg waiting for the launch. We went up to their metorological office and saw their satellite picture equipment. It was most interesting to see how the professionals do it; it turned out to be not so very different from the way I did back at home. I'd taken along a few of my pictures and they were interested to see pictures of the European continent just as I was interested in seeing pictures of California. There's nothing like satellite pictures for making the world seem small, unless perhaps it's amateur Radio!

The Nimbus 3 launch was set for 1:30 in the morning but long before that we were up at Mission Control watching the early stages of the count down. There seem to be many systems to check and double check and the tension mounts as one by one the green lights come on as the individual systems are cleared to go. Margaret and I were sitting right up there beside Mr. Huston the mission controller—just imagine it, sitting right at the mission controller's desk. If you can hardly believe it then neither could we. Shortly before launch time we went out to a vantage point to watch the take off. Those of you who follow these things will know that shortly after take off the missile had to be destroyed as it was going off course, but even this could not erase the magnificence of the launch itself. To really see with one's own eyes the rocket lifting off on its tongue of flame is a sight never to be forgotten. To say everyone was disappointed at the failure is to put it mildly —those few moments were, without doubt, the worst and only sad part of the whole adventure. What is so terrible is that so much work has gone for nothing—you can feel for all the people who have worked with the bird for so long and put so much of their life and enthusiasm into making a success—and all this comes to nothing in a hundred and ten seconds. But as one hardened member of the crowd said to me, "That's just how things are in this business, and you simply start from the beginning again." To be able to say that really shows just how great the space people really are; it's one thing to have boundless enthusiasm when everything is going well, but it is quite another to feel the same way when everything goes wrong.

San Francisco

The following day we went by road to San Francisco—up the coast to see the won-

[*Continued on page 50*]

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WHAT'S NEW?? 550 BIG WATTS!

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derful scenery. Although we were feeling the terrible anti-climax of the Nimbus failure it was impossible not to enjoy the magnificence of that drive. When we'd first caught a glimpse of the Pacific at Los Angeles, we had thought it looked just like any other coastline–but up here and along the Monterey coast it was a real picture. How we ever got to San Francisco I don't know because every few minutes we asked Ray to stop while we took some photographs. However we did eventually get there, though the journey had taken best part of eleven hours, and for once we didn't bother with a big meal but dined lightly in the hotel and went off to bed.

The last official day of our trip was spent sight seeing round the city. It's certainly a great place–I was disappointed to find that the Golden Gate Bridge was not golden, but just a dull red color, just shows you how you can pick up the wrong impressions from a geography book, doesn't it? One thing Ray failed to do was to get me to eat the local sea food–I think he was quite disappointed! But I'm not fond of that type of thing and settled for my usual steak instead. I knew I'd not be having steak like that once I got home again.

Canada

All good things come to an end and eventually it was time to say goodbye to Ray, as he left for Washington and we left for Toronto. What would *you* say to someone who has looked after you and your wife for a fort-night, put up with answering thousands of questions and the obviously slightly different ways of someone from another part of the world–well, we didn't know just what to say, but we felt Ray understood what we meant.

We spent a week in Canada with our children–going places, doing things, and saying things like every one does when you stay with your married youngsters. We did our best to spoil our grandchild in the limited time we had available! Then, we were sitting in a BOAC 707, out over the Atlantic, Prestwick bound. And six hours later, we touched down, back once again in GM-land, and back to Stranraer–again thanks to the kindness of GM3CEA who met us. It seemed funny to see the house again–to collect our two cats from where they'd been boarded out, and to think about going back to work. It seemed surprising when I switched the "rig" on, that it all still worked! We seemed to have been away for years.

Home

During our first night at home, we both woke up at about 3 in the morning local time –starving! Our stomachs were shouting for a decent steak at that time, in fact we had to get up and make a meal there and then (thought it was a bit more ordinary than what we'd been used to!)

And what are the general impressions now that a few months have elapsed and the trip can be seen in proper perspective? Obviously it was interesting simply to go to the U.S. Although, as chance would have it I simply did not have time or opportunity to meet any amateurs, it was exciting to meet *any* Americans–obviously they are just the same type of people as those I talk to on the amateur bands. But I think the overall impression was one of friendliness. Everyone we met tried to do something to make our tour more interesting. This didn't only apply to the General Electric people who were responsible for our being there, but to everyone we met whether they were space folk or not. All those in the hotels were nice–the people I met in connection with the publicity were charming – camera men, sound technicians, writers, continuity–the lot. The man we met in a post office in New Orleans who told us he was from Ireland just across the water from where we live at home or the woman at a restaurant in California who stopped her car to talk to us and was interested to hear I came from Britain. All the scienific personnel were friendly – whether they were directors or men working at the equipment. On the technical side I was immensely impressed with the enthusiasm that is evident everywhere and the genuineness of their wish to see space technology used for the benefit of all mankind. When I thought it over, that was really the reason why I was able to take part in the satellite program at all, which led eventually to having this wonderful adventure as the guests of G.E.

When you come to think of it, the people responsible for all the different aspects of the space program are doing something pretty wonderful–opening up a complete new world for all of us to enjoy. I for one, would like to say thanks, and to say I'm proud to take even the tiniest part in this program. ■

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CQ ATTENDS: THE 1969 HARRISON SSB SHOW

ALAN M. DORHOFFER,* K2EEK

Some of the crowd turns to "ham" it up for the camera.

OVER 3000 amateurs turned out on March 25, to attend the 18th annual SSB Amateur Radio Show sponsored by Harrison Radio Corp. This was by far the largest attendance in the show's history.

CQ, along with over 25 other exhibitors, was kept quite busy showing their wares and meeting all those who attended, plus trying to answer several questions at the same time.

Throughout the day, leading figures in the amateur radio industry held a series of seminars off the main exhibit area which helped alleviate the congestion there and set a brisk pace for the show to follow. The seminars also afforded the manufacturers an opportunity to answer specific questions on their products and gain first-hand information and ideas from "the field." The speakers included: Bud Henley, WAØPCV, Sales Manager, Galaxy Electronics, Inc, Inc.; Clyde Blyevin, Director of Marketing. Tri-Ex Towers Corp.; R. W. Ehrhorn, W4ETO, General Manager, Signal/One; Andy Andros, WØLTE, President, Hy-Gain Antennas; Stu Meyer, W2-GHK, Vice President, Ameco Division of Aerotron, Inc.

Every hour during the show (noon-9 p.m.), Bil Harrison, W2AVA, President of Harrison Radio Corp. drew winning prize stubs from among those filled out at registration. The entire show, including the prizes, was presented at no expense to the attending amateur. The Grand Prize of a Swan 260 Cygnet transceiver went to John M. Kyles, WA2GXG, of Malvern, N.Y.

If this year's show began a trend, then perhaps in a year or two they may have to look for a larger place to hold it. In any event, make it a point to meet us there next year. ■

Jim Taylor, Sales Manager for Hy-Gain Antennas, on the left looks out at the crowd while Bil Harrison, W2AVA, and Andy Andros, WØ-LTE, President of Hy-Gain, on the right speak to a visitor.

From left to right: Herb Johnson, W6QKI, of Swan Electronics, Prize Winner John M. Kyles, WA2GXG, Bil Harrison, W2AVA, and Dave Howard, WA6OQY, from Swan Electronics. John is cautiously accepting the Swan 260 Cygnet as Grand Prize winner.

*Managing Editor, CQ.

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Radio Amateur Satellite Corp. Formed On East Coast

BY GEORGE JACOBS,* W3ASK

ON March 3, 1969, an east-coast based radio amateur organization was incorporated to build new communication satellites for use by radio amateurs. Named the "Radio Amateur Satellite Corp." (AMSAT), the organization draws its membership from the legion of space and communication experts located in the Washington, D.C. area.

Among AMSAT's members are representatives of such organizations as the Johns Hopkins University Applied Physics Laboratory, IBM, Aeronautical Radio Inc., Communications & Systems, NASA Headquarters, NASA Goddard Space Flight Center, COMSAT, ARRL Headquarters, U.S. Information Agency, Office of Telecommunication Management, Federal Communications Commission, Federal Aviation Administration, RCA, etc.

Most of AMSAT's members are radio amateurs already involved in space programs and they represent some of the world's leaders in the design and construction of satellites. The group also has numerous contacts with high-level officials throughout the government and in the various industrial space laboratories. AMSAT has potential access to a wealth of obsolete space qualified hardware, left over from a number of famous space programs.

AMSAT's Objectives

A. To provide satellites that can be used for amateur radio communications and to conduct experiments by suitably equipped amateur radio stations throughout the world on a nondiscriminatory basis.

B. To encourage the developement of skills and the advancement of specialized knowledge in the art and practice of amateur radio communications and space science.

C. To foster international goodwill and cooperation through joint experimentation and study and through the wide participation in these activities on a noncommercial basis by radio amateurs of the world.

D. To facilitate communications by amateur satellites in times of emergencies.

E. To encourage the more effective and expanded use of the higher frequency amateur bands (v.h.f. and u.h.f.).

F. To disseminate scientific and technical information derived from such communications and experimentation, and encourage publication in treatises, theses, trade publications, technical journals, or other public means.

AMSAT Activities

The group has already begun enthusiastic participation in the following tasks:

Gravity gradient stabilization feasibility study.
Two-meter satellite repeater study and development.
Satellite v.h.f. antennas, study and development.
Thor-Delta launch vehicle interfacing.
AUSTRALIS-OSCAR qualification testing.
Solar and nuclear power sources study.
Satellite access and operating procedures.
Frequency coordination and selection.
Two-meter diplexer feasibility study.
Obtaining surplus space hardware and planning its use.
Obtaining piggyback rides on launch vehicles.

AMSAT also maintains close liaison with the ARRL and with Project OSCAR Headquarters.

AUSTRALIS Satellite

As its first project, AMSAT will have the opportunity to arrange for the launch of the Austrialian-built satellite named AUSTRALIS. The satellite has been shipped from Project OSCAR Headquarters in California to AMSAT, where it arrived on April 14. The AUSTRALIS satellite is now undergoing required environmental and qualification tests, in order to get it ready for launch sometime later this year.

This 35 pound satellite is battery operated and will transmit "HI" in slow Morse Code twice each minute on 2 and 10 meter beacon transmitters. The beacon transmitters are expected to remain in operation for as long as two months, and the satellite's orbit is expected to carry it over almost every point on

[*Continued on page 95*]

*11307 Clara Street, Silver Spring, Md. 20902

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THE INVERTED VEE CONTEST ANTENNA

BY EDWARD M. NOLL,* W3FQJ

WHAT is the ideal contest antenna? Two important factors are an omnidirectional pattern and a suitable grouping of low radiation angles such as can be obtained from inverted dipole and long-wire vee antennas. The broader low angle pattern accommodates medium distance and long haul DX. The omnipattern speaks for itself when bands are open and DX is coming in from all angles.

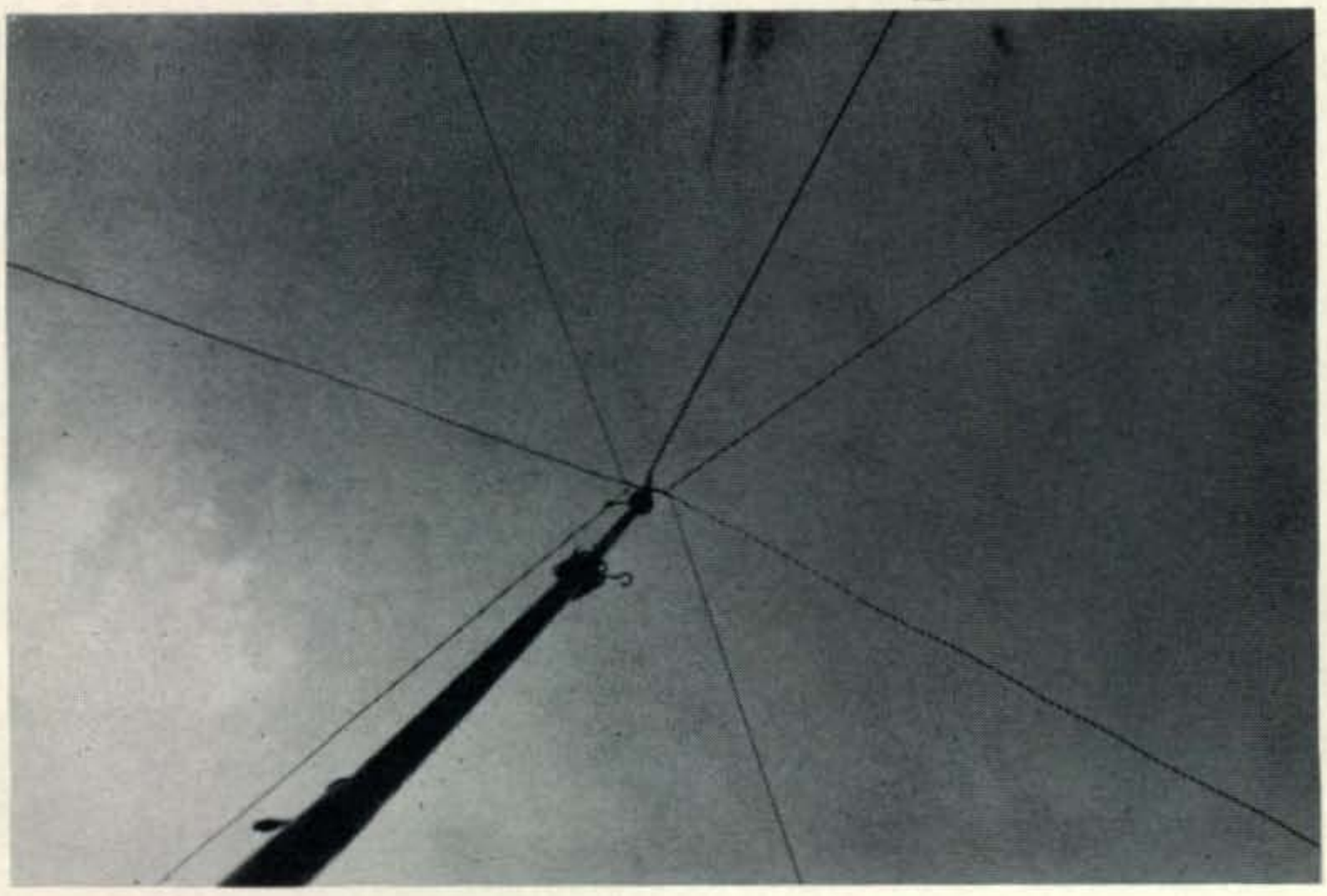
Optimum dipole performance is essential for 40 and 80 meter operation. Inverted dipoles are not a compromise antenna and are an improvement over a horizontal dipole in terms of omnidirectional and low angle characteristics. On 10, 15 and 20 meters some gain is helpful along with omnidirectional characteristics and low angles. The long-wire inverted vees incorporate these features.

Fast band changing from the operating position is a help in meeting changing DX and contest situations. If band changeover can be accomplished without changing antennas or adjusting tuners you can take better advantage of your operating time.

The W3FQJ inverted-vee contest antenna incorporates a number of the above features. Elements are cut to establish resonant conditions and, therefore, optimum operation of each of the three inverted antennas with a common feed point is feasible. No tuner is needed to establish low standing wave ratios.

Choice of transmission line length is helpful in establishing the favorable line conditions needed for direct connection to the transmitter. Line length is selected to establish the most favorable compromise for keeping the overall line length a whole multiple of a half wavelength. For coaxial lines with a velocity factor of 0.66, (RG-8, 11, 58, 59), use transmission line lengths that are a whole multiple of 45 feet long.

*3510 Limekiln Pike, Chalfont, Pa. 18914



Worms view of the mast showing the apex and feed line.

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This establishes ideal conditions for all bands except 80. Dipole loading on 80, however, is seldom a problem. If you wish to include 80, use line lengths which are a whole multiple of 90 feet.

Antenna Plan

The inverted-vee construction is in effect three separate antennas connected to a common feed point at the vee apex. The two legs of each antenna are related by 180°. However the three individual vees are mounted at equidistant angles from each other and there is a uniform 60° separation between adjacent legs of the complete antenna as shown in fig. 1.

One antenna of the mutual group of three is an 80 meter inverted dipole. This antenna is also resonant and active on 10 meters, operating as a 7/2 wavelength long-wire inverted-vee. On 10 it is seven quarter wavelengths on each leg and presents a low impedance at the feed point.

The second antenna is a 40 meter inverted dipole. As you know, an antenna of this length, if cut very carefully, functions as a 3/2 wavelength inverted-vee on 15 meters. Each leg is three-quarter wavelength long and there is a low impedance center feed point.

The third antenna is a 3/2 wavelength inverted-vee on 20 meters. This same antenna provides 11/2 wavelength resonance on 6 meters. The 40 meter inverted dipole also has a resonant point in the 6 meter band.

The exact dimensions for the antenna are given in fig. 1. Each length is cut precisely using an antenna noise bridge or s.w.r. meter. Lengths are shorter than the formula values, because of the nearness of the leg ends to ground. In general inverted-vee constructions run 2% to 6% shorter because of closeness to the ground and nearby conducting surfaces.

Patient cut-and-try testing is needed but when your work is complete you have an all-band and fast band-changing antenna that requires no switching or tuning.

Construction

The inverted-vee construction is of course simple and inexpensive. A 35-50 foot mast does the job. The antenna wires themselves provide top guying. A coaxial line to dipole connector is used at the apex.

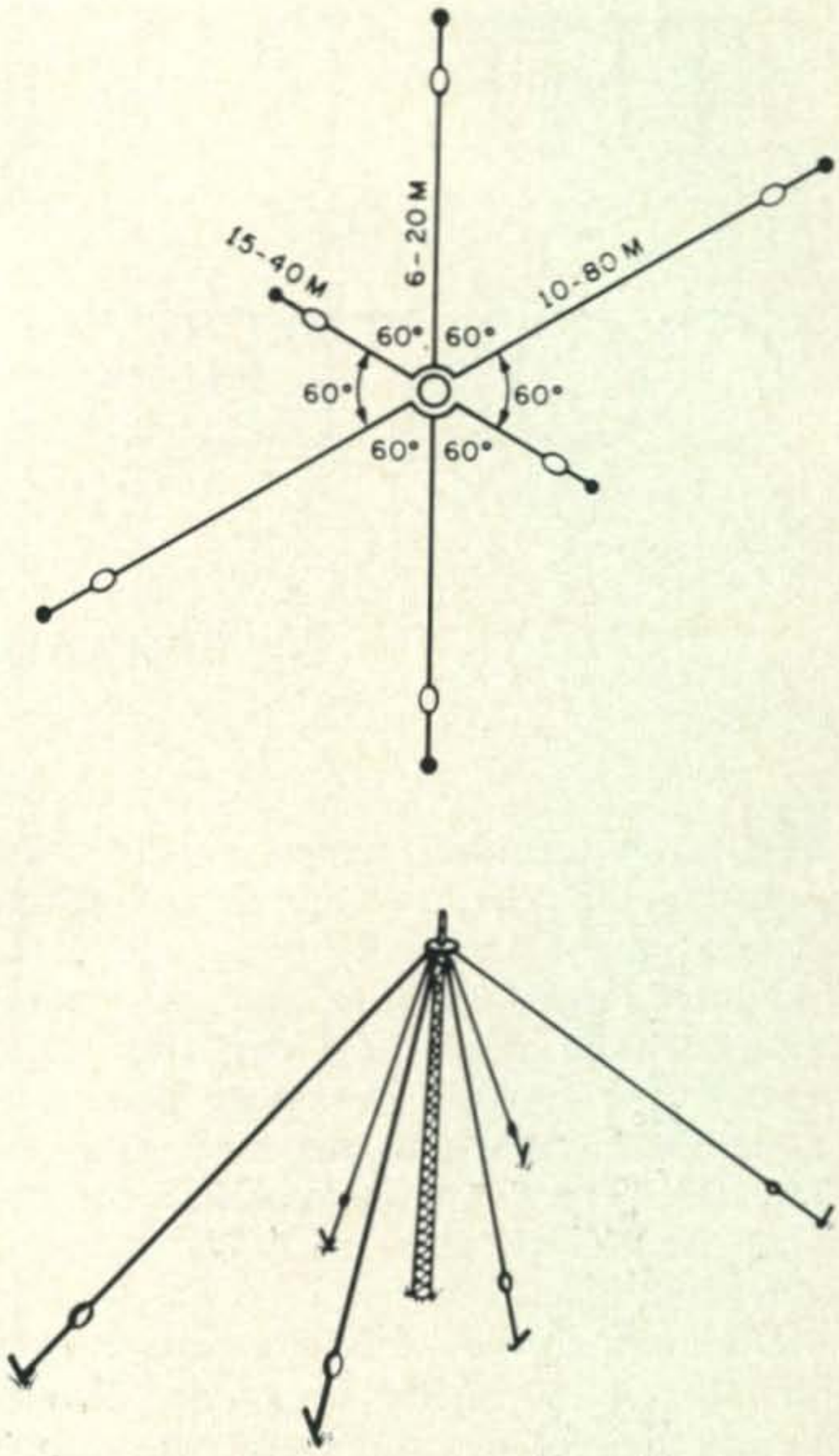

Fig. 1 - Two views of the inverted-vee all band antenna. The lengths for each leg of the antenna are given in the table below.

Band	Length Per Leg
80 - 10 m	58′ 1″
40 - 15 m	32′ 3″
20 - 6 m	49′ 2″

Legs are attached firmly, soldered and taped.

An insulator is attached at the ground end of each leg. Plastic washline ties the opposite end of the insulator to a convenient point. Each leg end is accessible and provides easy access for trimming and tuning the antenna precisely. Don't overlook the advantage of being able to tune your antenna from ground level while it is in its permanent operating position. Start with lengths longer than needed and trim back to your desired resonant points. ■

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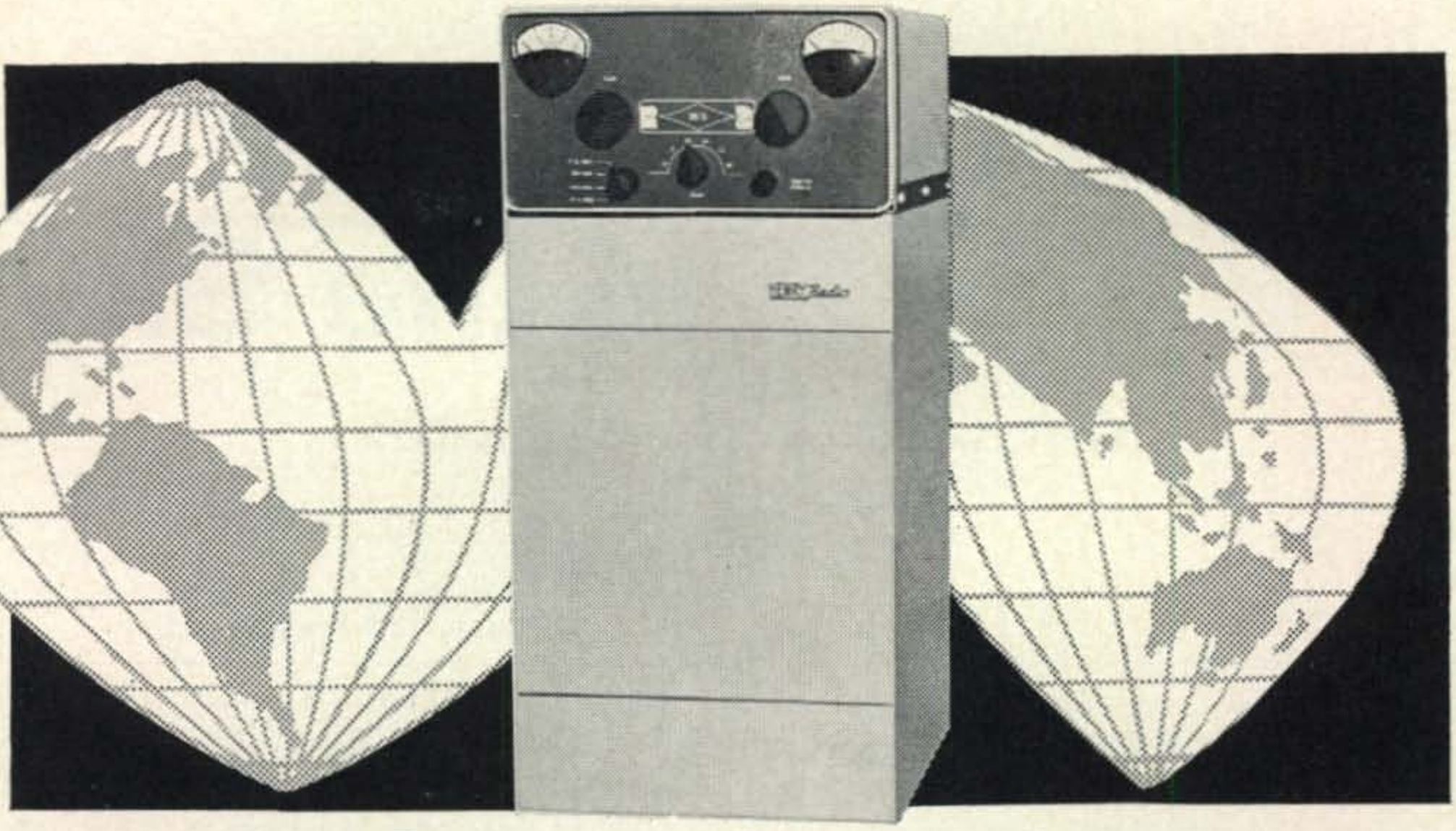

THE 2K-3 . . . A SUCCESS STORY

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For such success we are of course grateful, although not greatly surprised. From the beginning we have dedicated ourselves to the proposition that amateurs prefer to buy the best when it is available. Consequently, the 2K has always used the finest components we could buy. Integrity of design dictated that we include features not fully duplicated by any other manufacturer of amateur linears — Pi-L tank circuit, resonant input filter choke, resonant cathode Pi-input, double RF shielding and many other unique and expensive features.

Finally, in order to hold the price of the 2K-3 low enough so that the average amateur can afford it, we manufacture it and sell it ourselves direct to the consumer. The 2K-3 is unquestionably one of the finest values ever offered the amateur. By any reasonable standard the 2K-3 should be priced at $1000 rather than its remarkably low $745.00.

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"World's Largest Distributor of Amateur Radio Equipment"

"Said the Spider in the Sky"

BY HOWARD W. KELLEY,* K4DSN

"Ideals are like stars, you will not succeed in touching them with your hands, but like the seafaring man on the desert of waters, you choose them as your guides, and, following them, you reach your destiny"

—CARL SCHURZ

A SPINDLY, ugly, clumsy-looking, insect-like contraption that only the world could love has made its debut. In an age of super-smooth and sleek flying machines, U.S. astronauts will soon be flying an aerodynamic misfit to the moon and back.

The final payoff of the Apollo moon mission is to be carried out aboard the spidery Lunar Module (LM) whose homeliness is offset by its beauty of sophistication and practicality. Though its ability to space-fly is something of amazement about which pages could be written, this discussion is limited to the LM's communication ability.

In-Flight Communications

The communications subsystem aboard the Lunar Module is capable of three two-way combinations of in-flight or lunar surface radio links: LM to the orbiting Command Module (CM), LM direct to earth, and LM to the astronauts who are roaming about the moon's terrain.

*6563 Sapphire Drive, Jacksonville, Fla. 32208.

Table I—LM Frequencies

S-band Transmit	2282.5 mc
S-band Receive	2101.8 mc
V.H.F. Channel A	296.8 mc
V.H.F. Channel B	259.7 mc

As in the Apollo[1], the LM places its communications responsibilities in Unified S-band and v.h.f. equipment.

In flight (fig. 1), when the LM is on the earth side of the moon and separated from the Command Module, communication with earth is handled on S-band, but between the LM and CM information is passed back and forth on v.h.f.

As in the Apollo S-band system a multitude of information sources on the LM can be transmitted and received at the same time, on the same antenna and often on the same frequency. LM-to-earth S-band links contain voice, TV, digital uplink, ranging code signals, biomedical, and systems telemetry data (see Table III).

S-band voice is the primary means of communication between Mission Control and the two men aboard "Spider" (the voice identi-

[1]Kelley, Howard W., K4DSN, "The Voice of Apollo-8," March 1969, p. 17.

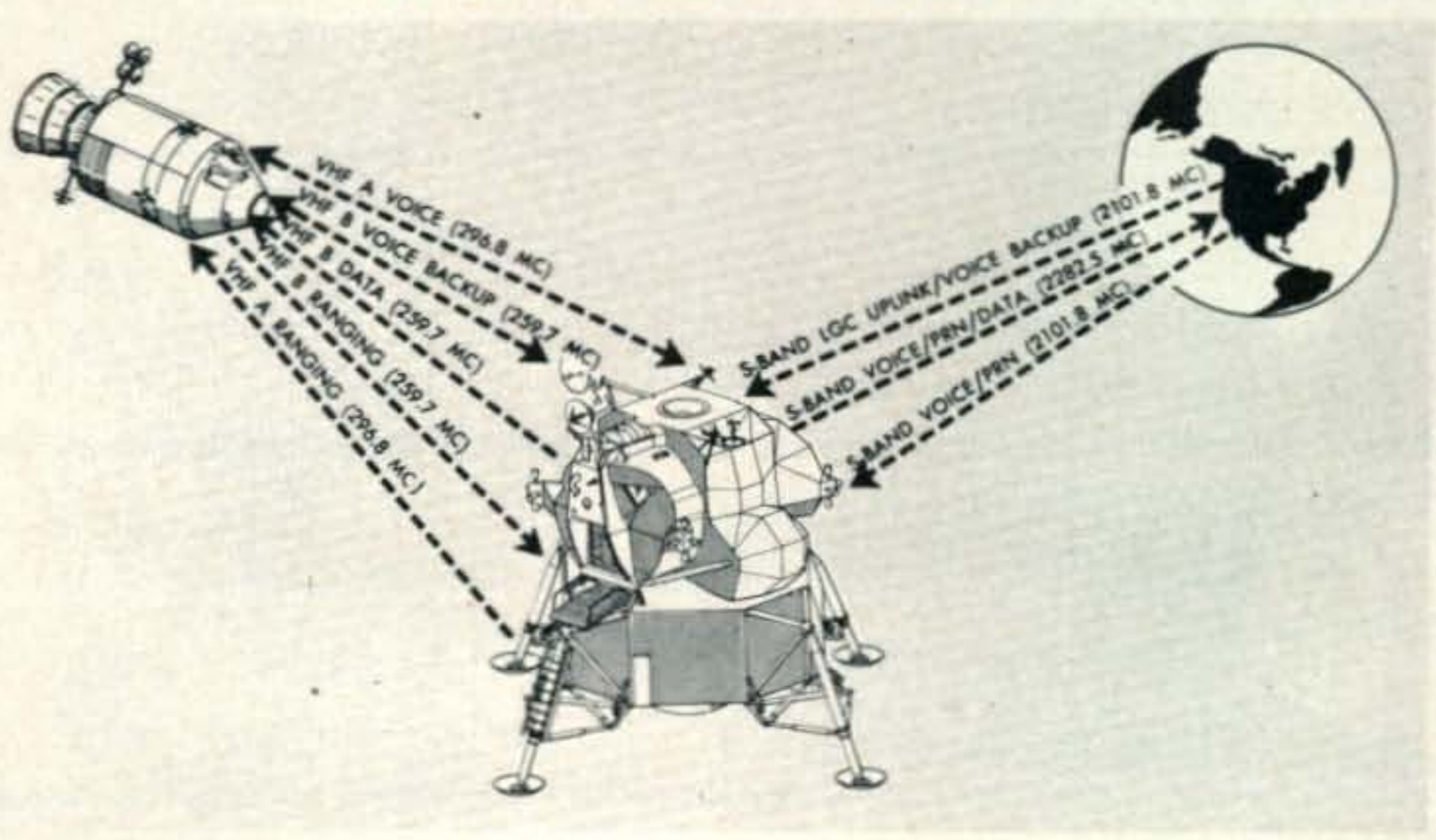

Fig. 1—In-flight communications.

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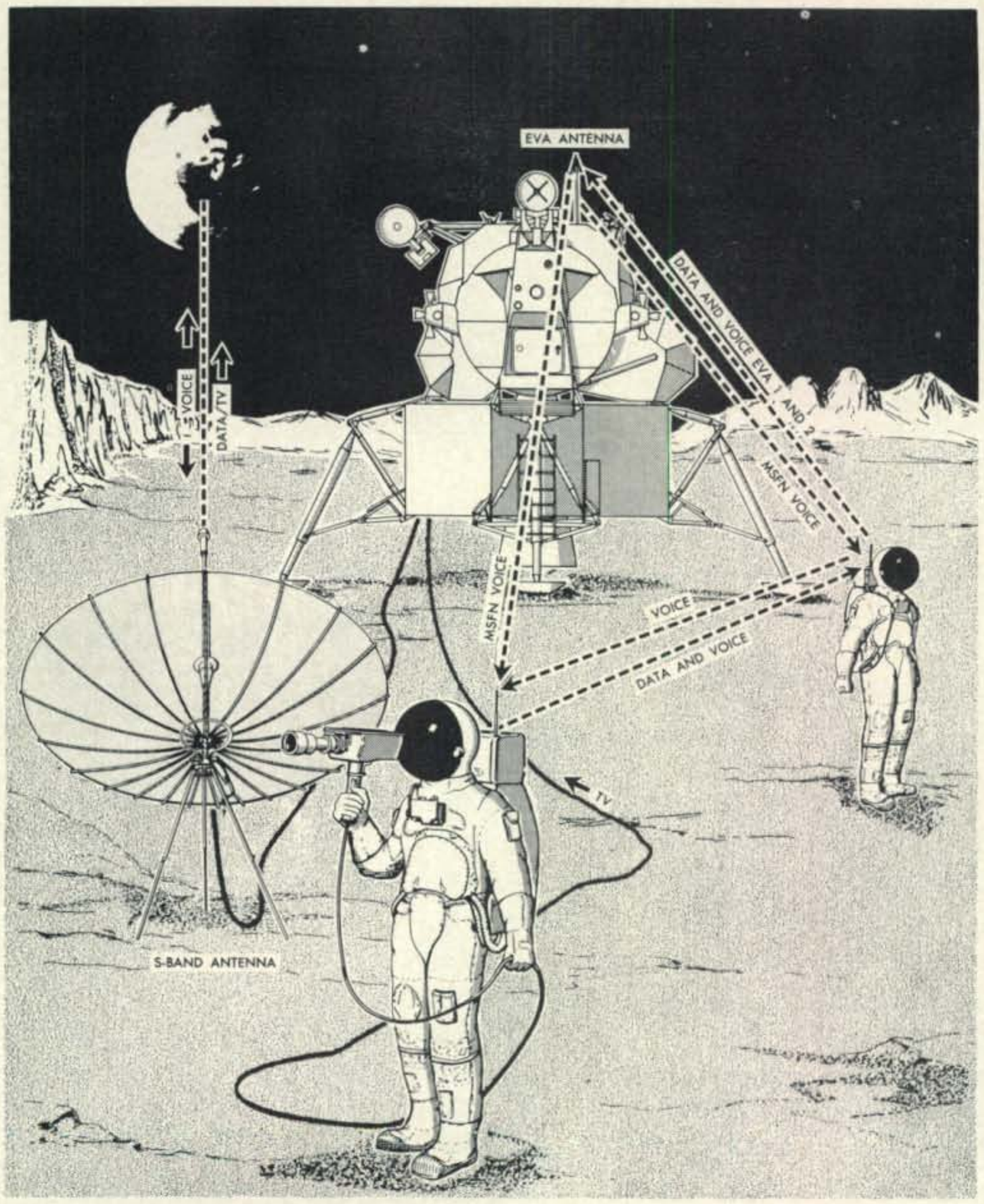

Fig. 2—Lunar surface communications. The two astronauts roaming about the moon's surface communicate with each other on 296.8 mc. The unattended Lunar Module acts as a repeater to relay to earth the v.h.f. communications via 2282.5 mc (S-band). Television pictures are also transmitted to the Manned Space Flight Network on S-band and biomedical and telemetry go along for the ride on subcarriers.

fier for the Lunar Module). Backup voice from earth is possible using the digital uplink channel, but this is usually tied up keeping the LM's guidance computer up-to-date.

In response to ranging code signals sent to the LM, the S-band equipment supplies earth stations with a return ranging code signal that enables Mission Control to track and determine range of "Spider."

Biomedical data pertinent to astronaut heartbeat is transmitted by the LM (so earthbound doctors can monitor and record the physical condition of the spacemen), as is telemetry, voice (using redundant S-band equipment) and, in case voice capability is lost, an emergency key is provided for c.w. communication to the Manned Space Flight Network.

Most of the same information can be exchanged between "Spider" and "Gumdrop" (voice identifier for the Command Module) that can be sent directly to earth from the LM. However, these communications are carried out on v.h.f. Normal voice chatter goes out on 296.8 mc simplex. Backup is accomplished on 259.7 mc simplex. V.h.f. ranging, which is initiated by "Gumdrop" uses both v. h. f. channels as a duplex operation.

When the two orbiting spacecraft are behind the moon, contact with Mission Control is not possible. Simplex voice is maintained over the 296.8 mc circuit between "Spider" and "Gumdrop" at this time while telemetry data is fed over channel B into tape recorders aboard the command ship to be stored and re-transmitted to earth at 32-times the original recording speed when radio conditions between earth and space improve.

Lunar Surface Communications

When the 16-ton Grumman Aircraft Spider has planted its legs into the moon's crust, the orbiting CM will use its S-band system to talk to earth and v.h.f. to maintain communications with the astronauts who are on the lunar surface (fig. 2). The Lunar Module then becomes the world's most expensive f.m./a.m. repeater. The LM takes the v.h.f. voice, converts it to S-band and retransmits it to the space network of earth receiving stations.

Should v.h.f. between the moonbound astronauts and the commandship not be satisfactory, earth stations may act as repeaters by re-tranmitting S-band from the moon back into space to the CM.

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Table II—Frequency Chart of Apollo/Lunar Module

Freq. (mc)	*Vehicle*	*Mode*	*Information*
2287.500 secondary	CM	PM	Voice, tracking/ranging, data
2282.500 transmit	LM	PM/FM	Voice, TV, tracking/ranging, data
2272.500	CM	FM	TV, data
2106.400 primary	CM	PM	Voice, tracking/ranging, data
2101.800 receive	LM	PM	Voice, tracking/ranging, data
296.800 Ch. A	CM/LM	AM	Voice, CM to LM, EVA, data
259.700 Ch. B	CM/LM	AM	Voice, CM to LM, data
243.000	CM	AM	Recovery beacon
10.006	CM	SSB	Backup h.f. recovery link

CM—Command Module of Apollo. LM—Lunar Module. EVA—Extra Vehicular Activity.

Television

LM-to-earth capabilities from the moon are the same as in-flight except that, in addition, TV may be directly transmitted to earth from the lunar surface. In fact, one of the first assignements of the LM crew, after checking for landing damage, is to erect a 10-foot 2200 mc parabolic antenna.

The television system has a much more utilitarian use than just to show earthlings the spectacle of man's first step on a foreign planet. It will provide the closest, most exacting view thus far of the moon's topography for instant evaluation by scientists in Houston. These same scientists can advise the spacemen which rocks to pick up and bring back, which features are important, and which way to point the camera. There are also plans to set the camera on a tripod a distance away from the LM so that we on earth can see the actual blastoff from the moon when the job is done and Spider returns to space for a rendezvous with the mothership. The television transmitter is located in the base section (descent stage) of the LM—the part that stays behind.

The small hand-held TV camera (fig. 3) designed for the Apollo program weighs only 4½ pounds. It has a bandwidth of 10 cy. to 500 kc and scans 10 frames per second (f.p.s.) at 320 lines and 5/8 f.p.s., 1280 lines. The 1-inch vidicon consumes about 7½ watts of power.

PLSS—Pronounced Pliss

The well-dressed astronaut who strolls along Lunar Lane wears upon his back an all important unit known as the PLSS—Portable Life Support System (fig. 4). The PLSS is a self-contained, self-powered rechargeable environmental control system. For four hours the back-pack supplies pressurized oxygen, cleans and cools the expired gas, circulates cooling liquids, and contains a transmitter for biomedical information and a dual v.h.f. transceiver for communication.

The PLSS has a contoured fiberglass shell to fit the astronaut's back, and a thermal micrometeoroid protective cover. It has three control valves, and, on a separate remote control unit, two control switches, a volume control, and a five-position switch for the dual v.h.f. transceiver. The remote control unit rests on the chest.

The astronaut has available to him primary and secondary duplex voice communication, and physiological and environmental telemetry all of which must go through the LM to the CM on v.h.f., then from the CM to earth on S-band. The v.h.f. antenna for the

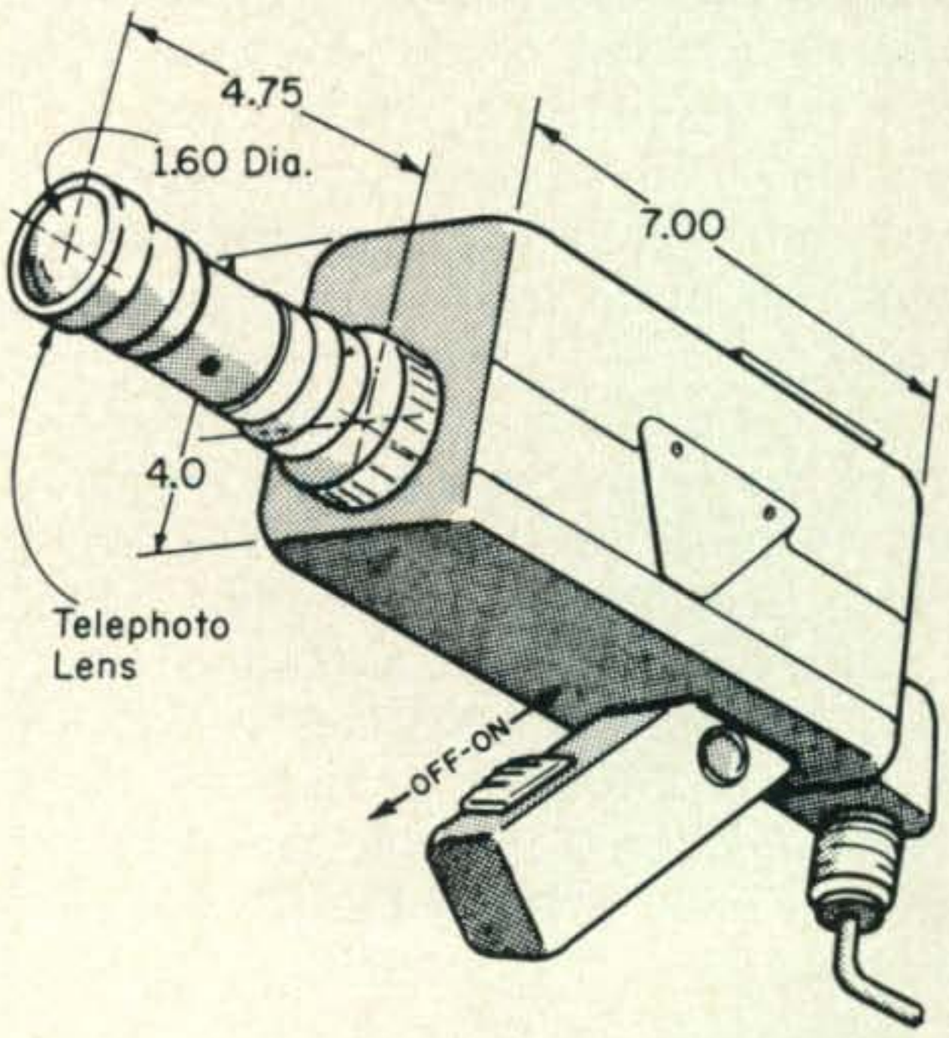

Fig. 3—One-inch Videcon TV camera. The small hand-held camera will give the first glimpse of the men on the moon, but will also allow earthbound scientists to pick and choose what geological samples are to be brought back.

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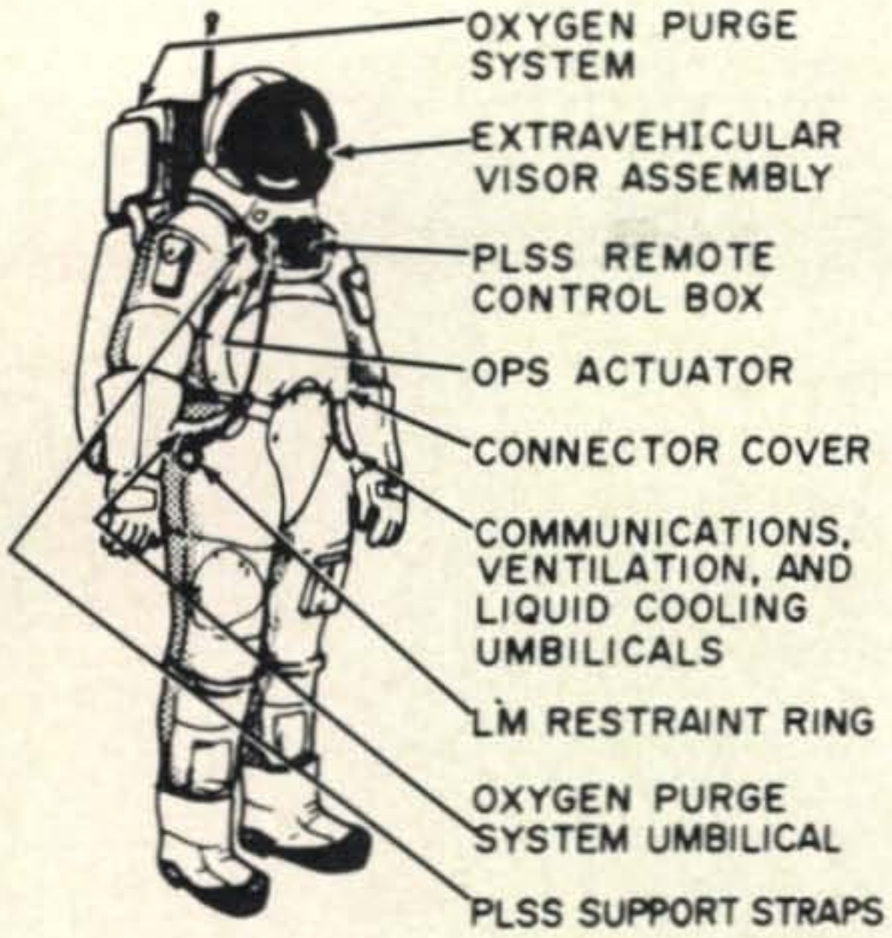

Fig. 4—Integral thermal micrometeoroid garment. What the well-dressed lunar astronaut wears. On his back is the PLSS—Portable Life Support Systems. Included inside the thermal micrometeoroid garment is a dual v.h.f. a.m. transceiver capable of voice communication and constant physiological telemetry.

PLSS is permanently mounted on the oxygen purge system. Two side-tone generators override incoming audio in the headphones to notify of low pressures or low fuel reserve.

RF Equipment

In several respects, r.f. equipment (fig. 5) on the LM is much like that on its big brother Apollo. (NOTE: Unlike military ships, astronauts don't refer to their spacecrafts as "she", but rather "he".) The S-band assembly consists of two identical phased-locked receivers, two phase modulated (p.m.) transmitters (0.75 watts output) with driver and multiplier chains, and a frequency modulator (f.m.) The receivers and phase modulators provide the ranging, voice, emergency c.w., and telemetry transmit-receive functions. F.m. is primarily used for video transmission, but accomodates pulse-code-modulation telemetry, biomedical, and voice transmission. F.m. also provides limited backup for both p.m. units.

When more r.f. is required amplifiers can be brought into play. This assembly consists of two amplitrons (primary; 18.6 watts output, secondary; 14.8 watts output), an input and output isolator (ferrite circulators), and two power supplies all mounted on a common chassis. The r.f. circuit is a series interconnection of the isolators and amplifiers. The amplifiers themselves (which are saturated, rather than linear) are broadband and exhibit high efficiency, high peak and average output power, but relatively low gain. The isolators protect both amplifiers and both S-band transmitter driver and multiplier chains. The isolators exhibit minimum isolation of 20 db and a maximum insertion loss of 0.6 db. Only one amplifier can be activated at a time and when neither amp is selected, a feedthrough path through the power amplifier exists with a maximum insertion loss of 3.2 db.

V.H.F. Equipment

Although the Apollo relies heavily on its S-band capabilities, the Lunar Module is oriented toward v.h.f. This equipment consists of two solid-state superhet receivers and two 5-watt a.m. transmitters. One transmitter-receiver combination operates on 296.8 mc (Channel A), the other on 259.7 mc (Channeel B), for simplex or duplex voice communications. Channel B may also be used to transmit pulse-code-modulation (p.c.m.) data from the LM to the CM at a low bit rate and to receive biomedical and space suit data from the astronauts who are outside the ship on the moon.

Signal Processor

The signal processor unit is the common acquisition and distribution point for most received and transmitted information, except that low bit rate split-phase data are directly coupled to v.h.f. Channel B and TV signals go directly to S-band f.m. The signal process-

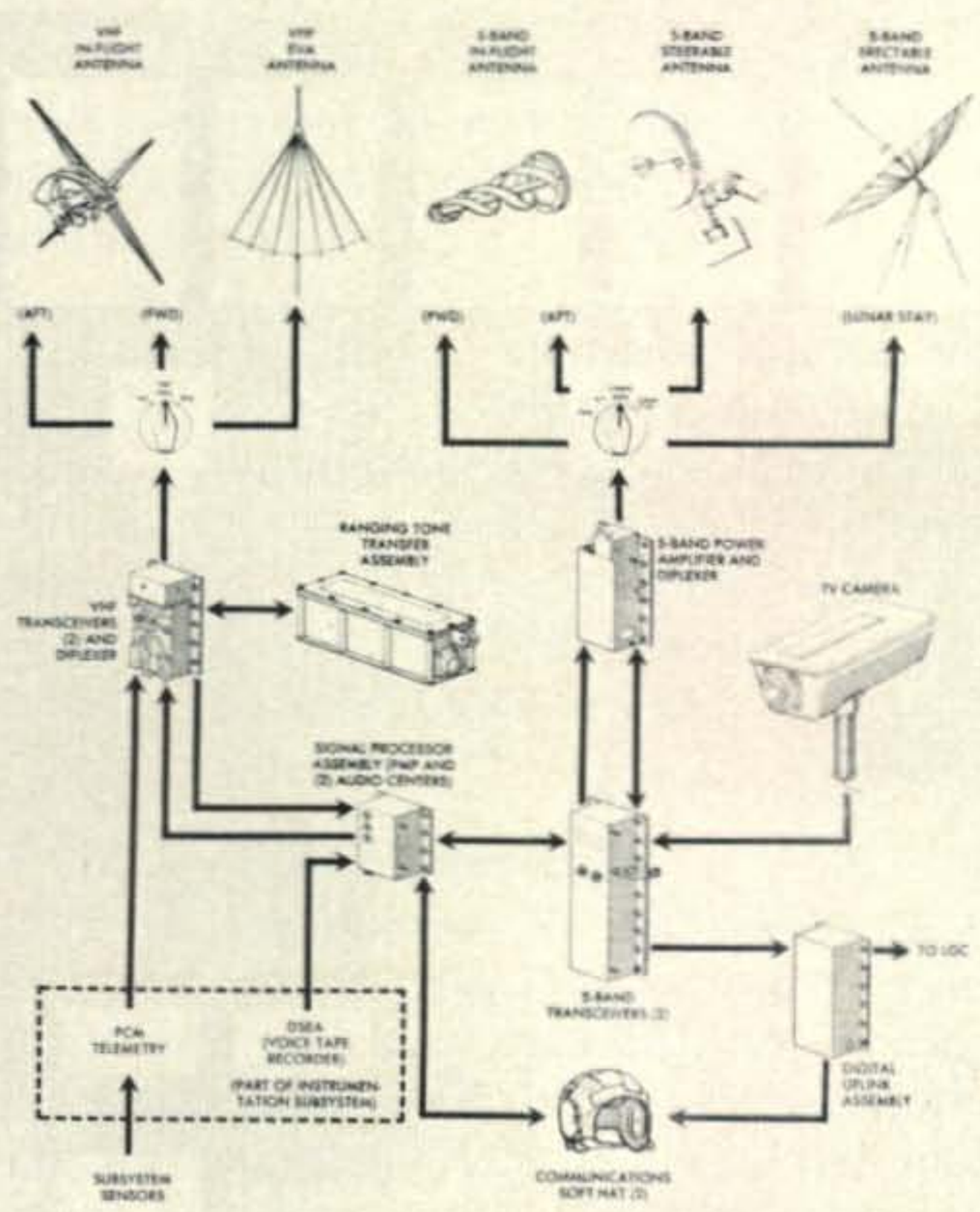

Fig. 5—Lunar Module communications subsystem.

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Table III—Lunar Module S-Band Capabilities

Information	*Freq. or Rate*	*RF Carrier Modulation*	*Subcarrier Modulation*	*Subcarrier Freq.*
Receive: 2101.8 mc:				
Voice	300 to 3000 cy.	PM	FM	30 kc
Voice Backup	300 to 3000 cy.	PM	FM	70 kc
Ranging Code	990.6 kilobits/sec.	PM		70 kc
Uplink Data	1.0 kilobits/sec.	PM		70 kc
Transmit:2282.5 mc				
Voice	300 to 3000 cy.	PM or FM	FM	1.25 mc
TV	10 to 500 cy.	FM baseband		
Biomedical	14.5 kc subcarrier	PM or FM	FM	1.25 mc
Lunar Surface Unit	3.9, 5.4, 7.35, 10.5 kc subcarriers	PM or FM	FM	1.25 mc
Voice	300 to 3000 cy.	PM baseband		
Biomedical	14.5 kc subcarrier	PM baseband		
Lunar Surface Unit	3.9, 5.4, 7.35, 10.5 kc subcarriers	PM baseband		
Voice Backup	300 to 3000 cy.	PM baseband		
Ranging Code	990.6 kilobits/sec.	PM		
Emergency Code	Morse Code	PM	AM	512 kc
Pulse-code-mod. non-return zero	High bit rate: 51.2 Low bit rate: 1.6	PM or FM	Phase Shift	1.024 mc

or assembly processes voice and medical information and provides the interface to the proper r.f. generator, tape recorder, modulator, or computer.

This signal processor includes an audio center for each astronaut and a premodulation processor where information is switched, mixed, and modulated. It also has a repeater function so that v.h.f. received signals can be re-transmitted on S-band.

The two identical audio center provide individual selection, isolation and amplification of audio received or transmitted from the LM. Each center includes a mike preamp, headset amplifier, VOX circuit, diode switches, audio gain controls, and an intercom system.

Digital Uplink

The digital uplink assembly decodes 2101.8 mc commands from earth and routes the information to the LM guidance computer. It also provides a verification signal to the pilots that the equipment has in fact received all the needed information from earth and got it in fine shape. However, if for some reason the computer doesn't get all the information it wants or it suspects some of it of being wrong, it will signal through the S-band transmitter "no-go" and ask for a repeat. The uplink commands addressed to the LM parallel those inputs available to the LM guidance computer via the display and keyboard accessible to the spacemen. The digital uplink assembly also provides another means of voice-backup if the received S-band audio circuits in the premodulation processor fail.

Ranging Tone Transfer

The ranging tone transfer unit operates with v.h.f. receiver B and v.h.f. transmitter A to provide a transponder function between the command and the moon vehicle. The

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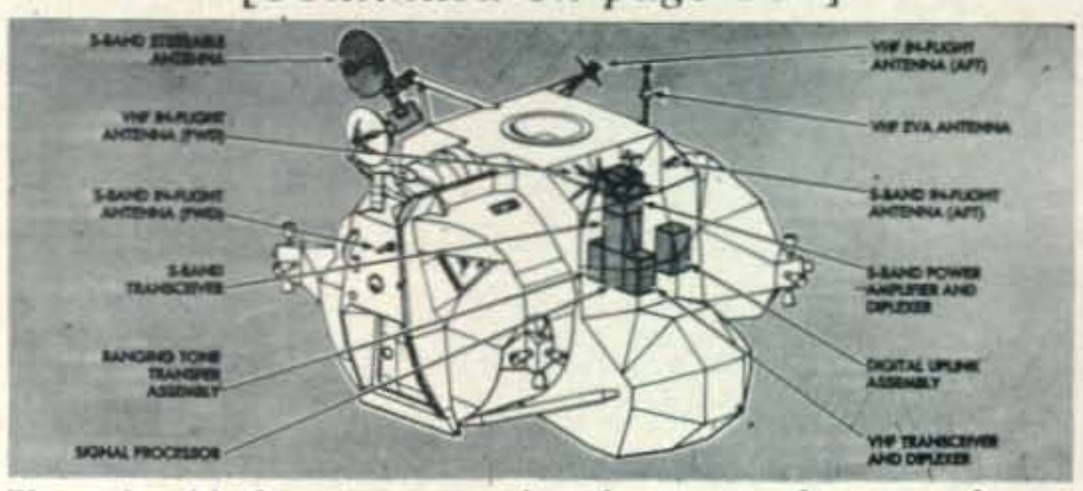

Fig. 6—Major communications equipment locations.

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CQ Reviews: The Heathkit SB-200 Linear Amplifier

BY WILFRED M. SCHERER,* W2AEF

THE Heathkit SB-200 Linear Amplifier has been around for quite a few years; nevertheless many requests are still being received for information on this piece of gear.

In view of this situation and inasmuch as *CQ* has never reviewed this table-top kilowatt job (mainly due to the fact that its forerunner, the Model HA-14 "KW Kompact" mobile version had already been covered[1]), we shall at this time discuss the SB-200.

This model is rated at 1200 watts p.e.p. input on s.s.b. and 1000 watts on c.w. which is available with 100 watts r.f. drive such as that obtained from the Heath SB-400/401 transmitter, the Heath SB-100/101 and HW-100 transceivers or other exciters in the same power class. This does not preclude its use with lower- or higher-power drivers as we will see later.

The SB-200 is a completely self-contained unit with a built-in power supply for operation from 120/240 v.a.c., 50/60 c.p.s. It is quite well compacted in a 6⅝" × 14⅞" × 13⅜" (H.W.D.) wrap-around cabinet with attractive styling to match the Heath SB-series of gear and thus makes a neat-looking job requiring relatively little desk space. It weighs 35 lbs.

Full coverage is obtained on the 3.5-30 mc amateur bands using bandswitched input and output circuits. The input impedance is nominally 52 ohms with broad-band pre-tuned-input circuits that need no tuning adjustment during operation.

The output is designed to work into 50/72-ohm impedances that present an s.w.r. within 2:1. This is realized with a Pi-network furnished with a variable loading control. A built-in reflectometer provides s.w.r. readings up to 3:1.

Details

Referring to the schematic diagram at fig. 1, the amplifier is an essentially grounded-grid affair and is operated in Class B using a pair of 572-B or T-160-L graphite-anode triodes connected in parallel.

R.f. drive is applied to the tube cathodes (filaments) through individual matching networks (pi or L types) tuned for each band. Use of such tuned circuits here ensures better efficiency with less distortion than with a passive input. RFC_1 is a bifilar-wound choke that maintains the tube filaments above r.f. ground and prevents the r.f.-drive power from being bypassed to ground through the filament-supply windings of the power transformer.

The Pi-network is made up using two inductors, L_1 and L_2. L_1 is tapped and is used alone for the 10- and 15-meter bands. L_2 is added for the other bands for which it is appropriately tapped. C_5 and C_6 are switched in only for 80-meter band operation.

The reflectometer is an in-line trough-line type. The panel meter can be switched to read the relative forward power (for which there is a sensitivity control) or the reflected power for which the meter is calibrated in terms of s.w.r. up to 3:1. The meter also can be switched to read 0-100 ma grid-current, 0-1000 ma plate current or 1500-3000 v. plate potential.

A.L.C.

The a.l.c. setup is a departure from the usual in that its operation is based on an *r.f.*

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*Technical Director, *CQ*.

[1] *CQ* Reviews: The Heathkit HA-14 "KW Kompact" Linear Amplifier, *CQ*, February 1966, page 52.

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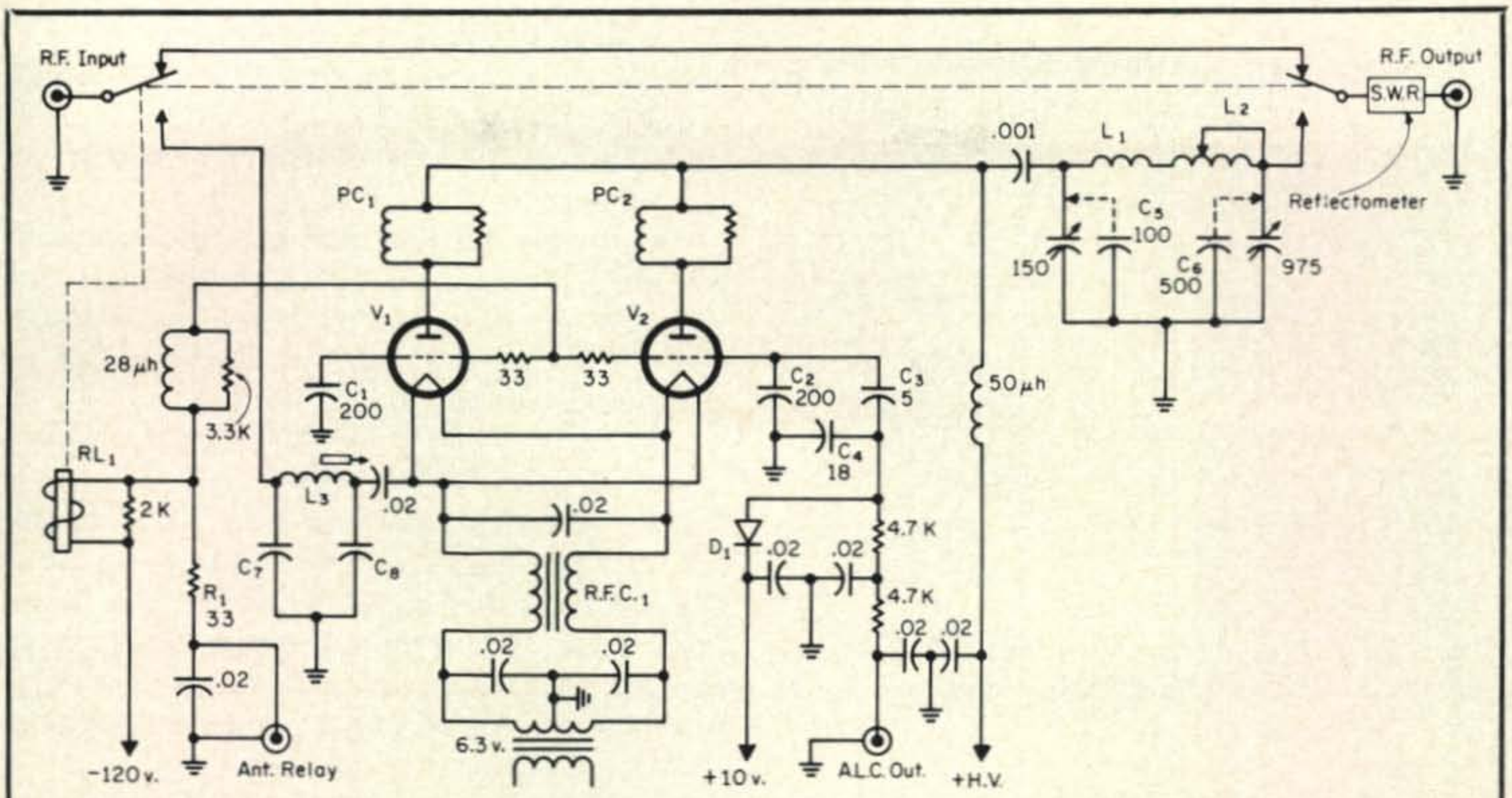

Fig. 1—Schematic for the SB-200 amplifier (power-supply and metering circuits not shown). The bandswitch alters L_3, C_7 and C_8 to form impedance-matching Pi or L input networks for the various bands. Other details are in the text.

voltage, rather than on an *a.f.* voltage that is developed during modulation when an amplifier starts to overload or draw grid current.

As shown at the schematic, the tube grids are not heavily bypassed to ground (by C_1-C_2 and some r.f. voltage thus appears at the grids. C_3 and C_4 comprise a voltage divider across the grid of V_2 from which a sample voltage is derived and rectified by D_1. The resulting d.c. voltage provides the automatic bias for reducing the gain of the a.l.c.-controlled stage in the exciter.

D_1 is reverse-biased into non-conduction by an a.l.c. *threshold* potential of +10 volts applied to its cathode from a tap on the plate-supply bleeder. When the r.f. voltage applied to D_1's anode exceeds 10 volts, the diode conducts and rectifies the r.f. to supply the necessary d.c. voltage for the a.l.c.

The threshold has been set for a.l.c. operation at the instant the r.f. voltage at the tube grids reaches the point just below that which occurs when the tubes are overdriven.

The advantage of this arrangement, over the conventional system, is that a.l.c. operation is not dependent on *some* overdrive before it takes hold, thus allowing it to be effective prior to the occurrence of *any* flat-topping or overdrive.

Since the a.l.c. is not dependent on an a.f. component during modulation, the a.l.c. voltage can be produced even with steady-state or c.w. drive.

Transfer Circuits

The r.f. circuits are switched with a d.p.d.t. antenna-changeover relay which is operated by the v.o.x. relay in the exciter. Operation is as follows: During receive, a bias of −120 volts is applied to the tube grids through the relay coil. The bias cuts off the plate current, eliminating the possibility of the generation of hash within the tube that might be heard in the receiver.

During this time the relay is not energized, because the exciter-relay contacts are not closed, nor do the tube grids draw current through the relay coil. Under this condition, the antenna is connected, through the normally-closed relay contacts, to the antenna terminal of the exciter if it is a transceiver; or to the antenna-connector of a separate transfer relay that would normally be used with a receiver-transmitter setup. This allows signals to be received.

On transmit, the contacts on the exciter v.o.x. relay ground the top end of the amplifier-relay coil through R_1, energizing the relay from the −120-volt bias source. The normally open contacts then close, connecting the exciter-setup output to the r.f. input of the linear and transferring the antenna to the linear's output.

At the same time, the resistance of the

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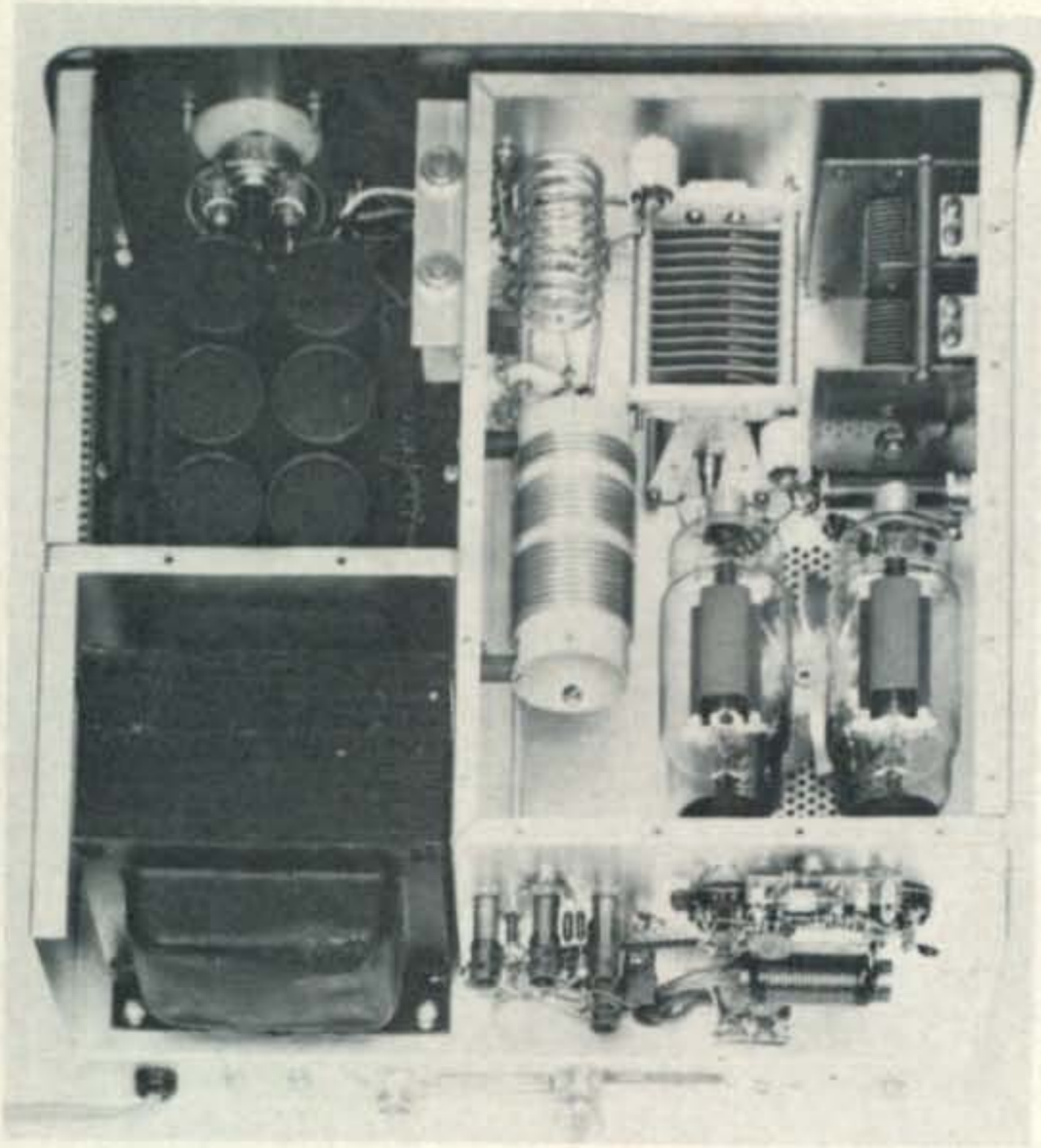

Top view of the SB-200. Enclosure for power-supply components is at upper left with circuit-breakers on its right wall. The amplifier enclosure is at the right. The input networks are in the center foreground with the bifilar filament choke below the tube sockets at the right. A perforated cover fits over the enclosures.

relay coil and R_1 form a voltage divider so proportioned that the current drawn through the circuit produces a drop of 2 volts across R_1. This appears as a negative voltage at the tube grids and thus provides operating bias for the amplifier tubes.

When the power switch on the SB-200 is turned off, there is no bias voltage to operate the changeover relay, so the antenna remains connected directed to the exciter setup for normal low-power operation without the linear.

The amplifier tubes have instantaneous-heating filaments, so along with the use of solid-state rectifiers in the power supply which also are instantaneously-performing devices, linear-amplifier operation may be had as soon as the power switch is turned on, making it possible to instantaneously switch back and forth between low power from the exciter alone or high power from the amplifier.

Power Supply

Operating power is obtained from a single transformer that has three secondary windings; one for 6.3-volt filament power, one for a −120-volt bias source and one for a plate supply of 2500 volts. A full-wave voltage doubler, consisting of eight silicon diodes in each leg, is used for the latter along with 21 mf of filter capacitance provided by six 125 mfd, 450 v., electrolytic capacitors connected in series. Voltage-equalizing resistors are installed across the capacitors. They also serve as a bleeder.

The power transformer has two primary windings that are connected in parallel for 120-volt operation, or in series for 240-volt operation. An 8-ampere circuit breaker is installed in one leg of each winding.

Construction

The SB-200 is assembled on a chassis on top of which are two shielded compartments. One encloses the amplifier proper, the tubes for which are mounted horizontally in a manner that eliminates the possibility of a grid-filament short due to filament sagging that could occur after long use.

A small motor-driven fan is located beneath the tubes and provides cooling by blowing air upwards against the portion of each tube envelope opposite the tube plate. Perforations on the chassis deck and in the enclosure cover and the amplifier cabinet provide an air-flow path for cool-air intake and warm-air exhaust. The fan goes on or off when the power switch is operated.

The variable capacitors for the pi-output circuit are ceramic-insulated. The one for loading is a two-gang job somewhat huskier than the usual t.r.f. receiving type. The plate-tuning capacitor is a wide-spaced high-voltage type. L_1 is a self-supporting inductor wound with #10 wire, L_2 is wound with #14 wire on a fiberglass form.

The tuned circuits for the cathode input are installed on the rear of the amplifier compartment on which the tube sockets also are located. Slug-tuned inductors are used along with mica fixed capacitors.

The bifilar filament choke is wound with #14 wire on a ferrite core, the use of which cuts down the number of turns otherwise required, raising the Q and holding down the wire resistance for a minimum filament voltage drop.

The bandswitch employs ceramic-insulated sections. Those for the output tank have dual contacts for adequately handling the r.f. current at the high power levels involved.

Except for the transformer, the power-supply components are located in a second enclosure and are assembled on a printed-circuit board. The circuit breakers are mounted on one wall of this enclosure in a way that allows them to be handily reset

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through access holes when the hinged cover of the cabinet is raised.

The reflectometer is located beneath the chassis and on the inside of the rear apron. It is built in a U-shaped metal trough with the transmission line conductor and the pick-up wires held in place by nylon spacers. One side of the trough is open which, together with the fact that the antenna relay also is exposed under the chassis (as is a long unshielded lead below the chassis between the band-switch and the loading capacitor), might allow sufficient r.f. to be induced into power leads to cause TVI, even through the external leads are bypassed. The job otherwise is pretty well boxed in with shielding to minimize the possibility of TVI difficulties.

Assembly

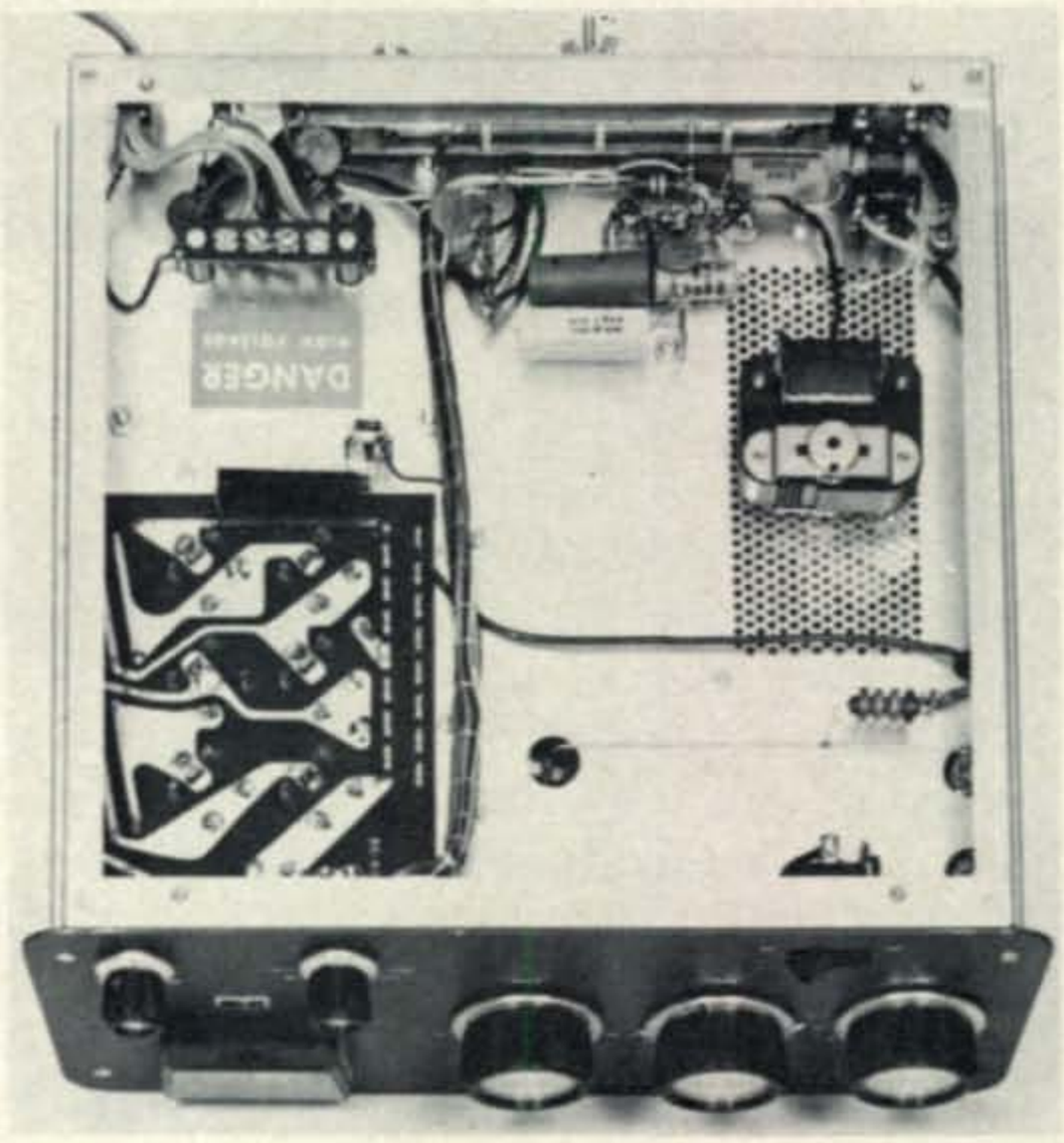
No problems were encountered with the assembly work, thanks to Heath's standardized easy-to-follow instructions and procedures. Upon its completion, the amplifier functioned properly in all respects "right off the bat." A total of 12 hours was required to do the job; however, for a less experienced builder, 15 hours or so may be needed.

Operation

Tuneup is a simple procedure during which time you don't have to hurry the adjustments or worry about burning up the tube grids as sometimes is the case with high-power rigs. Furthermore, the range of the tuning controls is so proportioned that the adjustments are rather broad, thus making them non-critical.

With the linear turned off, the exciter is tuned up for maximum output in the normal manner. With such drive applied, you then close the amplifier's power switch and adjust its plate and loading controls for maximum r.f. output as indicated by the meter which is first set for relative-power readings. You're now ready to go with high- or low-power transmissions available simply by flipping the SB-200 power switch on or off (this switch is a rocker type).

During initial tuneup with the exciter alone, it is best to check the s.w.r. of the load before turning on the linear, to make sure the load presented to the amplifier will fall within the 2:1 matching range of the linear amplifier. This is especially important for proper loading as described later. If needed, the s.w.r., as *seen by the amplifier*, often can be brought down by altering the length of the transmission line accordingly.



Bottom view of the SB-200. The printed-circuit board for power-supply parts it at the lower left. The reflectometer trough is at the center of the rear apron. The blower motor is near right center.

It also may be found that the tuning of the exciter may be slightly off when the amplifier is turned on, because the s.w.r. (or reflected impedance) seen by the exciter will vary btween 1:1 and 3:1 due to the fact that there is a variation in the nominal input impedance of the amplifier, depending on the band, and the portion of the band used. The reflected impedance also will change with various line lengths between the two units. In some cases, slightly retouching the exciter tuning may be needed.

Performance

With a monitored 100 watts of steady-state drive and with a power-line potential of 120 or 240 volts, measured under load, the plate-power input of the SB-200 at full tune-up amounted to 1150 watts with an r.f. output of 775 watts. This was essentially the same on all bands. With 100 watts of s.s.b. p.e.p. drive, the power input and r.f. output were 10% higher, thus adequately fulfilling the rating of 1200 watts p.e.p. input.

Under these conditions an oscilloscope trapezoid display indicated excellent linearity; while observations on a spectrum analyzer showed the 3rd-order distortion products to be within Heath's specification of −30 db relative to 1000 watts p.e.p. input. Actually, this was a limitation imposed by the exciter used at the time. The 5th-order product was −45 db.

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With 200 watts drive, the amplifier could be pushed to 1500 watts input with 1000 watts output. With s.s.b. peak power at these levels, flattopping was not evidenced, except for only a slight tendency to round off the peak of a trapezoid display. At the same time, a spectrum analysis showed the 5th-order product to rise to near the 3rd-order level which itself did not change significantly.

At these higher-power levels, no evidence of excessive tube heating or deterioration was found after periods of on-the-air operation with s.s.b. or during rigid bench tests; nevertheless, it must be kept in mind that such operation exceeds Heath's specifications and recommended power levels, as well as the tube ratings. In this respect, Heath's specifications call for a maximum p.e.p. input of 1200 watts (with 100 watts drive) using continuous voice modulation on s.s.b.; while for c.w. the input is rated at 1000 watts with a 50-percent duty cycle (key-down time not to exceed 5 minutes).

With low-drive levels of 45-50 watts, such as obtainable from the Heath HW-16 c.w. transceiver, the amplifier will put out 450-500 watts. From the power levels given herein, it may be noted that the apparent gain in power output decreases with drive levels (from 10 db with low drive to 7 db with high drive). This is primarily due to feedthrough of the r.f.-drive power which bears a smaller ratio to the power produced by the amplifier itself at high drive levels than with lower drive.

In order to maintain good linearity, particularly with high-power drive levels, during tuneup the amplifier must be loaded to beyond the maximum-output point; that is, past this spot to where the output starts to drop off. This also will be indicated by a very broad or hardly noticeable plate-current dip at resonance. The plate current under these conditions may be higher than recommended in the manual; however, the tubes will take it, at least during s.s.b. operation.

Insufficient loading can result in flattopping or other deteriorating effects with high peak levels, especially on the 40-, 20- and 10-meter bands where the tank impedance for high peak levels apparently is not quite as favorable as on 80 and 15. As a matter of fact, it was found that with proper loading as just described, use of the a.l.c. was not required, since no flattopping or other bad effects show up, especially at the recommended power levels.

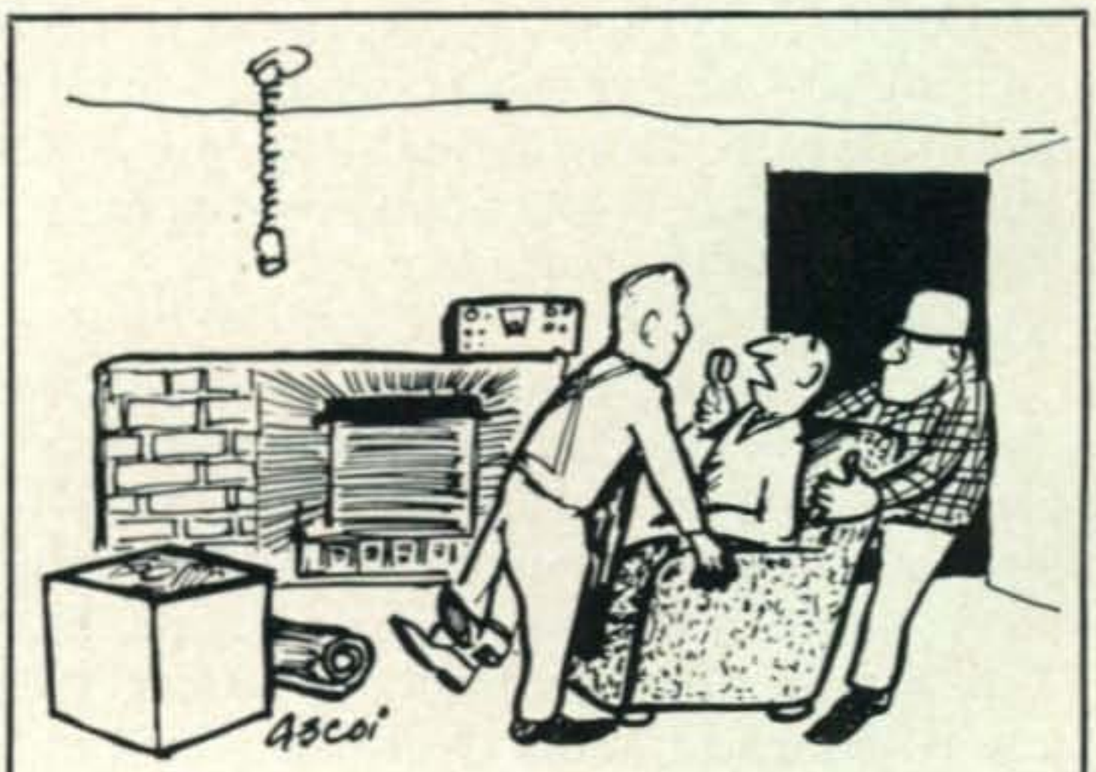
On the other hand, where the exciter delivers more than 150-200 watts, the use of a.l.c. would be desirable to limit the drive. Such exciters usually will require a higher a.l.c. voltage than that normally provided by the SB-200. This may be realized by reducing the a.l.c. threshold which can be done by connecting the cathode of D_1 to ground, instead of to the 10-volt tap on the power-supply bleeder.

Adjustments both for optimum loading and a.l.c. operation are best made while observing a trapezoid display on an oscilloscope (such as the Heath HO-10 or SB-610 Monitor-scopes) by sampling both the r.f. input and output of the amplifier. Either a two-tone test signal may be used or speaking into the microphone will suffice.

Observations thereby can be much more accurately and easily made than with an r.f.-envelope display. Furthermore, with the trapezoid display obtained as described, you're looking at only the amplifier performance towards its proper adjustment, thus eliminating possible confusion with the exciter preformance as could otherwise be the case with an r.f.-envelope display.

One final admonition—with a 120-volt supply line the amplifier draws up to 16 a.; while with a 240-volt source the current is 8 a. Therefore, for best regulation and overall performance, a 240-volt source should be used wherever possible. Also make sure this is a 230-240 line and not a 208-volt line.

As may have already been judged, the Heath SB-200 Linear Amplifier can really "take it" as well as "dish it out" while still maintaining a good-quality signal. It is a buy hard to beat at the kit price of $220. The producer is Heath Company, Benton Harbor, Michigan 49022. *—W2AEF*



"Actually you'll be the last QSO from this QTH..."

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DX

BY JOHN A. ATTAWAY,* K4IIF

THE spring season is just about over and those July-August DX doldrums will soon be upon us. It's been a good spring though, with sunspot numbers holding reasonably high. We've heard that there may be a double peak to this cycle, which means another top year or two if true. However, we've also heard that the peak is past and that we are definitely on the downside. We hope not as those days when 10 and 15 meters held nothing but a quiet hiss, and 20 was dead as a doornail before sundown, are still too fresh in our minds. Just remember that the decay of the cycle is slower than the upside so there will be plenty of good times yet before we hit bottom again.

De Extra

How NOT To Get Started As A QSL Manager—Much has been written about the correct way to QSL a rare station. One should always send a s.a.s.e. (self-addreessed, stamped envelope) or s.a.e. (self-addressed envelope) with IRC's (International Reply Coupons). It is just and proper that much be written on this subject because the QSLing system is greatly abused, frequently because so many people are not fully informed as to the proper procedures. However, there is a lesser known abuse of the system which occurs only infrequently, but still is worthy of note. I refer to the over-anxious DXer who decides to be a QSL Manager, but who goes about it in the wrong way. For the want of any other name let's call it jumping the gun.

We hadn't realized that there were such things as gun jumpers until we became responsible for the widely circulated monthly QSL Manager listing for *CQ*. What happens is that our friend the gun jumper, usually, but not always a state-sider, decides he would like to handle someone's cards so without much thought he offers himself as the QSL Manager for stations he works over the air. After a time he reaches what he thinks is an understanding with someone, and immediately dashes off a note to *CQ* and several of the DX bulletins to advise everyone that he now handles the cards for let's say ZZØZZ. Unfortunately, however, ZZØZZ *et al* are frequently just making conversation, and our friend never even receives a log. As a result he is in trouble with the trusting souls who sent him their cards with envelopes, IRC's, stamps, coins, etc. So are we because we listed him in the magazine and thus unknowingly disseminated inaccurate information. Sometimes we even get irate letters from the ZZØZZ's taking us to task for not checking. Unfortunately it isn't possible for us to check each listing sent in as it would be a full time task doing that and nothing more.

Sometimes our friend compounds his mistake by printing up a batch of ZZØZZ cards so he will be ready when the logs come in. After he waits a while and the envelopes pile up, followed in a month or two by 2nd and 3rd requests, he decides that nobody is going

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

Ed Hopper, W2GT, USA-CA Chairman and Gus Browning, W4BPD, in North Jersey last February just before Gus's departure for Africa.

S.S.B. DX Honor Roll

W2TP 317	W2ZX 305	W9JT 292	G3NUG 269
WA2RAU 316	K6CYG 305	K1IXG 288	G3WW 269
VK3AHO 315	W6YMV 303	W2LV 286	MP4BBW 267
W9ILW 315	WØQVZ 303	W6EUF 286	G2PL 265
TI2HP 314	XE1AE 302	K8RTW 286	G2BVN 264
W3NKM 314	W2BXA 302	W9EXY 284	W2MJ 261
DL9OH 312	G3AWZ 301	F2MO 283	DL3RK 259
W2RGV 312	G6TA 301	W3KT 281	G3DO 259
WA2IZS 312	W3DJZ 301	W1LLF 280	W6WNE 259
K6LGF 311	G3HDA 298	W6UOU 280	PJ2AA 258
G3FKM 310	5Z4ERR 298	W3FWD 279	K1SHN 257
KP4CL 310	K2DX 297	W4RLS 279	PAØEEM 256
WA8AJI 310	W4SSU 297	K4OEI 279	WA2EOQ 256
W4OPM 309	W4QCW 297	DL1IN 276	SM6CAS 254
W8DE 309	W8BT 297	K4HYL 276	W6BAF 254
I1AMU 308	W4UF 295	W7DLR 276	K6CAZ 254
W4NJF 308	W4PAA 294	PZ1AX 274	PAØSNG 252
G8KS 307	W8EVZ 293	K9EAB 273	K4GXO 252
W5KUC 307	K8ONV 293	K9LUI 273	VE6TP 251
K6YRA 306	W2FXN 292	W6RKP 272	W1AOL 250

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to send a card unless they actually QSOed ZZØZZ. Since he can't disappoint the gang he gives everybody 5/9/9 and ships out the confirmations. Unfortunately, though, people do send cards when they aren't in the log and word gets around.

This certainly isn't meant to discourage anyone from becoming a QSL Manager. Far from it as they are badly needed. Just please wait until the DX station sends you logs, or at least a letter, confirming the arrangement. You will know for sure, then, and PLEASE send us a note so we can publish it in our listing.

Gay Milius, W4NJF, operating 4U1ITU. Gay was a member of the 1967 CQ DX Award's Advisory Committee. Gay is now practicing law in Norfolk, Va. and is a member of the Virginia Century Club.

The WAZ Program

The following WAZ Certificate numbers were assigned during the month of March:

WAZ S.S.B.: WB2WOU–657, W5LEF–658, JA4XW–659, ZL3RK–660, JA2APA–661, DJ9MW–662, DL8QW–663, KØBUR–664, and HA5DU–665.

WAZ C.W.–Phone: W4JFW–2620, WØDAK–2621, YV5BOA–2622, KØARS–2623, W8TBZ–2624, HA5DJ–2625, VE3ADV–2626, OK2DB–2627, DJ5IO–2628, DL9PE–2629, DJ9VW–2630, G3VYF–2631, G3LDI–2632, OE1MEW–2633, and K9VYT–2634.

WAZ Phone: W6ESI–408, and W5LEF–409.

The WPX Program

The following list updates the Master WPX Prefix List (See February, 1969) and corrects several omissions and typographical errors. Those calls in italics are considered to be obsolete and not valid for Honor Roll purposes although qualified for the basic WPX program:

AGØ, AIØ (AIR), *AP4*, *DA1*, *DA4*, *DA7*, DC8, DX1, *ET1*, FPØ, *FQ3*, HH2, HH3, HH4, HQ1, HQ2, HU1, *KG1*, PJ1, PJ6, PJ7, PJ8, PJ9, PJØ, *OX1*, RV2, U1, UVØ, UW3, *VP4*, *XW9*,*YM4*, YO1, *ZS9*, 4JØ, 4TØ (4TA4), *7B4*, 8QØ (8QALK), 8I1, 9I2, 9I3, 9I4, and *9K3*.

The following WPX Certificate numbers were assigned during the month of March.

WPX S.S.B.: OE3WWB–339, 4A1AE–400, DL4CQ–401, WA3JDA–402, HS3DR–403, HB9AAA–404, and VP7NH–405.

WPX C.W.: OK3KFV–921, G2DF–922, ZL1AMQ–923, and DM3XSB–924.

WPX Mixed: W1EOA–194, K2DDK–195, and SP9AI–196.

WPX Phone: 4A1AE–167, W6CYO–168, and CX3BH–169.

The following qualified for WPX endorsements in March:

Continent Endorsements: *Europe:* CX9CO, DM3XSB, K2DDK, SP9DH, and W4WHW.
Africa: VE3AAZ. *Asia:* SP9DH. *North America:* WA5LOB. *South America:* CX9CO.

Band Endorsements: *20 Meters:* CX9CO, K2DDK, and SP9DH. *40 Meters:* SP9DH. *80 Meters:* SP9DH. *160 Meters:* W4WHK.

Mode Endorsements: *S.S.B.:* F9MO–500, F9MS–500, CX9CO–450, HB9AAA–450, OE3WWB–350, WA3JDA–350, W4DQD–350, WØGYM–350, 4A1AE–300, and HS3DR–250.
C.W.: DL1MD–500, F9MS–500, SP9AIJ–500, KØARS–450, G2DF–400, and WØHAO–350.
Phone: CX3BH–350.
Mixed: CX9CO–500, and W1EOA–500.

Jim Resler, W8EVZ, a past president of the Ohio Valley Amateur Radio Association, one of the top DX and Contest clubs of the world.

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3A2MJC is one of the most active of the six club stations in Monte-Carlo and one of its most active operators is Peter, 3AØEG whose home call is PAØOOQ. According to Peter getting a signal over the mountains toward the states is not an easy matter. *(Photo via K4DSN).*

The WPNX Program

One additional Novice qualified for WPNX in March. The winner was:

Robert L. Huffman, WN3JRY–12

The VPX Program

One additional shortwave listener qualified for the VPX Award:

Nathan Rosen, SWL/CHC #1–8
(Endorsed to 400 prefixes)

Complete rules for WAZ, WPX, WPNX, and VPX may be found in the January, 1969 issue of *CQ*, pages 63-65. Application blanks may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

The S.S.B. DX Award Program

Only 3 more amateurs qualified for the sideband award in March. Apparently, s.s.b. is now so commonplace that very few consider a sideband award to be challenging any longer. The new winners were:
100 Countries: WA6VSF–558, VP7NH–559, and EL2AK–560.

Klaus, DL8FR, tuning up for a round of DXing. Klaus is one of our recent WAZ winners.

DX Hall of Fame

In our write-up last month on Richard C. Spenceley, KV4AA, fourth winner of the DX Hall of Fame Award, we failed to mention that Mr. Spenceley was the father of the WPX Award. He conceived the idea of recognizing the number of prefixes worked at the time he was DX Editor of *CQ*.

In a few months the 5th DX Hall of Fame presentation will be made, completing the selections of the first *CQ* DX Award's Advisory Committee. Consequently we are now interested in the ideas of you, the readers, regarding further recipients of this honor. If there are individuals, not hitherto named, whom you believe meet the qualifications, please send their name and call to either the DX Editor or to your *CQ* DX Committeeman. The major requirement it that recipients of this Award must have made a major contribution to DX involving considerable sacrifice. A short biography of the candidate should accompany your nomination.

FRESNO—1970

The 1970 West Coast DX Convention sponsored by the Northern and Southern California DX Clubs will be held January 31 and February 1 at the Del Webb Townhouse in Fresno. *All* DXers are invited to attend. Further information will be released via this column as details are firmed up.

160 News

We hate to neglect all other news in favor of one item. However, this story of W1BB's contact with the HKØTU, Malpelo DXpedition is so interesting we will use it in it's entirety:

"A Night To Remember!! Tnx to Dale, W4DQS, and Bob, WØDX, I QSOed Malpelo briefly at 0641 and confirmed it at 0711, Feb. 23, for All Time country #103, and #100 on the present DXCC list.

"In the middle of the first contact things suddenly went kaput. The s.w.r. shot up and I was off the air. What a time for a failure! A quick check indicated a short *somewhere* in the 235 ft. of coax. It was the middle of the night with the temperature 33°F and a 25 m.p.h. wind blowing off the ocean.

"I grabbed my flashlight, gloves, and ear muffs and started up the ladder on the tower. There were 3 joints with fittings so I started by untaping and inspecting them. The first was OK but the second, about 130 ft. up, was shorted. When I stripped the vinyl water

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was oozing out from the braid. I rushed home, collected 175 ft. of spare coax, and up the ladder again. Hanging onto the ladder with one arm, holding the flashlight in my mouth, and my now gloveless fingers getting numb, I made a 'jury-rig' open splice where the bad connector had been. This done, I rushed back down and made the connection into the antenna replay. A quick test showed SUCCESS! The s.w.r. was back to 1:1.

"HKØTU was still on so I waited for a break and gave him a call. He came right back and the QSO was completed. I went QRT immediately as some of the gang thought I was making a 2nd QSO bandhog style. They didn't realize that the first try was incomplete.

"Relaxing in my chair I was a bit proud that at age 65 I was able to climb the tower at night in bad weather and make the emergency repairs in time. Here's to 'Happy Hamming always,' especially on 160."

The Frankford Radio Club

The following information is courtesy of John B. Johnson, K3BNS, 1968 President of the Frankford Radio Club of Philadelphia, our featured DX club this month.

Since the initiation of sponsorship of national and international operating competition awards for amateur radio clubs by the American Radio Relay League in 1936, the Frankford Radio Club has been a consistant front runner. Founded in 1930 in the Frankford section of Philadelphia, the membership has grown to include the top competitive and DX hams in the Delaware Valley as well as Honorary Members throughout the world.

Over the years, a friendly, but intense competition has developed with Frankford's foremost rival—the Potomac Valley Radio Club of Washington, D.C. While battling to a one-two finish in virtually every major contest held, these two talent-laden teams have set the pace for the rest of the field. The standards of equipment and skills for superior performance under the most severe conditions are established through this rivalry. In the late spring of each year, the two clubs take turns hosting a social get-together for the members to compare their experiences and savor their victories.

The distinctive red-white-blue Frankford QSL card depicting the Pennsylvania State Keystone monogram is probably one of the

Those of you needing Aland Island for the S.S.B. DX Awards can listen for Sigurd, OHØNI, one of the most active DXers in this rare awards country. *(Photo courtesy W4NJF).*

best known QSL's in all of hamdom. Hundreds of thousands of these cards have been sent all over the globe to confirm contacts with FRC members. The club sponsors the much-sought-after WFRC Award, given for contacting FRC hams.

Twice-monthly meetings are conducted to plan contest strategy, to receive DX QSL cards from the W3 Bureau Manager, W3KT, and to enjoy programs of topical interest. To sharpen contest skills and to maintain stations in peak condition, several intra-club competitive events are sponsored by the club throughout the year, pitting members in single operator competition.

Competitive operating is a demanding, tough, uncompromising challenge. It is the

Dr. Carl Keel, HB9P, of Zurich in action during last October's RTTY contest. Carl was first licensed in 1930, and was only the 12th Swiss amateur to receive a license. His converter is an Alltronics-Howard model L, and the printer is a Lorenz 15B.

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This photo was taken at the January meeting of the Amateur Radio Society of Iran. Shown left to right are: Wolfgang Bauer, DL2WB, Jamshid Partovinejad, EP2JP, Bud Collette, W4GUS, Gene Reed, WA5AUA, Ebish Nuban, EP2BF, Friedrich Wedemeyer, EP2BI, Henri Lecesve, EP2HL, Ted Libershal, QGL Manager, Clarence Wandrey, WA9EHZ, Mr. Macelledge, WB4BSF, Don Alexander, EP2DA, H. R. Carpenter, HC-5HC, and Chuck Bowers, EP2CB. EP3AM, EP-2BQ, EP2FD, EP2DW, EP2CH and several other active EP's were not present. The Society members and their wives meet the last Thursday of each month for an evening of socializing and making plans for coming activities. All amateurs visiting Tehran are most cordially invited to attend and may contact EP2CB, Chuck Bowers at the American Embassy for information.

EP stations are active on all bands, with 20 meters probably ruling as the favorite. Several EP's can be found nightly around 14225 and 14235 between 1230 and 1830 GMT. For those of you who still need an "EP" for Zone 21, QSL cards for all EP stations may be sent direct via the address in the call-book, or to the "Amateur Radio Society of Iran," Armish MAAG, APO N.Y., N.Y. 09205.

ultimate test of hams and their equipment, thus the Club Motto:

PROFICIENCY THROUGH COMPETITION

The FRC record in DX Contest competition is as follows:

ARRL International DX Competition

1938-Second	1951-First	1960-First
1939-Second	1952-First	1961-First
1940-Second	1953-First	1962-Second
1941-Second	1954-First	1963-First
War Years	1955-First	1964-First
1947-First	1956-Third	1965-Second
1948-First	1957-Third	1966-First
1949-First	1958-Third	1967-Second
1950-Second	1959-First	1968-Second

CQ Worldwide DX Contest

1960-Tenth	1965-Second
1961-Fifteenth	1966-Second
1962-Thirteenth	1967-Second
1963-no-entry	1968-Results
1964-Second	incomplete

Here and There

FL8, French Somaliland—Marcel, FL8MB, (FB8WW from 1963-1969) is now QRV on s.s.b. Listen for him near 21310 kc around 1830 GMT on weekends. QSL via P.O. Box 49, Djibouti, with 3 IRC's for an air mail reply. (Tnx F2YS/W2).

HK3TU—Praise pours in from all over the world for Bill's outstanding job of promptly confirming HKØTU contacts. One of the best QSL Managing jobs of all time.

HKØ, Malpelo—Films of the Malpelo DXpedition will be shown at the DX meeting of the ARRL National Convention, June 20-22, in Des Moines, Iowa. For further info contact Bill, KØUKN, the DX chairman.

HS, Thailand—It is now legal for W, K stations to work this rare country, but only U.S. amateurs using their calls portable, i.e., WA4-PUC/HS. At press time it was rumored that WA4PUC was the only person accorded this privilege, however, this is still unconfirmed.

I-Land in Contests—Joe, I1MOL, advises

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that Italian amateurs can only use a very restricted portion of the 80 meter band. Therefore, if you wish to work them in the contests listen only between 3647–3667 on phone, and 3613–3627 on c.w.

JT1, Zone 23–JT1AG is active around 14205 kc s.s.b. from 1500–1700 GMT.

NEDXA–Welcome home Herbie. It's good to see the North Eastern DX Association Bulletin being published again. The new address is K1IMP, 23 Jacqueline Road, Waltham, Ma. 02154.

OK5, Czechoslovakia–From April 1 to November 30, 1969, 10 stations in Presov are using the rare prefix OK5 to commemorate the anniversary of the city. Certificates are being issued for working 2 and 4 of these stations. Send log data and applications to Ing. Julo Cajka, OK3OM, Presov, Dubcekova 107, Czechoslovaka. *(TNX OK3BU).*

Postage Rates–We understand that W7EOE has succeeded in having a bill introduced in Congress which provides for lower postage rates on QSL cards to foreign countries. This is worthy of support. Please write your senator to support S-1420, Section 505, Title 39.

Silent Key–The DX world mourns the passing of Art Fonseca, W6SR, on Feb. 13 in San Francisco. Art was one of the real gentlemen of the old school and will be missed by DXers everywhere.

SK1, Gotland Island–Main operation every year is the SAC contest in September. The calls are SK1AQ and SK1BL.

SK9, 'Morokulia'–The rare prefix SK9 was was activated as SK9WL by SM5FC, and is an artificial state on the border of Norway and Sweden. Moro = fun in Norwegian. Kul = fun in Swedish. It is used for the joint production of charity programs by LA and SL broadcast stations. QSL to SM7CRW, *CQ*'s man in Scandanavia.

SU1, Egypt–Ibrahim, SU1IM, is reported to be quite active around 14050–060 kc c.w. at 0400–0500 GMT.

UAØ, Zone 23–UAØYT sent your editor a QSL without receiving one first. Obviously he is a good UAØ to work if you haven't confirmed Zone 23. He is very active on 14 mc c.w.

VK9, Cocos-Keeling–VK9RY will be QRV until about March, 1970. His favorite frequencies include 7050, 14050, and 21050 c.w., and 14195 and 21350 s.s.b.

WAC Record: Loyd Colvin claims the record for Worked All Continents–6 minutes–from

Horace, CX3BH/3A2CH, of Montevideo, Uruguay proudly displays his W1BB 160 Meter DX Award Certificate for making the "first ever" CX/W 160 QSO with W1BB. *(Photo courtesy W1BB).*

5L2KG in September, 1967 all on 14 mc s.s.b. Can anybody beat it? Here's how it went:

North America..0919 GMT....WB6RVG
Asia.....0919 GMT....JA1IDU
South America...0920 GMT....PY5WL
Oceania.....0923 GMT....VK2APK
Europe.....0924 GMT....DJ5WY
Africa.....0925 GMT....EA8FJ

Walt Knight, W6GB, claims the record for a WAC Roundtable–1 hour & 45 minutes–with OH2OJ, F7AH, LU7AS, OD5BZ, VK-3AEE, W6UQU, and ZD4AF. This was on March 23, 1957 when Walt was K6GMA.

YB, Indonesia (Zone 28)–Two active stations and their frequencies are YBØAAB, 14195 kc, 14320 kc, and 21445 kc; and YBØAR, 14195, 14270, or 21330 kc.

ZA, Albania–ZAØII has been heard on the west coast on 28615-620 kc s.s.b. around 1600 GMT. Legit? Doubtful as PAØTO says his beam heading is toward the U.S.A. from the Netherlands. However, ZA1AM on 140-83 kc had the correct heading. He gave his name as Chu and said to QSL to Box 29, Tirana.

ZL, Chatham Island–ZL3ABJ/C will be on the air until fall.

3V8, Tunisia–Bob, 3V8AC, activates this rare country. Try 28690 kc around 1600-1800 GMT. QSL to WB6EXK.

7P8, Lesotho–7P8AB, Doc, likes 14250 and 21300 s.s.b. Tuesdays and Fridays 1800-2000 GMT. 7P8AR, Ulli, is QRV on 5 bands with TH6DX at 75 ft., 2 element beam on 40, and 66 ft. vertical on 80.

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Propagation

BY GEORGE JACOBS,* W3ASK

TYPICAL summertime propagation conditions are forecast for the h.f. amateur radio bands during June. This means that optimum frequencies for DX propagation are expected to be somewhat *lower* during most of the daylight hours, and somewhat *higher* during the late afternoon, early evening and nighttime hours, than during the earlier spring months.

Short-skip openings, up to distances of at least 1300 miles, are expected to improve considerably on all h.f. bands as a result of more intense and widespread sporadic-*E* ionization.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1969. Short-skip predictions for June, for distances between 50 and 2300 miles, and from Hawaii and Alaska to the mainland, appeared in last month's column. Instructions for the use of this month's DX Charts may be found directly below the "Last Minute Forecast" which appears at the beginning of this column.

The following summarizes DX conditions expected on each h.f. amateur band during June. Refer to last month's column for similar information concerning short-skip openings.

A sharp decrease is expected in DX propagation conditions on 10 meters during June and the summer months. While fewer openings are shown in the Propagation Charts, some fairly good ones still should be possible to southern and tropical areas during most of the daylight hours.

Excellent world-wide DX propagation conditions are forecast for 15 meters. While the band may open for DX as early as daybreak on many days during June, peak conditions are expected during the late afternoon and early evening hours. The band should remain open to some tropical and southern areas well into the hours of darkness.

Around-the-clock DX jropagation conditions are forecast for 20 meters during June and the summer months. While the band is expected to open to most areas of the world during the sunrise period, peak conditions are forecast for the early evening hours and during most of the darkness period.

*11307 Clark Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for June 1, through July 15, 1969

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: 3, 12, 14, 21, 26. July 9, 15			B-C	C
Normal: 2, 4-6, 11-13, 15-16, 19-20, 22-23, 25, 27-28. July 2-3, 6, 8, 10, 14	A-B	B-C	C-D	D-E
Below Normal: 1, 7, 10, 17-18, 24, 29. July 1, 4, 7, 11, 13	C	D	D	E
Disturbed: 30. July 5, 12	D	E	E	E

How To Use These Charts

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

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

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

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

3—With the forecast rating noted above, start with the numbers in parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following 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 DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

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

6—The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid from June 15, 1969, through August 15, 1969, and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

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A sharp seasonal increase in static levels along with a shorter period of darkness is expected to result in noticeably poorer DX propagation conditions on the 40, 80 and 160 meter bands during June and the summer months. While some fairly good openings are still predicted for 40 meters, few are forecast for 80, and practically none at all for 160 meters. Whatever openings might be possible on these bands, should occur during the hours of darkness and the sunrise period.

[*Continued on page 95*]

June 15-August 15, 1969

TIME ZONE: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	07-08 (1) 08-11 (2) 11-14 (1) 14-17 (2) 17-19 (1)	08-13 (1) 13-14 (2) 14-16 (3) 16-22 (4) 22-00 (3) 00-04 (2) 04-06 (3) 06-08 (2)	19-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 21-23 (1)* 23-00 (2)* 00-01 (1)*
Northern Europe & European USSR	*Nil*	10-14 (1) 14-16 (2) 16-18 (1)	08-14 (1) 14-16 (2) 16-17 (3) 17-20 (4) 20-23 (3) 23-01 (2) 01-06 (1) 06-08 (2)	20-21 (1) 21-23 (2) 23-01 (1) 20-23 (1)*
Eastern Mediter-ranean & Middle East	*Nil*	10-12 (1) 12-16 (2) 16-17 (3) 17-18 (2) 18-19 (1)	11-13 (1) 13-15 (2) 15-18 (3) 18-22 (4) 22-01 (3) 01-02 (2) 02-05 (1) 05-07 (2) 07-09 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
West Africa	10-12 (1) 15-18 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-21 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-23 (4) 23-02 (3) 02-03 (2) 03-06 (1)	19-21 (1) 21-23 (2) 23-01 (1)
East & Central Africa	08-10 (1) 16-18 (1)	08-11 (1) 11-13 (2) 13-15 (3) 15-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-16 (2) 16-17 (3) 17-21 (4) 21-23 (3) 23-02 (2) 02-05 (1)	19-20 (1) 20-23 (2) 23-00 (1)
South Africa	09-12 (1)	00-02 (1) 07-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	23-00 (1) 00-02 (3) 02-04 (2) 04-07 (1) 13-14 (1) 14-16 (2) 16-18 (1)	19-20 (1) 20-22 (2) 22-01 (1) 22-00 (1)*
Central & South Asia	*Nil*	08-10 (1) 13-18 (1) 18-21 (2) 21-22 (1)	16-19 (1) 19-22 (2) 22-02 (1) 02-05 (2) 05-07 (1)	18-20 (1)
Southeast Asia	*Nil*	09-13 (1) 13-15 (2) 15-18 (1) 18-20 (2) 20-21 (1)	05-06 (1) 06-08 (2) 08-10 (1) 15-18 (1) 18-20 (2) 20-23 (1) 23-01 (2) 01-02 (1)	*Nil*
Far East	*Nil*	08-09 (1) 09-11 (2) 11-17 (1) 17-19 (2) 19-21 (1)	05-06 (1) 06-08 (3) 08-09 (2) 09-11 (1) 17-19 (1) 23-01 (1)	*Nil*
South Pacific & New Zealand	17-21 (1)	08-10 (1) 13-15 (1) 15-18 (2) 18-22 (3) 22-23 (2) 23-00 (1)	17-20 (1) 20-22 (2) 22-00 (3) 00-03 (4) 03-04 (3) 04-06 (2) 06-08 (3) 08-09 (2) 09-11 (1)	00-02 (1) 02-05 (2) 05-07 (1) 03-05 (1)*
Australasia	18-20 (1)	08-10 (1) 16-17 (1) 17-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	22-00 (1) 00-02 (2) 02-04 (3) 04-07 (2) 07-09 (3) 09-11 (2) 11-13 (1)	02-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
Northern & Central South America	10-13 (1) 13-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-15 (3) 15-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	05-06 (3) 06-08 (4) 08-10 (3) 10-15 (2) 15-17 (3) 17-00 (4) 00-03 (3) 03-05 (2)	18-19 (1) 19-22 (2) 22-03 (3) 03-04 (2) 04-05 (1) 19-21 (1)* 21-03 (2)* 03-04 (1)*
Brazil, Argentina Chile & Uruguay	10-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-23 (3) 23-01 (2) 01-02 (1)	15-16 (1) 16-18 (2) 18-19 (3) 19-01 (4) 01-03 (3) 03-04 (2) 04-06 (1) 06-08 (2) 08-10 (1)	20-23 (1) 23-04 (2) 04-06 (1) 00-06 (1)*
McMurdo Sound, Antarctica	*Nil*	13-15 (1) 15-19 (2) 19-20 (1)	16-17 (1) 17-20 (2) 20-02 (3) 02-06 (2) 06-08 (1)	20-01 (1) 01-03 (2) 03-05 (1)

Time Zones: CST & MST (24-Hour Time)

Central USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	*Nil*	10-15 (1) 15-17 (2) 17-19 (1) 22-00 (1)	00-04 (1) 04-06 (2) 06-15 (1) 15-16 (2) 16-18 (3) 18-20 (4) 20-22 (3) 22-00 (2)	19-22 (1) 22-00 (2) 00-01 (1) 21-23 (1)*
Northern Europe & European USSR	*Nil*	08-11 (1) 11-15 (2) 15-17 (1)	01-06 (1) 06-08 (2) 08-14 (1) 14-17 (2) 17-22 (3) 22-01 (2)	19-23 (1)
Eastern Mediter-ranean & Middle East	*Nil*	12-14 (1) 14-17 (2) 17-19 (1)	12-15 (1) 15-17 (2) 17-21 (3) 21-23 (2) 23-00 (1) 06-08 (1)	20-23 (1)
West Africa	09-11 (1) 15-18 (1)	09-11 (1) 11-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-21 (4) 21-23 (3) 23-02 (2) 02-04 (1)	19-23 (1)

*Predicted times of 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.

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East & Central Africa	15-18 (1)	12-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-01 (1)	19-22 (1)
South Africa	08-11 (1)	23-01 (1) 07-09 (1) 09-11 (2) 11-12 (1)	22-23 (1) 23-01 (2) 01-04 (1) 10-12 (1) 12-14 (2) 14-16 (1)	20-22 (1) 22-23 (2) 23-00 (1)
Central & South Asia	*Nil*	14-17 (1) 17-20 (2) 20-22 (1) 08-10 (1)	16-18 (1) 18-21 (2) 21-05 (1) 05-07 (2) 07-09 (1)	*Nil*
Southeast Asia	*Nil*	09-10 (1) 10-13 (2) 13-18 (1) 18-21 (2) 21-23 (1)	02-06 (1) 06-09 (2) 09-10 (1) 21-22 (1) 22-00 (2) 00-01 (1)	*Nil*
Far East	*Nil*	08-10 (1) 12-14 (1) 17-19 (1) 19-22 (2) 22-00 (1)	00-03 (1) 03-05 (2) 05-09 (3) 09-10 (2) 10-12 (1)	03-04 (1) 04-05 (2) 06-08 (1)
South Pacific & New Zealand	15-21 (1)	12-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	16-18 (1) 18-22 (2) 22-01 (4) 01-04 (3) 04-06 (2) 06-08 (4) 08-10 (2) 10-12 (1)	22-00 (1) 00-02 (2) 02-04 (3) 04-06 (2) 06-07 (1) 00-06 (1)*
Australasia	16-20 (1)	13-14 (1) 14-16 (2) 16-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	21-23 (1) 23-00 (2) 00-02 (4) 02-04 (3) 04-06 (2) 06-08 (4) 08-10 (2) 10-11 (1)	00-02 (1) 02-06 (2) 06-07 (1) 03-06 (1)*
Northern & Central South America	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-15 (3) 15-18 (4) 18-19 (3) 19-20 (2) 20-22 (1)	02-04 (2) 04-06 (3) 06-08 (4) 08-10 (3) 10-15 (2) 15-17 (3) 17-22 (4) 22-02 (3)	19-20 (1) 20-22 (2) 22-03 (3) 03-04 (2) 04-05 (1) 21-00 (1)* 00-03 (2)* 03-04 (1)*
Brazil, Argentina, Chile & Uruguay	08-12 (1) 12-15 (2) 15-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-20 (4) 20-22 (3) 22-00 (2) 00-02 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-23 (4) 23-01 (3) 01-02 (2) 02-04 (1) 04-06 (2) 06-09 (1)	20-22 (1) 22-01 (2) 01-04 (1) 22-03 (1)*
McMurdo Sound, Antarctica	*Nil*	13-15 (1) 15-18 (2) 18-20 (1)	13-16 (1) 16-18 (2) 18-00 (3) 00-03 (2) 03-06 (1)	20-21 (1) 21-23 (2) 23-05 (1)

Time Zone: PST (24-Hour Time)

Western USA To:

	10 Meters	*15 Meters*	*Meters 20*	*Meters 40/80*
Western Europe & North Africa	*Nil*	07-08 (1) 08-10 (2) 10-14 (1) 14-16 (2) 16-17 (1) 20-22 (1)	23-05 (1) 05-07 (2) 07-14 (1) 14-16 (2) 16-21 (3) 21-23 (2)	19-22 (1)
Central & Northern Europe & European USSR	*Nil*	06-08 (1) 13-16 (1) 20-22 (1)	13-15 (1) 15-20 (2) 20-23 (3) 23-00 (2) 00-07 (1)	19-21 (1)
Eastern Mediter-ranean & Middle East	*Nil*	06-08 (1) 12-19 (1) 19-21 (2) 21-22 (1)	12-15 (1) 15-19 (2) 19-21 (3) 21-23 (2) 23-00 (1) 05-07 (1)	*Nil*
West & Central Africa	07-10 (1)	06-10 (1) 10-12 (2) 12-16 (1) 16-18 (2) 18-19 (1)	12-14 (1) 14-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-03 (2) 03-07 (1)	20-23 (1)
East Africa	*Nil*	08-12 (1) 12-15 (2) 15-16 (1) 19-21 (1)	14-16 (1) 16-18 (2) 18-21 (3) 21-23 (2) 23-00 (1)	*Nil*
South Africa	*Nil*	07-09 (1) 09-11 (2) 11-12 (1) 22-00 (1)	14-16 (1) 21-22 (1) 22-00 (2) 00-06 (1) 06-08 (2) 08-10 (1)	19-22 (1)
Central & South Asia	*Nil*	07-09 (1) 09-11 (2) 11-13 (1) 17-19 (1) 19-21 (2) 21-22 (1)	22-04 (1) 04-08 (2) 08-11 (1)	*Nil*
Southeast Asia	*Nil*	07-08 (1) 08-10 (3) 10-12 (2) 12-15 (1) 18-20 (1) 20-22 (2) 22-00 (1)	22-00 (1) 00-02 (2) 02-04 (3) 04-06 (2) 06-08 (3) 08-10 (2) 10-13 (1)	02-06 (1)
Far East	13-15 (1)	08-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-16 (3) 16-18 (2) 18-21 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3) 04-06 (2) 06-09 (3) 09-11 (2) 11-14 (1)	01-02 (1) 02-05 (2) 05-06 (1) 02-04 (1)*
South Pacific & New Zealand	11-13 (1) 13-18 (2) 18-19 (1)	08-10 (1) 10-11 (2) 11-13 (3) 13-15 (2) 15-17 (3) 17-20 (4) 20-21 (3) 21-22 (2) 22-00 (1)	16-18 (1) 18-20 (2) 20-01 (4) 01-05 (2) 05-07 (4) 07-10 (2) 10-12 (1)	21-22 (1) 22-00 (2) 00-05 (3) 05-06 (2) 06-07 (1) 23-01 (1)* 01-04 (2)* 04-06 (1)*
Australasia	13-16 (1) 16-19 (2) 19-20 (1)	06-08 (1) 12-14 (1) 14-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-00 (2) 00-02 (1)	19-21 (1) 21-23 (2) 23-04 (4) 04-06 (3) 06-08 (4) 08-09 (2) 09-12 (1)	23-01 (1) 01-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 01-06 (1)*
Northern & Central South America	08-10 (1) 10-12 (2) 12-14 (1) 14-16 (2) 16-17 (1)	07-08 (1) 08-12 (2) 12-14 (3) 14-17 (4) 17-18 (3) 18-20 (2) 20-22 (1)	08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-23 (4) 23-02 (3) 02-05 (2) 05-08 (3)	19-20 (1) 20-23 (2)(23-02 (3) 02-04 (2) 04-05 (1) 20-00 (1)* 00-02 (2)* 02-03 (1)*
Brazil, Argentina, Chile & Uruguay	08-12 (1) 12-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-23 (4) 23-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-09 (1)	20-22 (1) 22-01 (2) 01-04 (1) 21-02 (1)*
McMurdo Sound, Antarctica	16-18 (1)	14-16 (1) 16-20 (2) 20-21 (1-	15-17 (1) 17-18 (2) 18-00 (3) 00-03 (2) 03-06 (1)	20-21 (1) 21-23 (2) 23-03 (1) 03-05 (2) 05-06 (1)

See page 110 for New Reader Service

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

A.G.C. Characteristics

This month's introduction involves a.g.c.-attack and-delay characteristics about which the following query is typical of those occasionally received.

QUESTION: Can you tell me in words how I can identify a "hard" or "soft" a.g.c. action and/or delayed attack and release? I cannot seem to find a description of these qualities in any literature and don't know what I am supposed to look for.

ANSWER: In respect to a.g.c. characteristics, a "hard" attack is evidenced by a sudden plop or an unpleasent impact-sound at the instant voice energy commences with strong s.s.b. signals. This is due to overshoot, before the a.g.c. takes hold. In other words, the a.g.c. does not cut down the receiver gain fast enough at the beginning of a voice pulse.

The effect usually disappears when the r.f. gain is lowered, in which case the attack is "softened" as will be noted by a more natural easing-in of the voice energy, because the lower signal level now requires a smaller range, if any, over which the a.g.c. has to work. This minimizes a larger difference, otherwise resulting in the receiver a.f. output, between the effect of a hesitant-starting a.g.c. action and full a.g.c.

The release time is that required for the a.g.c. to restore the receiver gain to normal as soon as the input signal ceases. When a fast-release time is employed, the receiver gain will come up quickly between words or syllables during an s.s.b. transmission and thus will allow the background noise to rapidly rise during such pauses. The effect is one that is called "pumping," since the signal and background levels alternately rise and fall in see-saw fashion, producing an unpleasant-sounding action.

When the release time is lengthened, the receiver gain is held relatively constant throughout a transmission sequence, so you don't have the annoyance of hearing background noise pop up during short pauses. The pumping is eliminated.

The approximate release time can be determined by tuning in a steady signal (such as from a crystal calibrator) for an S-meter reading at midscale or higher. Then remove the signal and note the time it takes the meter reading to drop 63% (to 37% of the signal reading). This will indicate the time constant for the a.g.c. release or decay, which for s.s.b. usually is set up for 1-2 seconds.

If the release is too slow, the receiver gain may not rise fast enough to immediately amplify a weak signal after a strong signal ceases. Also, if the receiver is used in conjunction with a transmitter, the receiver gain may not recover quickly enough at the end of your own transmission. This also is somewhat dependent on the muting setup used in the receiver.

These a.g.c. characteristics similarly apply to a.l.c. systems on transmitters.

Improved A.G.C. for Eico 753

QUESTION: I have an Eico 753 Transceiver. The a.g.c. action leaves something to be desired. The 6BA6 r.f. amplifier tube is designed to operate with lots of a.g.c. voltage, but all I get is about −2 volts on a large signal. Can you suggest a method of increasing the a.g.c. action?

ANSWER: More a.g.c. voltage in the Eico 753 can be obtained by disconnecting the a.g.c. diodes, $CR_{3\text{-}4}$, from the junction of $C_{67\text{-}68}$ and connecting them to terminal 5 of V_7 through a 22 or 47 mmf disc-ceramic or mica capacitor. This will apply a larger r.f. signal to the diodes.

To do the job, remove the tubes along the left side of the chassis, remove the mounting screws from i.f.-circuit board and then tip the board over toward the left. With a pair of pliers gripping the lead of CR_3 that is nearest the outside edge of the board, unsolder the lead from the foil on the underside and pull it out of the board hole. Do the same with CR_4.

On one lead of a 22 or 47 mmf capacitor, place insulated sleeving and solder this lead to terminal 5 of V_7 socket on the foil-side of the board. Route the capacitor lead around the edge of the board upwards so that the capacitor will be positioned above the board.

Solder the free lead of the capacitor to the

*Technical Director, *CQ*.

See page 110 for New Reader Service

free leads of CR_3 and CR_4 (both the capacitor and the diodes will be sort of standing up above the board). Keep the capacitor lead short and use a heat sink (pair of pliers) on diodes while soldering. Remount the circuit board and replace the tubes along the side of the chassis. Re-tune T_3 for maximum signal.

This modification will increase the a.g.c. potential to 4-5 volts with strong signals (above 100 μv.). A way to increase the a.g.c. even more would be to add a d.c. amplifier between the a.g.c. rectifiers and the a.g.c. line. This could be transistorized.

Another possibility would be to use an audio-derived a.g.c. system. Instead of rectifying the i.f., you would then rectify the output of the first a.f. amplifier. The a.f. gain control would then have to be moved to the *input* of the a.f.-output amplifier.

Reviews on Heath SB-301, 401 and 200

QUESTION: I am interested in obtaining copies of your reviews on the Heath SB-301, SB-401 and SB-200 amateur gear. When were these published? Now that I own this equipment, I am desirous of reading the reviews and knowing of any modifications you may have published.

ANSWER: The Heath SB-300 receiver was reviewed in *CQ*, September 1964, page 40. The Heath SB-400 transmitter was reviewed in *CQ*, December 1964, page 40. These are the forerunners of the SB-301 and SB-401, respectively which have some added features.

On the SB-301 these include an RTTY position, a 15-15.3 mc range for WWV coverage, a noise limiter and a panel control for switching the accessory converters. On the SB-401, these include a panel control for changing the v.f.o.'s over for on-frequency transceive operation using the SB-301 receiver v.f.o., or for independent frequency control of each unit using the individual v.f.o.'s.

A review on the SB-200 linear amplifier will be found in this issue. We have not published data on any other modifications.

RT18/ARC1 Conversion

QUESTION: I have an RT-18/ARC-1 v.h.f. transceiver and would like to convert it to ham use. Do you have any dope on this or know where I can get the information?

ANSWER: Nine pages of conversion data for the RT-18/ARC-1 appears in the *Surplus Conversion Handbook* available from *CQ*'s Circulation Department for $3.00. A schematic diagram, only, appears in the *Surplus Schematics Handbook*, priced at $2.50.

Transistor Source Including Japanese Types

QUESTION: Can you advise a good source of Japanese type transistors for replacement purposes, such as the 2SA, 2SB, 2SC, etc.?

ANSWER: About a year ago a source for transistors was recommended in this column, but inasmuch as we've had new readers since then, it will be given again at this time. It is: Transistors Unlimited, 462 Jericho Turnpike, Mineola, N.Y. 11501. Eli Furst, of T.U. carries a good stock of solid-state devices (transistors, f.e.t.'s, IC's, diodes, zeners, etc.) which, besides domestic types, includes the Japanese S-type and others. Where a specific type is not available, he can recommend or supply suitable substitutes.

NC-183 Improvements

QUESTION: I have an old NC-183 which is still going strong after 18 years, but would like to bring it up to date as much as possible. Could you give me a list of articles which have appeared in *CQ* about this receiver?

ANSWER: The only articles that *CQ* has published on NC-183 modifications are as follows:

"A Biography of a Modified NC-183," *CQ* March 1962, p. 52.

"Putting the NC-183 on SSB," *CQ* Janurary 1966, p. 42.

The latter includes the addition of a product detector. To avoid a socket change, you also could use a 6SA7 instead of the 6SJ7 for the b.f.o., with product-detector circuitry as shown for the 51-J in *CQ* December 1968, p. 64.

None of the above references include installation of a bandpass filter for s.s.b., but with a little intelligent operation you should do pretty well with the crystal filter now in the set using one of the various selectivity steps.

Tuning Fork Standard

QUESTION: Can you refer me to any articles on a tuning fork standard for RTTY?

ANSWER: An article in *CQ* April 1960, page 88, discussed a tuning fork standard using vacuum tubes.

Another article will be found in *CQ*, October 1962, page 68. This describes a transistorized job based on an original version which appeared in the Cowan Publication The New RTTY Handbook, page 174.

See page 110 for New Reader Service

Consumer's-Type Equipment Reports

QUESTION: Has anyone prepared a report on s.s.b. equipment similar to the *Consumer's Report* which is published on TV sets and other consumer products? If so, where might I obtain a copy?

ANSWER: As far as we know, no data is available in the way of a Consumer's Report on amateur gear, at least as far as recommending what is or what is not a good buy. You'll have to rely on the various monthly equipment reviews published in radio-amateur journals such as *CQ* and *QST*. Also supplement the data with reports from fellow amateurs who have had experience with the particular gear in which you're interested.

Improved A. M. For SB-300/301

QUESTION: With strong a.m. signals I notice distortion on my Heath SB-310 receiver. Do you know of any way to cure this?

ANSWER: The quality of a.m. signals with the Heath SB-300/301 and SB-310 receivers can be improved by adding a 1/2 watt resistor of 150,000 ohms across the diode detector CR_3 in the SB-300/301 or D_5 in the SB-310. The resistor may easily be installed by soldering it to the i.f. circuit board as shown at fig. 1.

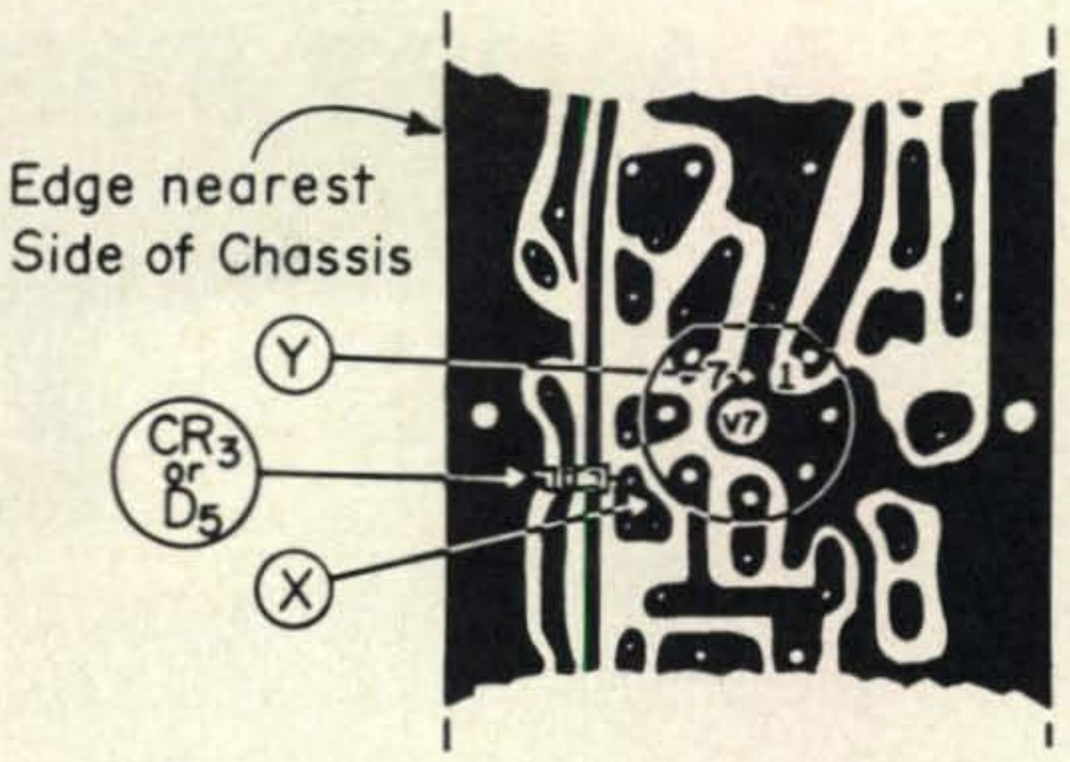

Fig. 1—Detector-diode resistor for SB-300/301/310 receivers should be soldered to bottom of circuit board at points X and Y. The diode is on the component-side of board.

S.W.R. and Resonance with 75-meter Dipole

QUESTION: I have a 75-meter dipole 118 feet long and 30 feet above ground. A balun is used at the feedpoint. The s.w.r. readings are 2:1 at 3850 kc, 1.5:1 at 3900, 1.1:1 at 3950 and 1.6:1 at 4000 kc. Does the s.w.r. indicate that the balun is narrow-banding the antenna, as resonance seems to be critical at 3950 kc?

ANSWER: From the figures you have supplied, the s.w.r. variations are about normal for an antenna of this type used on the 3.8—4mc range. Approximately 3.95 mc is the apparent resonant frequency of the antenna and thus the frequency at which the antenna impedance is resistive or non-reactive. This would thereby result in a 1:1 s.w.r. on a *suitably matched* transmission line.

The antenna impedance depends on the antenna height above ground which you indicate is 30 feet. This distance represents about 1/8 wavelength at 4 mc, and thus is a height which makes the antenna impedance about 30 ohms.

With a 50-ohm line, the true s.w.r. at resonance would be about 1.7:1; however, when the s.w.r. bridge is used at the sending-end of the line, it may indicate a lower s.w.r., depending on the degree of mismatch and the length of the line. This also can obscure resonance of the antenna itself.

The bridge can thus fool you as to the *actual* s.w.r. *on the line*. The only thing the bridge provides is an indication of the s.w.r. as it *appears to the transmitter* at the input to the line and it thus provides a measure of the type load to which the transmitter must be matched.

The most accurate way to use the bridge is right at the antenna—if you have a tall enough step ladder! On the other hand, when the bridge is at the sending end of the line, errors can be minimized by using a line that is a multiple of an electrical half-wave length. See the introduction to the August 1968 Q & A Column.

The number of turns on the balun should have no appreciable effect on antenna resonance, unless there happens to be a large mismatch between the line impedance and that of the antenna.

Cancellation of a Question

One of the letters received in the Q & A mail read as follows: "Yesterday I wrote you concerning a question about..... Please cancel this request. I have figured it out."

In respect to this, we appreciate the writer's considerate thoughtfulness, inasmuch as it not only has saved us needless work, but it also has made it possible to get to someone else's problem sooner. Thanks OM! ■

See page 110 for New Reader Service

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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Special individual logs are set up under each award providing space for a complete record of contacts and confirmations including log data required to be submitted with the award application.

The *DX Awards Log* required over two years preparation in order to contact radio clubs throughout the world for the latest data on awards currently being offered. It is the most complete and up-to-date source for such information. It will be invaluable to the "wallpaper collector" as well as any amateur of SWL making DX contacts.

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CQ BOOK MART

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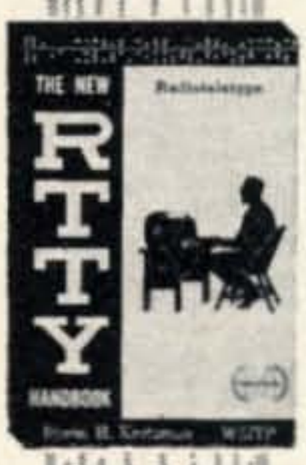

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Cat. #116. A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section on getting started, written by Byron Kretzman, a well known authority in the field.

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SURPLUS CONVERSION HANDBOOK

Cat. #122. Contains 192 pages of conversion articles including the famous Command Set's plus a whole slew of the most popular military surplus gear including such gems as: [illegible]522, ART-13, BC603, BC659, ARC 1, ARC 3, etc. Actually, it covers almost every piece of surplus gear worth the effort to convert for ham use.

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

June	6-9	CHC/FHC/HTH QSO Party
June	7-9	New York State QSO Party
June	15-21	Mass. Amateur Radio Week
June	22-23	Bermuda Phone Contest
June	28-29	ARRL Field Day
June 28 -	July 7	Wichita City QSO Party
July	5-6	Venezuela DX Contest
July	19-20	Columbia DX Contest
July	19-20	Minnesota QSO Party
July	19-20	Ontario QSO Party
July	20-21	Bermuda C.W. Contest
July	26-27	New Hamphire QSO Party
August	2-3	Illinois QSO Party
August	23-24	All Asian DX Contest
October	4-5	VK/ZL/Oceania Phone
October	11-12	VK/ZL/Oceania C.W.
October	11-12	RSGB 28 MC Phone
October	18-19	Boy Scouts Jamboree
October	18-19	WADM C.W. Contest
October	**25-26**	**CQ WW DX Phone Contest**
October	25-26	RSGB 7 MC C.W. Contest
November	8-9	RSGB 7 MC Phone Contest
November	8-9	ARRL SS Phone Contest
November	15-16	ARRL SS C.W. Contest
November	**29-30**	**CQ WW DX C.W. Contest**

CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, June 6
Ends: 0600 GMT Monday, June 9

Mailing deadline July 5th to: Clif Evans, W6BX, 3212 Mesa Verde Road, Bonita, Calif. 92002

New York State QSO Party

Starts: 1700 GMT Saturday, June 7
Ends: 0100 GMT Monday, June 9

Mailing deadline July 15th to: South Shore A.W.A., 116 Locust Street, Valley Stream, N.Y. 11581

*14 Sherwood Road, Stamford, Conn. 06905.

Mass. Amateur Radio Week

Starts: 0001 GMT Sunday, June 15
Ends: 2400 GMT Saturday, June 21

Applications must be received by July 31st by: Bill Holliday, WA1EZA, 22 Trudy Terrace, Canton, Mass. 02021

Venezuela Phone Contest

Starts: 0000 GMT Saturday, July 5
Ends: 2400 GMT Sunday, July 6

You do not have to be a winner to be eligible for a Certificate in this contest.

Stations in the Americas will qualify for this award by working 20 YV's and 10 other countries during the contest period. Stations on other continents only have to work 5 YV's and 5 other American countries. A remittance of $1.00 or its equivalent in IRC's is requested with each application.

Mailing deadline is September 1st to: Radio Club Venezolano, P.O. Box 2285, Caracas, Venezuela.

Complete rules for the preceeding 4 events were given in last month's CALENDAR.

Wichita City QSO Party

Starts: 0001 GMT Saturday, June 28
Ends: 0600 GMT Monday, July 7

The Wichita A.R.C. organized the party in celebration of the Wichita City Centennial.

There is no scoring system but a certificate may be gained by meeting the following requirements:

DX stations must work 3 Wichita stations.

Stations outside kansas, 3 Wichita and 7 Kansas stations.

Kansas stations, 5 Wichita and 10 out-of-state stations.

Wichita stations, 25 out-of-state stations.

A contact with Club station WØSOE is worth 3 Wichita QSO's.

Club members will be found on following frequencies: CW—14080, 7080, 3650. Phone —14340, 7280, 3920. Novices—7170, 3720.

Send your log data and an s.a.s.e. to the Wichita A.R.C., Att: John Bandy, WAØUTT, 2810 Euclid, Wichita, Kansas 67217

See page 110 for New Reader Service

1968 Contest Results—United States

OZ-CCA

W1MDO 76,302
W1CNU 2,214
K1IIK 1,296
W1JUK 966
W2MEL 30,817
W2CKR 765
W2ZV 252
W4WHK 12,672
WA8HDM 135
WN9YCY 408
WAØKDI 3,588
(W1MDO was 4th world high)

Helvetia XXII

W1TX 11,340
W1FZ 8,694
K1IIK 3,828
K1HVV 3,180
WA1FHU 3,132
W1AQE 840
W2ZV 5,880
WB2WAD 1,458
W2NCG 1,242
K2SBW 765
WA2BZV 450
W3DBX 10,320
W3FU 6,840
W4AZK 2,400
W4HOS 1,650
K4RDU 1,428
W4UF 1,200
WA5CBE 9,372
K5MDX 1,020
W6NEX 3,198
W6BIL 27
W7LVI 5,394
WA7JCB 144
K8NQP 1,188
W9JQD 12,546
K9CVO 4,650
K9VLZ 3,696
K9QWM 2,886
K9ABQ 660
WA9OQE 495
W9LKI 288
WA9MMT 126
WAØKDI 4,950
WAØAUB 4,158
WØDAK 1,104

DARC WAE—C.W.

Single Op.

W1BPW 149,671
W1DTY 52,800
WA1FHU 41,382
W1MDO 38,759
W1TW 21,672
W1AYK 4,972
WA1BXB 352
W1WMH 234
W2MEL 113,710
W2DKM 21,450
W2CP 15,975
W2ZV 12,643
WA2BZV 10,255
K2MFY 9,804
W2NEP 8,473
K2CPR 6,520
W2MT 4,843
W2CKR 2,392
W2MYK 2,238
WA2TGL 48
W2UL 24
K3HTZ 92,983
K7ADD/3 60,970
W3PG 55,510
K3MNT 55,048
W3YUW 52,364
W3AIZ 22,560
W3QQL 21,168
W3HVH 12,986
W3QOR 7,656
W3KTW 6,231
WA3ENR 3,171
W3AXW 3,051
W3CBF 2,673
W3MDO 952
WA3IXF 240
WA3GFN 224
K4DSN 27,560
W4HOS 16,560
W4WSF 4,640
W4LVV 3,058
W4KMS 646
W5IOU 73,304
W5FL 34,874
WA5NUK 10,915
W5EQT 4,495
W5QWN 1,590
WB6HGU/6 53,181
K6MG 6.438
DL7JY/W6 4,830
K6CQF 4,563
WA6JDT 1,800
W6GBY 105
K7WWR 11,914
WA7FKV 588
W8GQU 39,525
K8BCK 27,348
K8HZU 26,010
W5ODJ/8 4,408
W8DSO 4,009
W8DWP 3,075
W9VNE 78,650
K9WMV 10,332
OH1XO/W9 2,720
WAØKDI 24,531
WAØSDC 22,464
WAØPRS 216

Multi/Single

K6AHW 44,388
WA6GLD 16,422
K8UDJ 58,026
W9EXE 51,728

Multi/Multi

W3MSK 229,977

VK/ZL/Oceania

C.W.

W1EVT 10,530
W1DTY 4,172
W1AX 2,352
W1ESN 484
W1WY 352
W1SWX 40
W2LWI 6,039
W2ZV 450
W8IBX/2 24
WA2HAI 3
W3NU 9,928
W3VKD 4,890
W3DPJ 24
W4OMW 1,380
K4RDU 1,092
W4BYB 496
W4HOS 297
W4KMS 168
K4VQT 6
W5BUK 3,725
WA5TPO 50
K6HN 11,427
K6AN 10,175
W6RGG 7,174
K6HPZ 957
W6ID 360
W6GBY 144
K6DDO 70
W7IR 11,448
K7VPF 24
W9VNE 3,825
W9IHN 2,093
W9LKI 952
WØDYA 16

Phone

W1DTY 644
W2FCR 1,476
W3JNN 4,805
W3AKG 132
W3DPJ 56
W4HOS 848
W4WSF 114
W4BYB 96
W6GHM/5 8,064
K5JEF 6,562
WA5EFN 1,280
WA6EPQ 14,760
W6ISQ 825
K7RLS 1,027
WA7JRY 502
W8KIT 4,031
WØPAN 1,224
W9ECV/Ø 828

Results 1968 All Asian Contest

North America

Continental Winners

JA1CWZ 53,874
UA1KBA 13,725
WA6IVN 12,183
CX3BH 5,376
KH6GNE 3,485
CR7IZ 594

U.S.A.

All Band

WA6IVN 12,183
K6AHV 10,108
W3MSK 9,180
W1AW 5,887
W9AQW 5,796
W1EVT 4,136
WB6QJD 3,906
W4KXV 3,820
K2DJD 3,289
W6GEN 2,198
K7INE 1,120
K3HTZ 963
W1TW 824
W1DTY 760
W2HL 328
K4RDU 308
W4WSF 224
W5BUK 186
W9WEN 156
W6GBY 156
W4HOS 120
W3QOR 81
WA2BHJ 6

21 mc

W6MSM 1,290
W2LWI 155

14 mc

WA6AFI 3,405
WB6CWD 3,276
W3PG 1,924
W1YYM 1,100
WB6OLR/6 954
W5KC 175
K9CVO/1 75
W2MT 58
WB6RNS 51
WB6YAX 10
K3NPC 4

7 mc

W5EQT 270
K7VPF 42
W6ZGM 34

Canada

All Band

VE7SV 3,600
VE6VO 180

21 mc

VE7LB 294

14 mc

VE2DCX 46
VE7IQ 11

All on 14 mc

Alaska

KL7MF 250

Mexico

XE2AAG 270

Panama

HP1BR 90

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Columbia Contest

Starts: 0001 GMT Saturday, July 19
Ends: 2359 GMT Sunday, July 20

This is an annual contest to celebrate the independence of Columbia. The Columbians will work DX, other countries work HK's as well as other DX.

Use all bands, 10 thru 80 on both c.w. and phone, but cross band or mode contacts are not allowed.

Exchange: The conventional RS/RST report plus a progressive 3 figure QSO number starting with 001. The HK's will include their district with their number.

Scoring: *Stations in the Americas:* 3 points for each HK contact, 1 point for non-HK.

Stations on other continents: 5 points for HK and 1 point for non-HK contacts. The multiplier will consist of the sum of HK districts and different countries worked on each band. Final score, total QSO points times the sum of the multiplier from all bands.

Catagories: Single operator and multi-operator, both single and multi transmitter.

Awards: Certificates to the top scorers in each catagory in each country. There are also awards for the continental winners and the world leader.

You are expected to compute your score and check your log for duplicates and accuracy. Include a summary sheet with details and your name and address in BLOCK LETTERS.

Mailing deadline is September 30th. Logs go to: Independence of Columbia Contest, Ap. 584, Bogota, Columbia. (Air Mail is suggested.)

Minnesota QSO Party

July 20th–4 Periods

Phone: 0000–0400 & 1600–2000 GMT
C.W.: 1200–1600 & 2000–2400 GMT

This is the 4th annual QSO party sponsored by the Viking Amateur Radio Society.

Exchange: QSO nr., RS/RST and QTH. County for Minn. stations, ARRL section or country for others.

Scoring: For Minn., total QSO's times the multiplier, which is composed of ARRL sections and countries worked on phone, PLUS ARRL sections and countries worked on c.w.

Others: Total Minn. QSO's times different Minn. counties worked on phone PLUS counties worked on c.w. (max. of 87 on each mode)

Frequencies: c.w.–3580, 7080, 14080. Phone– 3880, 7280, 14280, 21380, 29600. Contacts on other frequencies and bands are also valid.

Awards: Certificates to the highest scoring station in each section and country. (min. of 5 QSOs) And each Minn. county. (min. of 20 QSOs) Special certificates to the two top stations, Minnesota and out-of-state.

Logs must show all contact information and score computed. Mailing deadline is August 11th and logs go to: Viking Amateur Radio Society, Box 3, Waseca, Minn. 56093. Include an s.a.s.e. for copy of results.

Ontario QSO Party

Starts: 1700 GMT Saturday, July 19
Ends: 2400 GMT Sunday, July 20

This is the first QSO party sponsored by the Radio Society of Ontario.

There are no power or time limitations, all bands may be used, and the same station may be worked on each band and mode for contact credit.

Exchange: QSO nr., RS/RST and QTH. County for VE3's, ARRL section for others.

Scoring: For Ont., 1 point per QSO multiplied by number of ARRL sections and countries worked.

Others: 3 points for each Ont. station worked multiplied by number of Ont. counties worked on each band.

Frequencies: 3560, 3685, 3855, 3909, 7030, 7240, 7290, 14040, 14140, 14225, 14290, 21050, 21300, 28100, 28600, 50250, 50360, 144-144.5, 145.8.

Awards: Certificates to the top scorers in each ARRL section and foreign country. And each Ontario county. (min. of 25 QSOs) Also a Trophy to the leading Ontario station.

Mailing deadline is August 31st and logs go to: Radio Society of Ontario, Att: Contest Chairman, P.O. Box 334, Toronto 18, Ont. Canada. Include a s.a.s.e. if copy of results are desired.

Bermuda Contest

Phone: June 22-23 **C.W.:** July 20–21

Starts: 0001 GMT Sunday
Ends: 0200 GMT Monday

This is the 10th anniversary of this contest sponsored by the Radio Society of Bermuda.

A few improvements have been made in the rules. You will note that phone and c.w. are now separate contests on different weekends, each with its own awards.

[*Continued on page 98*]

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THE awards PROGRAM

BY ED HOPPER,* W2GT

THE June, "Story of The Month" about Dave, WAØJKT/WAØRJH *AND* Dick, WAØDCQ, after this information on awards issued. Mixed USA-CA-3000 awards went to Leo Staley, WA5AEB and Arne Kangas, W8DCD. Mixed USA-CA-2500 awards were issued to Leo, WA5AEB; Bob Anderson, WA4LMR; and Paul Newberry, W4YWX. Bob, WA4LMR and Paul, W4YWX also received USA-CA-2000; 1500; 1000 and 500 awards endorsed All 14 mc SSB. Mixed USA-CA-2000 and 1500 awards went to Dick Brege, K8ODY. Frank Gerratana, WA1CXE won All SSB USA-CA-2000, 1500, 1000 and 500 awards. Mixed USA-CA-1500 awards were issued to Irene Kennedy, WA9EZP and Wilberta (Willie) Longwell, WA7IRD. A Mixed USA-CA-1000 award went to Gordon Evans, ZL1HW, the first 1000 award to a ZL/VK station. John Porter, K1PRB qualified for a USA-CA-500 award endorsed All A-1. Augusta Fox, WØMAI; and Richard Mencel, K9TSY qualified for Mixed USA-CA-500 awards—congratulations to *ALL*!

USA-CA HONOR ROLL

3000

WA5AEB 18
W8DCD 19

2500

WA5AEB 42
WA4LMR 43
W4YWX 44

2000

K8ODY 59
WA1CXE 60
WA4LMR 61
W4YWX 62

1500

WA9EZP 87
K8ODY 88
WA1CXE 89
WA7IRD 90
WA4LMR 91
W4YWX 92

1000

ZL1HW 151
WA1CXE 152
WA4LMR 153
W4YWX 154

500

K1PRB 702
WØMAI 703
WA1CXE 704
WA4LMR 705
K9TSY 706
W4YWX 707

Dave, WAØJKT and Dick, WAØDCQ

YES, TWO COUNTY HUNTERS, this month. The idea was to give as many details as possible of their 8 day, fifty thousand mile, forty two hundred QSO, eleven state, 164 COUNTY EXPEDITION.

This was their 4th County Expedition but even with all that experience, one never knows what they will run into. Dick's '65 Cheverolet Greenbrier truck, equipped with a Swan 240, 2 Hustler Antennas, sleeping bags, walkie-talkies and some spare parts, was to be their "home" for the duration.

The trip started from Minneopolis, Minnesota, Friday, June 7th and things went quite well until arriving in Iowa when the fan belt started slipping and many stops were made to re-adjust it.

In Belmont, Iowa, they were met by Phil, WAØEVO who loaned his Swan 240 to act as a spare. A new fan belt was obtained and installed. Later they were able to enjoy the hospitally of Steve, KØQJG and his XYL in Hayes, Kansas where they enjoyed the luxury of a soft bed, and it was a real treat after driving 18 hours a day and using sleeping bags.

Again more trouble with the truck, some

L-R: Dick, WAØDCQ & Dave, WAØJKT.

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

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Left to right: Dick, WAØDCQ, operating & Dave, WAØJKT, driving.

problems solved via a QSO with George, K9-CSL, then heavy thunderstorms and it was later learned that fortunately due to being a little behind schedule, they had missed the tornado in Tracy, Minnesota, that had killed 9 persons.

The last half of the trip was plagued by poor band conditions, at times few stations were heard on 20 and few good nights were had on 75.

Back in Minnesota, a stop was made at WAØLMK in Worthington, where Phil, WAØEVO and his family were waiting to pick up the Swan rig loaned as a spare. A wonderful evening was spent at Worthington and then back home June 14, extremely tried, broke, but all ready for the next expedition.

Many thanks from Dave and Dick to all who helped make the expedition a success, and especially to the Net controls who kept things moving so smoothly. Also thanks to WØKYG who helped keep them in touch with home, and to KØEVO, WAØLMK and *ALL* the others.

As mentioned before the trip, contributions would be accepted *after* the trip, to cover the estimated $150 expenses. And as predicted, the costs were just about $150, *excluding* parts, depreciation on Dick's truck and Dave's lost wages (from not working), which were not included.

The response with donations have been extremely satisfying and have covered most of the expenses. Thus plans are being formented for another long expedition. Those who sent donations will receive announcements of future plans by mail and should have received a color photograph taken by KØQJG, if any have been missed, be sure to write to Dave and Dick. To be absolutely sure of getting the data on future plans, send an s.a.s.e. to Dave.

Now for some information on the operators.

DAVE HUTCHISON, WAØJKT / WAØRJH of 6504 Logan Ave., South, Minneapolis, Minnesota 55423; is 22, still single (but looking hard). A Senior at the University of Minnesota, majoring in accounting. He was an s.w.l. for some time before getting interested in ham radio and got his first ticket in 1964.

From the beginning, Dave was interested and active in traffic handling on various local and interstate nets. He became manager of the Minneapolis Phone Net and made BPL 13 straight months.

One day tuning across 75, he heard that someone had a lot of Red Cross traffic for Minneapolis (this was after a tornado), he located the station on the 20 meter County Hunter Net and handled the traffic for about 4 hours. Dave became curious about this net and started checking into it, thus his interest in County Hunting began. A short time later he found the 40 meter County Hunters and fell in love with County Hunting and has been at it ever since. His confirmed county score is above 2800.

RICHARD (DICK) BAKER, WAØDCQ of 13730 Kinsel Road, Minnetonka, Minnesota 55343, is 34, was born and raised in St. Peter, Minnesota and later moved to Minneapolis.

Mrs. "Lil" Baker was born and raised in North Dakota, but later desired to live in a larger city and moved to Minneapolis. She is now a housewife (my wife says "homemaker"), enjoys gardening, baking, skiing, ice-skating and caring for their only child, Terry.

In 1963 they moved to Villa Park, Illinois

The APOLLO Certificate.

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(WA9KHW) but returned to Minnesota in 1966.

Dick spent 3 years in the Navy, as an Aviation Electronics Technician, where he gained his basic electronics experience and also attended code school.

After leaving the Navy, Dick received a degree in Education at Mankato State College in Mankato, Minnesota. After graduating, he decided not to enter teaching and went to work for Motorola in Minneapolis. The next 6 years were spent traveling through the southern part of the U.S., office work in Minneapolis and office work in Chicago.

In April 1962, Dick and Garry, WØOGM attended an auction and Dick came home with a transmitter and receiver. In order to satisfy/answer the many questions from "Lil", Dick quickly took the ham examination and received his license in July.

Dick's interests in ham radio are contests and County Hunting, and along with County Hunting he thoroughly enjoys mobile trips. These trips have included 31 mobile and 3 air mobile trips since 1964. During these trips, he has given out 744 counties, of which 418 were for the first time. These trips cover over 10,000 contacts and have covered over 25,000 miles.

On the long trips, Dick takes another ham and these have included Wayne, W9IKB; Mike, WAØKGD; Gary, WAØOGM; Dave, WAØJKT; and Phil, WAØEVO.

The home station includes: Drake T4X transmitter; R4A receiver; Gonset GSB 101 linear; 50 foot tower and TH4 beam. Also inverted V on 75, 40 and 20 if necessary.

The South Dakota Counties Award.

Letters

Bob Anderson, WA4LMR, writes "Well, here it is, finally, my USA-CA-2500 application. Four years intermitten work at it—frequent moves, medical school, internship, and now work with the USAF as a flight medical officer, have made the going difficult at times. But the last 12 months produced over 2000 counties for total of 2760 worked. The County Hunters are a great group and I'm glad to now be able to return many favors on frequent mobile trips in Georgia and Florida. Have been a *CQ* subscriber almost since becoming licensed in 1962, and have *always* read the USA-CA *(now THE AWARDS PROGRAM)* column *first*, keep up the great work, Ed!"

Leo Staley, WA5AEB, writes: "Glad to hear you check into the 14336 NET, and am amazed at the number of new "Hunters". The 20 meter activity surpasses anything we ever had on 40 meters, and as you've noticed has promoted International County Hunting. Although I am sure many people were involved, my credit for the success of the 20 meter Net goes to John Bowman, W4OHP. In the beginning John was working a split shift and opened the Net each weekday at 1800 GMT. He had a gentlemens' agreement with the Coast Guard Net Control to assume the frequency at their sign-off. For over a year, John held the Net together on the toughest of all conditions, "The Weekday Early Hours". Weekends have natural activity and potential Net controls, before giving up hunting he was at 3012.

For the many friends wondering of John's whereabouts, he is now temporarily "off-the-air" and working in Civil Service. His address is: John R. Bowman, W4OHP, Rte 2—Box 56R, Pensacola, Florida 32560. Maybe a few letters will get him back on the air". (Leo now has over 3060 confirmed).

Awards

Apollo Special Event Certificate: This certificate is awarded by the Kennedy Space

[*Continued on page 102*]

Active County Hunters at Jackson, Miss. Front row; L-R: K5KDG, WA4AFP, WA4LMR, K7ZJP, W5HDK, W4NXD, WØYLN, W4RMT. Back row; L-R: K4ARF, WB4KGJ, WA4FAT; W5PWG, W4YWX, W5POH.

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VHF TODAY

BY ALLEN KATZ,* K2UYH

JUDGING by the response we have received to the video modulator circuit we ran several months ago, there must be a lot of interest in amateur TV among *CQ*'s readers, and thus amateurs in general. Just getting a picture on the air however, is not enough; you must have audio along with it. You see, amateur radio by definition involves communication. It can be fun to send pictures back and forth and holding up signs to communicate. But even to the most ardent video enthusiasts, it eventually becomes evident that TV is an extention of voice communication. And for amateur TV operation to become something more than just a stunt or fad, it must involve both forms of information.

The question thus arises as how best to add voice information to the video signal. Commercially, this operation is accomplished by the use of two transmitters. One transmitter is amplitude modulated by the video signal, while the other transmitter is f.m. modulated by the voice signal on a carrier frequency 4.5 mc above that of the video transmitter. The outputs of both transmitters are combined at a duplexer and fed to a common antenna. Although this approach has been employed by a few amateurs, it does involve some complication. First of all, it obviously requires the use of two transmitters, although the voice transmitter need not be as high a power level as the video transmitter. The current commercial standard is about 10%. This means that if the video transmitter runs 1 kw, the aural transmitter is run at about 100 watts. The reason for this disparity between video and voice transmitter power is that a much higher "equivalent" signal-to-noise ratio is needed for the reception of a clear picture than for the reception of voice. Tests we have conducted indicate that a station must be able to supply a carrier of at least 50 to 60 db above the noise in a narrow band receiving system to produce a decent picture. Besides two transmitters, two feedlines and two antennas are usually required by amateurs using the above method, since duplexers are not normally available to them.

Another approach requiring less equipment, but still producing voice and picture which can be copied on a standard TV set makes use of a small 4.5 mc transmitter. This 4.5 mc transmitter or "oscillator" is f.m. modulated with voice information and its output is added to the video information at the input to the video modulator—see figure 1. This procedure produces an f.m. subcarrier 4.5 mc above the video subcarrier.

Despite the relative simplicity of this second method, the most popular way of transmitting voice information along with video information, appears to be the use of cross band operation—that is the use of a two meter voice link, besides the 432 mc video channel. This system has the advantage of built-in feedback, since most stations can transmit video on 432 mc, while listening on 144 mc for word on picture quality. The disadvantage of this approach is that it is dependent on the two meter link, and thus detracts from the concept of an ATV system.

Some of us who operate 432 mc phone have been using yet a different method. We modulate the carrier with both f.m. and a.m. modulation. This approach is particularly convenient, if you are using a converted f.m. transmitter as your 432 mc exciter, as many stations are doing today. The voice information is carried by the f.m. (narrow band) modulation which can be detected with a crystal controlled converter and communications receiver by means of slope detection

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

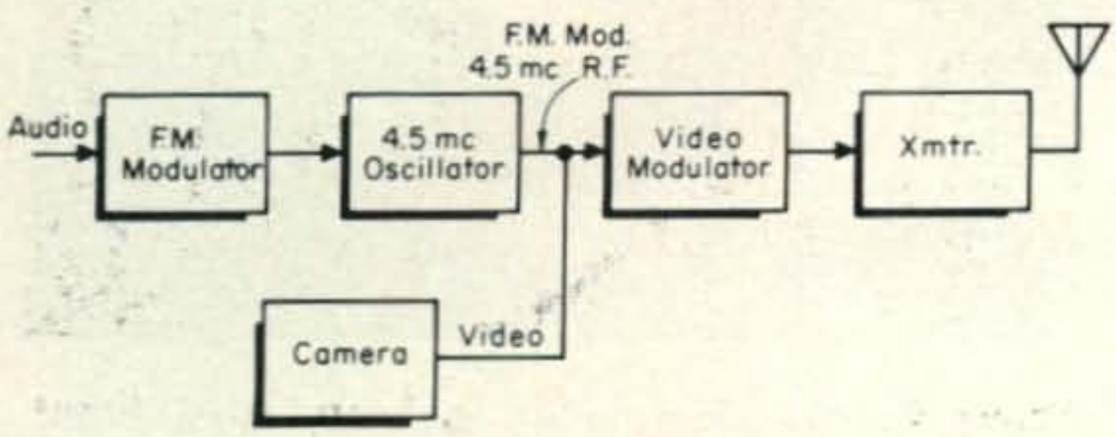

Fig. 1—A simple system for adding voice information to a TV signal.

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or f.m. descriminator where available. The amplitude modulated video information tends not to interfere with the small deviation f.m. modulation, as the video side bands are widely spread on either side of the carrier. Likewise, the video informaion is received with a TV converter and standard TV set. Because the f.m. deviation is small, it does not effect the wide bandpass TV receiver. The above system has worked well for us in the past, and was implemented by feeding the received TV signal from the antenna to a preamplifier, and through a Tee connector to the two separate converters.

In recent months TV activity has so increased in the N.J.–N.Y. area, that it has been necessary for TV stations to spread out and move above 432 mc to avoid interference with themselves, and in particular with normal narrow band phone and c.w. operation centered at 432 mc. It has been found that a move in frequency of only 1.5 to 2 mc is sufficient to eliminate interference to phone operation. Therefore, the same transmitter may be used for TV as well as narrow band operation with a minimum of retuning. However, as stations move higher in frequency, they move out of the bandpass of most crystal controlled converters. To receive the voice information of these stations, another possibility still exists.

If a transmitter is both f.m. and amplitude modulated, as done in the previous method, the audio signal may be received on a standard TV receiver by beating another signal 4.5 mc above the TV signal carrier with the TV signal. The effect of this extra

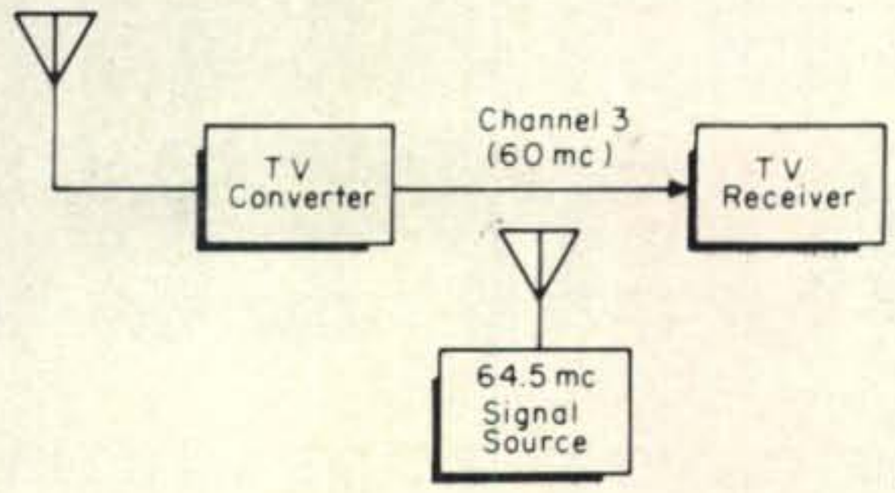
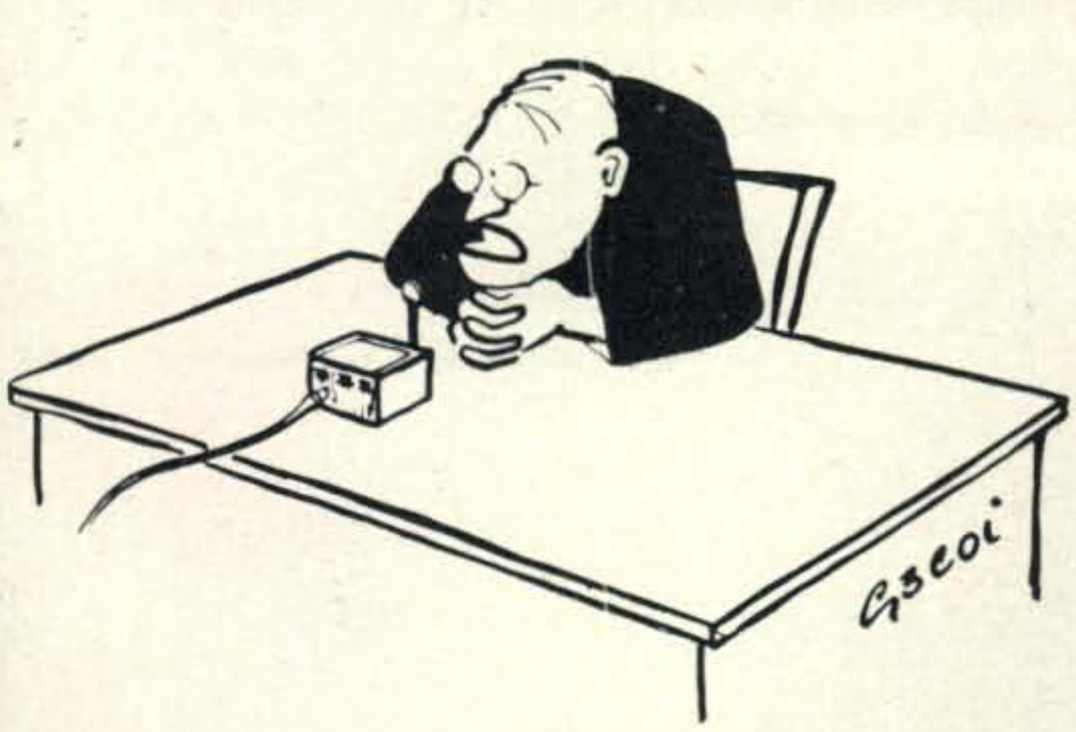


Fig. 2—A detection method for an f.m.—a.m. modulated video signal.

signal is to produce an f.m. modulated signal at the 4.5 mc sound i.f. frequency of the standard receiver. Because of the position of the added signal, it does not effect the quality of the TV picture. Neither does the f.m. modulation of the TV carrier, as noted earlier, effect the picture. In factor f.m. deviations of up to 20 kc can be used with no noticable effect on the picture received. As for sound quality it is excellent, because any amplitude modulation is eliminated by the f.m. detector limiters. This system can be implemented (as shown in figure 2) by placing a grid dip meter or signal generator near the antenna input of the TV receiver being used, and adjusting the signal source for best audio. If the output frequency of the TV converter being used is channel 3 (60 mc), then the source frequency should be adjusted to 64.5 mc. This method was first suggested to us by Frank, K2KVT, and has worked so well that it has been adopted by most amateur TV stations (in our area), and I expect it will eventually become the amateur standard.

73, Allen Katz–K2UYH

THE WORLD OF G3COI...



"The chief interest here is miniaturization..."

"Stand-by for a two-tone test..."

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

SEVERAL months ago I mentioned in this column the fact that computers were now being used to convert c.w. signals (Morse) to teleprinter impulses (Baudot). There has been considerable interest among readers in this process. Several correspondents have even written asking information about a much more complex conversion process: voice to teleprinter. There is one device which has turned up in surplus for Morse-to-Baudot translation, the Frederick Electronics 670 computer. There are not going to be more than a few 670's found in surplus right now, and even if all which have been produced by Frederick come on the market, they will hardly be a common item. Nonetheless, this is a fascinating device which I feel is worth a surplus column treatment. Fig. 1 is a photo of the front panel of the 670.

The process of translating c.w. code to Baudot code is done in a very straightforward way in the 670 by setting the c.w. characters into a memory device in a binary code which is then read out according to the Baudot code. This is a relatively simple process, using a matrix (fig. 2).

The trouble and complexity of Morse to Baudot conversion arises first in recognition of the Morse character, which may be sent by hand at no particular "standard" speed. Unlike RTTY signals which are sent at rigidly standardized rates, Morse has no set speed. Even machine-sending, while more consistent, is not standardized. "Fists" vary widely, spacing may be inconsistent, and automatic sending varies from station to station. How, for example, does the computer tell a badly sent space between a dot and a dash from a character space?

Even after the unit "reads" the Morse input, it must handle a considerable difference between Morse and Baudot codes' character length and rate. This involves "buffering" or temporary storage of each character during the conversion process.

Too, Morse does not contain information required in teleprinter copy for mechanical functions like carriage return, line feed, letters-figures shifts, space, etc. These functions must be inserted by the computer at the appropriate points.

Since Morse may be sent at high speeds, the input capability must vary widely, and to avoid "overrunning" the output, high Baudot speeds must be provided on the output side. Some models of the 670 offered parrallel outputs which could feed high-speed tape perforators running at several hundred Baud. For ordinary serial readout, speeds of 60, 75, and 100 words per minute are provided, in standard 5-level stop-start RTTY code.

Construction of the 670 is all solid-state, though the one I have uses no integrated circuits. It is quite complex, and does not lend itself to much tinkering. Built on 13 printed circuit boards, containing more than 340 transistors and at least as many more diodes, with many magnetic core units for storage purposes, the 670 is by all odds a sophisticated piece of gear, yet it is mounted in a small 19-inch cabinet only 5¼ inches high. To watch it synch up on NSS on 20 kc and print perfect press copy hour after hour is a fascinating business. It does almost as well on the more crowded amateur bands, where you can sit back and watch W4 chase a rare

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

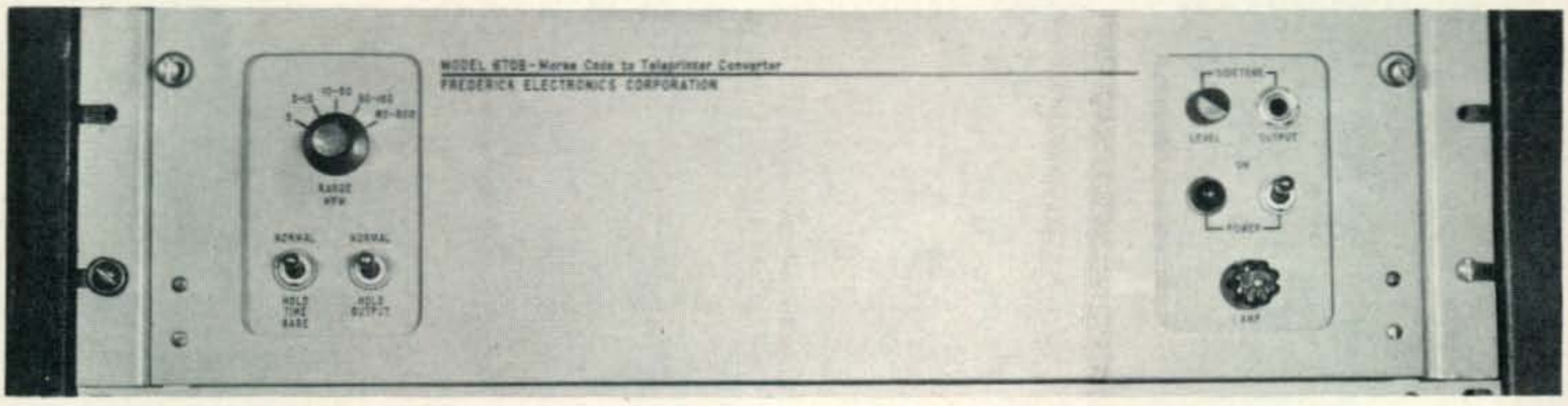

Fig. 1—The Frederick Electronics Corporation Model 670B computer for translating CW Morse signals into Baudot signals for printout on a Teletype machine.

See page 110 for New Reader Service

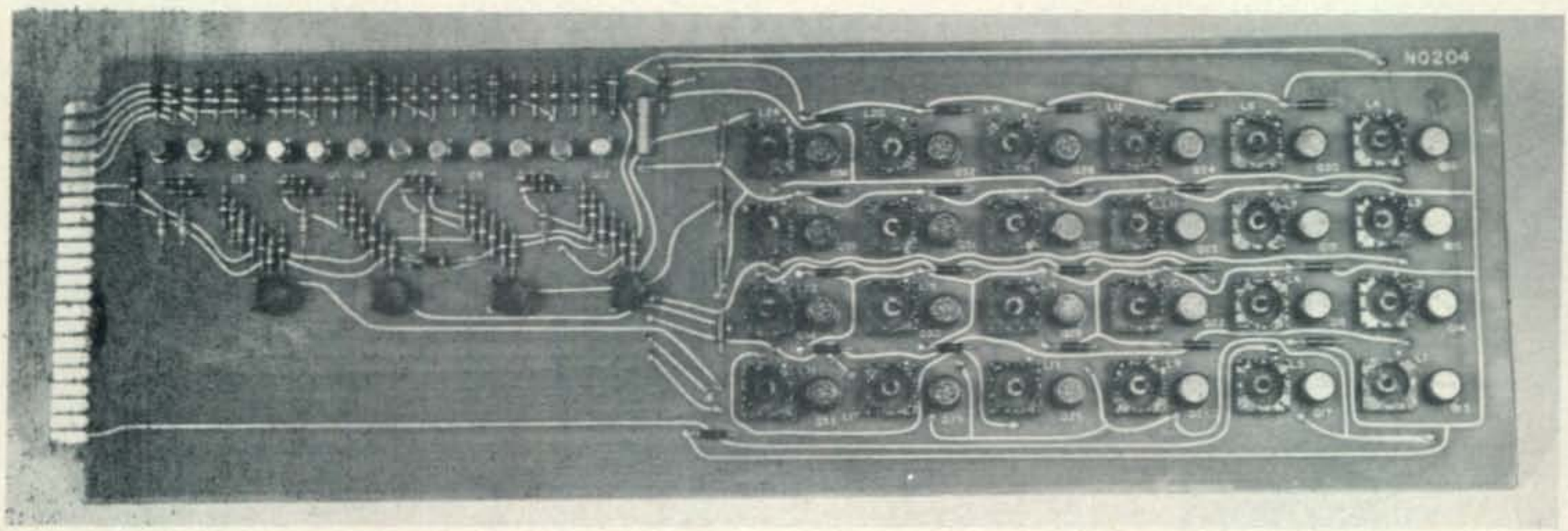

Fig. 2—The conversion matrix printed circuit board showing memory cores. Each transistor and its assorted core represent a single teleprinter character.

DX station half a world away.

Of course the F.E.C. 670 was designed for one of the military agencies, to monitor certain "interesting" signals for analysis...

Fig. 3 is a block diagram of the 670.

The input of the 670 is designed to handle a standard RTTY loop of 130 volts, d.c. at 60 milliamperes. In practice, the c.w. signal is received as an on/off audio tone which is demodulated in a converter much like a standard RTTY T.U. which turns frequency shift tones into keyed d.c. The keyed 60 ma loop drives the 670 input multivibrator, which puts out a tone which is transformer-coupled to the main, low-level, circuitry of the 670, thus providiing isolation.

An input filter removes splits and transients from the signal and passes a negative pulse to the Mark time base for each dot and dash, and a negative pulse to the space time base for each key-up period in the incoming c.w. signal.

The Mark time computer samples the incoming dot or dash and adjusts the mark time base output accordingly. The space time base also examines key-up intervals to identify them as element, character or word spaces. These two computers adjust the 670 as closely as possible to the speed of the incoming Morse signal.

Though it may sound simple, the process

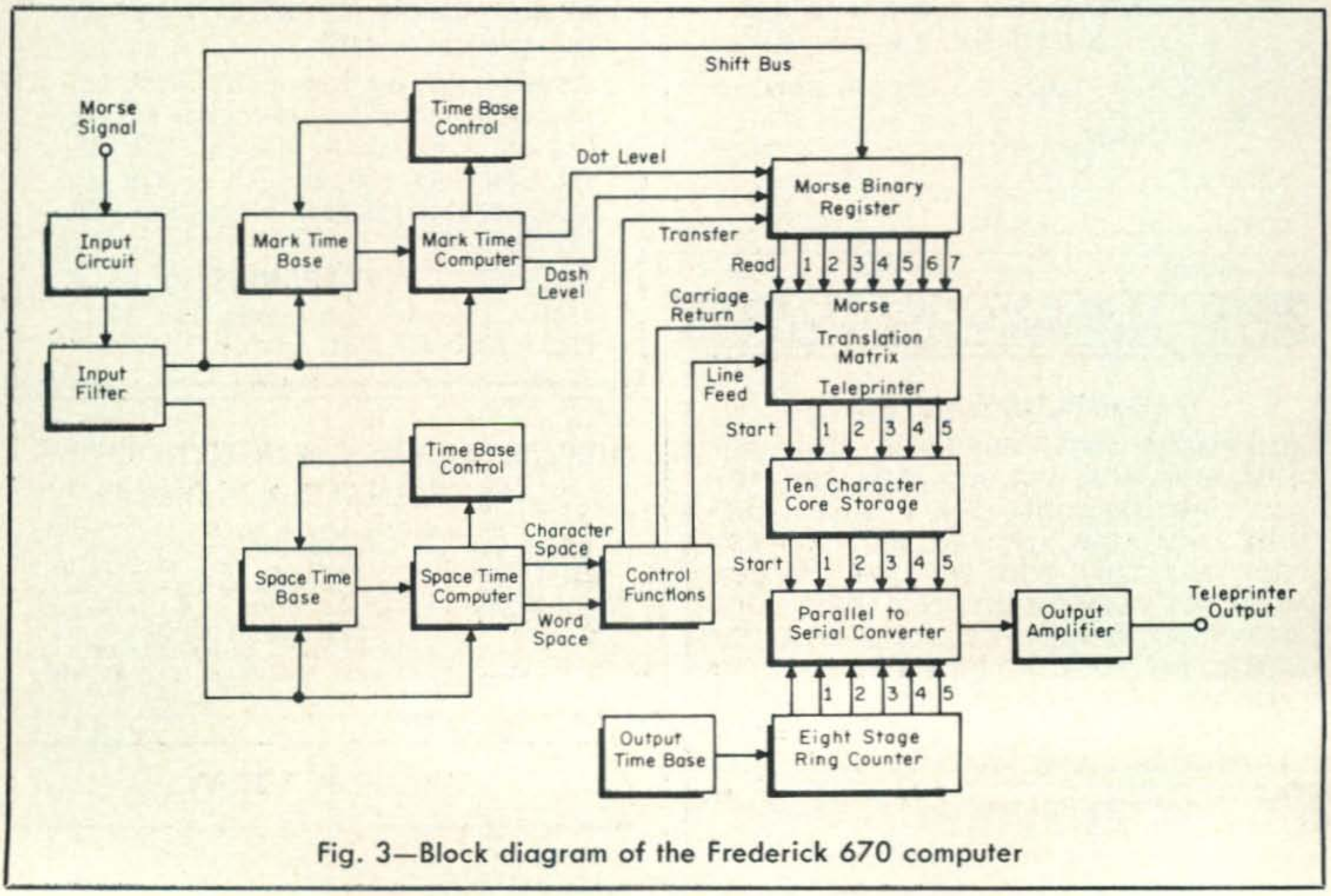

Fig. 3—Block diagram of the Frederick 670 computer

See page 110 for New Reader Service

MORSE	CHARACTER	BINARY	BAUDOT
• —	A	1010000	11000
— • • •	B	0001100	10011
— • — •	C	0101100	01110
— • •	D	0011000	10010
•	E	0100000	10000
• • — •	F	0100100	10110
— — •	G	0111000	01011
• • • •	H	0000100	00101
• •	I	0010000	01100
• — — —	J	1110100	11010
— • —	K	1011000	11110
• — • •	L	0010100	01001
— —	M	1110000	00111
— •	N	0110000	00110
— — —	O	1111000	00011
• — — •	P	0110100	01101
— — • —	Q	1011100	11101
• — •	R	0101000	01010
• • •	S	0001000	10100
—	T	1100000	00001
• • —	U	1001000	11100
• • • —	V	1000100	01111
• — —	W	1101000	11001
— • • —	X	1001100	10111

MORSE	CHARACTER	BINARY	BAUDOT
— • — —	Y	1101100	10101
— — • •	Z	0011100	10001
• — — — —	1	1111010	11101
• • — — —	2	1110010	11001
• • • — —	3	1100010	10000
• • • • —	4	1000010	01010
• • • • •	5	0000010	00001
— • • • •	6	0000110	10101
— — • • •	7	0001110	11100
— — — • •	8	0011110	01100
— — — — •	9	0111110	00011
— — — — —	Ø	1111110	01101
• — • — • —	.	1010101	00111
— — • • — —	,	1100111	00110
• — • — •	+	0101010	10001
— • • • —	=	1000110	01111
— • • • • —	–	1000011	11000
— • • — •	/	0100110	10111
• — — — — •	'	0111101	10100
• • — — • •	?	0011001	10011
— — — • • •	:	0001111	01110
— • — — • —	( )	1011011	11110

Fig. 4—Table of Morse to Binary to Baudot conversion in the computer.

is a sophisticated one, involving a series of gates which time the incoming signals to identify them as dots, dashes, or the three kinds of space elements. Longer than "normal" space elements will drive the speed register down, thus lowering the time base oscillator frequency, while shorter than "normal" elements will drive the register up, raising the time base frequency. This is accomplished in a six-stage ring counter which is reset by the trailing edge of each space signal.

From the time computers, the signal passes into the binary register (fig. 4) where each character is converted to a binary number and thence into the 5-level Baudot code.

After conversion to Baudot, each character passes into the ten-character storage section and a parallel-to-serial converter where sequential 7.42 characters are formed, consisting of a 1-unit start pulse, five code pulses, and a 1.42 unit stop pulse. (A full and simple eplanation of the standard RTTY code and its application to amateur communications is presented in detail in *The New RTTY Handbook* by Byron H. Kretzman W2JPT, available from *CQ*).

The internal output signal is a low-level audio pulse which is transformer-coupled to a bridge rectifier circuit and a pair of high-voltage transistors which will key an external 60 ma loop.

The full description of operation of the 670 requires 85 pages of text in the technical manual, but, fortunately much of the system can be treated as several "black boxes" whose precise operation need not be understood in order to use the unit. I find that only the output section has given trouble, and by replacing the original 2N698 output transistors with hefty DTS-413 types, that trouble has been cured. Cheaper 2N3440's would directly substitute for the 2N698's without re-drilling the printed circuit board and should do as well.

Hookup of the input loop is straightforward—only two connections need be made, observing polarity of course. Output too, is only a pair of leads to the 60 ma loop containing the teleprinter. Four output time bases are provided in the standard version, and a strap from "common" to the desired speed terminal will select the output speed, or a four position rotary switch may be connected to a remote panel to allow selection of any of the available speeds at will.

Front-panel controls on the 670 include POWER ON/OFF, HOLD-OUTPUT, which is merely a short across the output loop, and a HOLD-INPUT-TIME-BASE control. In the face of an extremely noisy input signal which could force the time computers rapidly and eroneously up and down, the hold switch applies 12 volts to both of the computer adjusting circuits and holds them at the last-determined speed. This act to "hold" a speed while experiencing momentary loss of signals as well.

Some models of the 670 will read a wide range of signals—10 to 50 w.p.m.— without external adjustment, while special models offer a selection, in several steps, from 3 to 300 w.p.m. When set *below* the incoming speed, the unit will sit with its output locked up for several characters, then, if the speed is within its rather wide range of automatic readjustment it will begin to print. If it is

See page 110 for New Reader Service

set *too high*, it will print a series of "T's" until it has had time to synch up on the input. If the correct speed is set initially, very little synch time is required.

Quick trouble shooting may be done by stages: if there is no output, *i.e.* the printer loop remains locked in Mark, the #8 board may be pulled out, putting a continuous "space" on the output. If this does not cause the printer to run open, there is a problem on the output board; probably a shorted output transistor.

Trouble may be isolated in the pre-translation portion of the unit by using an extender card to bring the center printed circuit board out of the cabinet. By momentarily applying "ground" to any one of the transistor collectors around the edge of the board. a RTTY character should be generated to the output loop. If it is not, the trouble of course lies between the matrix board and the output. If a character is printed, the input stages are at fault. Another quick check on the input is the sidetone jack—if no sidetone Morse is heard, the input connections are probably at fault.

If you think Morse to Baudot conversion sounds complex, well voice to Baudot is far more difficult, in fact to date no really complete translation of English language to any sort of electronic code has yet been accomplished. There are a lot of people working on it, including Radio Corporation of America and other large companies. Bell Telephone Laboratories have been working on the project for many years.

Voice signals are of course converted to analog electrical signals in any 'phone communications system, but thus far the only device which has been found capable of understanding the analog signal is a human ear at the other end of the circuit. Pulse Code Modulation techniques will convert voice to a serial digital signal, but again, it must be reconverted to sound at the output end. Digital voice signals do give promise of eventual conversion to, say, Baudot code signals which could operate a wide range of devices from a teleprinter to a telephone dial system to a computer which would select your groceries.

The digital voice signals could be run through a computer where they would be compared with the digital "image" of all the words in the computer's vocabulary. When the right word was found to match, translation circuits not unlike those in the 670 would convert the information into a teleprinter or other output.

Experimental voice-to-computer translators have consisted of a series of filters which split the voice sound into a number of frequencies, plus a series of amplitude-comparing detectors which feed a syllable memory-recognition computer. The human ear can distinguish between more than 1,500 different frequencies, and the ear feeds the brain information via several thousand nerve fibers, a complexity that even a roomsized computer would have difficulty managing to duplicate.

Some degree of simplification-reducing the number of discrete frequencies recognized for one—have of necessity been introduced in voice-recognition designs, but this appears not to seriously limit the ability of a machine to "read" distinct speech. What does limit them is the vocabulary problem. A Baudot output has to store only about 60 characters. Even an illiterate human being has a vocabulary of at least 10,000 words, and to be useful in a technically-oriented world, where more and more foreign terms must be understood as well as English, your well-rounded computer should have a vocabulary at least as large as the Oxford Universal Dictionary's 120,000 words. This would by no means be exhaustive. A complete computer vocabulary would contain the 500,000 words of the unabridged Oxford English Dictionary plus several thousand recent technical terms and a large number of foreign words. Sentence structure and grammar would also have to be programmed in.

Described in "bits" the demand for storage would be astronimical. A six-letter word in Baudot code requires 42 bits, plus more for control functions, or some 30 million bits for a good vocabulary.

Voice translation is being experimented with now for control of the Apollo mooncraft, using pre-coded voice recognition pattern cards for each Astronaut, but only 14 commands need be recognized, such as "up," "down," "stop," etc. The U.S. Post Office is trying to design a machine to understand zip codes spoken by mail sorters.

Though this is an exceedingly complex field, I would be interested in hearing from any readers who may have been working in this area, or thinking about it, as it is one of the frontiers of the communications art which we should be aware of. It may not be out of reach, after all, who would have thought that a Morse to Baudot converter would have shown up in surplus? ■

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Letters [*from page 11*]

the zener would not do much regulating with a 2.7 k series resistor.

I have built a similar bench supply but added a 2.5 k, 2 watt linear potentiometer across the zener diode with the base of Q_1 and C_2 connected to the variable contact. This allows the output to be varied from 0 to max. (1.3 volt less than the zener voltage). This simple addition makes a much more useful "bench" supply.

Hope this will be useful.

Ray Harland
Escondido, Calif. 92025

Satellite Corp. [*from page 52*]

earth several times a day. When successfully launched. AUSTRALIS will become OSCAR V, to mark the fifth successful launch in this series of radio amateur satellites, the first of which was rocketed into space on December 12, 1961.

Membership In AMSAT

Until AMSAT holds its first annual organizational meeting this coming November, the following radio amateurs are filling interim positions on the Board of Directors and are acting as the key officers of the organization:

Perry Klein, K3JTE—President
Jan King, K8VTR—Executive Vice-President
George Kinal, K2MBU—Vice-President, Engineering
C. A. Petry, W3AWN—Vice-President, Operations
Jim Puglise, W3CBJ—Secretary
Dick Mostow, W3YAV—Treasurer

AMSAT invites interested radio amateurs and amateur scientists to participate in its activities. An invitation is also extended to amateur radio clubs and organizations to participate on an affilliated basis. Membership is open both nationally and internationally. Complete membership information can be obtained directly from:

Membership Committee
AMSAT
P.O. Box 27
Washington, D.C. 20044

There will be more news concerning AMSAT and Project OSCAR in upcoming issues of *CQ*. ■

Propagation [*from page 75*]

In summary, 15 meters is expected to be the optimum DX band during the daylight hours of June, with 20 meters optimum during the hours of darkness and the sunrise period.

V.h.f. Ionospheric Openings

No major meteor showers are forecast for June, and very little auroral activity is expected. Check the "Last Minute Forecast" appearing at the beginning of this column, since whatever auroral propagation possible on the v.h.f. bands is likely to occur on those dates forecast to be below normal or disturbed.

Sporadic-*E* ionization is expected to reach a near-seasonal peak during June, resulting in very frequent short-skip openings on 10 meters, numerous 6 meter openings, and an occasional opening on 2 meters.

[*Continued on page 98*]

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- Two EIMAC 3-500Z Triodes in Class "B" Grounded Grid
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The old saying "You get what you pay for applies to speech processing, too! The AUTOLEVEL VOLUME COMPRESSOR will turn every penny of your $87.50 into pure Talk Power. Expert hobbyists in any field know that getting the best performance depends upon using the best in equipment, and the AUTOLEVEL is the finest speech processing device available—at ANY price!

$87.50 amateur net

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The HORIZON VI 50MHz F.E.T. Receiving Converter provides excellent performance at a moderate price. It features its own built-in power supply, and offers high rejection of Channel 2 TV. The dual gate MOS FET transistor mixer gives the HORIZON VI high immunity to cross-modulation and overload, and its handsome styling makes it an attractive addition to any Ham station.

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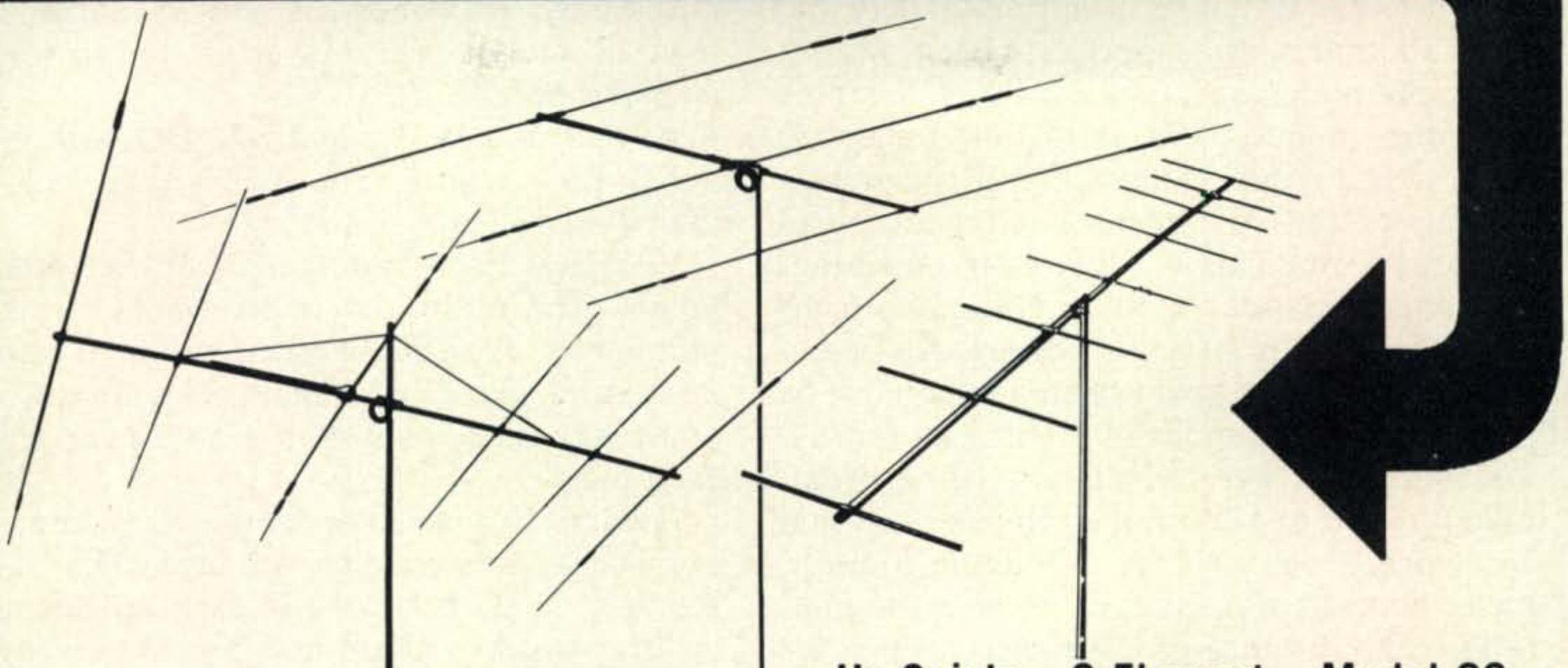

Hy-Gain's 8-Element Model 28

SPECIFICATIONS

MECHANICAL

Longest Element	3'6"
Boom Length	14'
Turning Radius	7'6"
Wind Load at 80 MPH	20.7 lbs.
Maximum Wind Survival	100 MPH
Net Weight	7 lbs.
Mast Diameter	1¼" to 1⅝" OD
Boom Diameter	1¼" OD

ELECTRICAL

Gain	14.5db
Front-to-Back Ratio	25-30db
Maximum Power Input	1 KW
VSWR (at resonance)	1.5:1
Impedance	52 ohms
Uni-directional Pattern	

Order No. 341 **$19.95**

ALL NEW hy-gain 10-15-20

6-Element SUPER THUNDERBIRD DX Model TH6DXX

- New "Hy-Q" Traps
- Up to 9.5db Forward Gain
- 25db Front-to-Back Ratio
- SWR Less Than 1.5:1 on all Bands
- Takes Maximum Legal Power

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Delivers outstanding performance on 10, 15 and 20 meters. Separate and matched "Hy-Q" Traps for each band. Feeds with 52 ohm coax. Hy-Gain Beta Match presents tapered impedance which provides most efficient 3 band matching and provides DC ground to eliminate precipitation static resulting in maximum F/B ratio, SWR less than 2:1 at resonance on all bands. Mechanically superior construction features taper swaged slotted tubing allowing easy adjustment and permitting larger diameter where it counts. Has heavy tiltable boom to mast clamp.

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- Up to 8db Forward Gain ■ 25db Front-to-Back Ratio
- Takes up to 300 Watts AM; 600 Watts P.E.P.
- Rotates with Heavy Duty TV Rotator
- Turning Radius 14.3 ft.

Order No. 221 **$89.95**

Hy-Gain TRIBANDER BALUN Model BN-86

Order No. 242 **$14.95**

SPECIFICATIONS

ELECTRICAL	Model TH3Mk3	Model TH3JR	Model TH2Mk3
Gain	8db	8db	5.5db
Front-to-Back Ratio	25db	25db	15-20db
Maximum Power Input	1 KW, AM	300 Watts AM; 600 Watts PEP	1 KW, AM
VSWR (at resonance)	Less than 2:1	Less than 2:1	Less than 2:1
Impedance	52 ohms	52 ohms	52 ohms
MECHANICAL			
Longest Element	27 ft.	24.2 ft.	27.3 ft.
Boom Length	14 ft.	12 ft.	6 ft.
Turning Radius	15.7 ft.	14.3 ft.	14.3 ft.
Wind Load At 80 MPH	103 lbs.	85 lbs.	94 lbs.
Maximum Wind Survival	100 MPH	80 MPH	100 MPH
Net Weight	36 lbs.	21 lbs.	23 lbs.
Mast Diameter	1¼" to 2½"	1¼ to 1⅝"	1¼" to 2½"

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- 18 Isaac St., Norwalk, Conn. 203 - 838-4877
- 225 Rte. 46, Totowa, N.J. 201 - 256-8555

Propagation [*from page 95*]

Long periods of 10 meter short-skip openings, between distances of approximately 400 and 1300 miles, are expected to occur almost daily. Six meter openings, between distances of approximately 750 and 1300 miles are likely to occur during most days of the month. During periods of intense and widespread sporadic-*E* ionization, "two-hop" openings up to approximately 2400 miles may also be possible on both 10 and 6 meters. An occasional 2 meter short-skip opening may also be possible during periods of intense sporadic-*E* ionization, between distances of approximately 1200 to 1400 miles. Here's a tip that has worked out well for predicting 6 and 2 meter short-skip openings. Observe the *minimum* skip distance on 10 meters. When it's down to about 450 miles, check 6 meters. Chances are that 6 will be open in the same direction. When the 10 meter short-skip distance is down to about 200 miles, or the skip on 6 meters is less than 450 miles, check the 2 meter band for a possible opening.

Sunspot Cycle

The Swiss Federal Solar Observatory, the world's official keeper of the sunspot records, reports a monthly mean sunspot number of 139 for March, 1969. During March, day-to-day sunspot activity was more intense than at any other time during the present cycle.

.The mean sunspot number reported for March results in a 12-month running smoothed sunspot number of 107 centered on September, 1968. The sunspot cycle is based upon these smoothed sunspot numbers. A smoothed sunspot number of 99 is predicted for June, 1969, as the present cycle declines slowly from its maximum intensity.

73, George, W3ASK

Announcements [*from page 12*]

New York area. Broadcast at 11:15 A.M. over WHCU-AM and again at 7:30 P.M. over WHCU-FM in Ithaca, the show features David Flinn, W2CFP, and other "guest Stars" from the world of amateur radio. Topics to be covered in the series range from basic information on licensing for the newcomer bitten by the bug, through explanations for the benefit of the general public on what amateur radio is and does, to news of interest to the already licensed "ham."

Plans are underway to make the series of programs available to other radio stations throughout the country. Anyone interested in this latter idea is invited to contact Mr. Flinn at 10 Graham Road West, Ithaca, N. Y. 14850, phone (607) 273-9333 for more information. ■

Contest Calendar [*from page 84*]

Its open to U.S. and Canada working Bermuda only. All bands are now available, 3.5 thru 28 mc but operation is limited to single operator only.

Exchange: W/Ks and VE/VOs will give a RS/RST report. The VP9's will include their Parish.

Scoring: Each completed QSO is worth 3 points. The multiplier is determined by the number of Parishes worked on each band. (max. of 9 per band) Final score, total QSO points times the sum of the multiplier from each band.

Awards: Certificates to the top scorer in each U.S. and Canadian call area. The "Top Banana" in each contest is expected to pick up his award in Bermuda. The Society will provide transportation and accomodations for a week's stay, for the winner and a friend of his choice. Wow! How about that.

Logs: Keep all times in GMT. Check for duplicates and correct scoring. Your name and address in BLOCK LETTERS and include a signed declaration that all rules and regulations have been observed. Logs must be received by the Radio Society of Bermuda P.O. Box 275, Hamilton, Bermuda no later than August 15th.

Parishes and abbreviations

Devonshire–DEV, Hamilton–HAM, Paget–PAG, Pembroke–PEM, Sandys–SAN, Smiths–SMI, Southampton–SOU, St. George –GEO, Warwick–WAR.

New Hampshire QSO Party

Starts: 1700 GMT Saturday, July 26
Ends: 2300 GMT Sunday, July 27

This party has been revived by the Bow Radio Association after an absence of three years.

There are no power or time restrictions and the same station may be worked once on each band and mode.

Exchange:QSO nr., RS/RST and QTH. County for N.H., state, province or country for others.

Scoring: For N.H., total QSOs times a multiplier determined by the states, provinces and countries worked. (N.H. may work other in state stations)

Others: Total QSOs times N.H. counties worked. (max. of 10)

Frequencies: CW–3680, 7080, 14080, 21080, 28080. SSB–3950, 7250, 14250, 213-50, 28550. RTTY–3610, 7040, 14090, 210-90. VHF–50.4, 145.4, and Novice freq.

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GC-1A	$ 79.00	TR-106		350 &		Comm. IC-700T SSB		2-B	$179.00	GSB-101	$89.00
HG-10	$ 29.00	and VFO	$109.00	117XC	$325.00	Xmit, IC-700R rcvr,		**EICO:**			
SB-300	$219.00	R-100A	$ 49.00	410C w/22		IC-700 power		722 VFO	$24.00	**HALLICRAFTERS:**	
SB-110A		**LAFAYETTE:**		adaptor	$ 99.00	supply	$299.00	**GALAXY:**		SX-117	$175.00
w/HP-23	$319.00	HE-45 w/HE-61		14C module	$ 45.00	**CENTRAL**		Galaxy V w/AC		SX-110	$ 79.00
Six'er	$ 39.00	VFO	$59.00	**UTICA:**		**ELECTRONICS:**		& Speaker	$339.00	SX-99	$ 69.00
HO-10	$ 45.00	HE-45A		650 and VFO	$89.00	10-A	$39.00	Gal. V Mk. II w/AC		HT-46	$225.00
HW-20 (NBFM		w/Mic	$59.00	**TEST EQUIPMENT:**		MM-2	$45.00	& Spkr.	$359.00	SX-115	$349.00
Conv)	$139.00	**NATIONAL:**		IG-42 RF		**CLEGG:**		RV-1	$ 49.00	SR-400	
VHF-1		NCX-5		Heath Gen.	$49.00	99'er	$79.00	NOX-1	$ 15.00	w/AC	$599.00
(Seneca)	$129.00	w/NCX-A	$395.00	TE-44 Lafayette		**COLLINS:**		2000T		HA-6/P-26	
SB-100		NCX-500		capacitor		KWM-2 w/Waters		Linear	$289.00	AC	$119.00
w/AC	$369.00	w/AC	$389.00	checker	$ 7.00	Q-Mult.	$625.00	**GONSET:**		**HAMMARLUND:**	
SB-620	$ 89.00	NCX-200		HP-1 Hallicrafter		32S-3	$525.00	G-77A		HQ-145C	$189.00
JOHNSON:		w/AC	$309.00	low voltage		516F-2	$115.00	w/AC-DC	$69.00	HE-110C	$ 99.00
Matchbox 275		**RME:**		supply	$45.00	32S-3		G-66B3/way		HQ-170C	
w/Ind.	$59.00	DB-22A	$19.00	E.M.C. tube		w/516F-2	$595.00	supply	$69.00	w/Speaker	$139.00
Adventurer	$24.00			tester	$15.00						

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See page 110 for New Reader Service

Awards: Certificates to the two highest scorers in each New Hamshire county, and the top scorer in each state, province and country. A cup to the over-all winner.

Mailing deadline is August 6th and logs go to: Sam Colby, WA1CBP, RFD #3, South Bow Road, Concord, N.H. 03301

Editor's Notes

The bands were really buzzing during our recent WPX SSB Contest. Many stations were heard sending four figure contact numbers during the second day of the contest, so some record breaking scores are expected. The Brazilians had everybody confused with a series of new prefixes they were using. It seems they were given special permission to use PT, PU, PQ and etc. instead of the conventional PY during the contest. The prefix hunters must have had a field day.

Only recently discovered that the USSR boys were also holding a phone contest on this week-end however very little evidence of this activity was heard.

As I mentioned last month, it was impossible to announce the results of our WW Phone Contest of last October, in this issue. The dock strike really loused up the incoming surface mail. However the Phone results will be in the next issue.

A new recently revised I.A.R.C. CPR Zone list is now available. A s.a.s.e. to me or *CQ* will get you a copy.

We are holding the following certificates, winners in the 1967 World Wide Contest, for lack of address. GM3SVK, HA2MM, JA4BJO, LZ2KRS, LZ2RF, OX3ZO, YO3-ZM, ZD5M, 7XØAH, 9X5SA. Anyone knowing the latest QTH of any of the above stations can do them a big service by forwarding it to me.

73 for now, Frank, W1WY

Pilot Light [*from page 32*]

transformer whose secondary supplied 2.5 v. at 10 amps, center-tapped. One half of the secondary was connected in series with the heater. If the heater drew as much as 10 amps, the voltage drop would have been only 1.25 volt, easily tolerable in a 120 volt system. An Omni-Glow pilot lamp connected across the primary served as the indicator. There was practically no power dissipated by the series winding in this arrangement, as the load it presented was mostly reactive. Tests showed that as little as 2 amps load would supply enough voltage to light the lamp. ■

See page 110 for New Reader Service

MORE GREAT BUYS FROM ARROW—

AMECO CODE PRACTICE OSCILLATOR AND MONITOR

A combination code practice oscillator and CW Monitor. (No connections to transmitter required.) Transistorized. Has built-is speaker, tone control and headphone jack.

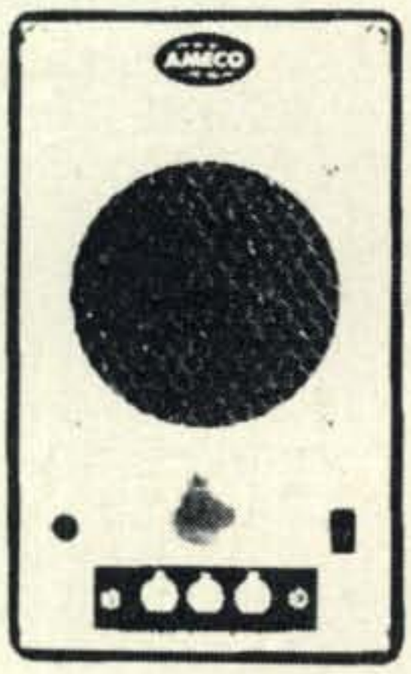
Model OKK, Kit (less batteries) . . . . . $ 9.95

Model OM, wired and tested, (less batteries) $15.20

Similar unit, but without CW RF Monitor Feature.

Model OCPK, Kit (less batteries) . . . . . $ 7.95

Model OCP, wired and tested, (less batteries) $10.50



AMECO UFO-621

VFO for 6, 2 and 1¼ meters. Transistorized oscillator plus built-in zener diode regulated power supply gives highest stability. Ideal match for Ameco TX-62 and other VHF transmitters.

Wired and tested $59.95

AMECO CODE PRACTICE RECORD SETS

Fastest, simplest way to learn code. Available in 33 1/3 or 45 rpm records. Sample FCC-type exams included for ham and commercial licenses.

	33 1/3	45
Jr. Code Course (100 series)	$3.95	$4.95
Sr. Code Course (101 series)	7.50	8.50
Adv. Code Course (103 series)	3.95	3.95
Extra Code Course (104 series)	3.95	—

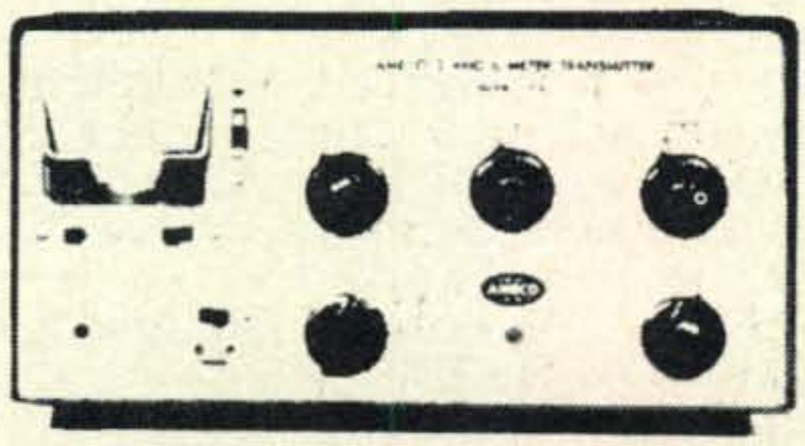
AMECO NUVISTOR CONVERTERS FOR 50, 144 and 220 Mc. HIGH GAIN, LOW NOISE

Deluxe line of Ameco VHF Converters uses three RCA Nuvistors to obtain an extremely low noise figure and high gain. A gain control is included to reduce the gain if necessary. There converters do NOT become obsolete when the receiver is changed.

Model CN-50W, CN-144W or CN-220W wired, (specify IF) $49.95

Model CN-50K, CN-144K or CN-220K in kit form, (specify IF) $34.95

PS-1 Power Supply, Wired and tested . . . $12.50



AMECO TX-62 TRANSMITTER

In response to the demand for an inexpensive, compact VHF transmitter, Ameco has brought out its 2 and 6 meter transmitter. There's no other transmitter like it on the market. 75 watts input, phone and CW. Built-in solid state power supply. Broadbanded circuits make tuning easy. Uses inexpensive crystals or external VFO.

Wired and tested $149.95

ARROW ELECTRONICS, INC.

- 900 Rte. 110, Farmingdale, N.Y. 516 Myrtle 4-6822
- 97 Chambers St., N.Y., N.Y. 212 - Digby 9-4411
- 525 Jericho Tpke. Mineola, N.Y. 516 - Ploneer 2-2290
- 18 Isaac St., Norwalk, Conn. 203 - 838-4877
- 225 Rte. 46, Totowa, N.J. 201 - 256-8555

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DX [*from page 73*]

QSL Information Correction

In the April DX Column we erroneously listed K6KA as the QSL Manager for VK9-KA. K6KA is the QSL Manager for VK9AK, Norfolk Island. QSLs for VK9KA go directly to him.

QSL Information

AP2AR–Via W8QWL.
AP5CP–Tiger Amateur Radio Club, c/o Dacca Signals, Dacca 6, Pakistan.
CR6LF–To W3HNK.
CT1OF–c/o WA3HUP, 105 June Drive, Camp Hill, Pa. 17011.
DL4FS–To W8IMZ.
EL8J–Via LA6OJ, P. O. Box 6, Blomsterdalen, Norway.
FB8XX–To F2MO, Michel Dort, Maison Helda, 64 St. Pierre d'Irube, P. P. France.
FB8ZZ–c/o F8US, 28 rue des Poilus, 78 Mesnille Toi, France.
F3KW, F5CZ, & FØFZ–Via WB2QXX.
FØRW–To K1IMP.
FM7WO–c/o WB2SSK.
FY7YR–Via VE3BYN, J. K. Ritchie, 449 Dovewood Drive, Niagara Falls, Ontario.
GC3UML–To G3UML, 95 Collinwood Gdns., Clayhall, Ilford, Essex, England.
GD6UW–c/o D.O.T.M., Box 7388, Newark, N.J. 07107.
HA5KBP & HA5KBX–Central Radio Club, P.O. Box 214, Budapest 5, Hungary.
HKØTU–Via HK3RQ.
HS3DR–To VE3DLC.
KC6BW–c/o WA3HUP.
KC6BY–Via WB9ALM.
KC6CS–To Milton Bennett, c/o Peace Corps, Truk, Caroline Islands 96942.
KG6IG–c/o K8WXV.
HV3SJ–Via WB2ETI.
KW6EJ–To W2CTN.
MP4TCQ–J. Hammond, 5 Polbroc Place, Kirkconnel, Sanquhar, Dumfriesshire, Eng.
MP4TJK–c/o DL7JK, Ampfingerstr. 35, 8 Muenchen 8, Germany.
OE2ZON–Via W8IMZ.
OESHGL–P.O. Box 567, Metropolis, Il. 62960.
OK5BU–To OK3BU.
PA9IF–c/o W8IMZ.
PYØEP–Via PY1MB
CRW, SM7DQC, and SM5EAC. 'Morokulia'
SK9WL–To SM7CRW, P.O. Box 24, 560 12 Waggeryd, Sweden Send 3 IRC's for return via the bureau, 4 IRC's for surface mail, and 5 IRC's for air mail.)
SVØWA, WI, WMM, WN, WOO–c/o K3EUR.
TA2E–Via VE3ABF.
TJ1AQ–Jorge Bernal, HK3HR, Apartado Aereo 90321, Bogota 8, Columbia.
TL8GL–To VE2DCY, 8900 Lacordaire, St. Leonard de Port Maurice, Quebec.
TT8AF–c/o Jean Fremon, P.O. Box 444, Fort Lamy, Chad.
UP2KBC–Via W3YI.
VK2BRJ/VK9–To W4WS.
VKØKJ–c/o W4HJE.
VKØWR–Via Operations Officer, USCG *South Wind*, c/o FPO, N.Y. 09501.
VP2AW–To W9FIU, 1707 W. Clark St., Champaign, Illinois.
VP2VY–Lester Scott, Box 2923, St. Thomas, V.I. 00801.
VQ9A/A–c/o W4ECI, 3101 Fourth Ave., South, Birmingham, Ala. 35233.
VR1L–Via Gary Stilwell, 7164 Rock Ledge Terr., Canoga Park, Calif. 91304.
VS5PH–c/o DL3RK, P.O. Box 262, 895 Kaufbeuren, Germany.
VS6DO–To VS6AL, 148 Waterloo Road, Kowloon Tong, Hong Kong.
WA4PUC/HS–To WA4PUC.
WB2VKB/KG6–John Dobson, 603-34th. St., Vienna, W. Va. 26101.
W8IMZ/LX–c/o W8IMZ.
YA2HWI–Via W9FLJ, 627 E. Main St., Barrington, Illinois.
YBØAR–P.O. Box 2761, Djarkata, Indonesia.
YVØAA–c/o VY Bureau.
ZA1AM–P.O. Box 29, Tirana, Albania.
ZD3A–Via W4ECI.
ZS3AW–To DJ3KR.
ZS3BS–c/o WB2RLK, 1603 Berkley Ave., Beachwood, N.J. 08722.
3A2CU–Via DL7FT.
3AØEJ–To DK1KH.
4S7DA–c/o W6FJ.
5A1TA–Via G3HCT, J. Bazley, Ullenhall, Solihull, Warwicks., England.
5A3TX–To WA3HUP.
5R8CJ–c/o WAØRZB.
6W/W4BPD–Via W4ECI.
7P8AB–P.O. Box 389, Maseru, Lesotho.
7P8AR–P.O. Box 194, Maseru, Lesotho.
7P8YL–P.O. Box 194, Maseru, Lesotho (XYL of 7P8AR).
8P6AY–To W4OPM.

73, John, K4IIF

Awards [*from page 87*]

Center Amateur Radio Society (SCARS) to contacts made during each manned Apollo Space Mission. A QSL sent to the club, WB-4ICJ, P.O. Box 21073, Kennedy Space Center, Florida 32815 along with 4 or 5 stamps to help the club meet expenses, are all that is required. The club presently operates on 3975, 7275, 14340 and 21340 s.s.b. with dipoles, and on the 15 meter Novice band. Operation begins at the time of the Saturn V space booster lift-off and continues until the members are exhausted (about 8-10 hours). Keep up with the Apollo launch dates to obtain the QSO and certificate.

The South Dakota Counties Award: South Dakota has been one of the few states not offering a "Worked All Counties Award" but the Sioux Falls Amateur Radio Club has changed this situation! The South Dakota Counties Award is issued for 2 way radio communications with stations in different counties in South Dakota. The AWARD is offered in three classes: 1st figure U.S. &

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Canada, 2nd figure for DX including KH6 & KL7. Basic or Class C-25/15; Class B-50/30 and Class A-67/67. The usual rules of MER, TCR and AOMB/M apply. The fee for the basic award is $1.00 and Class B & A 10¢ and a s.a.s.e. or 1 IRC. Send GCR list containing station and county worked and date. Other information such as band and mode should be listed if such an endorsement is desired. There is no time limit for the contacts. The award is also available to SWLs and is free to B/P. Send to custodian: Ed. Eastwold, WA-ØSBR, 1204 Laurie Drive, Sioux Falls, South Dakota 57103. Ed plans to do much mobiling this summer and promises to visit all South Dakota counties!

Notes

Many thanks to Paul, W4YWX for that photograph of the 14 County Hunters taken in Jackson, Mississippi March 8, 1969. They are all very active on the Independent County Hunter Net and I've had the pleasure of QSOs with, and QSLs from ALL!

Sorry, short of space, but do write and let me know—How was your month? 73, Ed., W2GT.

Apollo Converter [*from page 21*]

converter r.f. and mixer output coil, using the i.f. receiver S meter as an added aid.

After the signal alignment is completed, a diode noise generator may be used for getting the circuits touched up for best n.f. The overcoupled r.f. circuits have to be tuned back and forth for final best results on both r.f. channels. Lack of r.f. oscillation, a noise figure in the 2 to 3 db range, and good gain all add up to an evening's work on the alignment of the r.f. circuits.

If more modern transistors are used in the oscillator chain (an f_T of 700 or higher, and h_{fe} of much higher values than that of the 2N706 or 8), the series trap circuits could probably be eliminated. It seemed more economical to use the low priced surplus 2N706 types with the added trap circuits to get the required amount of oscillator injection to the f.e.t. mixer. The one or two volts of r.f. injection isn't always obtainable without some effort or expense.

The converter draws about 15 ma on the average from a 9 volt battery. It was also tested with a 12 volt supply and no changes were needed in the tuning adjustments. The oscillator injection, however, seemed to be a little high with a 12 volt power supply. ■

Spider In The Sky [*from page 60*]

v.h.f. ranging tone input is made up of two acquistion tone signals and one track tone signal. Accurate ranging is accomplished when the track tone signal from the CM is received and re-transmitted from the LM.

Antennas

The S-band steerable antenna (fig. 6) is a 26-inch diameter parabolic reflector with a point source feed that consists of a pair of cross-sleeved dipoles over a ground plane. Primarily this antenna provides deep-space voice and telemetry communications and deep-space tracking and ranging. This radiator functions over 174° azimuth and 330° elevation coverage and can be operated manually or automatically. Initial positioning is done manually to orient the steerable antenna within ±12.5° (capture angle) of the line-of-sight signal received from the earth. Once the antenna is positioned within the capture angle, it can operate in the automatic mode within the limits of its gimbal mount.

In flight, two omni-directional S-band antennas can be used; one forward, one aft on the LM. The radiators are right-hand polarized helicals that collectively cover 90% of the sphere at −3 db or better. As mentioned earlier there is also an erectable 10-foot parabolic surface reflector that is unstowed from a side compartment of the decent stage after landing.

The two v.h.f. in-flight antennas are also omni-directional, right-hand circularly polarized radiators. An 8-inch conical monopole wiht 12-inch radials is used between the LM and the spacemen equipped with the PLSS. The monopole is mounted on the top of the LM and is erected by an astronaut after landing the LM.

Summing up the communications system aboard the Lunar Module, it might be said that flexibility is the by-word, for in nearly every respect, redundancy of function has been "engineered-in."

Without waxing too poetic, it might be said that despite the superficial ugliness of America's "Spider in the Sky," its real beauty "lies in the harmony of man and his industry" that it represents.

In subsequent issues of *CQ*, the author will explore other areas of the American space effort, particularly those related to radio communications. ■

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Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $2.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

Subscribers to **CQ** are entitled to one free 3-line ad per month. Ad copy must be accompanied by mailing label from subscription copy of **CQ.**

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.**

POLICE — FIRE — AIRCRAFT — MARINE — AMATEUR — CB CALLS on your Broadcast radio with Tunaverter! Tunable-Crystal controlled! Guaranteed! Free Catalog. Salch Company, Woodsboro 9, Texas 78393.

10 METER amateur band linear R.F. amplifiers for base or mobile use. Base units: "Hornet"—200 watts PEP output—$104.95; "Raider"—400 Watts PEP output—$149.95; "Maverick"—2,000 watts PEP input—$244.95. Mobile: "Scorpion"—200 watts PEP output—$99.95; 'Bandit II"—up to 500 watts PEP output—$169.95. Electronic relay switching. All units designed for transceiver operation. State drive power when ordering. Dealer inquiries invited. D & A Manufacturing Co., 1217 Avenue C, Scottsbluff, Nebraska 69361.

SIX METER CLUB of Chicago, Inc. 12th Annual Hamfest Sunday, August 3, 1969—"Picnic Grove" on U.S. 45 in Frankfort, Ill. $1.50 Advance $2.00 at gate—Val Hellwig, K9ZWV, 3420 S. 60th Ct., Cicero, Ill. 60650.

39th—ARRL WEST GULF Division Convention August 15, 16 & 17, Amarillo, Texas. For an ideal summertime weekend of ideas, fellowship, entertainment, fun (and maybe good luck) you can't miss at $10.50 for registration. W5WX, Panhandle Amateur Radio Club, Box 5453, Amarillo, Texas 79107.

WRL's used gear has trial-terms-guarantee! KWM1—$299.95; Swan 240 $179.95; Galaxy Vmk2—$279.95 HX-50—$199.95; Invader 200—$249.95; Galaxy 2000 plus linear $329.95; Ameco R5 — $59.95; HR-20 — $79.95. Hundreds more. Free "blue-book". WRL, Box 919, Council Bluffs, Iowa. 51501.

T.V. Cameras — Heavy Duty Industrial. Trade-ins. These are beefed-up babies that really give "positively the brightest, clearest picture you ever saw!" Complete with Schematic lens and vidicon. $250.00. C.C.T.V. Center, Inc., Route 46, Little Falls, N.J. (201) 256-7379.

HAMFEST sponsored by Lancaster & Fairfield County ARC at Derby Downs one mile south of Lancaster, Ohio on BIS road, Route 793 June 8th. Gigantic Swap Shop. $1.00. registration with gifts every half hour. Lots of surprises. Good food at reasonable prices.

CLOSEOUT SALE: Three transistor converters, 50-54 mhz in, 14-18 mhz out. Crystal, $6. Adjustable frequency, $5. Syntelex, 39 Lucille, Dumont, N.J. 07628.

COLLINS 75S-3 (serial no. 12,341), front end Mod. by VCZ, mint condition, $390. E.C. Schmults, W2VNA, 361 Old Roaring Brook Rd., Mt. Kisco, NY Tel: (914) MO 6-7378.

FOR SALE: Heath SB401 with crystals, factory checked, never used $200. Elmac, AF67 with home-built power supply $50. E. K. Leavenworth, R#3, Goldwater, Michigan 49036.

WANT TO BUY early radio receivers, speakers, parts, magazines, call books for amateur museum Erv Rasmussen, W6YPM, 164 Lowell Street, Redwood City, Cal. 94062.

NEW! Call, name, address printed on gummed stickers 500 only $1. Free samples. W0CFL, Dolores, Colorado 81323.

FOR SALE: Hallicrafter HT 37 with Dow Key relay ready to go, also SX 101A receiver. Excellent condition. Manuals supplied. $350 takes both. Cannot ship, sorry. W2GIE. Phone 212-926-3961.

FOR SALE: Lampkin Frequency Meter type 103-B perfect condition $150.00. Receiver-APR-1, 300 to 1,000 MC. $25.00. International KB-1 6 meter transceiver operates on 110 V.A.C. or 12 V.D.C. needs some work. $40.00. Don Moler, 1342 Whitney Ave., Hamden, Conn. 06517, 288-7236.

HAMFESTERS RADIO CLUB, Chicago, Illinois, proudly announces its 35th Annual Midwestern Hamfest, Sunday, August 10th at Santa Fe Park, 91st & Wolf Road, SW of Chicago. The Hamfest features manufacturer and distributor exhibits, swappers row, awards, clowns and games for children, and activities for the XYL. Featuring the Swan 500C with AC PS, the Hamfest climaxes "Illinois Amateur Radio Week August 3 thru 10th". For information and tickets write Tom Ondriska, WN9YZW, 6609 South Kedvale, Chicago, Illinois 60629.

NOMINATIONS are due for 1969 Illinois Amateur of the Year award to be presented at the 35th Anniversary Hamfest. Hamfesters, 6000 South Tripp, Chicago, Illinois 60629.

3 Plastic Holders will frame and protect 60 cards, $1.00, or 10 Holders $3.00. Prepaid and guaranteed. Patent 3309805. Tepabco, Box 198Q, Gallatin, Tennessee 37066.

RTTY gear for sale. List issued monthly, 88 or 44 Mhy toroids, uncased, five for $2.00. Postpaid. Elliott Buchanan and Associates, Inc., 1067 Mandana Blvd., Oakland, Calif. 94610.

TEST EQUIPMENT WANTED: Any equipment made by Hewlett-Packard, Tektronix, General Radio, Stoddart, Measurements, Boonton. Also military types with URM—( ), TS—( ), SG—( ) and similiar nomenclatures. Waveguide and coaxial components also needed. Please send accurate description of what you have to sell and its condition to Tucker Electronics Company, Box 1050, Garland, Tx. 75040.

FOR SALE: Drake 2B with 2BQ Q multiplier, Heath DX 60 and HG10. Need money for school, make me an offer. WA8LRU, 1501 40th Avenue, Menominee, Michigan 49858.

MANUALS—TS-323/UR, TS-173/UR, TS-186D/UP, BC-638A, R-274/FRR, $5.00 each. Many others. SASE brings reply. Sam Consalvo, 4905 Roanne Drive, Washington, DC 20021.

FOR SALE: 75A4 Vernier Knob, Noise blanker .8 & 3.1 KHZ filters, external compression amplifier 200HZ filter, $350.00. GPR 90 Rcvr Xtal calibrator, outboard product protector, vernier knobs, Tapetone converter 50-54 MHZ—$250.00. Tristo galv. tower 54' 10-15-20 Hygain Beam, rotator. You dismantle, $150.00. Shipping and packaging receiver not included. Carl Thorsell, 1195 E. 77th St., Kansas City, Mo. 64131.

JOHN INVADER 2000 and two spare PLI75S $600., Hammarlund HQ180C and noise blanker $300, 2M Xmtr $50, 2M converter $50, electronic key $50. James Long, WA4LYK, 1690 Fairview Ave., San Luis Obispo, Cal. 93401.

LINEAR AMPLIFIER—1200 watts P.E.P. 80-10, compact. $135. Photos on request. Mort Caldwell, W8IFN, 128 Parkview, Wesyover, West Virginia. 26505.

SWAP: 420 mc. Xcvr kit. Also 60 transmitting receiving tubes. Want R-77/ARC-3 Rcvr and A.C. power supply. Mike Bruski, 1039 W. 7th Ave., Oshkosh, Wisconsin 54901.

See page 110 for New Reader Service

WANTED: Antique transmitting and receiving tubes made prior to 1920. W2EZM, 431 Oakland, Maple Shade, N.J. 08052.

MOTOROLA T44A-6A/Trans. Tu204 Diagram and conversion data to 432 Mc. FM. wanted. Thowe, 10734 Dunaway, Dallas, Texas. 75228.

FOR SALE: HQ-170-C Hammarlund receiver late serial 5213 with 24 hour clock, bought new, mint condx, $150, K4CEB, 86 Hickory Grove, Concord, N.C. 28025.

PARTS FOR SALE: Tubes, meters, large capacitors, etc. SASE for list. Bob Sullivan, W0YVA/4, 4423 N. 17th St., ARL, Va. 22207.

GALAXY OWNERS: Modify Galaxy III, V, and Mk-II to higher power of Mk III. SASE. J. Kreska, 2817 Lakewood Dr., Garland, Texas 75040.

WANTED: Mint SX-146. Prefer with Xtal Cal and CW filter. Paul Adams, WA7KLA, 4126 N. 48th Drive, Phoenix, Ariz. 85031.

FOR SALE: Sylvania 101A TV camera, excellent condition, complete w/lens, manual. $250. H. Beene, Box 638, Mesilla Park, New Mexico, 88047.

FOR SALE: Govt. Surplus, New. 230 mc amplifier AN/TRA-19 with P.S. manual. $29. no shipping, please —local pickup. W2EEJ, 821 Rutgers Road, Franklin Sq., N.Y. (516) IV 6-0809.

WANT: op. manual-scheme—Viking II. Copy or original State terms. PLEASE. Box 502, Lathrop, Calif. 95330.

SELL Deluxe, Rack Mount TT/L-2, With scope indicator, fully auto. $175. W4AIS, 7 Artillery Taylors, S.C. 29687.

CALIFORNIANS, Sierra Hamfest, Bowers Mansion between Reno & Carson City, Nevada, August 23, 1969 QSP QSL for details NARA, Box 2534, Reno, Nev.

REALSITIC-DX-150: Received as Christmas present; for sale. No reasonable offer will be refused. Jack D. Gollahon, W9TLL, 955 E. Wood Street, Decatur, Ill. 62521.

WANTED: Complete set of QST mags from 1916 to 1932. Also want QST binders. L. Mueller, 12700 Elliott Ave., SP 287, El Monte, Calif. 91732.

WANTED: Johnson 6N2 VFO factory wired preferred, Tom Brown, WB6DHZ, 2451 East Glenoaks, Glendale, California 91206.

KWM-2 with PM-2 ac supply and CC-2 carry case $750. Koch P.O. Box 182, Mars Hill, N.C. 28754.

ELECTRONIC COUNTERS: Berkeley Mod 510. Berkeley Mod 1556 with Mod 1450 Digital Printer. SASE for info. W9TKR, 505 South Elmwood, Waukegan, Ill. 60085.

WANT: Good Cassette Tape recorder. Will trade xmtg. tubes, test equipment, etc. G. Samofsky, 201 Eastern Parkway, Brooklyn, New York 11238.

FOR SALE: In mint condition, original cartons, with all cables and additional xtals to cover WWV and commercial RTTY stations; HT-44, SX-117, and P-150-AC Power supply, $425.00 and will pay shipping. W5MN, Post Box 1835, El Dorado, Arkansas 71730.

FOR SALE: Collins 62S-1 converter for 6 & 2 meters. Absolute mint condition used only three hours. Original packing and manual. $600.00. W1MZB, F. J. Coyle, 45 Sunset Road, Bristol, R.I.

FOR SALE: Heath 10-21 scope. Excellent condition. Extras! $37.50. Money order only. William Karl, 24 Mill Street, Coopertown, N.Y. 13326.

WANTED: Operating manual es schematic for Barker & Williamson 5100 xmitter. Also B & W 51-sb exciter. State condx and price. B. Rahn, 1511 E. Mann, Little Chute, Wisconsin. 54140.

MICROPHONE — D104 with Push-to-talk stand — like new — $18.00. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805. 914-NE 3-7077.

WANTED: Early radio tubes with seal off tips, Sodion S13, S14, D21, and 50 watters. W9LGH, 610 Monroe Ave., River Forest, Ill. 60305.

WANT SWAN Model 22 Dual VFO adaptor. Don Thomas, 813 N. 4th Street, Millville, N.J.

SAROC Fun Convention January 7-11, 1970. QSP QSL card with ZIP for details to W7PEV, SAROC, P.O. Box 73, Boulder City, Nev. 89005.

WANTED: SR-400, HA-20, VFO and PS-500 AC power supply. Must be in good condition. WB4KQV, 805 Burton Street, Rocky Mount, N.C. 27801.

FOR SALE: HT 37 100 watts HT 41 1000 both $375. Heath SB 300 rcvr. $175. W2FEI. 516-295-5411.

WANTED: Decent receiver & a matchbox. VE6PR, Box 892, Claresholm, Alta, Can.

FOR SALE: Heath HR-10, excellent electrical and physical condition, expertly wired, with xtal calibrator, $65 or best offer. WA1HUH, 10 Woodridge Rd., Wellesley, Mass. 02181.

FOR SALE: Wheatstone oiled 15/32" perferator tape for Bohme equipment. P. L. Lemon, 3154 Stony Point Road, Santa Rosa, Cal. 95401.

FOR SALE OR TRADE: HW-32 Heath 20 meter transceiver $70. Geo. Botsford RR #1, Ainsworth, Nebr. 69210.

QST Mar. 43 to Dec. 65, 25¢ per copy plus postage or $10. the lot. You pick up. W3IND, M. P. Ekas, 914 Claire Avenue, Huntingdon Valley, Pa. 19006.

WANTED: HRO-50 plug-in- coils. Send list and prices. Ed Wagner, WA9SZH, 6307 East Gate Rd., Monona, Wis. 53716.

SALE—Viking Ranger II-6-160 transmitter—Factory wired—original price $359. Sell for $95. Geffner—48 Park Ave., E. Merrick, N.Y. 11566.

WANTED: Books on VFO's—state price—Also want a good HRO-5 or HR050. Wells Chapin, W8GI, 2775 Seminole Rd., Ann Arbor, Michigan 48104.

MICROWAVE SPECTRUM ANALYZER Vectron SA-25 need info on it. Sell perfect 32V3, Omage Orths. CVM5 Mod Xfmr W8EJ, 7056 Noble, Cincinnati, Ohio 45239.

WANTED: Waters rejection tuning kit for 75S-1. Also 70K-2 P.T.O. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Massachusetts 01056.

FOR SALE: Heath VTVM model IM-13 brand new, used only 2 times $25. Telrex 5 element 2 meter beam model 2M-5C $10. Write Robert Simon. 1694 Linden Place, No. Merrick, N.Y. 11566. Call 516-538-3250.

FOR SALE: HT-37, excellent $175, Norelco 101 recorder $25, both with manuals. Tom Fitzpatrick, 1923 Oxford Circle, Lexington, Ky. 40504.

NOVICE XTALS: 2-80M, 4-40M, and 5-15M. All 11 xtals $10. postpaid. AM Fox, Box 895, Greeley, Colo. 80631.

T.V. Sweep Generator FM-TV-AM-precision mod. E 400 Mint condition. Mayford C. Ogle, 240 Reagan Drive, Gatlinburg, Tenn.

WANTED: Will pay a dollar a piece for old QST binders. Bro Gerald Malseed, 8102 La Salle Rd., Towson, Md. 21204.

SELL OR TRADE: HX-50, Millen KW Transmatch and P&H DI-1 Scope. Want SSB 40 Meter orall band transceiver. Les Turner, W7BKQ, 2213 Sunland Ave., Las Vegas, Nevada 89106.

SELL HW-16, perfect $95 or best offer. Ant. Tuner, '67 handbook, $20. Tom Ginkel; 820 Center; new Ulm, Minn. 56073.

SELL OR TRADE: Very good 51J-4. $450.00. or SSB Xcvr. EP2CB POB2000 USADO, US Embassy APO NY NY 09205.

See page 110 for New Reader Service

NOVICES: Drake 2NT xmtr—$95. Mint cond. Never put on air. Dale Merkey, Route 2, Myerstown, Penna. 17067.

FOR SALE: Mint Hallicrafters S-108 rcvr. Excellent Novice equipment. 80-10 mtrs. $100. or best offer. WN4MDA, Sam West, 623 S. Broad, Portland, Tenn. 37148.

SELL: CREI Electronics Engineering Correspondence course, complete $50.00. Glen Richie, R#2, Box 149, Salem, Virginia 24153.

FOR SALE: Polycomm 6M transceiver with mic, 117 VAC and 12VDC, VFO or xytal controlled—$125. Hallicrafters HT-18 VFO $25. Globe Chief Deluxe 80-10M, 90W, CW xtal transmitter—$30. All above with manuals. L. Iannone, M.D., 100 High Street, Buffalo 14203 N.Y.

WANTED: Following Heathkit xmitters needing work or repairs: AT-I, DX-20, DX-35. Stan W8QKU, 2748 Meade, Detroit, Mich. 48212.

FOR SALE: BC-779B (Super Pro) with home brew power supply $125.00. Heath AT-1 and AC-1 $35.00. All excellent. George Wright, Jr., 620 Emmons, Dalton, Ga. 30720.

Back Issues of Electronics for Sale at $6 per volume 1941-1968. FW Chapman W8TKR, 1367 Villa Rd., Birmingham, Mich. 48008.

SELL: Ham-M rotor with 50 feet cable rebuilt $70.00, need 2API CRT. George H. Schade, 7015 N. 4th Place, Phoenix, Arizona.

FOR SALE: HQ-180 with clock and speaker mint condition. $225.00. W9ALP, 4522 S. Kedvale Ave., Chicago, Ill. 60632.

FOR SALE: Heath HX-11 cw transmitter, 50 watts, like new, $34.00. Cal Enix, W8EN, 104½ W. Chicago Rd., Sturgis, Mich. 49091.

ESTATE SALE: Factory-wired Johnson Ranger, $75. Hammarlund HQ-110, $100. Good condition. W. Pemberton, WA9CDP, 5800 Twickingham, Evansville, Ind. 47711.

FOR SALE: One Gonset G-50 Transceiver for 6 meters. Mint and guaranteed condition, Best offer. K3YMN, 2185 Sampson Street, Pittsburgh, Pa. 15235.

OLD OLD TIMERS CLUB needs you. Any amateur licensed for forty years is eligible. Send your QSL card to Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, NE, Cedar Rapids, Iowa.

WANTED: Gonset G-76 AC power supply. Ed Bernash, WA2SBT, 6137 Lake Ave., Orchard Park, N.Y. 14127.

WANTED: QSOS with Boy Scouts in Idaho & Wyoming for WAS-BSA. Jay WN2HJY, 616 Pheasant Lane, Endwell, N.Y. 13760.

SELL: H/P 560A digital printers; H/P AC-4A indicating decade counters. 3 each; PL-172 Linear with spare new tube. WA4RGL, 1507 White Oak Court, Martinsville, Va. 24112.

FOR SALE: Viking Challenger $58.00 or best offer, in good condition plus shipping; L. Covey, 238 Jenness St., Lynn, Mass. 592-1657. KIJAR.

VALIANT: FW 720 $120. EICO 720 F/W—$35. Heath HG-10 $25, Heath Balun $5. All manuals. Coley, K4MPE, 3208 Yanceyville, Greenboro, N.C. 27405.

HELP FORMER DXs become W: Write your U.S. Senator and House Repres. urging support for Sen. Goldwater, K7UGA's Senate Joint Resolution 27. Ex YO2BO.

FOR SALE: New Swan DC & AC power supply. $110.00 VOX new $200.00. W4ALG, prepaid delivery. M. Johnston, 2625 University Blvd., Tuscaloosa, Ala. 35401.

FOR SALE: National NCX-5, Mk. II; like new, HB AC supply, $395 firm. Will ship original carton expense. Bill Campbell, W5GPQ, 8638 Twelve Oaks Dr., Texas City, Texas 77590.

WANTED: Collins gear at bargain price. Will pay cash if price is right. W4AIS, 7 Artillery Rd., Taylors, S.C. 29687.

SELL: HRO-7 w/Xtal Calibrator. Old, but it made DXCC for me. Local only $50, W6GTE, (213) AN 8-8868.

SELL: QST, CQ, 73 any amount; wanted handbook. E. D. Guimares, Jr., WAIBFD, 17 West End Ave., Middleboro, Mass. 02346.

B&W 5100 and 51SB complete, HE45B, Heath twoer Chester Ludlam WA5CMC, 2309 Bullington, Wichita Falls, Texas.

WANTED: FIL Xformer 2.5V 10A 10KV INS, Hallicrafters Sky Buddy or Sky Champion, Amperex HF-100 Tube. W7JI, 235 E. 15th Street, Tempe, Arizona. 85281.

DONATIONS wanted for North Springs Amateur Radio Club. Need old parts, receivers, trans., tubes, magazines, Tech. books, etc. Will you help get these interested high school students on the air. Send donations collect to North Springs Amateur Radio Club, c/o Carey Coggins, 7125 Hunters Branch Drive, Atlanta, Georgia 30328.

NEW ENGLAND HAMS! The Portland Amateur Wireless Association Meets every Tuesday at 7:30 PM, 227 Spring Street, Portland, Maine. Coffee and Donuts, Code and Theory Instruction, Eyeball QSO's.

WANTED: Early 1920's battery operated receivers and early wireless equipment. Also want QST and CQ binders. Radio equipment need not be in working condition. State price. K0SVJ, D. T. McKenzie, 1200 W. Euclid, Indianola, Iowa.

FOR SALE: Johnson signal Sentry $11.00., New Dow Key Relay 110v $12.00, Heath QFL, $5.00. Valiant 1 needs work, $75.00. Bill Bailey, W0FNK, Elk Creek, Mo. 65464.

FOR SALE: SX 100 Hallicrafters Receiver—excellent condition—asking $150., phone 201-337-8352, write W. Lockmuller, 11 Stone Fence Road, Oakland, N.J. 07436.

FOR SALE: Forty MTR mobile CW rig with 12 volt pwr supply $30., VFO see Dec. 67 CQ, $20., New Calif. perf Cabinets 5½ x 8½ x 11, $5.00 each. W6BLZ, 528 Colima Street, La Jolla, 92037.

ONLY $325.00 buys mint Galaxy V Mlc III, purchased last December. Less than 5 hours on the air. Also speaker console—factory cartons. W2DAP, 21 Twisting Drive, Lake Grove, N.Y. 11755. Ph. (516) 588-7598.

WANTED: Johnson Navigator C. W. transmitter. W8PBO, 45265 Fairchild, Mt. Clemens, Mich. 48043.

WILL PAY CASH $150.00 for late model, clean, SX117 with xtals all bands. W4AIS, 7 Artillery, Taylors, S.C. 29687.

CANADIANS: Expert amateur equipment repairs by gov't licensed radio technician and amateur (VE6TW). Bob Fransen, Box 197, Sherwood Park, Alberta.

COLLEGE Expense, Apache xmer and manuals, exclt. condition $80. Vibroplex Champion $15. Charles Melancon, WA5QQB, P.O. Box 20272, Baton Rouge, La. 70803.

FOR SALE: EICO transceiver with AC supply $120.00 HE-45 6 meter transceiver $35.00. Heath Seneca 6 & 2 M. transmitter $100.00. Pierson KE-93 Mobile Rcvr. with DC supply $40.00. Eugene Prince, 720 Maple Street, Camden, Ark. 71701.

WANTED: Coil set "AA" for HR060 state best price. Cedric Reitnauer, RDZ, Boyertown, Pa. 19512.

WANTED: Model 28 TD LxD with cover Radiola 17, state condx. and price. R. Mendelson, 27 Somerset Place, Murray Hill, N.J. 07971.

FOR SALE: Collins KWM2, P M-2 A.C. supply, 516 El D.C. supply, mobile mount. Make cash offer. W9ATU, 6533 No. Sand Street, Milwaukee, Wisc. 53223.

See page 110 for New Reader Service

WANTED: Sturdy 60 ft. crankup, Reno/Sacrento area. Heinz, K7KHA, 2530 Tybo, Reno, Nevada 89502. 702-358-4532.

LAMPKIN: 205-A F.M. Modulation Meter, new quad scale model, perfect $200. BC-221 W/Book $35. Heath PS-3 Bench 0-500V P/S $18. W. Davis, 4434 Josie Avenue, Lakewood, California 90713.

WANTED: Manual or parts for "periguard" intrusion detector manufactured by Westinghouse. Will swap 28 KSR teletype for above unit. Ans. all letters. J. Thomsen, W9YPV, 8280 S. Tennessee, Claredon Hills, Ill. 60514.

WANTED: Early model HRO with band spread coils, and national SRR-receiver with 5 meter coil, Jeff Noel, K4ZKU, Nokesville, Va. 22123.

EXCELLENT GEAR—Collins 51J-3 $400.00, NCX-5 MKII with A.C. Supply and calibrator $525.00. Remote VX-501 VFO for the NCX-5, New— unused—$150.00. Much more—stamp for list. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022.

CE100V orig. crate, spare finals $295, HE45B 6M $50, Matchbox 275W wsWR new cond $60, G76 w/DC $125 Art Ford, 6 Stoothoff Rd., East Northport, N.Y. 11731.

HP13 $49, SWAN 175 $90, NC100XA $45, RME4350 $75, HE80 w/2M $60. Art Ford, 6 Stoothoff Rd., East Northport, N.Y. 11731.

SELL: Heath Marauder HX-10 and Heath Chippewa KL-1 S'S'B exciter and Lin Amp. Local only. W60RS, P.O. Box 416, Arcadia, Cal. 91006.

FOR SALE: DX100, Central 20A with VFO, Elmac AF67, PMR7 and M-1070 PWR supply, Hallicrafter S53 VFO and NBFM. M. Schwartz, 166-36 24th Road, Flushing, N.Y. 11357.

HEATH HM 10A Tunnel Diode Dipper; mint condx, $35. or trade for HG-10A or B VFO, no checks returned without SASE. WN3CEN, 9304 Viers Drive, Rockville, Md.

FOR SALE: Hy Gain 6mtr 6 element beam with AR-22 Rotor & wire—$39.95. Good condition. Geffner, 48 Park Ave., East Merrick, L.I., N.Y.

RTTY INFORMATION for the Amateur interested in RTTY. F. DeMotte, P.O. Box 6047, Daytona Beach, Florida 32022.

VHF-UHF DX: 8 year old club now in 2nd year with new format. Over 30 pages per month: photos, DX reports, features. Year $3.50—US funds. Samples 30¢. WTFDA, Box 5001-Q, Milwaukee, Wisconsin 53204.

FOR SALE: BC 348R-$40, and S38-$20. instructions for both. Loomis, 4328 State Road, Saginaw, Mich. 48603.

Hi-Plains Hamfest at Plains Kansas on May 18th at grade school gym. Covered dish dinner & large swap table. Further details W0NIO, WB Catlin, Box 412, Buffalo, Okla. 73834.

1969 ARRL S.W. Division convention. San Diego, California. October 17-19, 1969. P.O. Box 1469, San Diego, Calif. 92112. Don't miss it. WB6SQZ.

FOR SALE: Valiant 1 + SB10 $100. DX60 + HA90 VFO $60 DXIDO $60 NC155 receiver $100 All Gud-WA3EWQ—5636 Westgate Road Lanham, Md. 20801. Local pickup.

FOR SALE: Heath HW100 and HP23 $275. Galaxy III AC and DC supplies $275. Duane Van Winkle, K0FJR, Washington, Iowa. 52353.

CENTRAL ELECTRONICS 20A with VFO and Book $115. Swan 250 with AC supply mint $300.00, TR44 Rotator mint $50. W5SYB, 5000 Hall Amarillo, Texas. 79109.

FOR SALE: HA 460 6 mtr Transcur, built-in AC DC supplies w/ant., manuals spacetubes, mtg bracket, cables, used to 50 hours. $90. Dr. R. Redman, 8500 Fairburn Dr., Springfield, Va. 22150.

WANTED: Person to modify Heath Tower as indicated in May 1968, QST and QST February, 1969. State your complete price for service and parts. Prefer you pickup. R. Hajdak, WA3JDT, 4 Homer Street, Greenville, Pa. 16125.

MAY I BORROW circuit diagram of R77/ARC-3 surplus 2-meter recvr. from someone? Guar. return. Pay postage both ways. W6RNE, M. Garey, 932 Jefferson, Los Banos, Cal. 93635.

FOR SALE: R-388, Galaxy V, AC-DC, 15 and 28 RTTY all equip. like new WA0KLC, 315 E. 20, Grand Island, Nebr.

WANTED: Cliff-Dweller, 40/80 rotatable dipple. R. Schweizer, WB2PCF, 240-27-145 Ave., Rosedale, L.I., N.Y. 11422. (212) LA 8-6124.

Mr-400 Mobile mount for SR400, $40. J. Swank, 657 Willibar, Washington, Ohio 43160.

FOR SALE: Juliette APB-11 H AM-Police Rcvr. Less than month old, exl. cond. With case and earphone, $10. R. Urban, 909 Breezewick Rd., Balt., Md. 21204.

SELL: Feq. meters, BC 221-T, TS-174/U, built in regulated AC supplies, $75 ea. Watt meter 1000 PEP $20. Carl, 15563 MuskingumBlvd., Brook Park, Ohio 44142.

GARAGE DOOR Recvr. and transmitter. New in carton! Alliance Mfg. Model RCNB code L, channel J. $20. WVASI, 15 Kensington Oval Isle of Sans Souci, Davenport Neck, New Rochelle, N.Y. 10805.

"HOSS TRADER ED MOORY" says if you don't buy your Ham gear from him, you might pay too much. Shop around for your best price and then call the "HOSS" before you buy!
Close Outs on new equipment! New Galaxy 5 Mk III, $295; Early model Swan 500C, $395.00; New Swan 410C VFO and 22B VFO adaptor, (Reg. $147.00) Cash price $89.00; Hy-gain TH6-DX Beam, $99.00; New Rohn 50 ft. Heavy Duty Foldover Tower PREPAID, $195.00; New Mosley TA-33 Beam and Demo Ham-M Rotor $179.00.
USED EQUIPMENT: 75A-4, $349.00; HQ-170, $149.00; Hallicrafters SX-117, HT-44 and supply $425.00; TR-4, $409.00; T4-XB, $339.00; R4-B, $299.00; Ham-M Rotor, $79.00. "ED MOORY", Wholesale Radio Co., Box 506, DeWitt, Arkansas, 72042. Phone (501) 946-2820.

BTI-LK-2000—$500.00. Frank Bahw, W8QVR, McComb, Ohio.

POWERSTATS: O-130 Vac 60 cycle at 22.5 Amps $40. New unused 0-230 Vac 60 cycle at 9 Amps $30.00. B. H. Hart, Woman Lake, Pine River, Minn. 56474.

FOR SALE: HT-37 CW/SSB/AM transmitter at $225. Heathkit Apache CW/AM transmitter at $100. Arc-1 transceiver at $25. All in good condition with manuals. Art Reade, W6DHW, 3530 Damien Ave., #177, La Verne, Cal. 91750.

FOR SALE: Eico 753 pwr. supply & calibrator in excellent condition. Also, 50' R68/V and W2AV balun. All for $135, plus shipping. Don Bilderback, WA7ACF, Seattle Pacific College, Seattle, Wash. 98119.

WANTED: Direct current ampere-hour meter. Art Ferguson, VE3HP, 1534 Stoneybrook Cres, London, Ontario, Canada.

FOR SALE: Collins mechanical filter; 2.1 kc bandpass $10.00; 70K-2 5-line VFO $15., 4CX1000A $35.00; pair matched 4CX350'S $15. W9KYZ, 615 E. Otjen St., Milwaukee, Wisconsin 53207.

HW-32A & HP-23A, HRA-10-1 $145, AN/SRR-13A Rcvr. $250., Tecraft 50MC. Conv. $45, Twin City TU 430, TR-106 $70. Write for details. G. Confrey, Killingsworth, Conn.

FOR SALE OR SWAP: 2 Motorola handie talkies FPTR1-307050 MHZ with handsets $50. J. Wasiewicz, 229 Sarles Lane, Pleasantville, N.Y. 10570.

EXCESS Ham, Hi-Fi gear, TV accessories must go. Stamp for list. 1705 Kaywin Ave, Bethlehem, Pa. 18018.

See page 110 for New Reader Service

WANTED: QST magazines for last quarter 1967 and all year 1968— L. M. Covey, 238 Jenness St., Lynn, Mass. 01904. K1JAR.

SALE OR TRADE: Excellent HW-12A for $90.00 or trade for HW-16. Sam P. Carroll, 907 S. E. 48th, Olympia, Wash. 98501.

WANTED: Comdel Speech Processor with manual H. B. Smith, Box 452, Birmingham, Mich. 48012.

I HAVE some toroids suitable for DC to DC converters to 25 watts output. Free information. Henry Cates, 8815 Bangert Pl. Berkeley, Mo. 63134.

WANTED: 220 mc. transmitter Tecraft or equivalent, W2CVW, 13 Robert Cir., S. Amboy, N.J. 08879.

TRADE HT-40 Xmitter, HR10 Rcvr, need sweep mrkr. gen, HV metered probe, all band dipole, Grid dipper. Kuntaman 6350 Hampton, Portage, Mich. 49081.

FOR SALE: KWM-2 #15220 (new, 10/68), 516F-2, $895. 312B-5, $250. 75S3-B, 0.5 kcs, $500. GSB-201, $200. 75A-3, $225. James Craig, W1FBG, 29 Sherburne Avenue Portsmouth, N.H. 03801.

FOR SALE: Johnson Adventurer 50 W. cw 80-10 with manual $25. Frequency Meter BC-221-M with calibration and manual $75. AM Fox, Box 895, Greeley, Colo. 80631.

WANTED: conversion data & diagram for T44A-450 Mc Motorola to 432 Mc. Thowe, WA5TPT, 10734 Dunaway, Dallas, Texas. 75228.

NC300/cal & spkr—$200.00. Viking II w/VFO $100. HE45A—$85.00. ART13 make offer. K5ZUV, 911 S. Liberty, Okmulee, Oklahoma 74447—will ship.

SELL CQ back issues 1957 through 1968. Also Popular Electronics. Offers? F.O.B. W6CZP, 850 Groff St., Pomona, Calif. 91766.

WANTED: Any equipment for ham club. Can't pay much, donations appreciated. Dave Naatz, Immanull College, West Grover Rd., Eau Claire, Wis. 54701.

WANTED: EICO 75A3, Heathkit HW-12 or HW-22. State price and condition. C. Tunwall, W0FWF, 2220 N. Zenith, Davenport, Iowa. 52804.

211 OR 311 TUBES: Need source. WN4KKM, 521 Woodlawn Ave., Calhoun, Ga. 30701.

ANTIQUE: Collector item Kolin B. Kennedy Battery RCVR issued Oct. 6, 1914. Make offer or write for details. Bill Shipley, WA4WTO, 303 Oak Ave., Cookeville, Tenn. 38501.

BARGAIN: Pair unused 4CX250B's. Plus Rotron Fan and 8 1,000 PIV/1 Amp. Tophats, all for $25.00, and shipping. Samofsky, 201 Eastern Parkway, Brooklyn, New York. 11238.

WANTED: B & W Coils BCL or BVL all bands, Amperex HF100, Taylor T200 and 822. K7JI, 235 E. 15 St., Tempe, Ariz. 85281.

WANTED: Source of parts for a 1954 RCA model CT-100 color TV (CTC2 chassis) B. G. Mahrenholtz, K4-QQK, 307 Old Fort, Tullahoma, Tenn. 37388.

TRADE: One Collins Lavoie double pulse generator like new, one Berkeley 5510 Frequency counter and, one 511AD Tektronix scope. All for a 75A4 or 75S3 with three filters. W5VJP, P.O. Box 582, Fairview, New Mexico. 87532.

FOR SALE: HW-16, **perfect,** $95. or best offer. Also all-band ant. tuner from '67 Handbook $20. Tom Ginkel, WA0AHV, 820 Center, New Ulm, Minn. 56073.

WANTED: 8 cond. ham-m rotor control, sell mint T-150-A, WA0VBM, Bruce Grumstrup, 1724 S. Bluff, Clinton, Iowa. 52732.

FOR SALE: Viking 500, al condx. manual, orig. cartons. Best offer F.O.B., Omaha, Nebraska, Lee Menshik, W0NNW, 4538 Polk, Omaha, Nebr, 68117.

SELL: Three unused perfect 826 tubes for $8.50 each. H. A. Roddick, 5105 East Sunset, Yakima, Wash. 98901.

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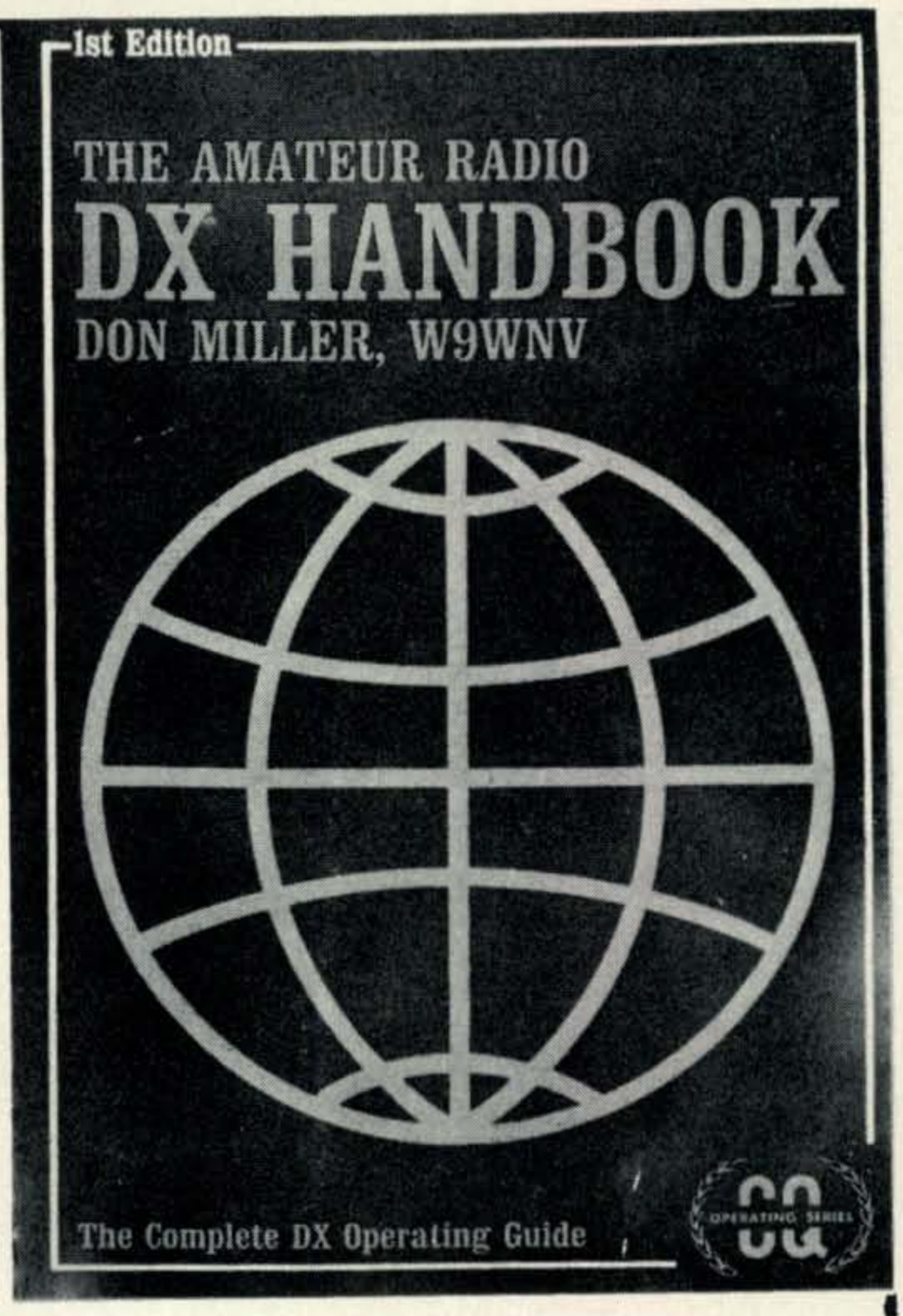
The Amateur Radio DX Handbook is off the presses and on dealers shelves. It is not a compilation of past articles appearing in CQ nor is it a discourse on amateur politics or "who did what to whom." It is in fact a 200 page volume detailing every aspect of working DX and understanding how you did it. It is the difference between occasionally working DX by accident and being a consistently good DXer.

The chapter headings listed below only give a general idea of the type of material covered in great detail throughout the volume. This information is not only vital to American amateurs but is applicable to every active amateur in the world.

Inspect a copy at your local distributor or use the coupon below to order a copy direct.



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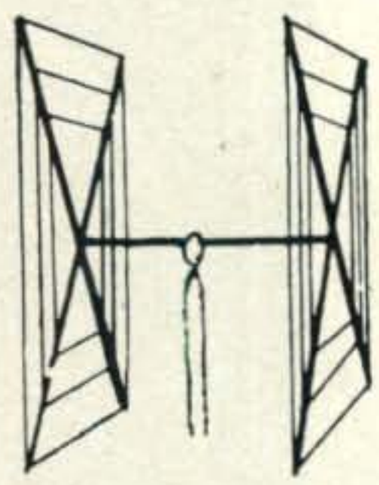
Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount: uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



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Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

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Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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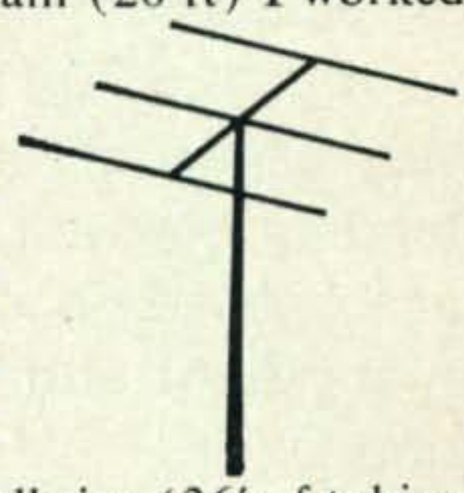
1805 Purdy, Dept. CQ, Miami Beach, Fla. 33139

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$19	4 EL 10	$18
3 EL 20	25	7 EL 10	32*
4 EL 20	32*	4 EL 6	18
2 EL 15	15	8 EL 6	28*
3 EL 15	19	12 EL 2	25*
4 EL 15	25*	*20' boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

HOW TO ORDER: Send money order. We ship immediately by REA Express, charges collect. Gotham ham and CB antennas are available for pick-up in: Rockford, Ill.; Orange, Calif.; Cleveland, Ohio; Daytona Beach, Fla.; Calgary, Canada; Hannibal, Mo.; Indianapolis, Ind.; South Bend, Ind.; Oklahoma City, Okla.; and in the Benelux Countries and Australia. Write for name and address of franchised distributor. Other cities open.

See page 110 for New Reader Service

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Our new GT-550 has all those great qualities of the famous Galaxy V's ...and then some! **It has new POWER...550 watts SSB,** making it the hottest transceiver made! **A new single scale VFO Dial** makes frequency interpolation child's play...the **new skirted knobs** make tuning and band-changing a split-second job...and, **that slick, king-sized finger-tip tuning knob** works like a dream! *Still the most compact—only 11¼ x 12⅜ x 6"!*

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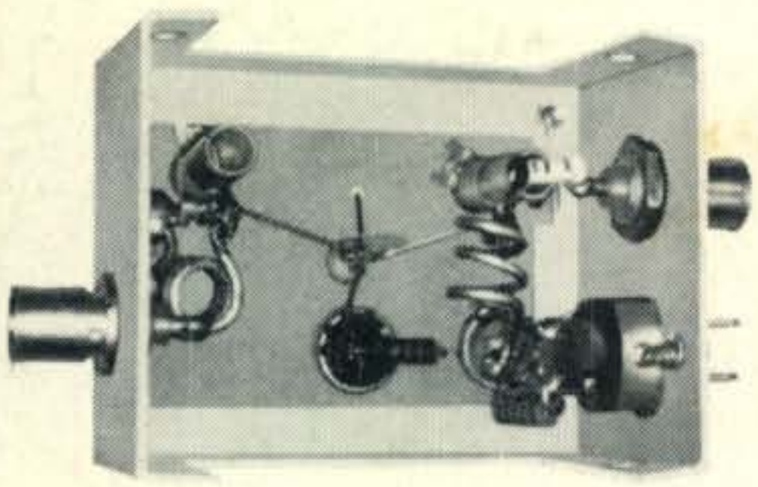
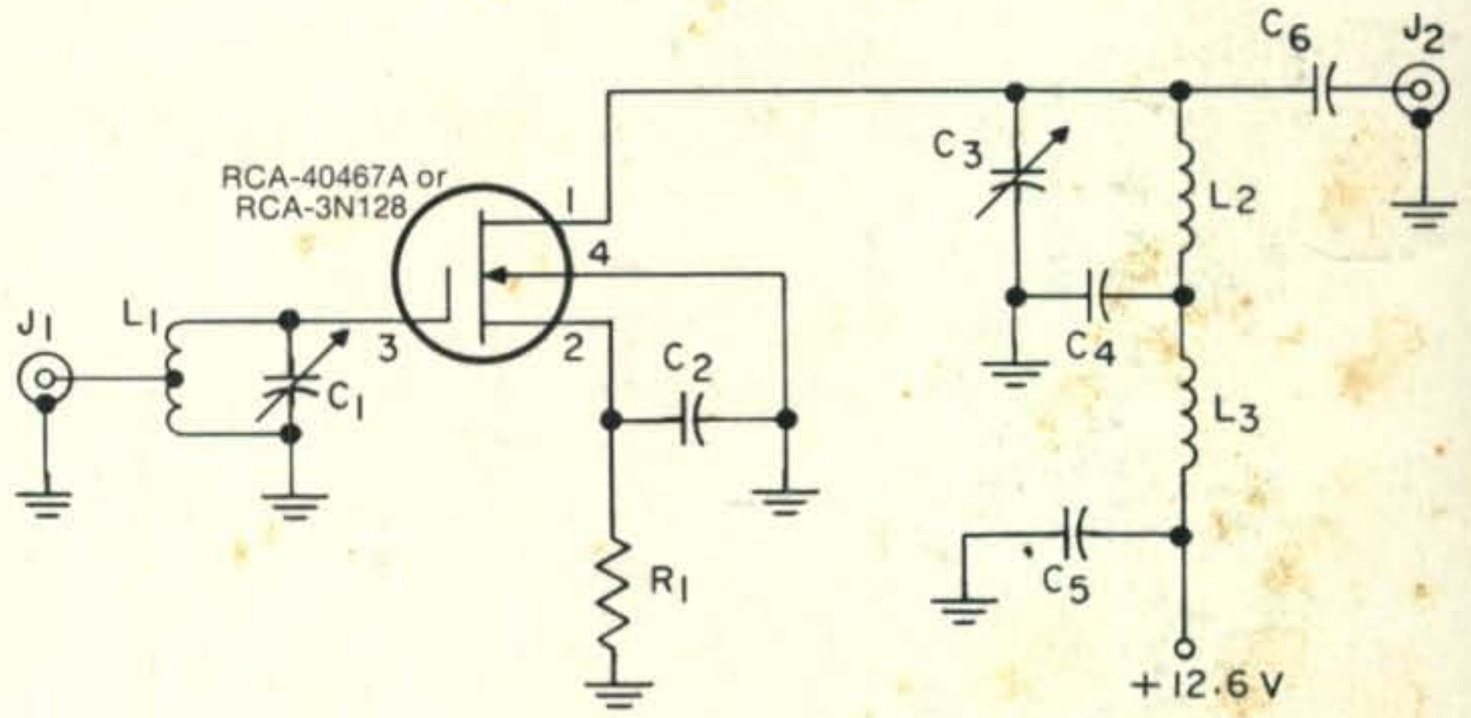
Full details are available in the November and December 1968 "Ham Tips". Write RCA Electronic Components, Commercial Engineering Section **F-15SD**, Harrison, N. J. 07029 for copies.

All RCA devices listed are available from your RCA Industrial Solid-State Distributor.

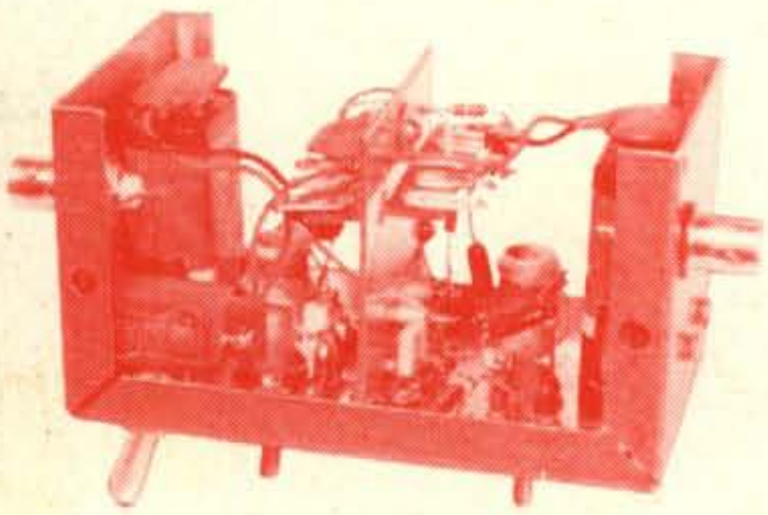
10 meter and 2 meter Pre-Amps

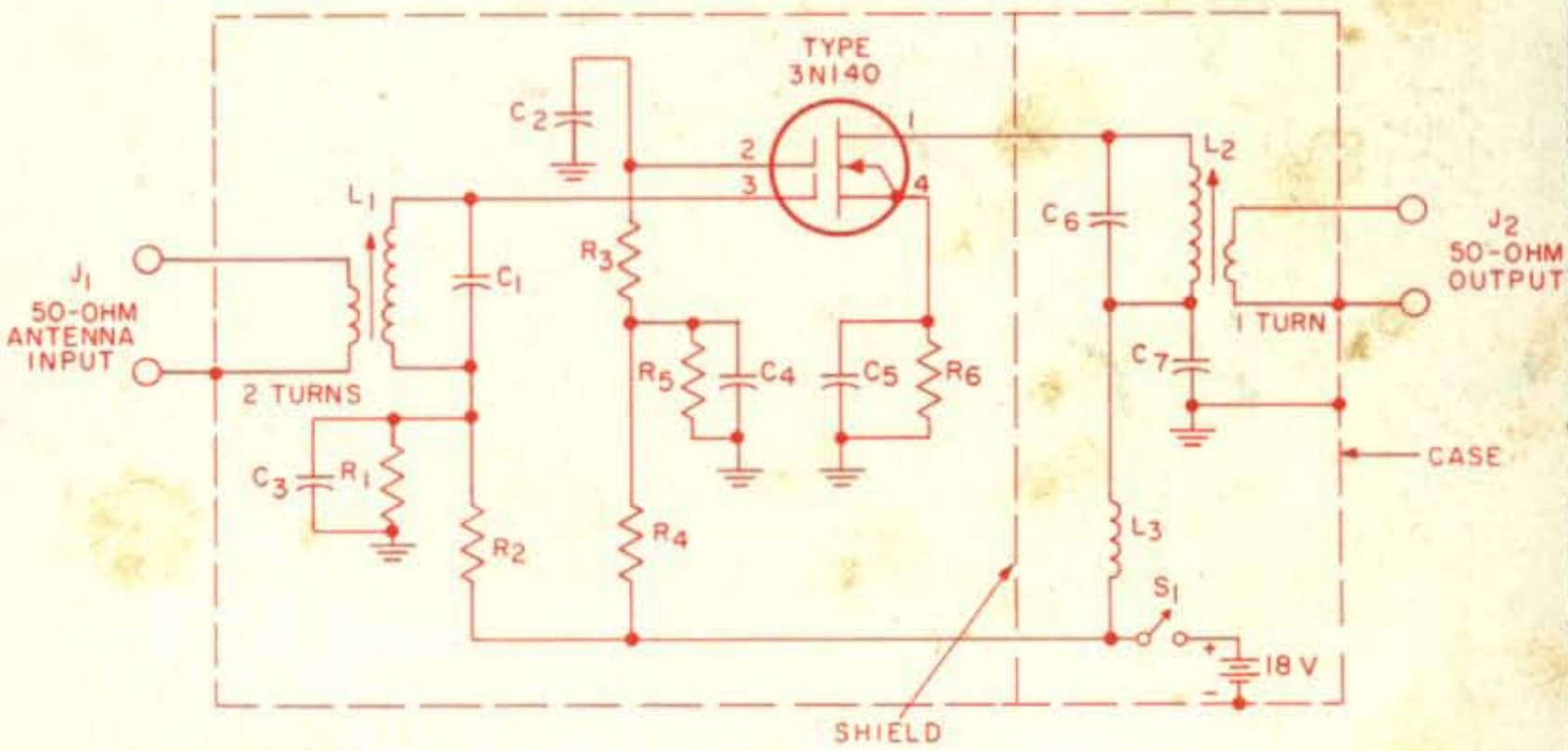
Single Gate MOS/FET 2M Pre-Amp





Dual-Gate MOS/FET 10M Pre-Amp





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