ICD 08240

Amateur Radio

CQ begins its 32nd year in amateur radio.

CQ

January 1977

$1.25

FLASH!

FCC SUSPENDS ALL

AMATEUR

E FEES

JAN.1

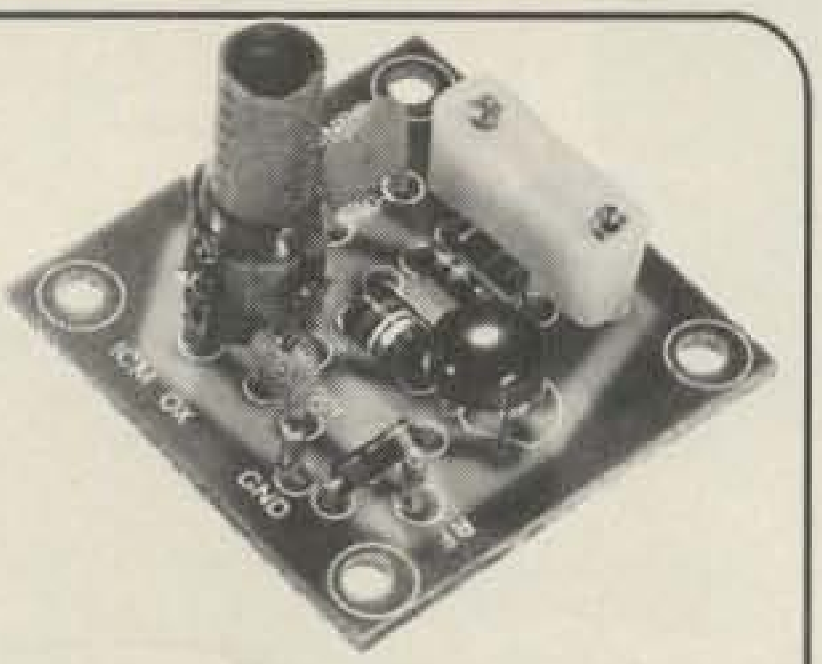
Be your own greeting card this season via SSTV. George and Abe have Bill DeWitt and his new SSTV Overview series to thank for their upcoming birthday pictures. To join in the fun read page 17.

The Radio Amateur's Journal

for the experimenter!

INTERNATIONAL CRYSTALS & KITS

OSCILLATORS • RF MIXER • RF AMPLIFIER • POWER AMPLIFIER



OX OSCILLATOR

Crystal controlled transistor type. 3 to 20 MHz, OX-Lo, Cat. No. 035100. 20 to 60 MHz, OX-Hi, Cat. No. 035101
Specify when ordering.

$3.95 ea.

MXX-1 TRANSISTOR RF MIXER

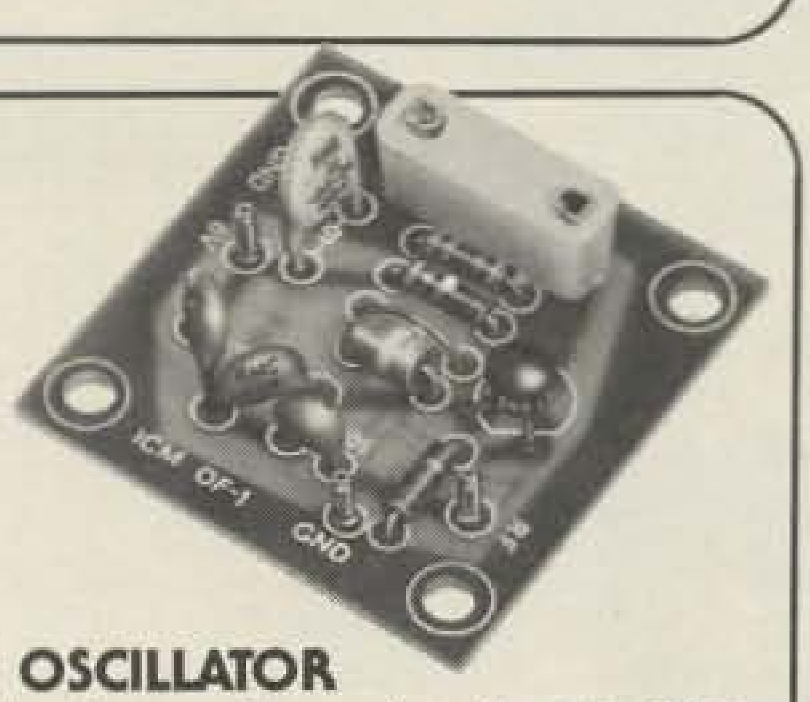
A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106
Specify when ordering.

$4.50 ea.

PAX-1 TRANSISTOR RF POWER AMP

A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated. 3 to 30 MHz, Cat. No. 035104
Specify when ordering.

$4.75 ea.



OF-1 OSCILLATOR

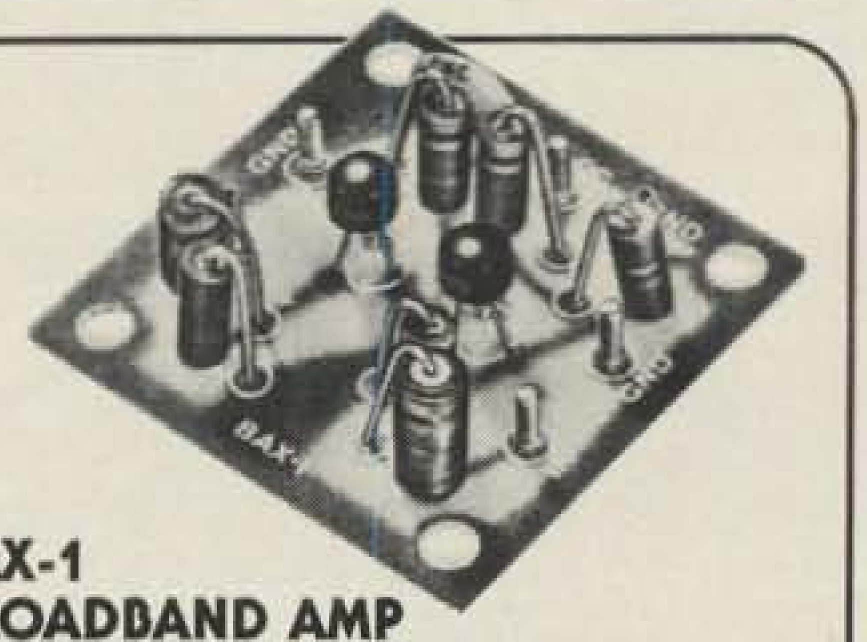
Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 HI, Cat. No. 035109
Specify when ordering.

$3.25 ea.

SAX-1 TRANSISTOR RF AMP

A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 035102. 20 to 170 MHz, Hi Kit, Cat. No. 035103.
Specify when ordering.

$4.50 ea.



BAX-1 BROADBAND AMP

General purpose amplifier which may be used as a tuned or untuned unit in RF and audio applications. 20 Hz to 150 MHz with 6 to 30 db gain. Cat No. 035107
Specify when ordering

$4.75 ea.

.02% Calibration Tolerance

EXPERIMENTER CRYSTALS

(HC 6/U Holder)

Cat. No.	Specifications	
031080	3 to 20 MHz — for use in OX OSC Lo *Specify when ordering*	$4.95 ea.
031081	20 to 60 MHz — For use in OX OSC Hi *Specify when ordering*	$4.95 ea.
031300	3 to 20 MHz — For use in OF-1L OSC *Specify when ordering*	$4.25 ea.
031310	20 to 60 MHz — For use in OF-1H OSC *Specify when ordering.*	$4.25 ea.

Shipping and postage (inside U.S., Canada and Mexico only) will be prepaid by International. Prices quoted for U.S., Canada and Mexico orders only. Orders for shipment to other countries will be quoted on request. Address orders to:
M/S Dept., P.O. Box 32497,
Oklahoma City, Oklahoma 73132.

ICM

International Crystal Mfg. Co., Inc.
10 North Lee
Oklahoma City, Oklahoma 73102

ANNOUNCING AN EXCITING NEW 2-METER TRANSCEIVER FROM KENWOOD

the

TR-7400A

Featuring Kenwood's New and Unique CONTINUOUS TONE CODED SQUELCH SYSTEM

4 MHz BAND COVERAGE

25 WATT OUTPUT

FULLY SYNTHESIZED

UNIQUE SQUELCH SYSTEM
The TR-7400A may be used on your favorite repeater, no matter what type of squelch system is used. The continuous tone coded squelch (CTCS) may be used for both transmit and receive or for transmit only. Tone burst operation may also be used.

SYNTHESIZED, 800 CHANNELS
The phase-locked loop (PLL) frequency synthesizer in the TR-7400A divides the 4 MHz bandwidth into 400 channels at intervals of 10 KHz. The frequency may be offset 5 KHz higher with the push of a button, thus providing 800 discrete channels.

REPEATER OFFSET
A convenient front panel switch offsets the transmit frequency of the TR-7400A up OR down 600 KHz for standard repeater operation. This offset circuit uses digital technology to provide a highly stable offset frequency without spurious response. A dual color LED indicates the direction of offset from the displayed receive frequency.

OUTSTANDING RECEIVER PERFORMANCE
Large-sized helical resonators with high Q minimize undesirable interference from outside the 2-meter band. The large helical resonators, 2-pole 10.7 MHz monolithic crystal filter, and MOSFET front-end circuitry combine to give outstanding receiver performance.

TONE PAD CAPABILITY
A jack is provided to allow convenient connection of a tone pad to the TR-7400A.

FINAL PROTECTION CIRCUIT
The final transistor in the TR-7400A is protected from antenna impedance mismatch. Excessive reflected power reduces the amount of drive to the final transistor rather than turning off the final stage. This practical feature allows continued safe operation at a reduced power level whether the antenna system becomes opened or shorted.

TRIO-KENWOOD COMMUNICATIONS INC.
116 EAST ALONDRA/GARDENA, CA 90248

KENWOOD
...pacesetter in amateur radio

TR-7400A Specifications

Range: 144.00 MHz to 147.995 MHz
Mode: FM
800 Channels: 5 KHz spaced
Sensitivity: Better than 0.4 uV for 20 dB quieting
Better than 1 uV for 30 dB S/N
Squelch Sensitivity: Better than 0.25 uV
Selectivity: 12 KHz at −6 dB down
40 KHz at −70 dB down
Image Rejection: Better than −70 dB
Spurious Interference: Better than −60 dB
Intermodulation: Better than 66 dB
Receive System: Double conversion
First IF: 10.7 MHz
Second IF: 455 KHz
Audio Output: More than 1.5 Watts (8 ohm load)
RF Output Power: 25 Watts (High)
5-15 Watts (Low-adjustable)
Antenna Impedance: 50 ohms
Frequency Deviation: ±5 KHz
Spurious Response: Better than −60 dB
Tone Pad Input Impedance: 600 ohms
Tone Burst Duration: 0.5 to 1.0 sec.
CTCS Range: 88.5 Hz to 156.7 Hz
Microphone: Dynamic, with PTT switch, 500 ohms
Voltage: 11.5 to 16.0V DC (13.8V DC nominal)
Current Drain: Less than 1A in receive (no input signal)
Current Drain: Less than 8A in transmit
Polarity: Negative ground
Temperature Range: −20 to +50 degrees C
Dimensions: 182 mm (7-3/16") wide
270 mm (10-5/8") deep
74 mm (2-7/8") high
Net Weight: Approximately 2.8 kg (6.2 lbs.)

CQ — JANUARY, 1977 — VOL. 33, NO. 1

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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

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Allow six weeks for change of address. Printed in the United States of America.

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

Hy-Gain verticals stand alone.

Hy-Gain multi-band vertical amateur antennas are entirely self-supporting. They require no towers or guys and go up in just a few square feet yet they offer remarkable performance. Their omnidirectional pattern means no rotator is required. Hy-Gain verticals go up easily with just a few hand tools and their cost is surprisingly low.

See your Hy-Gain dealer for the antennas that give you the performance you want, take minimum space and have your kind of price. Hy-Gain verticals.

18HT 6-80 meters.
The only vertical antenna on the market offering multi-band performance without traps. The Hy-Gain 18HT utilizes a unique stub decoupling system to maximize efficiency, frequency stability and band isolation. It also offers a 50 ohm input impedance for all bands.

The 18HT features automatic band switching, ¼ wavelength performance on 40 and 80 meters, 1¾ wavelength on 10 and 15 meters. Maximum legal power rating on all bands. It is entirely self-supporting and requires no guys. Heavy duty, slotted, taper swaged, aircraft quality aluminum with full circumference compression clamps is used for radiators. The 24′ tower is all rugged, hot-dip galvanized steel and all hardware is iridited for corrosion resistance. Special hinged base for easy raising and lowering. **Order No. 182**

18AVT/WB 10-80 meters.
The Hy-Gain 18AVT/WB gives you true wide-band performance in limited space. And now we've made it even better. The 18AVT/WB now has an improved 80 meter coil and an oversize corona ball on the whip to eliminate wasteful and noise corona discharge.

This antenna is rated in excess of maximum legal power 10-40 meters and up to 1 KW PEP on 80 meters. Entirely self-supporting, requires no guys. All tubing is slotted, taper swaged, aircraft quality aluminum with full circumference compression clamps.

The 18AVT/WB has automatic band switching and utilizes three air dielectric Hy-Q traps for exceedingly stable performance and true ¼ wave resonance on all bands. May be roof mounted with Hy-Gain 14RMQ kit. Recessed SO-239 connector prevents moisture deterioration. 12″ heavy duty mast support bracket.
Order No. 386

14AVQ/WB 10-40 meters.
The Hy-Gain 14AVQ/WB uses the same trap design as the famous Hy-Gain Thunderbird beams. 3 separate air dielectric Hy-Q traps with oversize coils for superb stability and ¼ wave resonance on all bands. Automatic band switching.

An extremely low angle of radiation is utilized for superior DX performance. Taper swaged, slotted aircraft quality aluminum tubing. Entirely self-supporting, no guys required. Recessed SO-239 connector prevents moisture damage. 12″ heavy duty mast support bracket. Roof mount with Hy-Gain 14RMQ kit.
Order No. 385

12AVQ 10, 15 and 20 meters.
The 12AVQ also uses Thunderbird design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Entirely self-supporting, requires no guys.

For superior DX transmission, the 12AVQ uses a very low radiation angle. Has automatic band switching. Aircraft quality, slotted taper swaged aluminum tubing. Recessed SO-239 connector prevents moisture damage. Heavy duty 12″ mast bracket. Roof mount with Hy-Gain 12RMQ kit. **Order No. 384**

18V 10-80 meters.
High efficiency, low cost vertical with quality construction for long life. Easily tuned to any 10-80 meter band by adjusting feed point at base inductor. An exceptional value.

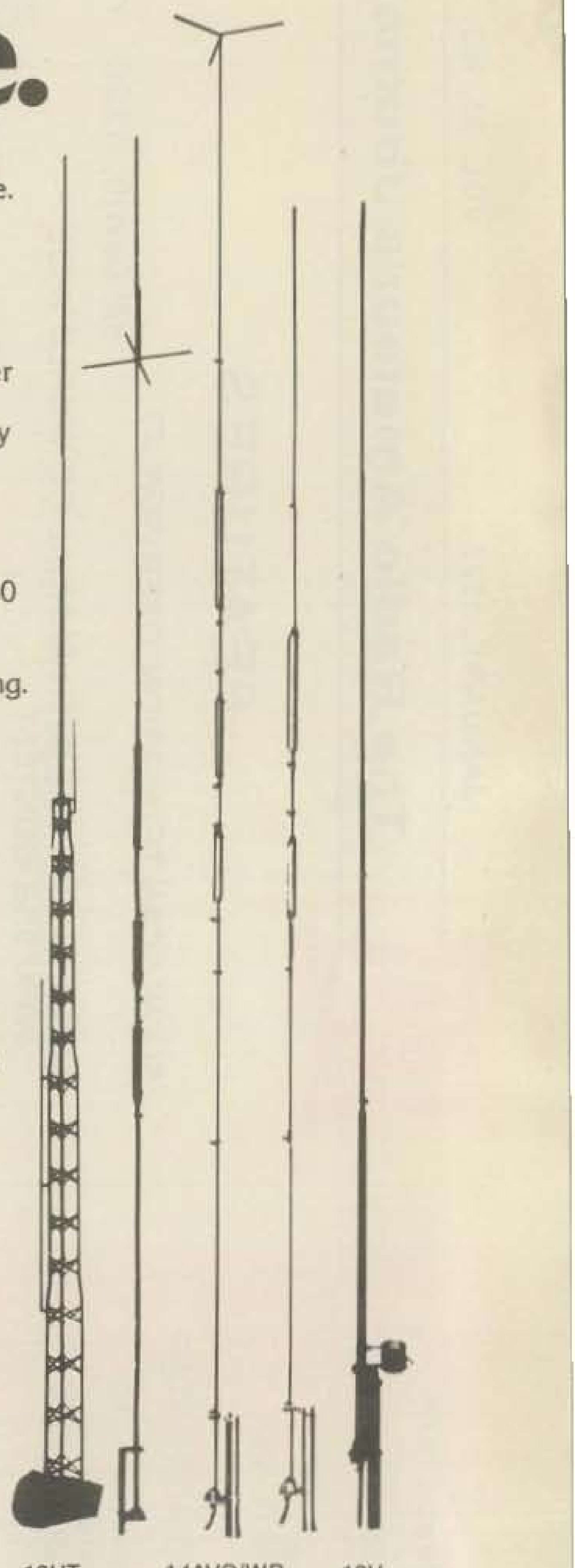
18′ radiator of heavy gauge aluminum tubing. Mounts on any 1-⅝″ mast. Self-supporting, requires no guys. Easily erected, portable. 12″ heavy duty mast bracket. Roof mounts with 14RMQ kit.
Order No. 193

HY-GAIN VERTICAL ANTENNA SPECIFICATION COMPARISON

	18HT	18AVT/WB	14AVQ/WB	12AVQ	18V
Electrical					
Max. power input	1 KW AM 2 KW PEP	1 KW AM 2 KW PEP (1 KW PEP on 80)	1 KW AM	1 KW AM	250 watts AM 500 watts PEP
VSWR	2:1 or less	2:1 or less	2:1 or less	2:1 or less	2:1 or less
Impedance	50 ohms	50 ohms	50 ohms	50 ohms	50 ohms
Mechanical					
Height	50′	25′	18′	13′6″	18′
Shipping Weight	96.7 lbs.	10.7 lbs.	8.2 lbs.	7 lbs.	4.6 lbs.
Mast Diameter	None required	1⅝″	1⅝″	1⅝″	1⅝″

hy-gain® Amateur Radio Systems.

Hy-Gain Electronics Corporation 8601 Northeast Highway Six; Lincoln, NE 68505
Distributed in Canada by Lectron Radio Sales 211 Hunter Street; Peterborough, Ontario



18HT 18AVT/WB 14AVQ/WB 12AVQ 18V

Zero Bias

Our cover photo this month shows two conventional TV monitors displaying the outputs of Robot Research's new Model 400 Digital Scan Converter and their now-discontinued Model 300 Storage Tube Scan Converter. Bill DeWitt, our SSTV Editor thought the pictures displayed were appropriate for our presidential birthday holidays!

January not only marks the start of a new year but in our case commemorates the start of our 32nd year publishing CQ, The Radio Amateurs Journal. As you may have noticed we are also changing the logo of CQ slightly adding the words Amateur Radio to our title. This is not done to impress visitors to your shack or to remember what CQ is all about but to call attention to CQ by non-amateurs.

Beginning with the February issue CQ will be distributed on all major newsstands, candy stores, drug stores and the like via the ICD division of Hearst Publications. We are putting an additional 60,000 copies available to ICD initially in order to reach people who have either never heard of amateur radio or who have given some casual thought or interest in amateur radio. Most of the titles of our amateur publications do not really tell the prospective buyer what the magazine is about or what types of articles are contained. It is hoped that the person looking at the magazine counter will stop and pick up a copy of CQ via this method.

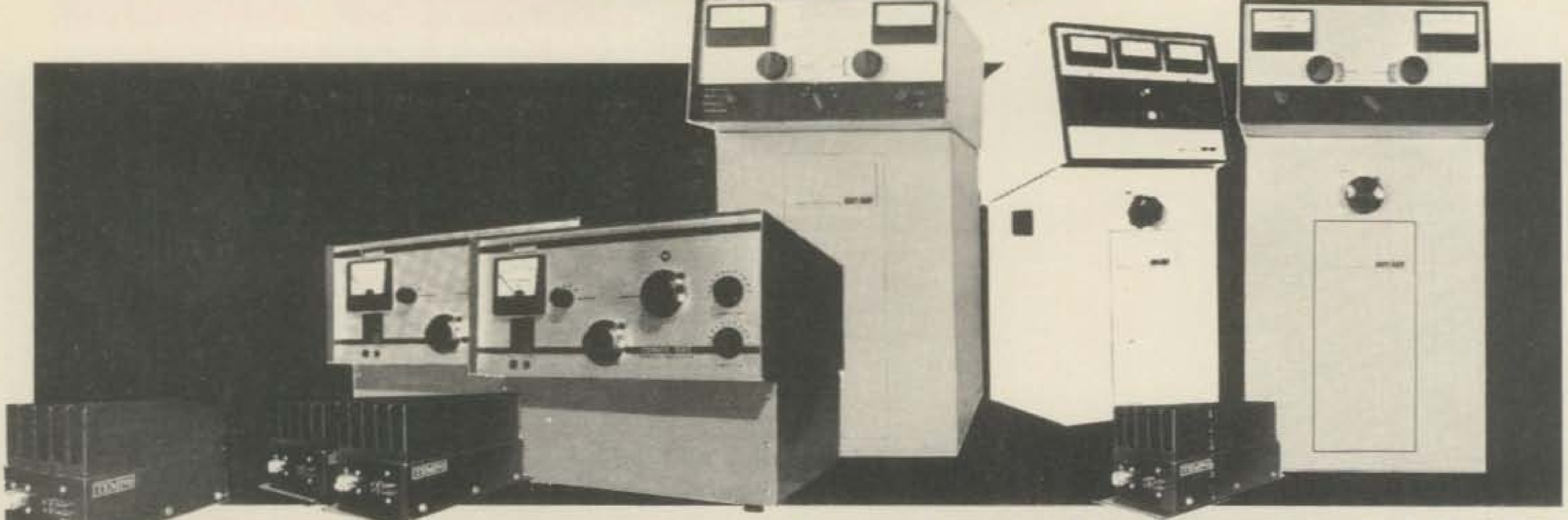
This will enable many of CQ readers to also buy their copy at a more convenient location and in general just makes CQ more available to more people. CQ by the way will be the only amateur magazine that is available to the general public via newsstands. The others as of yet have not availed themselves to this system.

Starting with February we will also be moving our printing operation from the east coast to the mid-west and therefore it is anticipated that CQ will be on time. If you recall the Message From The Publisher in our Oct./Nov. issue, Richard Cowan said that we would be turning out 3 issues in just nine weeks, well we've done it! In fact, the February issue was completed a day or two before the January issue in order to meet an earlier deadline. This Editorial for January is being written as February is being printed. If it seems confusing to you then you can imagine what it was like here at CQ for the last several weeks trying to keep everything moving and on schedule. I want to thank all of our columnists and contributing authors who supplied us with the material to make this change a sucess. It is doubly remarkable to think that all of this has occured by the beginning of December.

As this is being written before Christmas and you will be reading this after the fact, I hope that we have by the time this is read, realized some if not all that we anticipated for the holidays in the way of gifts and pleasant memories and that we have started to enjoy the excitement of a new year and all this has to offer.

73,
Alan, K2EEK

ONLY HENRY RADIO OFFERS THE WORLD'S MOST COMPLETE LINE OF AMPLIFIERS



30 MODELS! THE WORLD'S FINEST LINE OF AMATEUR AMPLIFIERS. BOTH VACUUM TUBE AND SOLID STATE... FOR HF, VHF AND UHF... FIXED STATION AND MOBILE... LOW POWER AND HIGH POWER. NEVER BEFORE HAS ONE COMPANY MANUFACTURED SUCH A BROAD LINE OF AMATEUR AMPLIFIERS

2K-4...THE "WORKHORSE"

The 2K-4 linear amplifier offers engineering, construction and features second to none, and at a price that makes it the best amplifier value ever offered to the amateur. Constructed with a ruggedness guaranteed to provide a long life of reliable service, its heavy duty components allow it to loaf along even at full legal power. If you want to put that strong clear signal on the air that you've probably heard from other 2K users, now is the time. Operates on all amateur bands, 80 thru 10 meters Move up to the 2K-4. Floor console...$995.00

3K-A COMMERCIAL/MILITARY AMPLIFIER

A high quality linear amplifier designed for commercial and military uses. The 3K-A employs two rugged Eimac 3-500Z grounded grid triodes for superior linearity and provides a conservative three kilowatts PEP input on SSB with efficiencies in the range of 60%. This results in PEP output in excess of 2000 watts. It provides a heavy duty power supply capable of furnishing 2000 watts of continuous duty input for either RTTY or CW with 1200 watts output. 3.5-30 MHz ....$1395.

4K-ULTRA

Specifically designed for the most demanding commercial and military operation for SSB, CW, FSK or AM. Features general coverage operation from 3.0 to 30 MHz. Using the magnificent new Eimac 8877 grounded grid triodes, vacuum tune and load condensers, and a vacuum antenna relay, the 4K-ULTRA represents the last word in rugged, reliable, linear high power RF amplification. 100 watts drive delivers 4000 watts PEP input. Can be supplied modified for operation on frequencies up to about 100 MHz. ...$2950.00

TEMPO 6N2

The Tempo 6N2 brings the same high standards to the 6 meter and 2 meter bands. A pair of advanced design Eimac 8874 tubes provide 2,000 watts PEP input on SSB or 1,000 watts on FM or CW. The 6N2 is complete with self-contained solid state power supply, built-in blower and RF relative power indicator. ...$895.00

TEMPO 2002

The same fine specs and features as the 6N2, but for 2 meter operation only. ...$745.00

TEMPO 2006

Like the 2002, but for 6 meter operation. ...$795.00

TEMPO VHF/UHF AMPLIFIERS

Solid state power amplifiers for use in most land mobile applications. Increases the range, clarity, reliability and speed of two-way communications. FCC type accepted also.

Model	Drive Power	Output Power	Price	Model	Drive Power	Output Power	Price
LOW BAND VHF AMPLIFIERS (35 to 75 MHz)							
Tempo 100C30	30W	100W	$159.	Tempo 100C10	10W	100W	$149.
Tempo 100C02	2W	100W	$179.				
HIGH BAND VHF AMPLIFIERS (135 to 175 MHz)							
Tempo 130A30	30W	130W	$189.	Tempo 80A02	2W	80W	$159.
Tempo 130A10	10W	130W	$179.	Tempo 50A10	10W	50W	$ 99.
Tempo 130A02	2W	130W	$199.	Tempo 50A02	2W	50W	$119.
Tempo 80A30	30W	80W	$149.	Tempo 30A10	10W	30W	$ 69.
Tempo 80A10	10W	80W	$139.	Tempo 30A02	2W	30W	$ 89.
UHF AMPLIFIERS (400 to 512 MHz)							
Tempo 70D30	30W	70W	$210.	Tempo 40D01	1W	40W	$185.
Tempo 70D10	10W	70W	$240.	Tempo 25D02	2W	25W	$125.
Tempo 70D02	2W	70W	$270.	Tempo 10D02	2W	10W	$ 85.
Tempo 40D10	10W	40W	$145.	Tempo 10D01	1W	10W	$125.
Tempo 40D02	2W	40W	$165.	Linear UHF models also available			

TEMPO 100AL10 VHF LINEAR AMPLIFIER

Completely solid state, 144-148 MHz. Power output of 100 watts (nom.) with only 10 watts (nom.) in. Reliable and compact ...$199.00

TEMPO 100AL10/B BASE AMPLIFIER ...$349.00

please call or write for complete information.

Henry Radio

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

Prices subject to change without notice.

Announcing

• **Laporte, IN** — The LaPorte, Indiana ARC will hold its Winter Hamfest on the 27th of February, beginning at 8 AM (Chicago time) at the LaPorte Civic Auditorium. Good food, plenty of FREE tables 50 miles East of Chicago. Talk-in on 01-61 and 94, Donation $2.00 at the gate. Information from LPARC, P.O. Box 30, LaPorte, IN 46350.

• **Traverse City, MI** — The Cherryland Amateur Radio Club will hold its 4th annual Swap 'n Shop on Saturday, February 12, from 9 AM to 4 PM at the Northwestern Michigan College. A donation of $1 will include a chance on all prizes. There will be plenty of free display tables for whatever you may wish to bring in electronic equipment and parts. Everyone is welcome and a turnout of over 300 Hams and experimenters is expected from all over Michigan. For more information please contact Bill Mader, WA8WWM, at (616) 326-6392 or Box 2, Empire AFS, Mich. 49630.

• **Livonia, MI** — The Livonia Amateur Radio Club would like to announce that the 7th Annual L.A.-R.C. Swap 'n Shop will be held on Sunday, February 27, 1977, from 8:00 A.M. to 4:00 P.M., at the Stevenson High School in Livonia, Michigan. There will be plenty of tables, door prizes, refreshments, and free parking available. Talk-in on 146.04/.64 and 146.52 Simplex. For further information, write Neil Coffin, WA8GWL, c/o Livonia Amateur Radio Club, P.O. Box 2111, LIvonia, MI48150.

• **Mansfield, OH** — The Mansfield, Ohio Mid * Winter Hamfest Auction will be held on February 6th at the Richland County Fairgrounds in Mansfield. Prizes, Flea Market, Auction. Large Heated Building. Doors open 8 AM Talk-in 146.34/94 and .52/.52. Tickets $1.50 in advance $2.00 at the door. Contact Harry Frietchen, K8JPF, 120 Homewood, Mansfield, Ohio 44906 or phone (419) 529-2801 or 419-524-1441.

• **Griffith IN** — The Lake County Amateur Radio Club's 24th annual banquet is Saturday February 19, at 6:00 P.M., at the Griffith Knights of Columbus Hall, 1400 South Broad Street, Griffith Indiana. All the food you can eat, wine fountain, entertainment, guest speakers, special awards, door prizes, cash raffles, and a dance band after. Tickets are $7.50 each: no door purchase. Write (prior to Feb. 3) to Herbert S. Brier, W9AD (W9EGQ), 409 S. 14th St., Chesterton, IN 46304.

A NEW ERA IN AMATEUR RADIO ARRIVES

ATLAS 350-XL

ALL SOLID STATE SSB TRANSCEIVER • 350 WATTS • 10-160 METERS

The State of the Art in
Amateur Radio Transceivers for the Next Decade.

ATLAS 350-XL

- ALL SOLID STATE
- SSB TRANSCEIVER
- 350 WATTS P.E.P. OR CW INPUT
- 10 THROUGH 160 METER COVERAGE

With selectivity control, and optional plug-in auxiliary VFO or crystal oscillator.

The all new Atlas 350-XL has all the exciting new features you want, plus superior performance and selectivity control never before possible.

10-160 METER

Full coverage of all six amateur bands in 500 kHz segments. Primary frequency control provides highly stable operation. Also included is provision for adding up to 10 additional 500 kHz segments between 2 to 22 mHz by plugging in auxiliary crystals.

350 WATTS

P.E.P. and CW input. Enough power to work the world barefoot!

SELECTIVITY CONTROL (Standard feature)

This amazing new breakthrough in filter design is truly the filter of the future. Selectivity control on the front panel provides control of bandwidth as well as selection of upper or lower sideband, or double sideband. Continuously variable from 300 to 2700 Hz bandwidth. Shape factor is better than 1.7, with ultimate rejection better than 130 dB. Selectivity for SSB can be set for maximum voice fidelity at 2700 Hz bandwidth, providing transmission and reception of audio from 300 to 3000 Hz, or it can be narrowed down to 2400, 2100 or even 1500 Hz if necessary to reduce adjacent channel QRM. Selectivity can be narrowed gradually to as little as 300 Hz for CW reception.

This amazing new breakthrough in filter design is by Bob Crawford and Eckert Argo of Consulting Engineers. Atlas Radio is privileged to be first to offer this "programmable filter" in the radio communication field and for sometime to come will be the only one.

DIGITAL DIAL READOUT

The Atlas 350-XL has space provided for quick installation of this plug-in accessory. Provides precise frequency readout to 1/10 of a kHz. All L.E.D. Dot Matrix 6 digit display.

MODES OF OPERATION

Standard features: lower or upper sideband, push-to-talk or VOX operation, full break-in or semi-break-in CW operation.

RECEIVER INCREMENTAL TUNING

This standard feature enables you to receive up to 5 kHz above or below your transmitting frequency.

AUDIO FREQUENCY NOTCH FILTER (Standard feature)

PLUG-IN AUXILIARY VFO or CRYSTAL OSCILLATOR (Optional)

Auxiliary VFO is plugged into the space provided on the front panel of the 350-XL. You have a second tuneable VFO with same tuning ranges as primary VFO for tuning to a separate transmit or receive frequency. L.E.D.'s indicate which VFO, primary or secondary, will be used for receive and transmit.

Or instead of the auxiliary VFO a Crystal Oscillator may be plugged into the front panel. Eleven crystal sockets are available with a vernier control for exact frequency setting.

SAME PLUG-IN-AND-GO MOBILE FEATURE AS OUR FAMOUS 210x/215x

The 350-XL has its own optional Mobile Mounting Bracket for quick, easy plug-in or removal from your car. All connections are made automatically.

IDEAL FOR DESK TOP OR MOBILE OPERATION

Measuring just 5 in. high x 12 in. wide x 12½ in. deep, and weighing only 13 pounds, the Atlas 350-XL offers more features, performance and value than any other transceiver, regardless of size, on the market today!

MANY MORE SPECIAL FEATURES

See your dealer or write for the 350-XL brochure with complete list of features, capabilities, and specifications.

Base Price . . . . $995.

Digital Dial Frequency display and Auxiliary VFO, as illustrated, are optional accessories.

350-XL ACCESSORIES

- 350-PS MATCHING AC SUPPLY

Includes front facing speaker and phone jack. Provides 14 volts filtered and regulated D.C. for both low current and high current circuits of the 350-XL. Internal space provided for future installation of accessories such as CW Keyer, Speech Processor, Phone Patch, etc. Operates on 100-130 or 200-260 volts, 50-60 Hz . . $195.

- DIGITAL DIAL
- PLUG-IN AUXILIARY VFO, MODEL 305
- PLUG-IN AUXILIARY OSCILLATOR, MODEL 311
- PLUG-IN MOBILE MOUNTING KIT
- AUXILIARY CRYSTALS

  for providing additional 500 kHz tuning ranges between 2 to 22 mHz.

ATLAS 210x/215x SSB TRANSCEIVERS

Our famous little compact SSB Transceivers remain a very important part of our product line.

ATLAS RADIO INC.

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Special Customer Service Direct Line (714) 433-9591

Our Readers Say

Help Save 450 MHz

Editor, CQ:

Help save our 450 mhz. frequencies through community based public service interactive educational ATV teaching electronics. Subscribe to LIMARC ATV Repeater Fund. Buy fluorescent bumper stickers promoting: "Friendship, Public Service, Technology through Amateur Radio." $1 each, 6/$5. Send to LIMARC, c/o Ed Piller, W2KPQ, 80 Birchwood Park Drive, Syosset, N.Y. 11791.

Ed Piller, W2KPQ
Syosset, N.Y.

Talk Back

Editor, CQ:

It is obvious that your article "A Push Button To Dial Telephone Converter" (Sept. '76) was never constructed and tested. The schematic for the 500 telephone and the modification show the same error. You have the bell connected across the telephone line. Since the bell resistance is less than 1000 ohms, this will pull dial tone and you will make one call but never hang up.

The proper connection is to put the network capacitor inseries with the bell, forming a series resonant circuit at approximately 20 cycles (the ringing voltage) and keeping the bell isolated from across the line (DC wise).

I also refer you to Bill Orr's column, truckers are called 18 wheelers, not 16 wheelers. (check with your S9 counterpart, TOMCAT). Finally, a cophase harness is also an impedance transformation. As Bill describes it, just take some coax and parallel it, a guaranteed 2:1 mismatch. However, in the real world, the harness is 72 ohm, quarter wave, which takes the 50 ohm antenna and steps it up to 100 ohms. At the transmitter, two 100 ohms in parallel give 50 ohms, or a good match.

Actually, 3/4 wavelength is used since it would be tight with each leg only 1/4 wavelength long.

Finally, Bill misses the point of cophase. The main reason for the trucker is to reduce the shadow the trailer makes:

If you draw it to scale, you will see that one antenna will provide coverage where the second antenna is blind due to the trailer shadow.

The directivity ahead and behind is exactely what the truckers want since they want reports and conversation ahead and behind, not chit-chat from the 'civilians'.

Gil Kowols, W9BUB

Central American DXpedition

Editor, CQ:

Seven very fortunate "hams" spent part of their bicentennial summer on a unique combined DX-pedition and public service project in Latin America. These participants held reciprocal calls and were able to meet and know people (including many local amateurs) in Honduras, Nicaragua, Ecuador and Bolivia. This unusual experience of being able to visit a foreign country as someone other than "just a tourist" was available to WB5CFI, Al; WA5GNT, Swank; K5–HXR, Jim; WB5KPL, Mike; WA5KRI, Deanna; WB5OZZ, Don; WB5RIY, Ron; and WA5ZMF, Chris. One of the most rewarding experiences is having these DX amateurs visit us stateside after a previous exchange of ideas, courtesies and hospitality south of the border. Though the "DX-pedition" is not a first class tourist cruise, the participants of the pilot program agree that it was an enriching, broadening and very different experience . . . and a lot of fun!

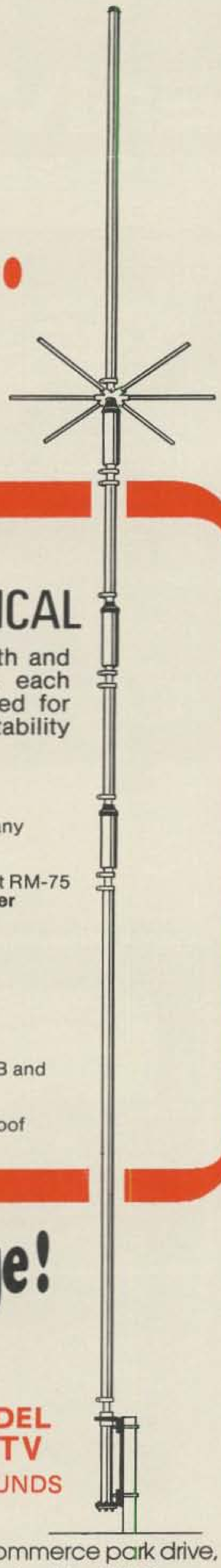
The "Amigos de las Americas" organization has conducted immunization dental and opthamalogical programs through the ministries of health in Central and South America for the past twelve summers. This volunteer group has used amateur radio for communications between the staff locations and the Houston office. The Amigos solicit radio operators and stateside monitors for the 1977 summer. The approximate dates are June 5 - August 31. Applicants will be taken on a first come, first served basis. The amateur radio operator participating should have a technician or higher class of license. Positions will be open from 2 to 4 weeks (2 week minimum). Stateside monitors are needed 24 hours daily on 15, 20, and 40 meters. The tentative list of countries that will participate include: Guatemala, Honduras, Nicaragua, Costa Rica, Ecuador, Boivia, Paraguay and the Dominican Republic.

The amigos agree to provide a place for the radio operator to stay with sanitary facilities, three meals a day, and potable water while the amateur is handling communications for the organization. They will cover excess baggage charges of transporting radio equipment for Amigos use. They will pay incidental expenses incurred by the radio operator to set up or maintain the communications program. The Amigos request the participants read two selected books of latin american culture and return the accompanying study sheets and tests. Where Amigos chapter schools are available the radio operators may attend. The "hams" may take their own equipment or use equipment belonging to the Amigos.

If you are interested in participating write to Deanna Mercurio, 10339 Sagerock Drive Houston, TX 77089.

Deanna Mercurio
Houston, TX

if the 4-BTV weighs 39% more... what do others leave out?



HUSTLER FIXED STATION FOUR BAND VERTICAL

The 4-BTV is longer for greater aperature, larger in diameter for strength and bandwidth, heavier traps for precision and safety factor. Individually, each subassembly weighs more to collectively give you an antenna designed for convenience of assembly and installation, a wide margin in mechanical stability and far superior electrical performance.

- **Lowest SWR**—PLUS!
- Bandwidth at its **broadest!** SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers **"Spritz" extruded** to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with **low loss—high strength** insulators.
- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
- **Stainless steel clamps** permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be **easiest assembly** of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for **75 meter operation** when desired.
- Top loading on 75 meters for broader bandwidth and **higher radiation efficiency!**
- Feed with **any length** 50 ohm coax.
- Power capability—**full legal limit** on SSB and CW.
- Ground mount with or without radials; roof mount with radials.

one setting for total band coverage!
40 THROUGH 10 METERS

HUSTLER ANTENNA PRODUCTS—for sixteen years—original designs—created and manufactured by American ingenuity, labor and materials—used by communicators throughout the world.

Hustler designs are patented under one or more of the following assigned to New-Tronics Corporation: 3287732, 3513472, 3419869, 3873985, 3327311, 3599214, 3582951

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MODEL 4-BTV
15 POUNDS

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KENWOOD ...the Pacesetter in

TS-520 TS-820

HF

The ultimate transceiver . . . Kenwood's TS-820. No matter what you own now, a move to the TS-820 is your best move. It offers a degree of quality and dependability second to none, and as the owner of this superb unit, you will have at your fingertips the combination of controls and features that, even under the toughest operating conditions, make the TS-820 the *Pacesetter* that it is.

Unprecedented demand plus the painstaking care Kenwood lavishes on each TS-820 has created a back-log of orders, but rest assured, it's well worth waiting for. Once you have operated the TS-820 you will not be satisfied with anything else.

Features

Following are a few of the TS-820's many exciting features.

SPEECH PROCESSER • An HF circut provides quick time constant compression using a true RF compressor as opposed to an IF clipper. Amount of compression is adjustable to the desired level by a convenient front panel control.

IF SHIFT • The IF SHIFT control varies the IF passband without changing the receive frequency. Enables the operator to eliminate unwanted signals by moving them out of the passband of the receiver. This feature alone makes the TS-820 the pacesetter that it is.

PLL • The TS-820 employs the latest phase lock loop circuitry. The single conversion receiver section performance offers superb protection against unwanted cross-modulation. And now, PLL allows the frequency to remain the same when switching sidebands (USB, LSB, CW) and eliminates having to recalibrate each time.

TS-820 Specifications

FREQUENCY RANGE: 1.8-29.7 MHz (160 - 10 meters)
MODES: USB, LSB, CW, FSK
INPUT POWER: 200W PEP on SSB
160 W DC on CW
100 W DC on FSK
ANTENNA IMPEDANCE: 50-75 ohms, unbalanced
CARRIER SUPPRESSION: Better than 40 dB
SIDEBAND SUPPRESSION: Better than 50 dB
SPURIOUS RADIATION: Greater than -60 dB (Harmonics more than -40 dB)
RECEIVER SENSITIVITY: Better than 0.25uV
RECEIVER SELECTIVITY:
SSB 2.4 kHz (-6 dB)
4.4 kHz (-60 dB)
CW* 0.5 kHz (-6 dB)
1.8 kHz (-60 dB)
*(with optional CW filter installed)
IMAGE RATIO: 160-15 meters: Better than 60 dB
10 meters: Better than 50 dB
IF REJECTION: Better than 80 dB
POWER REQUIREMENTS: 120/220 VAC, 50/60 Hz, 13.8 VDC (with optional DS-1A DC-DC converter)
POWER CONSUMPTION: Transmit: 280 Watts
Receive: 26 Watts (heaters off)
DIMENSIONS: 13-1/8" W x 6" H x 13-3/16" D
WEIGHT: 35.2 lbs (16 kg)

VFO-820

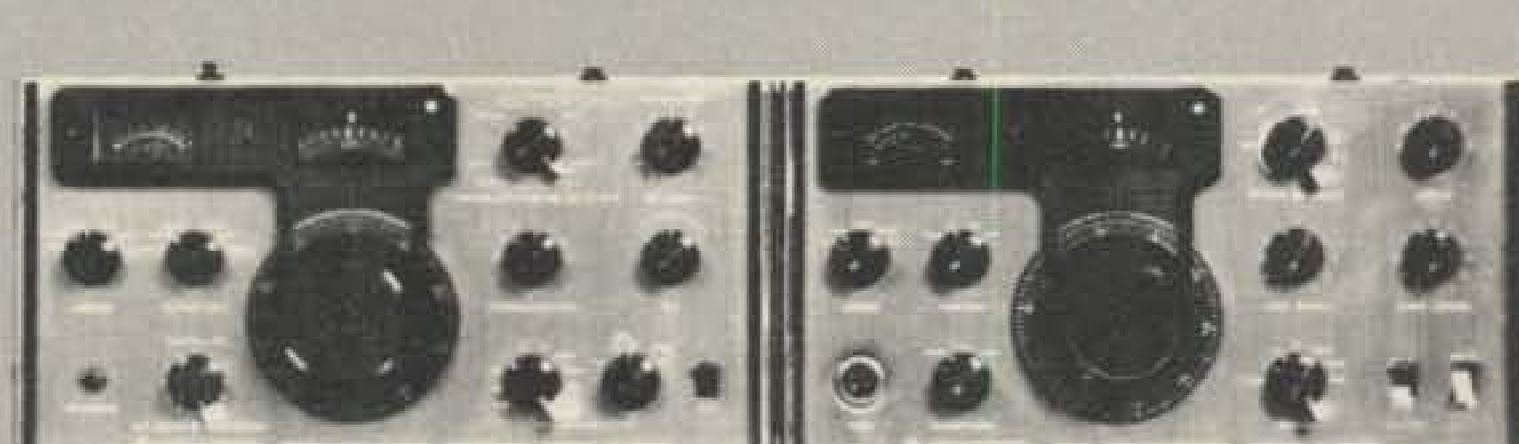
Solid state remote VFO designed exclusively for use with the TS-820 "Pacesetter". Contains its own RIT circuit and control switch . . . is fully compatible with the optional digital display in the TS-820.

TV-506 (Subject to FCC certification) **TV-502** **VFO-520** **TS-520** **SP-520**

As a TS-520 owner, you go on the air with a sense of pride and confidence. Thousands of these precision-built beauties are in operation all over the world . . . in ham shacks, field day sites, in DX and contest stations and in countless mobile installations. No other rig has ever offered the performance, dependability, versatility and value that is built into every KENWOOD TS-520.

You have certainly heard the TS-520's clean signal on the air and have probably heard a lot of glowing praise by other hams. So if you don't already own a 520, maybe it's time you did.

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watts DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPPRESSION: Better than –45 dB
UNWANTED SIDEBAND SUPPRESSION: Better than –40 dB
HARMONIC RADIATION: Better than –40 dB
AF RESPONSE: 400 to 2600 Hz (–6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB 2.4 kHz (–6 dB), 4.4 kHz (–60 dB), CW 0.5 kHz (–6 dB), 1.5 kHz (–60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x S-2001, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.



R-599D T-599D

The R-599D is the most complete receiver ever offered. It is entirely solid state and covers the full amateur band, 10 thru 160 meters, CW, LSB, USB, AM and FM. The T-599D transmits CW, LSB, USB and AM, has only 3 vacuum tubes, built-in power supply and full metering.

Because of the larger number of controls and dual VFOs, the combination offers flexibility impossible to duplicate with most transceivers . . . for example, transmitting and receiving on different frequencies, no matter how far apart.

TRIO-KENWOOD COMMUNICATIONS INC. 116 EAST ALONDRA/GARDENA, CA 90248

KENWOOD
. . . pacesetter in amateur radio

IN 2-METER & "220" MOBILE, MIDLAND MAKES IT

Midland makes four tough, top-performing mobile transceivers for serious amateurs. Reading from the top: There's Midland's newest—Model 13-510—with P.L.L. synthesizer, simplex and offsets to give it 4,000 frequency capability between 144 and 148 MHz. Combined with just about the most sensitive, selective dual conversion receiver you'll find, and a transmitter that puts out an honest 25 watts, you could hardly ask for more.

In the second row, there's Midland's deluxe, 30-watt 2-meter mobile—Model 13-505—featuring selective or simultaneous control for 12 crystal-controlled channels with "Channel A" priority switching, and such Midland standards as automatic VSWR protection and connection for tone burst.

The third row lines up Midland's basic 2-Meter mobile—Model 13-500. This popular 12-channel, 15-watt transceiver has a complete multiple FET front end couple with high-Q helicalized cavity resonators. Despite its small size (2¼" h. x 6⅜" w. x 8⅞" d.), it's designed for exceptional service and serviceability.

At the bottom is Model 13-509, Midland's "220" mobile. With 12-channel capacity, crystal controlled, it shares the compact size and receiver features of the 13-500 above, while delivering 10 watts output power (switchable to 1 watt when you want it).

All four are leading values from the leading name in personal communications: Midland.

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Dept. C, P.O. Box 1903, Kansas City, MO 64141

Want to know more about Midland Amateur Radio? Write for our free brochure today.

Triple chrome plated hardware is one reason why A/S is number one in antennas.

We're not about to rust on our laurels.

All of a sudden, the 2-way audio world has been flooded with a bewildering assortment of antenna brands. Some of these (including some that remarkably resemble ours) do not measure up to the performance, reliability and appearance standards that have made A/S antennas number one for over 20 consecutive years.

Superficial chrome plating (or no plating at all) is one way to cut cost without being obvious – for a few months. Whips made of inferior stainless steel work perfectly – until they hit their first tree limb. And erratic coil winding you can't see can cut miles from range.

A/S has never compromised its professional standards – the hidden virtues that make a world of difference in the performance of your radio system. Look for the stripes of quality. Your best assurance that you're getting what you're seeing.

® "Stripes of Quality"

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Here's a quick way to change your perspective on amateur radio. Bill DeWitt takes the mystery out of SSTV and puts you behind the camera. Hello World.

Slow Scan Television, Overview '77 Part I

BY BILL DEWITT*, W2DD

Editor's Note

Recognizing the need for introductory information regarding slow scan television, *CQ's* SSTV Editor, Bill DeWitt, has written a descriptive article on this subject. As Bill points out, this article omits many details and optional methods. It is a generalized overview for those who are not equipped to wallow in the nitty-gritty of this complex subject. The article will be presented in two parts.

Part 1 deals with WHAT and HOW, plus some definitions. It gives the reader some familiarity with the terminology of SSTV.

Part 2 will deal with specific pieces of equipment, how they're used, and operating practices.

If you want to know more about SSTV without getting all tangled up in technology, this article is for you! K2EEK

Interest in slow scan television (SSTV) is growing by leaps and bounds these days due to recent developments making it possible to view still pictures from all over the world on a conventional TV set monitor. Lowered prices of certain solid state chips needed in the equipment used have brought the "off-the-shelf" cost to amateurs into a range where SSTV gear is competitive with other amateur items such as power amplifiers etc.

However, it is apparent that not all amateurs are familiar with what's going on in this field, and those interested sometimes have difficulty getting enough information of a general nature to decide whether they want to get into this facet of amateur radio or not.

This article provides simplistic, generalized answers to questions often asked by people not involved in slow scan television.

*2112 Turk Hill Road, Fairport, N.Y. 14450

Two Highly Un-Technical Definitions

Perhaps a good place to start is by explaining the difference between the terms FAST SCAN and SLOW SCAN.

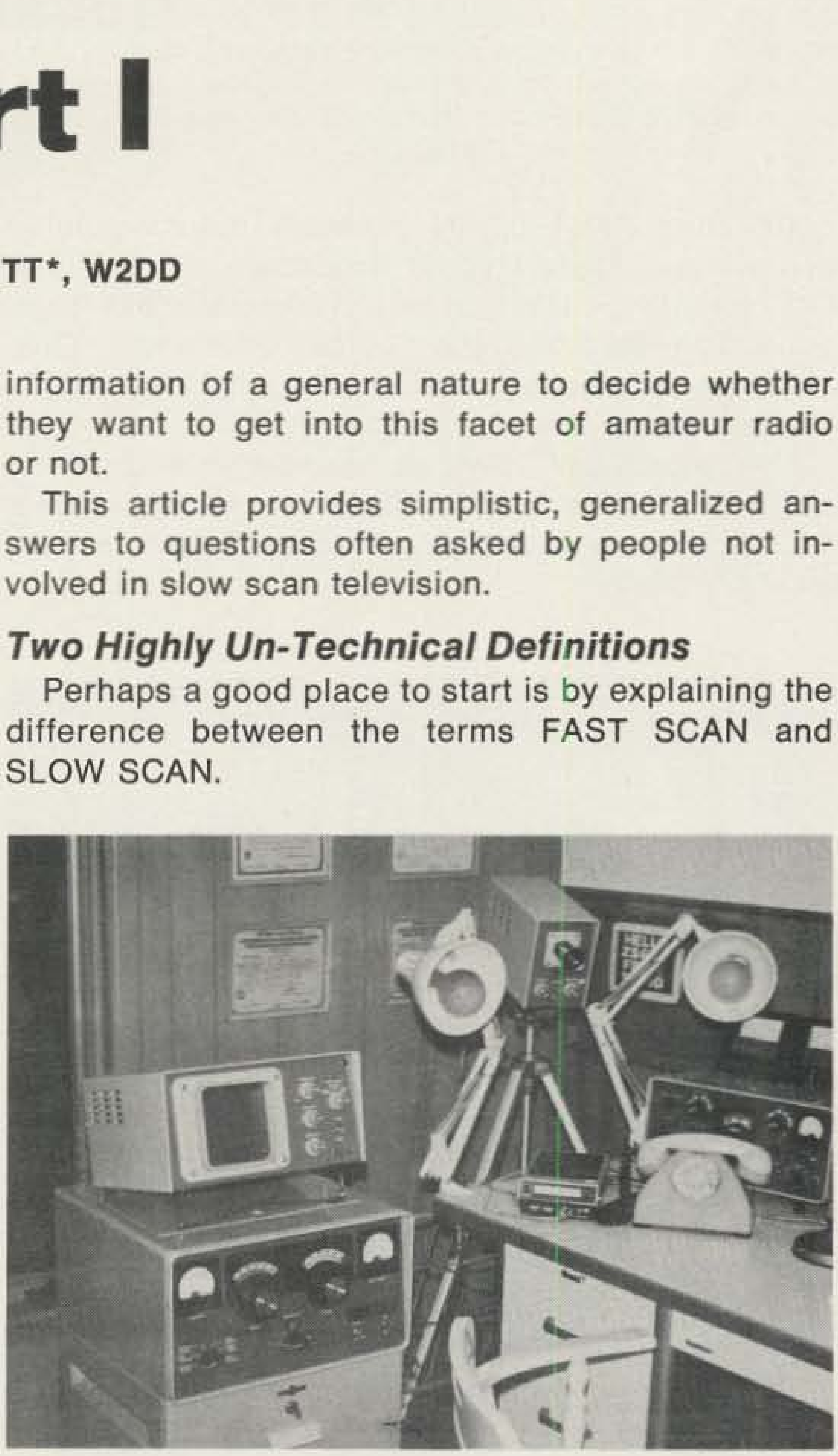

Fig. 1—All the makings for SSTV fun. At the left, a Robot Research Model 70 Monitor for viewing SSTV pictures on a long-persistence radar-like screen. Between the white lamps is a Robot Model 80 camera set up to transmit a picture of the operator. A Sony tape recorder is used to record SSTV "video" as described in the text.

Fig. 2—A station identification picture is shown here as displayed on both SLOW and FAST scan monitors. At the left, the bright sweep of the CRT beam proceeds down the screen. At the right, the complete station "ID" is seen displayed on a Panasonic monitor after scan conversion by the Robot Model 300 Storage Tube Scan Converter.

The term FAST SCAN generally means a television signal generated at broadcast or "Regular TV" rates. In the US, that means a nominal 525 lines per picture (two 256 line "fields" interlaced). One complete picture is transmitted every one-thirtieth of a second.

The term SLOW SCAN as used by amateurs generally means a television signal that creates a nominal 120 line picture every 8 seconds. It really is S-L-O-W SCAN!

Fig. 3—A closed circuit display of a color snapshot reproduced via SSTV. Starting with an image about 1 inch high (in the snapshot), this 4¾ inch square picture on a Robot Model 70 Monitor screen was created by the use of a close up lens on the television camera. (That's Peggy DeWitt's passport picture.)

Why Don't Amateurs Use "Regular TV" In The H.F. Bands?

In other words, why mess around with SLOW SCAN and its still pictures when TV with motion and color has been around for years?

The bandwidth required for Black and White broadcast TV is about 3 MHz. That's roughly equal to the total of *all* frequencies available to U.S. amateurs from the 3.5 through the 14 MHz. bands! So, FAST SCAN TV has to be strictly a u.h.f. proposition for amateurs.

To get around this bandwidth problem, Copthorne MacDonald invented SSTV which has a bandwidth of approximately 3 kHz. *In accordance with license restrictions* then, SSTV can be used in the h.f. bands from 3.5 through 29 MHz.[1] Most activity at this time centers around 3845, 7171, 14230, and 21340 kHz. with some stations on about 28860 during 10 meter band openings.

Are Special Receivers And Transmitters Needed For SSTV?

No. For the h.f. bands, you can use conventional s.s.b. receivers and transmitters (or transceivers) for SSTV communication.

SSTV gear can be regarded as sort of an add-on type of thing like RTTY. The SSTV signal simply feeds into the audio input of the transmitter for transmitting, or is fed from the audio output of the receiver into a monitor for picture viewing. (See below.)

The pictures are derived from variable audio tones that "warble" up and down according to the nature of the picture. Certain frequencies represent the range of tones from black to white, and synch signals have to be added—but more about this later.

What Is Needed To See SSTV Pictures?

To view SSTV pictures you need a MONITOR. A monitor is a device for converting audio signals mentioned above into structured images displayed on a cathode ray tube screen. You might think of it as sort of a TV set without the r.f. section.

There are two kinds of monitors. Those used originally (and probably 80-90% of those in use today) employ a cathode ray tube having a long persistence phosphor (like radar screens) that makes it possible to view the eight second long pictures. See fig. 1. The picture starts at the top of the screen and proceeds downward at a rate of 15 lines per second. But even with the radar-like screen, the picture fades out at the top of the screen as the scanning proceeds downward.

The second type of monitor is essentially a black and white TV set (minus the r.f. part). Its use requires that the SSTV signal be converted to FAST SCAN by means of a SCAN CONVERTER. See fig. 2.

It is the use of SCAN CONVERSION that has so

[1]Meaning the ten meter phone band.

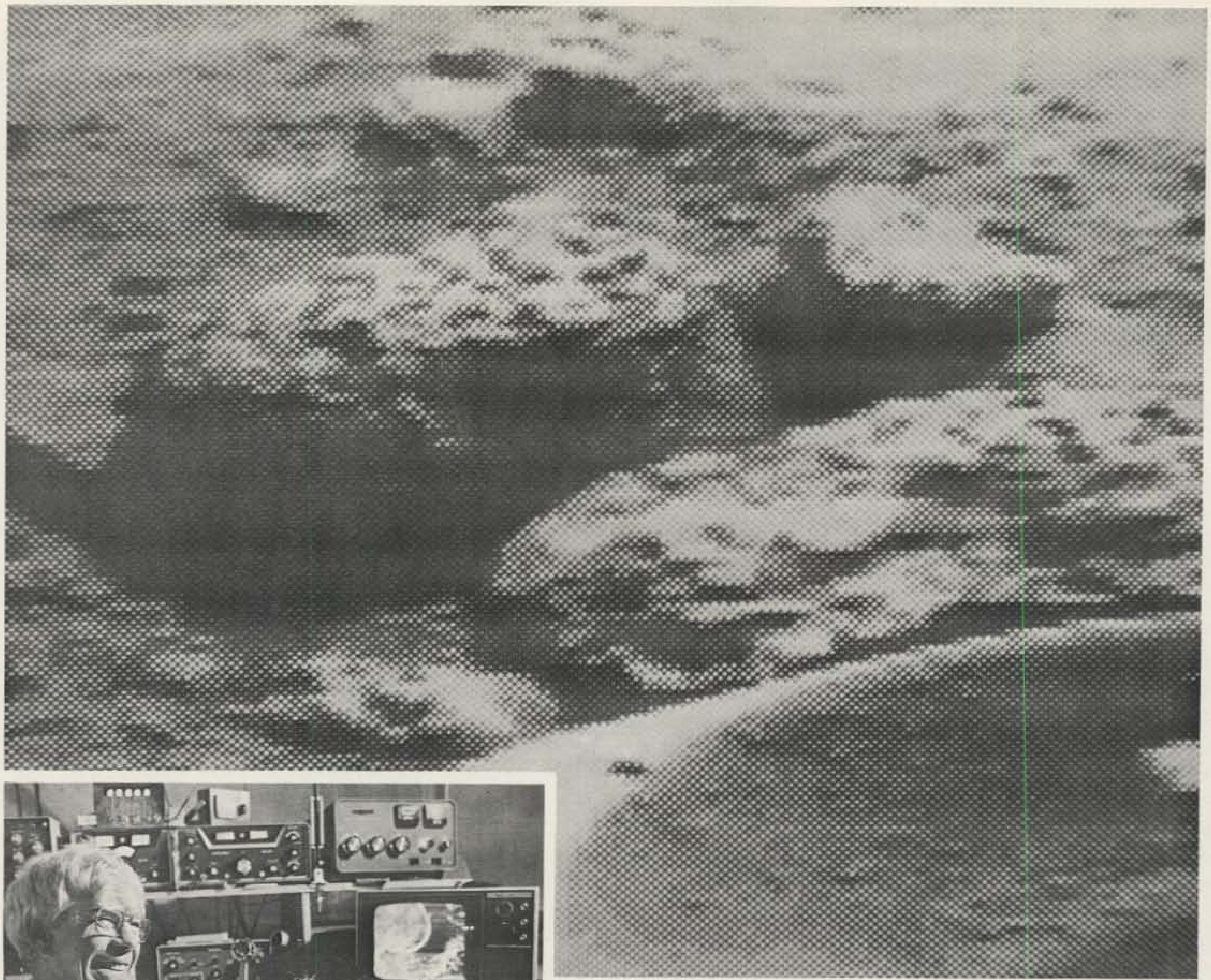

Fig. 4—Test picture received by W2DD from F6BDJ displayed on a 14 inch monitor via scan conversion.

dramatically increased amateur interest in SSTV during the past year.

What Are Scan Converters?

Scan converters are used to convert FAST SCAN signals to SLOW SCAN and to convert SLOW SCAN signals to FAST SCAN. (I *said* that I was going to provide some simplistic, generalized answers, didn't I?)

The cameras used in schools, industry, stores, etc., represent a darned good source of "surplus" TV cameras for the amateur involved in SSTV. But wait, you say, "Those are FAST SCAN cameras, aren't they?" Yep, but by using (you guessed it!) a scan converter, you can take the video output of the camera, convert it to SLOW SCAN, and pump it into your SSTV system. That's an example of FAST to SLOW scan conversion. Now let's go on to another example of scan conversion.

Although SSTV images are still most generally viewed on the screen of monitors using the radar screen type CRTs, it is indeed more desirable to view the pictures in complete form on a FAST SCAN monitor. This requires converting the SSTV information to the FAST SCAN rate. So, in this case, SLOW TO FAST SCAN CONVERSION is used.

Fig. 5—Portrait type photo received by W2DD from KV4CM under average band conditions. (Displayed on FAST scan monitor via Robot Research's new Model 400 Scan Converter.

There's much more that could be said about scan converters and how they work but we'll leave that for a later article. For this discussion of SSTV, let's just say that a scan converter is a device for converting FAST to SLOW, or SLOW to FAST! Now let's go on to some other aspects of SSTV.

How Much SSTV Activity Is There?

There are probably about 12,000 amateurs with some form of SSTV equipment in over 100 countries around the world. As your eye scans this printed page, there are no doubt several hundred of these amateurs swapping pictures via SSTV on one band or another.

What Kind Of Pictures Do You See On SSTV?

Subject matter varies considerably. Name, report, and location exchanges probably top the list, but pictures of "Ye Operator" and his family are seen in great quantity. Some SSTVers specialize in cartoon subjects. Pictures of vacation travels are popular as are "girlie" shots (of varied nature!). Very few circuit diagrams are seen, but pictures of homebrewed gear are sent in great abundance. Unfortunately only a few amateurs ever show pictures of their homes other than "the shack".

Pictures of the surface of Mars have been transmitted regularly by N6V, a specially licensed station at the Jet Propulsion Labs in California. This use of SSTV has created great interest and resulted in some excellent public relations attention for amateur radio (as well as slow scan itself).

How Good Is Picture Quality?

The degree of detail that can be resolved in SSTV images is limited by the 120 line structure of each frame and other considerations. However, the picture quality can be very good with strong signals and favorable conditions. As you might expect, fading and interference can cause slight to complete picture disruptions. Without the use of close-up lenses on the TV camera, print size must be limited to about ⅜", assuming a one to one reproduction at the receiving end. By the same token, a beautiful "Pepsodent" smile may not show the individual teeth unless the teeth are over ¼ high on a flat copy photo being televised. Fine line detail, like fronds of hair, just don't make it. But I can personally vouch for the fact that you can recognize hams you've met "on the air" when you see them in person! Perhaps some of the pictures included with this article are the best evidence of what quality can be expected of SSTV. See figs. 3, 4, and 5.

What Frequency And License Restrictions Apply To SSTV?

The rules vary quite a bit from one country to another, so it's best to find out what applies where YOU are! In the United States on the h.f. bands, it's pretty much an Advanced and Extra Class proposition except for 29 MHz and up where the General Class operators can use SSTV.

U.S. Extra and Advanced Class operators are permitted to use SSTV in their restricted areas of the phone bands from 3.5 through 21 MHz. The 29 MHz. and up bands are of course also useable by these operators for SSTV.

What Is Needed To Transmit SSTV Pictures?

To be able to transmit SSTV pictures you need one or more of the following: A TV camera fitted for SSTV operation; a "keyboard"; An *audio* tape recorder of good quality.

A "keyboard" is a device that looks like a typewriter, but its keys control a solid state character generator with circuitry that produces alpha-numeric characters for transmission and viewing on a monitor screen. In other words, you type out words on this keyboard and they show up on the TV screen. Neat, eh? Saves printing a lot of stuff on paper or cardboard and then pointing the camera at it! See fig. 6.

Because SST "video" signals generated by a camera or keyboard are in reality audio tones of varying frequencies between 1200 Hz. and 2300 Hz., they can be recorded on a conventional tape recorder. Yes, you can record "CQ SSTV," your name,

(Continued on page 75)

Fig. 6—In the foreground, a Sumner Electronics and Engr. Model HCV-3KB Slow Scan TV Keyboard. The title, KV4CM, was added to the portrait of fig. 5 by using the keyboard to "write in" the call letters. More about this technique in Part 2 of this article.

20th Annual CQ World Wide WPX/SSB Contest

0000 GMT MARCH 26-2400 GMT MARCH 27, 1977

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

EXAMPLE

Year 1977

World Wide WPX SSB Contest

Last Full Weekend of March

Call Sign W8IMZ — U.S.A. Country

[X] Single Operator: [X] All Band [ ] Single Band

[ ] Multi-Operator (All Band Only): [ ] Single Transmitter [ ] Multi-Transmitter

	QSO's (minus duplicates)		QSO Points		Prefix		Score		Rest Periods (Single Operator Stations Only)
1.8 mc	20	→	29	×	9	=		1.8 mc	
3.5 mc	24	→	48	×	13	=		3.5 mc	0300 to 0500
7.0 mc	32	→	69	×	16	=		7.0 mc	0630 to 1100
14 mc	131	→	301	×	81	=		14 mc	2230 to 0530
21 mc	66	→	162	×	30	=		21 mc	0700 to 1000
28 mc	41	→	99	×	23	=	↓	28 mc	2230 to 2400
All Bands	314	→	708	×	172	=	121,776	All Bands	Total: 18 hrs.

How to score: QSO Points x Prefixes = FINAL SCORE
A Prefix is counted only once. Score bottom line for All Band Score (Do not add scores from each Band).

Station Description: DRAKE-TR4C + RV4C + L4B + DENTRON 160 TRANSVERTER

Antenna(s) MOSLEY-CLASSIC 33-(10/15/20) + INVERTED "V" ON 40/80. LONG WIRE FOR 160.

Operators:

Remarks (Biggest thrill in Contest, funniest story, comments, etc.): "FINALLY WORKED W2WC ON 160 MTRS." — CLUB COMPETITION: CREDIT MY SCORE TO — MAD RIVER CONTEST Gp.

This is to certify that in this contest I have operated my transmitter within the limitations of my license and have observed fully the rules and regulations of the contest.

(Signature) Bernie Welch

Type or Print

Name BERNIE WELCH Call W8IMZ

Address 7735 REDBANK LANE

City DAYTON

State or Country OHIO Zip 45424

Logs must be postmarked no later than May 10 77

Note: Duplicate QSO's can mean disqualification.

Mail to: CQ Contest Committee
14 Vanderventer Ave.
Port Washington, N.Y., U.S.A. 11050

CQ Form 1078 · 1972

Sample summary sheet.

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

III Bands: All bands, 1.8 thru 28 MHz may be used, but operation is confined to two-way single side band *only*.

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

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

VI Points: 1. Contacts between stations on different continents; count 3 points on the 14, 21, and 28 MHz bands, and 6 points on the 7, 3.5 and 1.8 MHz bands.

2. Contacts between stations in the same continent but not in the same country; count 1 point on 14, 21 and 28 MHz, and 2 points on 7, 3.5 and 1.8 MHz. (Exception: Contacts between different North American countries count 2 points on 14, 21 and 28 MHz, and 4 points on 7, 3.5 and 1.8 MHz. This applies to North American countries *only).*

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

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

A **"PREFIX"** is considered to be

the three letter/number combination which forms the first part of an amateur radio call. (W1, W2, WB3, K4, WA6, WD8, W0, DL7, G3, IT9, 4X4, 3D6, 4J9, PY7, VK4, JE3, VE3, etc.) See WPX Awards Program information if additional clarification is necessary. It is available from W6TCQ.

Special event, commemorative and other unique prefix stations are also encouraged to participate.

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

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

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

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

1. In every participating country.

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

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

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

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

X Trophies & Plaques: *(Donors)*

1. WORLD—Single Operator, Single Band. *(Jack Reichert, W3ZKH)*

2. WORLD— Single Operator, All Band. *(North Florida **DX** Assn.)*

3. WORLD—Multi-operator, Single transmitter. The Ted Thorpe, ZL2AWJ Memorial. *(Don Miller, W9WNV)*

4. WORLD—Multi-operator, Multi-transmitter. The Chuck Swain, K7LMU Memorial. *(Don Miller, W9WNV)*

5. USA—Single Operator, Single Band. The Joe Johnson, W5QBM Memorial, *(Richardson Wireless Klub)*

6. USA—Single Operator, All Band. (Bob Epstein, K8HLR)

7. CANADA—Single Operator, Single Band. *(Gene Krehbiel, VE7KB)*

8. CANADA—Single Operator, All Band. *(Garth Hamilton, VE2VY)*

9. WORLD—Contest Manager's Plaque. To the DXpedition especially organized and operated in the WPX Contest, that the Commitee considers the most worthy. A minimum of three logs must be received. *(Bernie Welch, W8IMZ)*

XI Club Competition: A club award is being considered, provided interest continues to increase, and additional logs are received indicating the fact.

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

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

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

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

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

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

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

If official forms are not available you can make your own with 40 contacts to the page.

XIV Deadline: All entries must be postmarked no later than May 10, 1977. From rare isolated areas the deadline will be made more flexible. Your support is appreciated.

Logs go to: *CQ* WPX SSB Contest Committee, 14 Vanderventer Avenue, Port Washington, NY 11050 USA.

\EXAMPLE/

1977

WORLD-WIDE WPX SSB CONTEST

CQ CQ Page 5 of 13 Pages

CALL 4U1ITU Log For 21 Mc Band COUNTRY UNITED NATIONS-GENEVA

([redacted])

DATE / Time GMT	STATION	SERIAL NUMBER Sent	Received	Fill in only when QSO is mult. PREFIX	Points
26 MARCH					
1615	LA5QK	57160	57123	LA5	1
33	CT3BK	59161	59562	CT3	3
36	4J9B	58162	59799	4J9	
38	VU2DK	57163	57602	VU2	
48	KV4AA	56164	56333	KV4	
1705	VP5MZ	55165	59501	VP5	
14	WA4EYR	59166	59299	WA4	
17	W1WY	56167	55069	W1	
28	W1GYE	59168	57102		
38	WB4VQO	56169	56032	WB4	
46	WB3BAT	59170	59299	WB3	
1802	W8BI	57171	59183	W8	
06	WA9BWY	59172	59298	WA9	
13	WB8IAY/Ø	58173	57173	WBØ	
17	W8IMZ	57174	58069		
19	XE1LLS	59175	59309	XE1	
24	HI8MOG	59176	59281	HI8	
27	HI8EVA	59177	57075		
~~38~~	~~VP5MZ~~	~~54178~~	~~45595~~		0 Dup.
50	W6MAR	59179	59210	W6	3
1900	W6YRA	59180	59203		
10	W4SYL/5	57181	56090	W5	
18	WA7OBL	59182	58139	WA7	
25	5W1AZ	59183	59602	5W1	
33	VK4VU	59184	59599	VK4	
40	WA6EVX/KG6	59185	59403	KG6	
48	JA6UBK	46186	54121	JA6	
56	KA6RI	55187	57399	KA6	
2010	OA4AHA	59188	59493	OA4	
16	PY3AHS	59189	59491	PY3	
26	VE3BMV	59190	59435	VE3	
2038	W2PV	59191	59422	W2	
REST OFF — 2040				0640 = 10 HOURS	
27 MARCH					
0641	W4WSF	59192	59301	W4	3
58	DK2BI	57193	56714	DK2	1
0712	SP9AI	57194	57401	SP9	
15	UX3R	56195	56395	UX3	
17	JW5NM	55196	57194	JW5	
19	G4BBA	59197	59291	G4	
20	G4DBW	59198	59093		
			TOTAL POINTS THIS SHEET	33	100

CQ Form 1069 eff. Feb. 1968

Sample log sheet.

Part II, the conclusion of this discussion covers a variety of waveguide characteristics and concepts. There's a lot more to it than meets the eye.

WAVEGUIDES—Part II

BY GARY H. PRICE*, W6IRA

In part one[1] we examined propagation in a simple parallelplate waveguide and outlined how the concepts used could be extended to describe propagation in more realistic waveguides, such as the common rectangular guide. Let's continue our discussion by first examining in more detail the cutoff characteristics of modes in the rectangular guide.

We had found in part one that cutoff is characterized by, among other things, the wavelength along the guide becoming infinite. As in the case of the parallel-plate guide, the ratio of the wavelength along the wave path to that along the guide is just the cosine of the angle between them. This angle is in turn closely related to those which the wave path makes with perpendiculars to each pair of guide walls; the sum of the squares of the cosines of these three angles is unity. (This relationship is just a generalization to three dimensions of Pythagoras' Theorem that the sum of the squares of the sides of a right triangle equals the square of the hypotenuse.)

Suppose we take one pair of guide walls to be separated a distance $\underline{a}$ and the other pair a distance $\underline{b}$, as shown in fig. 4. Call α the angle between the wave path and the perpendicular to the first pair of walls ($\underline{a}$ part), call β the angle between the wave path and the perpendicular to the other pair of walls ($\underline{b}$ apart), and call β the angle between the wave path and the perpendicular to the other pair of walls (b apart), and call γ the angle between the wave path guide axis. Then we can write the angle relationship as

$$\cos^2 \gamma = \left(\frac{\lambda}{\lambda_g}\right) = 1 - \cos^2\alpha - \cos^2\beta. \quad (5)$$

But the wave patterns across the guide determined by the boundary conditions at the walls require that the wave along the wave path project an integral number of half cycles onto each perpendicular. This condition specifies the angles α and β:

$$\cos\alpha = \frac{n\lambda}{2\underline{a}} \quad (6)$$

and

$$\cos\beta = \frac{m\lambda}{2\underline{b}} \quad (7)$$

where n is the number of half cycles projected onto the perpendicular spanning the width a, and m is the number projected onto the perpendicular spanning the width b. Thus, m and n are just the subscripts in the mode identifiers: $TE_{m,n}$ or $TM_{m,n}$.

If we substitute the equivalents for $\cos\alpha$ and $\cos\beta$ from Eqs. (6) and (7) into Eq. (5) and rearrange the result, we can now obtain the desired expression for λ_g, the wavelength along the guide:

$$\lambda_g = \frac{\lambda}{\left[1 - \left(\frac{n\lambda}{2\underline{a}}\right)^2 - \left(\frac{m\lambda}{2\underline{b}}\right)^2\right]^{1/2}} \quad (8)$$

If we let b become very large so that our rectangular waveguide begins to look like a pair of parallel plates, Eq. (8) reduces to Eq. (4) for the wavelength along the parallel-plate waveguide. Indeed, it would be somewhat disconcerting if it did not!

Finally, the cutoff wavelength of the guide is just that value of λ for which λ_g becomes infinite. For this to happen, the denominator of Eq. (8) must become zero. Thus, we require

$$1 - \left(\frac{n\lambda_c}{2\underline{a}}\right)^2 - \left(\frac{m\lambda_c}{2\underline{b}}\right)^2 = 0. \quad (9)$$

If we rearrange Eq. (9) to give λ_c explicitly, we find

$$\lambda_c = \frac{1}{\left[\left(\frac{n}{2\underline{a}}\right)^2 + \left(\frac{m}{2\underline{b}}\right)^2\right]^{1/2}} \quad (10)$$

The mode normally used in a rectangular waveguide is the $TE_{0,1}$ mode, which has the lowest cutoff frequency. Substitution of the values $\underline{m} = 0$ and $\underline{n} = 1$ into Eq. (10) gives $\lambda_c = 2\underline{a}$ for the cutoff wavelength of this mode, the value quoted in standard

*733 Blue Sage Drive, Sunnyvale, CA 94086

[1]*CQ*, Dec. 1976, p. 62.

references. If the rectangular guide were nearly square in cross-section, there would be only a narrow range of frequency between the cutoff of the $TE_{0,1}$ mode and that of the $TE_{1,0}$ mode, for which the roles of the two pairs of walls are reversed. Since it is usually desirable to operate a waveguide with but a single mode above cutoff, and since operation near cutoff generally increases losses, the spacing between the broad walls of rectangular waveguides is normally made much less than (conventionally one-half) that between the narrow walls.

Circular Guide

A second common waveguide is that having a circular cross-section. A detailed discussion of the modes in the circular guide would involve somewhat less familiar mathematics than that appropriate to the rectangular guide, but otherwise procedes in much the same manner. As for the latter, the possible modes in the circular guide can be enumerated in terms of their polarization, TE or TM, and two indices that denote the half-cycle patterns of the fields across the guide. For the circular guide, one of these indices describes the field variation from the guide center, or axis, to the wall; the other index describes the field variation around a loop encircling this axis. The lowest-order mode (i.e., that which is cutoff at the lowest frequency) is the $TE_{1,1}$ mode This mode has a field pattern somewhat similiar to the lowest-order mode in the rectangular guide, the $TE_{0,1}$ mode, as can be seen from fig. 5.

The second lowest cutoff frequency in the circular guide is possessed by the $TM_{0,1}$ mode. This mode is particularly useful because the fields have rotational (azimuthal) symmetry about the cylinder axis. This symmetry permits the insertion of rotary joints into the guide without affecting the fields seen by coupling probes. However, particular care is necessary in such situations to ensure that the lower-order mode not be excited as well by poor probe placement or by imperfections in the guide. Such difficulties are largely avoided in a guide operated beyond cutoff for all except its lowest-order mode since the cutoff-mode fields decay rapidly with distance from their excitation point.

Transmission Lines

We noted in the introduction that transmission lines can be considered a particular type of waveguide. As such, their behavior is more like that of the parallel-plate waveguide than that of the rectangular waveguide. The major distinguishing feature of transmission lines is the absence of a cutoff frequency for the lowest-order mode. This mode would be equivalent to a $TE_{0,0}$ (or $TM_{0,0}$) mode, if such were possible in the rectangular guide.

Such a mode, designated a TEM (transverse electric and magnetic) mode, requires two separated conductors, between which the electric field lines

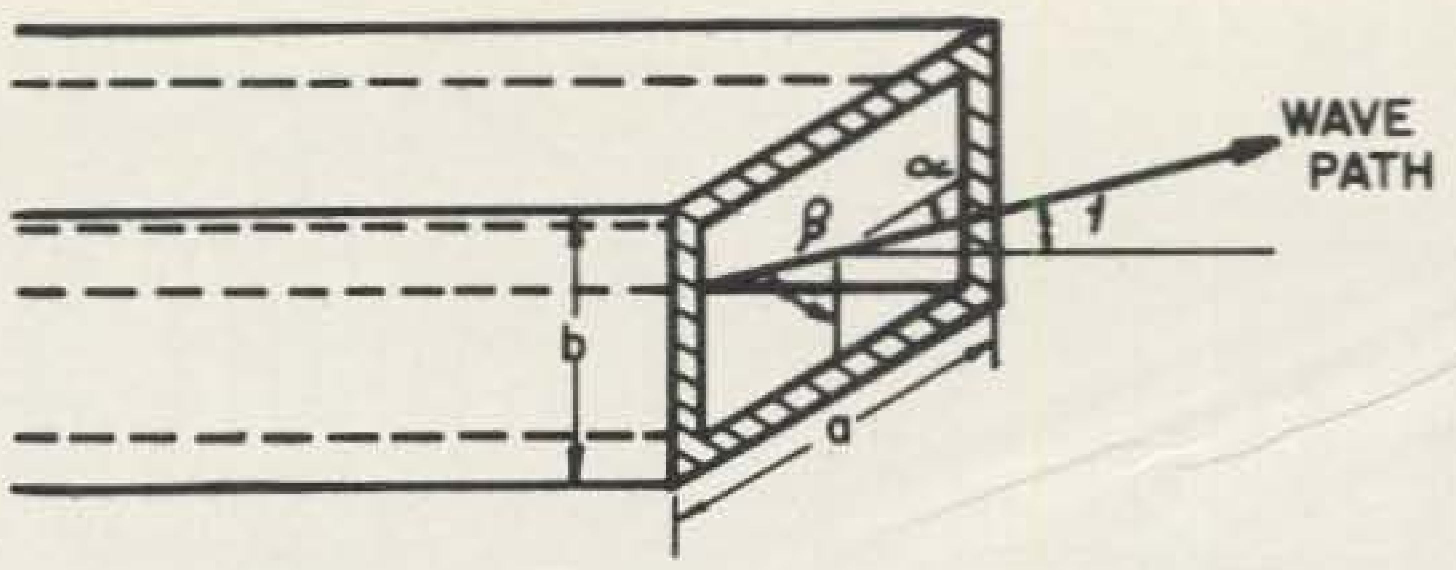

Fig. 4—Wave-path geometry in rectangular waveguide.

can run at right angles. The field is not required to vary periodically in the other transverse direction since in this direction no boundaries are encountered. The magnetic field is perpendicular to the electric field and parallel to the conductors; thus, its component perpendicular to the conductors is automatically zero, satisfying the magnetic-field boundary condition. The TEM-mode fields in a coaxial transmisssion line are shown in fig. 6.

Coupling

The general requirements for a probe to couple energy into and out of a waveguide effectively are readily understood in terms of the field patterns in the guide. In simplest terms, the probe must match the field characteristics of the mode to be excited. An electric-field probe, for example, can take the form of a short monopole protruding into the guide, with the guide wall in which it is placed forming the equivalent of a ground plane. Such a probe would excite and sense those modes that have an electric-field component normal to the wall on which the probe is mounted. Similarily, a magnetic-field probe can take the form of a loop encircling magnetic-field lines of the mode to be excited, or sensed. Since the tangential component of the magnetic field need not be zero at the guide walls, a loop encircling this field component can be readily formed by bending a probe back around in a half circle to contact the wall.

In order to illustrate placement of such coupling devices more concretely, consider the $TE_{0,1}$ mode in a rectangular guide. The electric- and magnetic-field components of this mode are constant across the guide between the closely-spaced, broad walls and have a single half-cycle variation across the guide between the widely-spaced, narrow walls. This behavior is illustrated in fig. 5(A) for the single electric-field component, which runs across the narrow width of the guide, between its broad walls. In addition to this field component, the magnetic field has two components. One of these is parallel to the guide axis (longitudinal) and is maximum and of opposite sign at the two narrow walls of the guide, diminishing to become zero and change sign midway between them. The other magnetic-field component runs across the broad width of the guide between its narrow walls, at which it is zero; it is maximum midway between them.

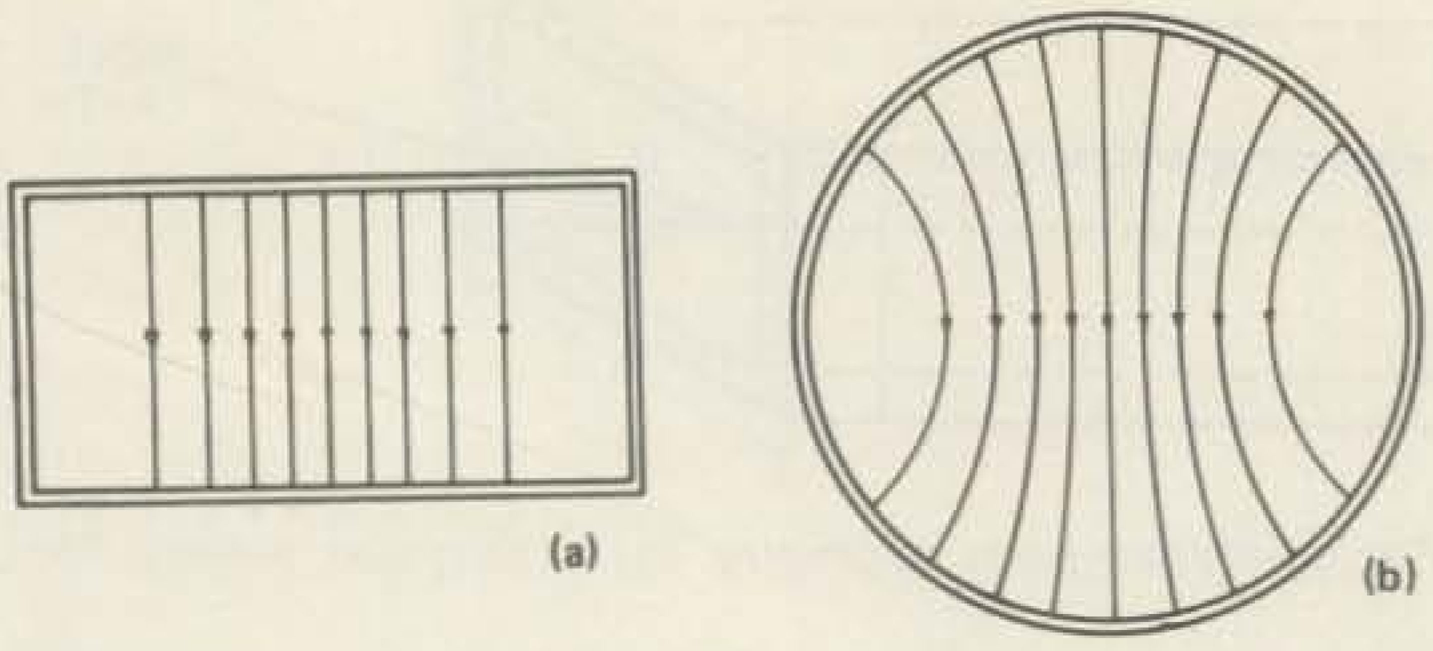

Fig. 5—Electric fields of lowest-order mode in rectangular and cylindrical waveguides.

If we wished to excite this mode with an electric monopole, it could be placed, then, at the midpoint of one of the broad walls of the guide, where the normal component of the electric field is greatest. Alternatively, we could excite the mode with magnetic loops placed to link the magnetic fields present at either the narrow or the broad guide walls. A loop placed on one of the broad walls would be oriented with its plane parallel to the guide axis in order to link the transverse magnetic-field component at that wall, but one placed on one of the narrow walls would be oriented with its plane perpendicular to the guide axis in order to link the longitudinal magnetic-field component at that wall.

It is also desirable for some purposes to provide openings in the guide walls with minimal disturbance to the fields inside. Proper placement of such openings can be simply determined by consideration of the current flow in the guide walls. Namely, any slit should be parallel to this flow, so as not to interrupt it. The current in the wall is closely related to the tangential magnetic field at the wall, much as are the current in a wire and the magnetic field surrounding it—in both cases the magnetic field at the surface of the conductor is perpendicular to the current in it. Thus, for the $TE_{0,1}$ mode of the rectangular guide, the transverse magnetic-field component present at the broad walls is accompanied by a current along the guide in these walls. This current is maximum at the midpoint of each broad wall and diminishes to zero at the junction of these walls with the narrow walls. The longitudinal magnetic-field component is present at both the broad and the narrow walls, and is accompanied by a transverse current across each wall from one edge to the other. This current is uniform across the narrow walls, but is becomes zero and changes sign at the midpoint of the broad walls. Thus, a slit can be cut along the midline of one of the broad walls, or across one of the narrow walls, without interrupting any current path. Ideally, such a slit will not perturb the fields in the guide.

In addition to their use to couple energy into or out of waveguide, isolated probes are sometimes used to provide tuning adjustments in conjunction with other probes or devices. In such use, the function of the tuning probe is to couple to the propagating mode and scatter a portion of its energy. The presence of the scattered wave modifies the field pattern in the guide, and this modification in turn affects the coupling characteristics of the other devices in the guide. Placed near a receiving or transmitting probe, such a tuning probe functions much like a parasitic element in a conventional beam antenna.

An extreme example of the effects of a scattered wave is provided by a solid conducting wall closing the end of a guide. Such a wall reflects back down the guide essentially all the energy incident upon it, thus setting up a standing-wave pattern along the guide in addition to those across it. If the guide is terminated in this way at both ends, satisfaction of the field boundary conditions at all three sets of walls is possible only for certain discrete frequencies, and we have a resonant cavity.

A Macrowave Guide

Waveguide principles also have wider application than is commonly realized. Consider, for example, propagation around the earth by means of reflection from the ionosphere. The earth and the ionosphere can be considered as the walls of a waveguide which is grossly similar to our simple parallel-plate example. For the high-frequency radio bands normally of interest to us, this waveguide is a great many wavelengths wide, and thus permits an enormous number of propagating modes. This richness makes a waveguide description awkward, and not particularly revealing.

World-wide radio transmissions are also possible, however, at much lower frequencies, down into the very-low-frequency (v.l.f.) band, from 3 to 30 kHz, and even below. The Sanguine system, much in the news some years ago, envisioned the use of frequencies in the tens-of-Hertz range! These low frequencies are reflected at altitudes on the order of 80 kilometers in the lower ionosphere. The earth-ionosphere waveguide is thus only a few to several wavelengths wide at v.l.f., and a managable number of modes are above cutoff. At even lower frequencies, below about 2 kHz, the guide is cutoff for all but the TEM mode.

The earth-ionosphere waveguide at these low frequencies displays many intriguing characteristics not encountered in more conventional waveguides. Its multimodal nature, for example, leads to periodic variations of the field strength along the guide. These fluctuations are caused by interference between the different modes, whose wavelengths along the guide differ. In the tens-of-Hertz frequency range, the wavelength is the order of the earth's circumference, and the guide begins to show the characteristics of a resonant cavity, with standing waves formed by interference between waves traveling in opposite directions around the earth. The existence of these resonances was first postulated by the German scientist Schumann, after whom they are named, in 1952. The resonances are continually excited by radiation from lightning discharges. The lowest resonance frequency, at which the earth's circumference is just one wavelength, is about 8 Hz.

The ionospheric boundary is also a complex, lossy reflector, whose properties vary with the angle at which the wave path intersects it and with the direction of the path relative to the earth's static magnetic field, as well as with geographic location and with time. Consequently, the modal properties vary in a complicated way as functions of these parameters, and often change dramatically with path orientation and wave frequency.

Curiously, at the grazing angles of incidence of the wave path characteristic of the lower-order modes in a guide, the ionosphere tends to act like a 'magnetic conductor' at v.l.f.; that is, the component of the magnetic field parallel to the ionospheric boundary tends to vanish, rather like that of the electric field at the surface of a conventional conductor. The ground, on the other hand, behaves like a conventional conductor. As a result, the lowest-order mode at v.l.f. is a TM mode with a quarter-cycle field variation from ground to ionosphere. Furthermore, as a result of the polarization-mixing property of ionospheric reflection, the characteristic modes are at best only approximately TE and TM. Given this complexity, it is understandable why confusion existed for a time concerning the appropriate way to index the earth-ionosphere waveguide modes at v.l.f.

Acknowledgment

The comments and suggestions of George Parks, W6AOF, upon reading an earlier version of the manuscript proved very helpful. Most of the figures were drafted by Scott Price, whose assistance is much appreciated.

Bibliography

The following texts supplement and extend the material presented above in various ways.

L. V. Blake, *Transmission Lines and Waveguides* (John Wiley & Sons, Inc. New York, 1969). Good discussion of concepts; keeps mathematics to a minimum.

S. Ramo and J. R. Whinnery, *Fields and Waves in Modern Radio,* second edition, Ch. 9 (John Wiley & Sons, Inc. New York, 1953). Straightforward engineering discussion of waveguide properties; including diagrams of fields for lower-order modes in rectangular and cylindrical guides.

J. C. Slater, *Microwave Transmission* (Dover Publications, Inc., New York, 1959). A classic, but mathematical. ■

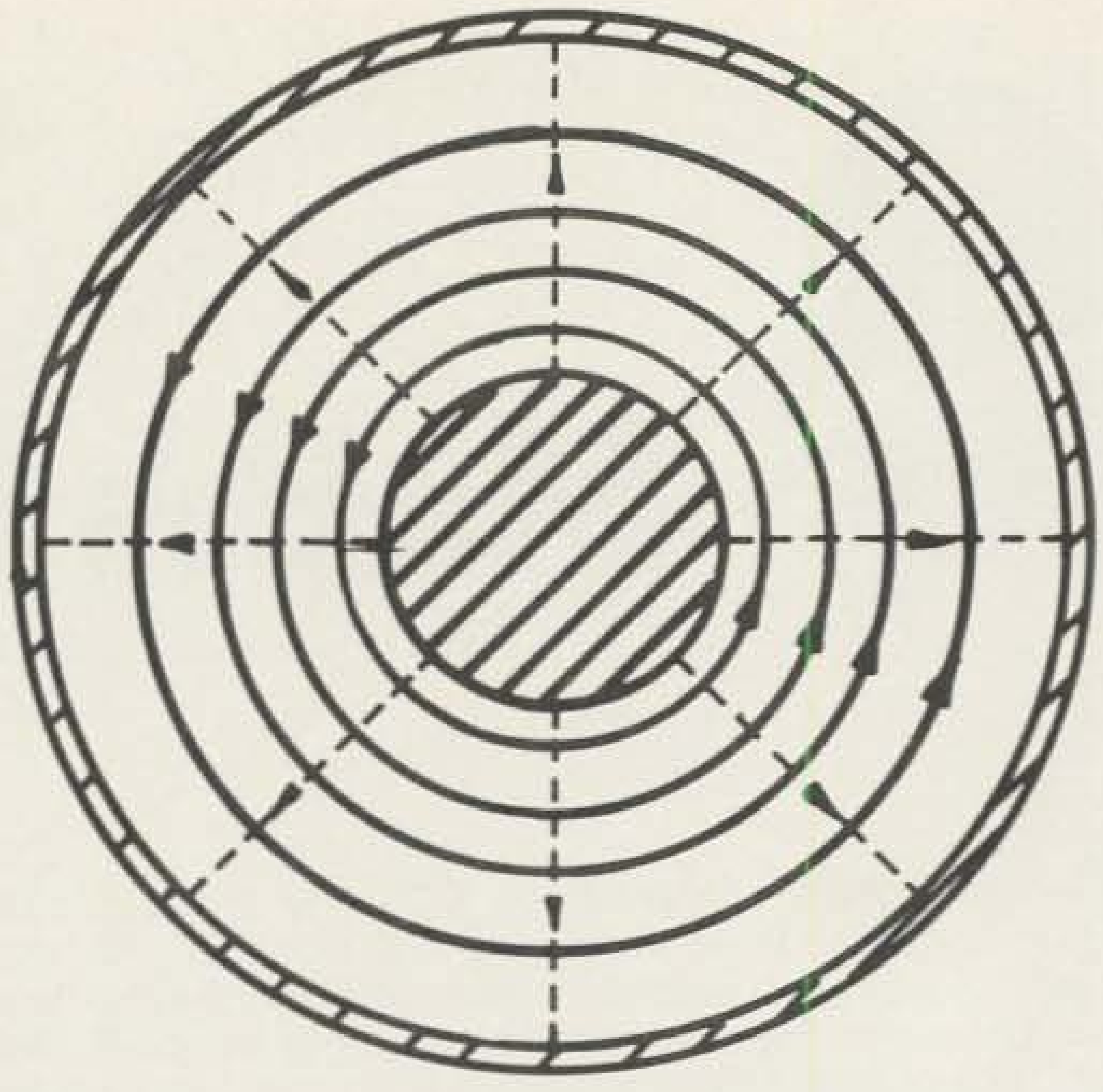

Fig. 6—Fields of TEM mode in coaxial transmission line.

Math's Notes

BY IRWIN MATH, WA2NDM

The conversion of standard BCD digital signals to the popular decimal or seven segment readout codes is well known to the experimenter. In fact, many integrated circuits, enabling the driving of most available readout devices exist making this job even easier.

This month, however, in response to several readers' requests, we will discuss the opposite. The conversion of decimal and seven segment signals back into BCD. This technique is useful where data needs to be sent over distances as it reduces the number of necessary wires from 10 or 7 to 4 per decade.

Another application is to further process signals directly from the readout of an instrument, DVM, counter, etc. without tapping into the rest of the instruments' circuitry.

Fig. 1 shows the schematic of a simple-to-implement decimal to BCD converter. Note that a digital "1" or high level on any input forward biases the appropriate diodes in the circuit to produce a digital "1" or high output at the respective BCD output. The output lines may be connected to inverters, individual transistors and the like to produce the proper drive requirements for CMOS, TTL, DTL, or any other desired logic system. Current drawn from a readout will be a function of the load resistor values used as well as the value of the input isolating resistors. This point should be kept in mind when choosing these components.

*5 Melville Lane, Great Neck, NY 11020.

In fig. 2 we have employed a National Semiconductor DM 86L25 as a seven segment to BCD converter. This integrated circuit was specifically designed for the job and will convert either standard or inverted seven segment inputs to BCD. It is a 5 volt device however and must be used at this V_{cc} level-unlike the diode converter just described. The outputs of the DM86L25 may be converted to other logic levels if desired by the addition of additional resistors, transistors or, in the case of CMOS, simply a buffering inverter.

As already stated, the use of these converters makes the transfer of digital data over long distances significantly less expensive and simpler than by means of multiple wires.

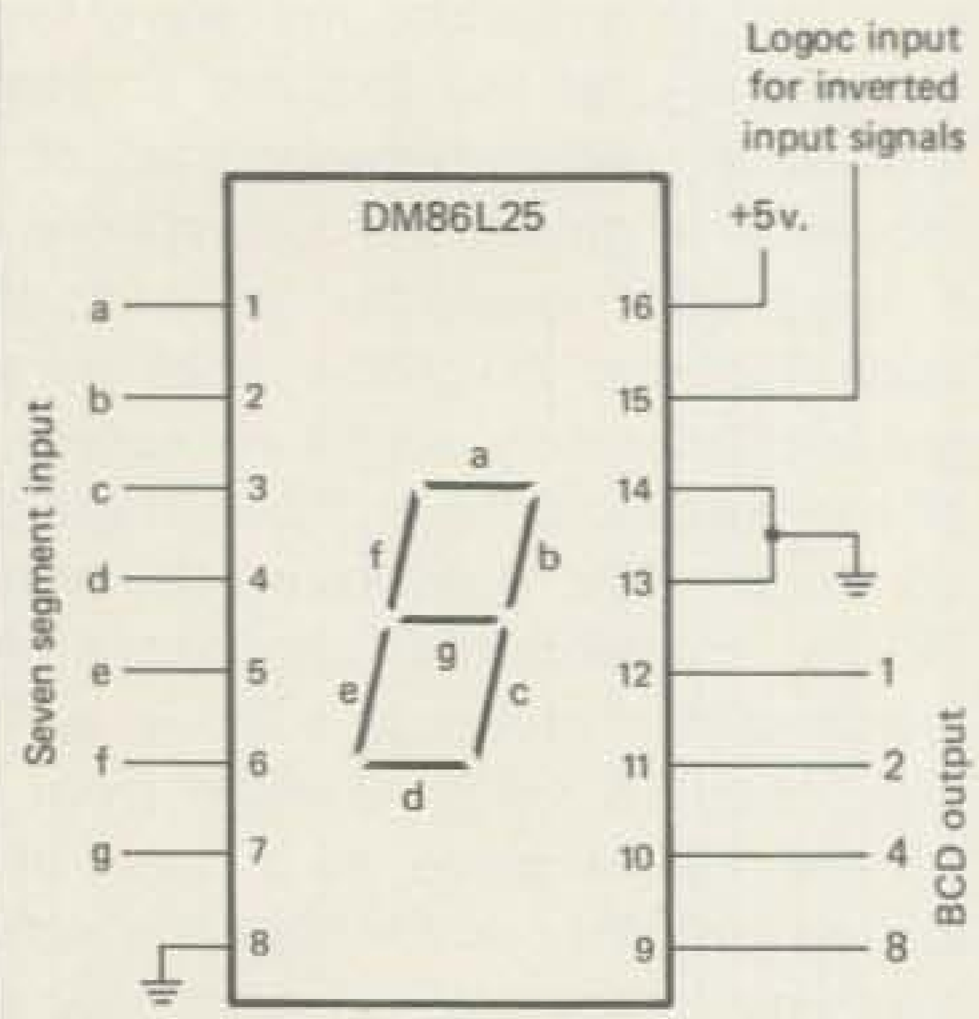

Fig. 2—A 7 segment to BCD Converter. See the data sheet on this device for the operation of pins 13 to 15.

Another question we have been asked by several readers of the two part calculator chip series we did in August and September of 1976, is "how do I convert the multiplexed calculator output signals to "stable" nonflickering BCD for use with additional circuitry?" A solution, I hope, is given in fig. 3.

Here we are using a DM 86L25 as a seven segment to BCD converter which in turn drives a SN7475 quad latch to "store" the signals.

As you know, each number of a calculator display of the type we described in the series, is only energized at one time interval during a complete scan of all of the numbers. The proper interval is further determined by a "digit" output signal so that even though the segments of all readouts are energized at the same time, only the selected one lights.

The DM 86L25 continually converts

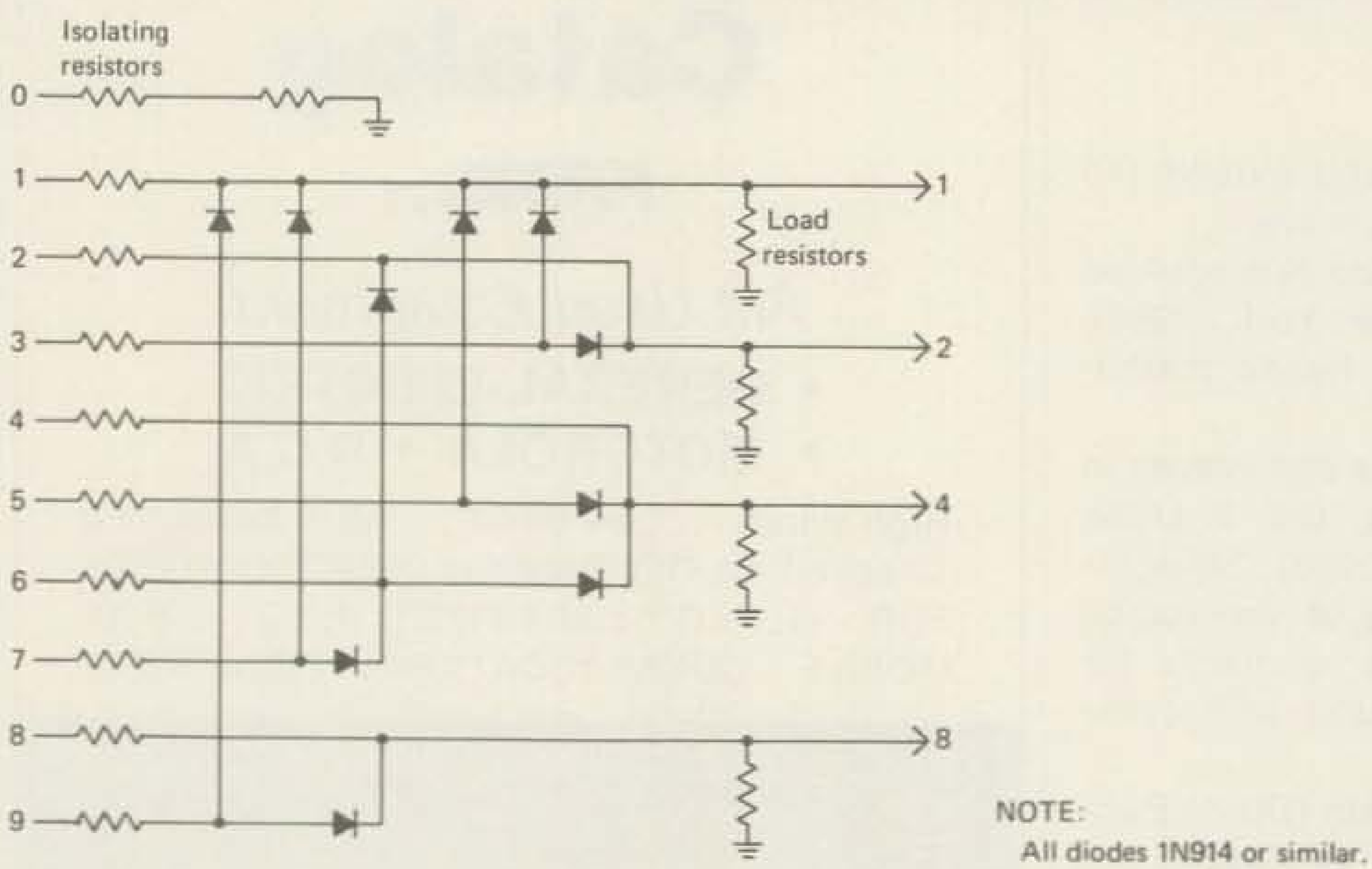

Fig. 1—Basic decimal to BCD converter described in the text.

the seven segment information to BCD as the numbers change, but only at the correct time is the SN7475 associated with a particular number "updated." This SN7475 then holds or stores the proper number (making it available as an output) until it is re-updated when the number changes.

The schematic shows only two digits for clarity but of course as many as are desired can be accommodated by adding more DM 86L25s and SN7475s.

Before employing these chips in the converters just described, it is strongly advised that you write to National Semiconductor at 2900 Semiconductor Drive, Santa Clara, California, 95051, and ask for data sheets on the chips. They will be of the greatest use when the circuit doesn't work because of some minor point that was omitted or not considered.

When using the calculator chip, by the way, be certain that your V_{cc} level comes on very rapidly. Several readers have apparently ignored this point with the result that the circuitry simply refuses to operate. One solution is an additional on-off switch, directly in the V_{cc} line of the MM5736. Another solution is a simple time-delay relay which applies V_{cc} to the calculator chip after all filter capacitors are fully charged—usually ½ to 1 second.

A very happy New Year to all readers of Math's Notes and may the coming year bring all of your wishes and desires.

73, Irwin, WA2NDM

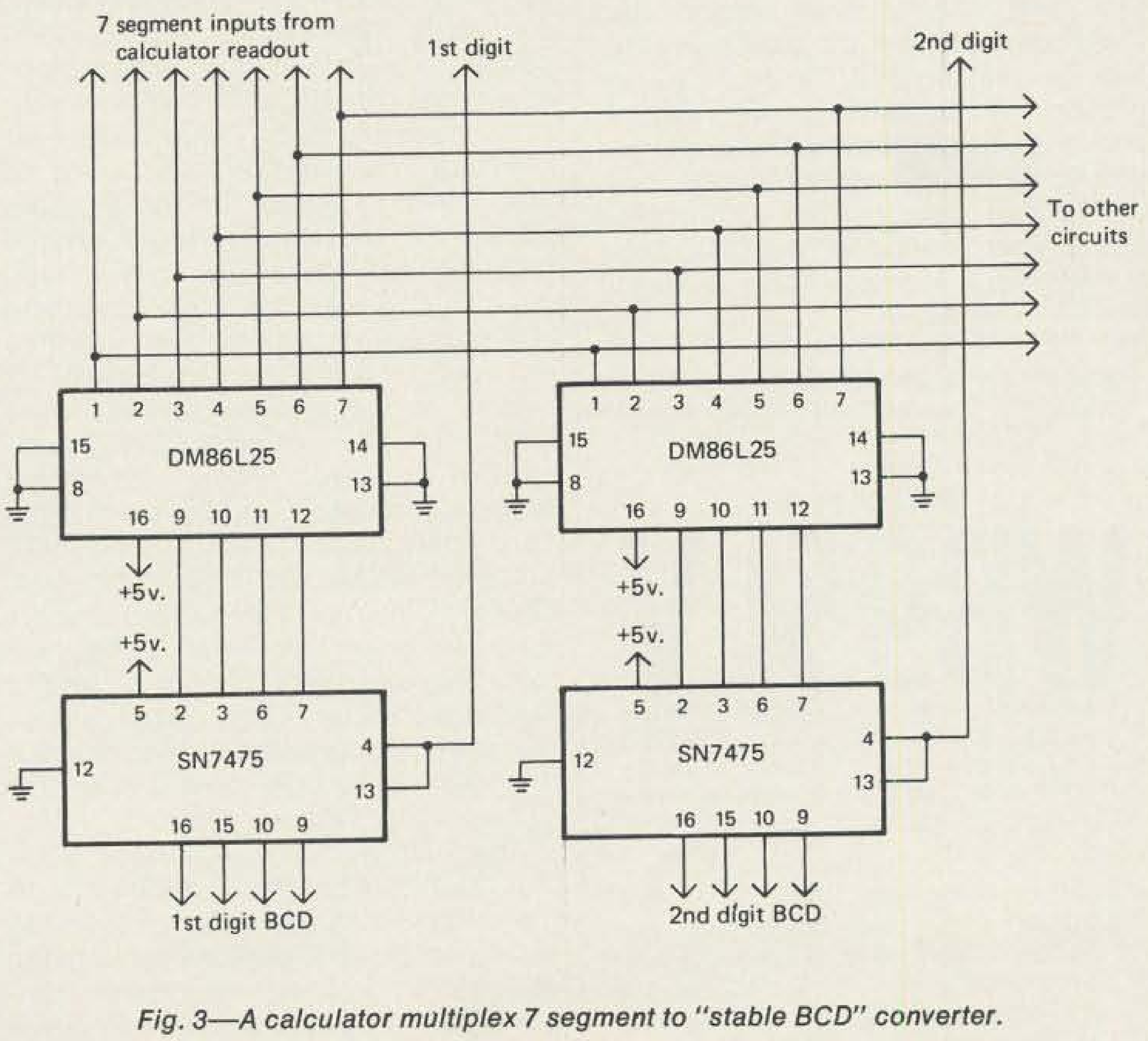

Fig. 3—A calculator multiplex 7 segment to "stable BCD" converter.

Novice

BY HERBERT S. BRIER*, W9AD

Getting And Sending QSL Cards— The Call Book

As soon as an amateur receives his new or modified license, he waits impatiently for the *Call Book* to list his call sign, license class, and name and address. When the FCC computer kicks out an amateur license, the licensee's copy is mailed to him with minimum delay, often appearing in his mailbox within a few days of the date of issue. Another copy of the license goes to the *Call Book* for its editors to extract the information for the *Call Book* entry, after which the copy goes into the FCC files. The system breaks down, though, because the FCC is slow in getting the information to the *Call Book*. As the *Call Book* publishes only one annual winter domestic edition and one foreign edition and three supplements for each, any delay in making the annual winter edition is particularly aggravating because comparatively few people subscribe for the supplements.

You can help getting information about your license in the *Call Book* a little more promptly. Any time you receive a license showing a new call sign, address change, or other information not already in the *Call Book*, mail a photocopy of the license to the *Call Book* with a note to the editors explaining why you are sending it. Major changes in call signs are handled by the *Call Book* thusly: "W9EGQ Now W9AD," and a completely new listing for W9AD is included in the appropriate place.

*409 So. 14th St., Chesterton, Ind. 46304.
[1]Radio Amateur Call Book, Inc., 925 Sherwood Drive, Lake Bluff, Ill. 60044.

This simple, "one-color" QSL card has all information on the face of the card, convenient for QSL cards displayed in albums or on the "shack" wall. Incidently, the card was handled by the W7IZH QSL Service.

QSL Cards

The important reason that most amateurs want their call signs and addresses published in the *Call Book* promptly and accurately is to receive QSL cards from stations they work. "QSL" cards take their name from the international "Q" signal, QSL: "I acknowledge receipt of . . ." and are used to confirm 2-way radio contacts between amateurs. QSL cards are like kisses: they are expected to be returned in kind. Physically, standard QSL cards are the size of U.S. postal cards. Other sizes cost more to mail and are awkward to file. The call letters of the sending station are normally printed on the face of the card. Its city, state, county, and country, plus the name and address of the operator, are also included on the front of the card.

Half of the address side of the card is usually reserved for the business of the card: "Radio (call letters of the station receiving the card): This card confirms our 2-way (mode) contact on —— MHz at (time and date in GMT or Universal Time). Your signals were RST——" A small space for remarks is usually provided, and a brief description of the station equipment, including antennas rounds out this part of the QSL card, except for "Thanks" or "Please QSL. 73, ——"

The Ham Ads of the various amateur radio magazines abound with the offers of QSL card printers to send prospective customers samples of their work upon request accompanied by a couple of coins to cover return postage. We wish to impress all readers, however, that a letter or plain postal card containing the required information will be accepted as proof of contact for any operating award as readily as an elaborate printed card.

Al Ferreira, WN2EQP, 1309 Maple Hill Road, Castleton, N.Y. 12033 uses a World War II TCS transmitter-Receiver running 50 watts on 80 and 40 meters. His antenna is a 80 meter dipole. He battled a hive of bees to get the antenna up. Al wants to be a forester when he gets out of school. We are sending WN2EQP a 1-year subscription to CQ for sending us this picture. If you want to try your luck, send a clear picture of you at the controls of your station and a brief history of your radio career to: Photo Contest, c/o Herbert S. Brier, W9AD, Novice Editor, CQ Magazine, 409 South 14th St., Chesterton, Indiana 46304. Nonwinners will also be published as space permits.

Where And When To Send QSL Cards

It is generally considered advisable in well-behaved amateur circles to have worked the station before sending a QSL card to verify the contact. Nevertheless, there are always a certain number of cards received that do not check with the recipient's log. Most of the non-checking cards are the result of common mistakes like transposing letters in call signs, confusion in

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changing local time to universal time, and misreading dates. For example, you would probably think a date written 2-10-76 meant February 10, 1976. Many foreign countries put the day first and the month last. Moral: Always write out the name of the month.

After working a station whose QSL card you want, you must decide where to send your card. If his address is not in the *Call Book*, you can ask the operator for his address and send him your card immediately. It works better than waiting for the other fellow to QSL first. Except for beginners and amateurs needing a particular QSL card, the average amateur resists QSLing first, because a certain percentage of "100 per cent QSL'ers" are better at promising than at delivering.

Do not waste your expensive cards and postage on addresses like: "Operator Pete, Radio Station WD9-XYZ, Any Place, Some State 12345." As the Post Office is more and more automated, the less likely incompletely addressed mail is to be delivered. But if you have confidence in the address you used on an unanswered card, wait a couple of weeks and try again. Mail does get lost or mislaid. Possibly, the non-QSLer does not have any formal cards and doesn't realize that you would be happy with any written confirmation. (You would, wouldn't you?) Mail your second card in an envelope with a courteous note. A stamped, addressed return envelope doesn't hurt, either. In the meantime, try working other stations from the missing locality.

Foreign QSL Cards

In several ways, exchanging cards with foreign stations you work may seem simpler than with U.S. stations. You can send the card to the addressee's *Call Book* address; via his national QSL Bureau, the address of which heads his country's listing in the *Call Book*. The complete list of National QSL Bureaus appear periodically in *QST* and in other publications. If you are an ARRL member, you can send up to 20 foreign amateurs to be distributed via the foreign QSL Bureaus a month for a dollar fee. You can send your QSL card to the DX station's "QSL Manager," or via a privately run QSL Bureau.

Whichever of these possibilities you use to send your foreign cards, most of the foreign QSL cards you receive will be via the ARRL incoming QSL Bureau—if you keep postpaid envelopes on file with your call area bureau for your cards. If you work DX or hope to work DX, keep a supply of 5" × 7" envelopes on file with your call-area QSL bureau. Put

(continued on page 78)

New CQ DX Contest Directors Named

Robert Cox, K3EST, and Carl "Larry" Brockman, WA6EPQ, have been appointed co-directors of the CQ World-Wide DX Contest.

The new directors' responsibilities include supervision of both the DX Contest and the Contest Committee.

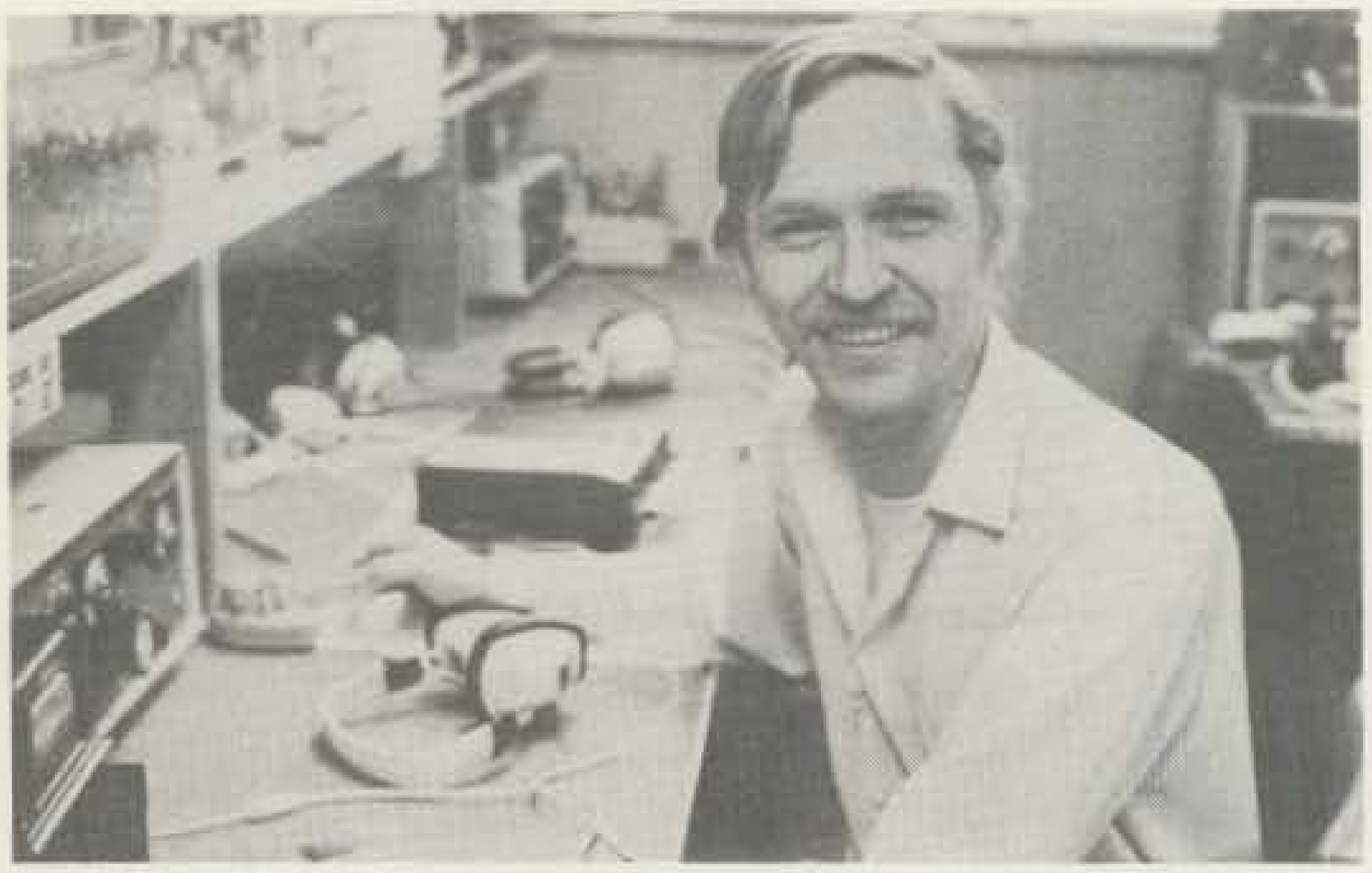
Bob, K3EST, is a veteran member of the Contest Committee who lives in the Washington, D.C. area. He operates the CQ & ARRL DX contests from the multi-multi, W3AU. And single-ops the other contests during the year.

He's a college professor (anatomy & physiology) who also enjoys birdwatching and camping. Bob is co-holder the world Multi-Multi phone record which he and his PVRC teammates set at PJ9JR with a 19-million point DX-pedition in 1974.

Larry, WA6EPQ, was first licensed in 1959 and joined the Contest Committee in 1973. Dr. Brockman is a Technical Supervisor at Hughes Aircraft Co. in Los Angeles. When not contesting, Larry likes to chase DX. He's an avid photographer. And with his wife, Jane, and their two sons enjoys experimental gardening.

Larry is a past president of the So. California DX Club and a member of the DXCC Honor Roll.

Frank Anzalone, W1WY, continues in his position as Chairman of the Contest. ■



Robert "Bob" Cox, K3EST.

Carl "Larry" Brockman, WA6EPQ.

CQ Reviews:

The Yaesu YC-355D Frequency Counter

BY HUGH R. PAUL*, W6POK

With the advancement of IC technology, the cost of frequency counters for amateur use has dropped to the point that they are no longer considered a luxury item for the ham shack. A survey of the market reveals a number of units that are ideal for amateur use. We will attempt to report in the coming months on some of those units considered to be good buys.

The Yaesu YC-355D is one of several counters manufactured by Yaesu Musen Co. It happens to be the lowest priced unit (229.00) in the line, but would appear to meet the needs of the majority of radio amateurs.

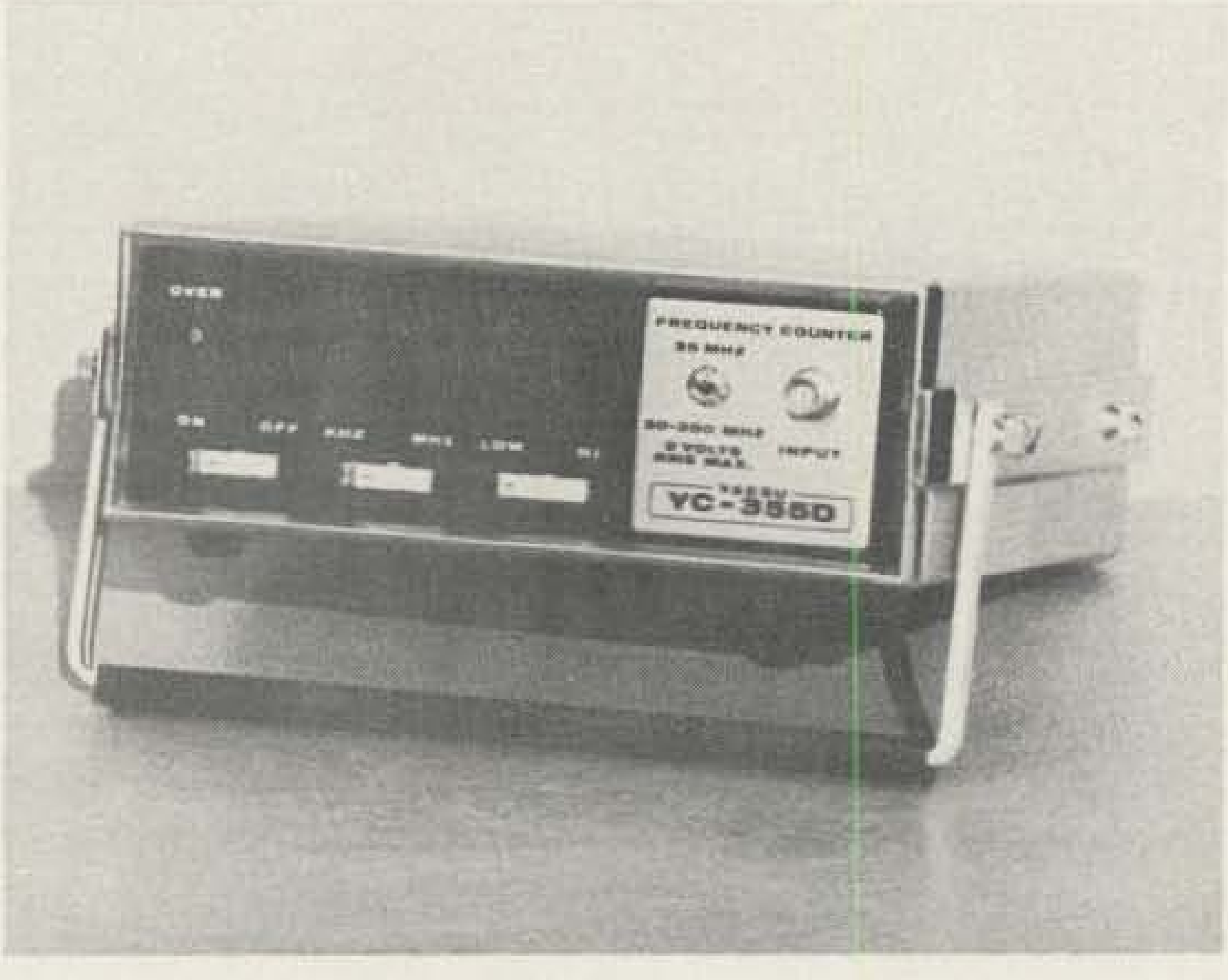
The YC-355D offers a 5 digit Nixie type display that will read to 8 digits. This is possible because the counter is a dual range system. If the counter is on the MHz range and the indicators show 12.346 MHz, then the actual frequency is between 12.345 and 12.346 MHz. If the range switch is set to kHz then the next 3 digits can be read off, i.e. it may then show 45.678 kHz. The actual frequency as read would then be 12.345678 MHz, however the last digit will be one count in error, i.e. the last digit could be a 7 rather than an 8.

Accuracy of the count is dependent on the stability of the time base, which is rated by Yaesu to be within ± 25 parts per million over the extreme temperature range of 0 degrees C (32 deg. F) to 40 degrees C (104 deg. F). At 25 degrees C (76 deg. F) the stability is rated at ± 5 parts per million. The time base employs a 1 MHz crystal, without an oven. At a stability of plus or minus 5 parts per million this would mean that the time base would be 1 MHz plus or minus 5 Hz, assuming that the time base oscillator had been properly calibrated to 1 MHz to begin with. If you were reading a frequency of 146 MHz you could have an error of as much as plus or minus 730 Hz. At temperatures other than 25 degrees C the error would be greater.

The unit tested was purchased from a local Yaesu dealer, straight off the shelf. After unpacking, the counter was allowed to run for 30 minutes and then was set up to read the output of a laboratory signal generator. A lab counter with a time base oscillator locked to WWV was also set up to read the output of the signal generator. The accuracy of the lab counter is better than 1 part per million. Surprise, both counters were reading the same. Ambient temperature was 70 deg. F or 21 degrees C if you prefer.

Similar tests were run over a period of time and the YC-355D was found to read within 1 part per million most of the time at ambient temperatures of 70 to 80 degrees F. The greatest error noted over this range was 2 parts per million for short durations. This is excellent accuracy and considerably better than claimed by Yaesu. An effort was made to find other users of the YC-355D and compare findings.

It appears that the accuracy specified by Yaesu for the YC-355D is a long term figure. If you will take the time to calibrate the time base oscillator periodically with WWV, the accuracy of the counter can readily be within 5 parts per million for ex-



Front view of the Yaesu YC-355D frequency counter.

*291 Macalester Drive, Walnut, CA 91789

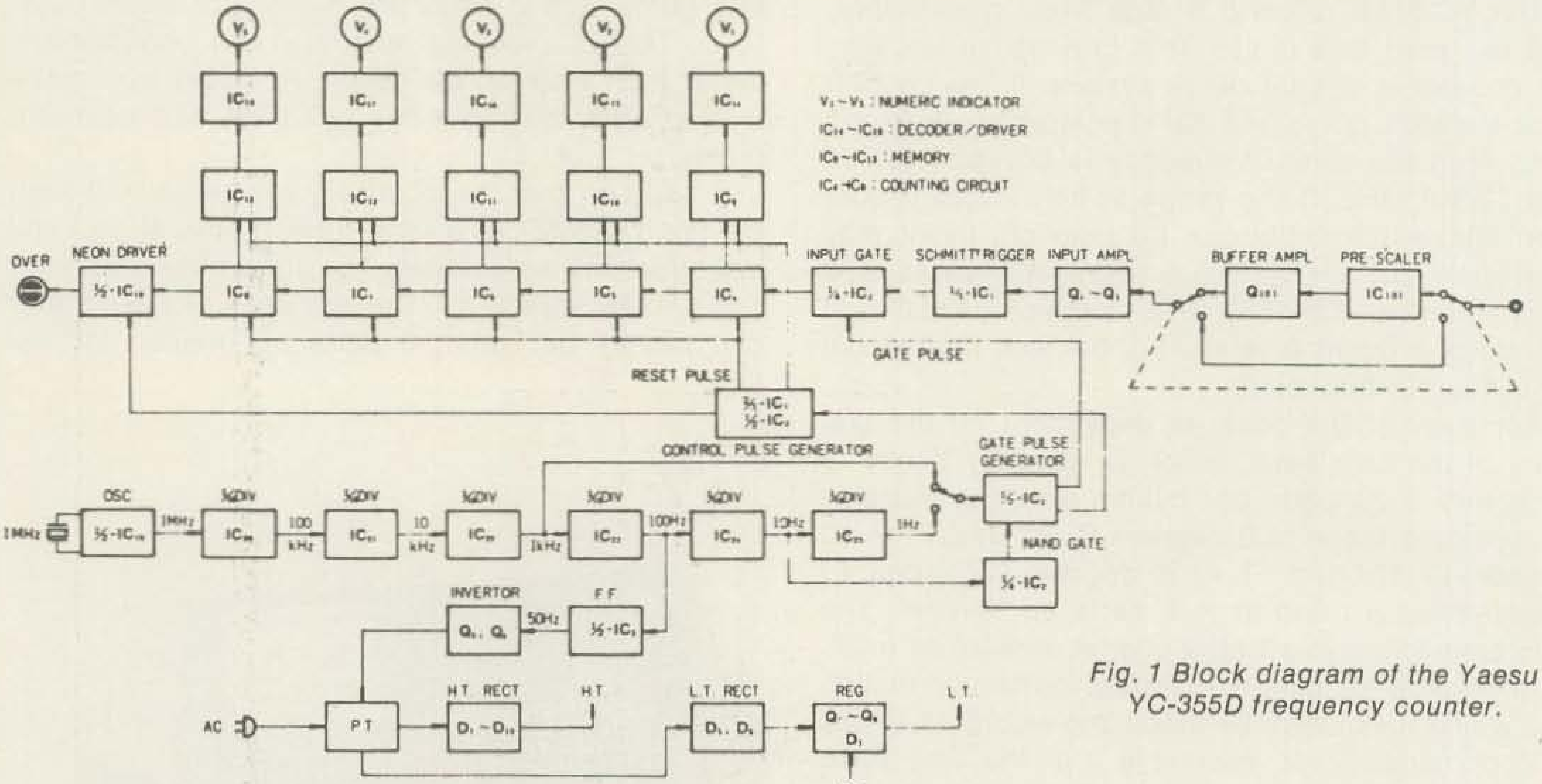


Fig. 1 Block diagram of the Yaesu YC-355D frequency counter.

tended periods of time and within 2 parts per million for shorter periods.

The block diagram illustrates the divider chain, which derives either 1 kHz or 10 Hz from the 1 MHz crystal oscillator to control the gate pulse generator. The counter has two ranges for reading frequencies from 5 Hz to 200 MHz. When the range of 30 MHz to 200 MHz is selected, the input signal is routed through the built in pre-scaler. A Schmitt trigger is used to convert the input signal to a square wave for driving the counter chain consisting of ICs 4 through 8.

(continued on page 75)

Even if you didn't get one of these beauties in your stocking, the improvements may well benefit your present rig.

Signal/One Transceiver Improvements

By ROBERT A. SULLIVAN,* WØYVA/4

One of the most sophisticated pieces of equipment to be made available for the amateur market was the SIGNAL/ONE transceiver, models CX7, CX7A, CX7B. These beautiful rigs contain just about every feature one might imagine and as such, are very complicated. Unfortunately they are no longer manufactured and it is difficult to obtain repair information. It appears that in the near future an updated version of the CX7 series will be made available as the CX11[1], but there is still a need for technical information to keep the numerous CX7 series units operational.

Over the years numerous problems have arisen with the CX7 that indicate the need for minor changes in design. This article describes numerous modifications that have proven useful additions to the CX7 in terms of operational reliability and convenience. The modifications described have been installed by numerous owners, including myself, with excellent results.

Because of the complexity of the CX7 it is suggested you do not tear into the rig without some previous electronics knowledge. If you do not feel qualified get someone to help you.[2] Detailed step-by-step instructions are not given for all the modifications and it is assumed you have at your disposal the original technical manual or better still, the improved Thomas Advertising Company manual.[3]

Receiver Incremental Tuning (RIT)

Although the CX7 does provide an A/TO mode (transmitter frequency offset), no provisions for RIT were included. The circuit of figure 1 may be easily constructed on a small piece of vector board and mounted on a new potentiometer which replaces the existing FSK front panel potentiometer. Install and adjust as follows:

(**a**) Remove the existing FSK pot and mount the new RIT pot (R3) in its place.

(**b**) Connect white wire #10 on the arm of the FSK pot to the arm of R3 (This will allow RIT with VFO B).

(**c**) Blue wire #52 is —15 volts and may be used for the —15 volt supply to the vector board assembly.

(**d**) Add new wires for +5 volts, ground, and R/T line. Route as required.

(**e**) Turn RIT on and adjust R3 for the center of the frequency range and put the knob on so the pointer is at 12 o'clock.

*P.O. Box 6216
Arlington, VA 22206

[1]Details concerning the CX11 are available from Payne Radio, Springfield, Tennessee or from the SIGNAL/ONE Corporation, Box 127, Franklin Lakes, New Jersey, 07417.

[2]Write to the author for suggestions for help or for additional information on the modifications.

[3]This manual is available from the author or directly from Thomas Advertising Company, 715 Silver Spring Road, Suite 210, Rolling Hills Estates, California, 90274.

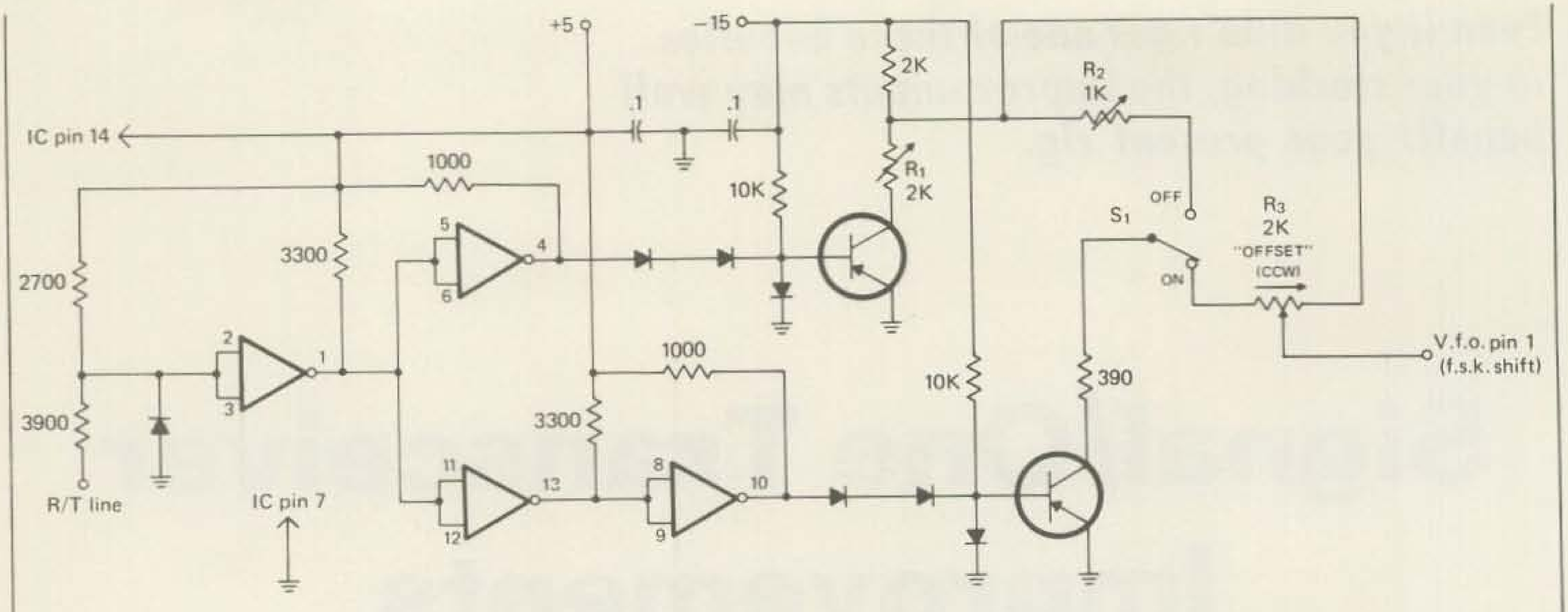


Fig. 1—Receiver offset tuning schematic. The IC is an SN7401, all diodes are 1N4148, transistors are 2N2907. Switch S1 is mounted on R3, the new offset control. All potentiometers have a linear taper.

(f) Turn RIT off and adjust R2 for the same frequency as read in the above step.

(g) Key transmitter and adjust R1 for this same frequency.

This modification will provide approximately ±4kHz of offset. VFO A may also be used with the RIT modification. If this is desired, an additional wire would have to be routed between VFO A and the new RIT board.

Additional Cooling

This is a **must!** Although the CX7 utilizes a massive heat sink at the rear panel for the 8072 final, additional cooling is required for reliable operation. Place a small muffin fan on top of the cabinet midway between the final cage and power transformer. It is also desirable to mount a 4×4 inch aluminum shield between the final cage and power transformer to act as a heat shield.

Protection For Counter Board Against Inadvertent High Voltage

Certain failures will allow the counter board to see +1500 volts on the +300 volt line which will damage nearly every semiconductor on this board. A simple modification will prevent this damage by blowing a fuse. (This modification is not required by those rigs using the newer LED boards such as the one provided by Cunningham, K0HHP). Install the circuit of fig. 2. If the +300 volt line rises to a high value, the zeners will conduct and cause the fuse to open.

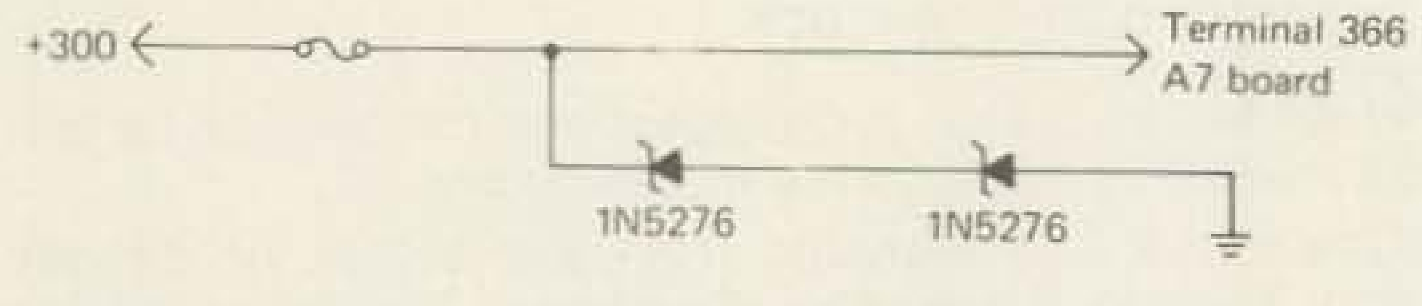


Fig. 2 — Counter board high-voltage protection.

Final Tube Protection

Fuse the screen at .05 amp. A fuse holder may be installed on the rear panel. Access to the screen lead is at the feedthroughs located on the final cage.

Parasitic Oscillations

Most parasitics will be cured by placing a single ferrite bead on each of the grid and screen terminals at the 8072 socket.

Reducing Intermodulation Products On Strong Signals

When in the A/TO transmit mode, both of the 35 MHz oscillators are running when in the receive mode, resulting in intermodulation products on strong signals. The following change will shut the offset oscillator off except in Spot or Transmit modes:

Connect a diode (1N914, etc.) on S2 board with cathode to A/TO switch (S2B) pin 12 and anode to Spot switch (S2E) pin 17.

Preventing RF Driver Board Damage

If coupling capacitor C30 fails with an 8072 plate-to-grid short, 1800 volts will appear on the driver board! Additional protection can be obtained by replacing the present 1 kV unit used for C30 with a 3 kV disc of the same value.

Installation Of MFJ CWF-2 Filter

Narrow c.w. filters are difficult to obtain for the CX7 and are quite expensive. The little c.w. filter by MFJ does an excellent job and can be mounted inside the rig and switched with the Mode switch. No external mechanical modifications are required. Bandwidths of 70, 110, and 180 Hz are provided and are selected in the FSK, CW3, and CW2 positions of the Mode switch respectively. (The CW1 position pro-

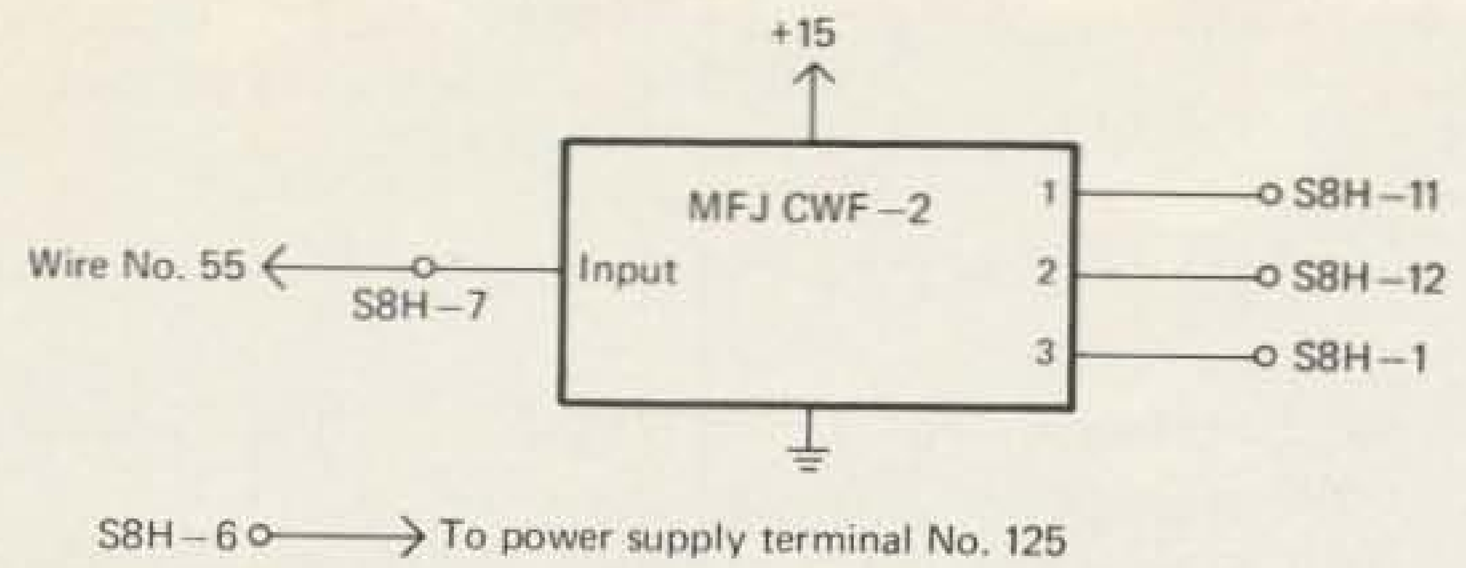


Fig. 3 — Connection diagram for MFJ CW Audio Filter. Switch identification numbers are from Thomas manual, Fig. 6-1.

vides the normal 2.1 kHz bandwidth.) Mount the unit near the Mode switch (I used one of the brackets near the filters at the rear end of the Mode switch) and perform the following step-by-step. See fig. 3.

(**a**) Remove wire #355 from S8H-7.

(**b**) Remove wire #185 from S8H-6.

(**c**) Solder wire #355 to wire #185 and properly insulate the splice.

(**d**) Install a jumper from S8G-6 to S8G-7. (Wire #184 is connected to S8G-6 and wire #353 is connected to S8G-7.)

(**e**) Mount the MFJ filter in a convenient location near the mode switch.

(**f**) Connect the MFJ filter "+" to any point in the +15 volt line.

(**g**) Connect the MFJ ground to any ground location.

(**h**) Remove coax #35 (audio input to terminal #125 on power supply board) and connect to S8H-7. Coax #35 will not reach this switch terminal and therefore will have to be extended. Shielded wire is not required for this extension. Hookup wire will do.

(**i**) Connect MFJ filter input to S8H-7 (same terminal as in step h).

(**j**) Connect a new wire from S8H-6 to terminal #125 on power supply board.

(**k**) Connect MFJ filter output #1 to S8H-11 (180 Hertz output).

(**l**) Connect MFJ filter output #2 to S8H-12 (110 Hertz output).

(**m**) Connect MFJ filter output #3 to S8H-1 (70 Hertz output).

(**n**) Clip jumper from S8H-12 to S8H-1. (The jumpers between S8H-7, 8, 9, and 10 should be left in place.)

The installed 2.1 MHz filter is still utilized for AM, L.S.B., U.S.B., and CW1 positions of the Mode switch. Note that with this modification installed no auxiliary filters can be used.

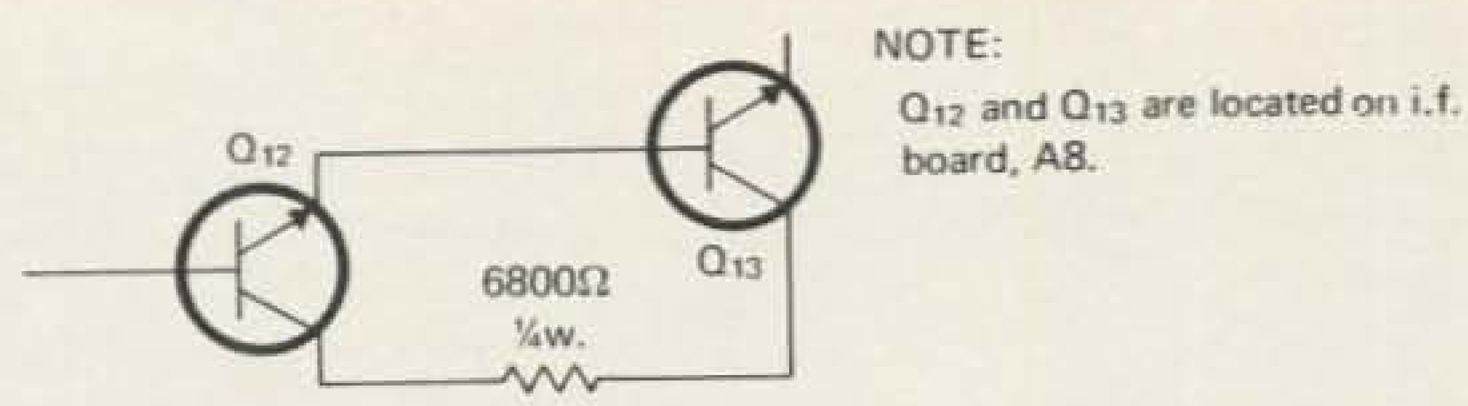


Fig. 5 — Improved a.g.c. action modification showing the addition of the 6800 ohm resistor.

Improved Audio

The CX7 is a bit shy on audio output especially at the narrow bandwidths when using an audio filter. Furthermore, the audio output integrated circuit used in most units (PA237) is no longer available. The circuit shown in fig. 4 will provide more and cleaner audio than is presently available and do it with considerably less parts. This modification can replace the PA237 or the MFC9020 integrated circuit used on some units. Build the circuit of fig. 4 on a small piece of vector board and then perform the following steps:

(**a**) Remove the existing audio output integrated circuit and associated components. (Be sure to remove C17.)

(**b**) Mount the new output stage board adjacent to the power supply board and as near as possible to terminal #125.

(**c**) Run wires for ground and +15 volts to the new board from the power supply board.

(**d**) Disconnect the small coaxial cable from terminals 125 and 126 on the power supply board and connect to the new board input terminals.

(**e**) Clip and insulate wire from terminal 130 on power supply board and run a new wire from the output of the new board directly to the speaker output jack. (The output transformer is no longer used, however it may be retained at the expense of some audio output if 600-ohm output is still desired.)

Note: Since the 24-volt supply is no longer used when this modification is made, the parts associated with this supply may be removed. These are Q11, Q10, R22, R30, and C18 on the power supply board.

Improved AGC

The addition of a single resistor as shown in fig. 5

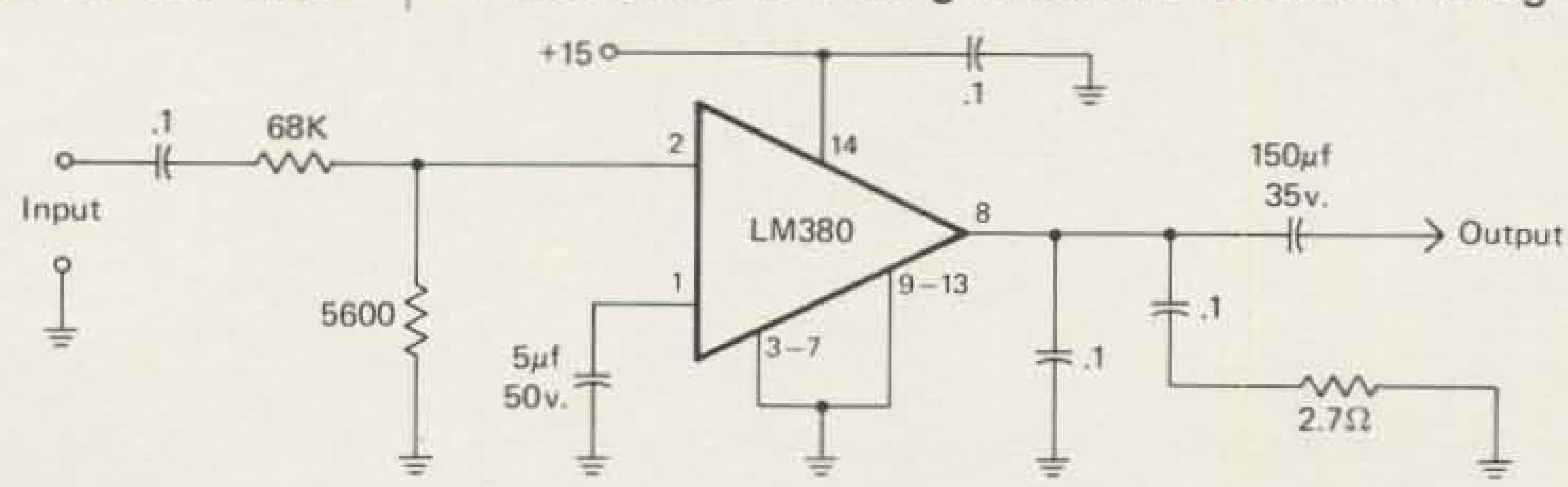


Fig. 4—Updated output stage using the National LM380 integrated circuit. Terminal #130 from the power supply board should go directly to the speaker jack.

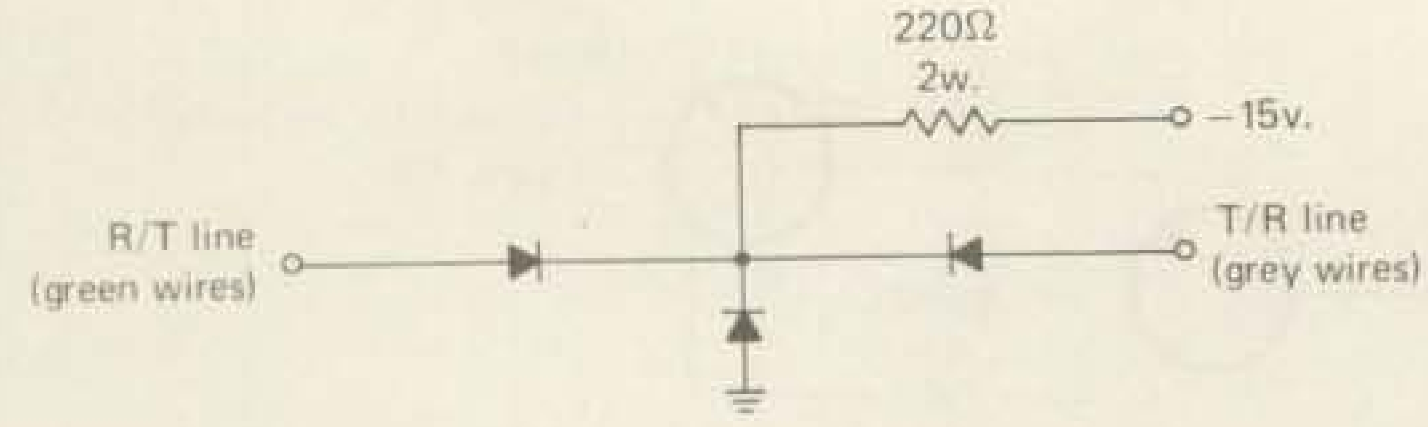


Fig. 6 — Schematic of diode network to eliminate frequency shift when switching from one transmit VFO to the other.

will eliminate loud pops in receive due to AGC action. Q12 and Q13 are located on the i.f. board, A8.

Reducing Frequency Shift When Switching V.F.O.'s

Adding the network shown in fig. 6 will nearly eliminate the frequency shift exhibited when switching from one transmit v.f.o. to another. The most convenient place to mount the network is near the power supply board where T/R, RT, and —15 volt lines are available. (All R/T lines are colored green and all T/R lines are colored gray.)

Power Supply Modification

Most failures in the CX7 are associated with the power supply board. (CX7 and CX7A.) The CX7B power supply was redesigned to utilize solid-state regulators which greatly reduced power supply complexity. It is an easy matter to modify the CX7 and CX7A power supply boards to use these regulators. One each of the Motorola MC7815, MC7915, and MC7805 regulators are required. Perform the following step-by-step:

(**a**) Remove Q1, Q2, Q3, Q4, Q7, and Q8 from the existing power supply board.

(**b**) Run a wire through the board where the emitters of Q2, Q3, Q4, and Q8 were originally. Solder the top end of the wire to the ground plane and the lower end to the original emitter line.

(**c**) Install a jumper wire across R12.

(**d**) Install a jumper wire across R21.

(**e**) Install a jumper wire from the junction of R10 and R11 to pin 174 which is the low voltage side of R13.

(**f**) Install a jumper wire from the junction of R19 and R20 to pin 171 which is the low voltage side of R22.

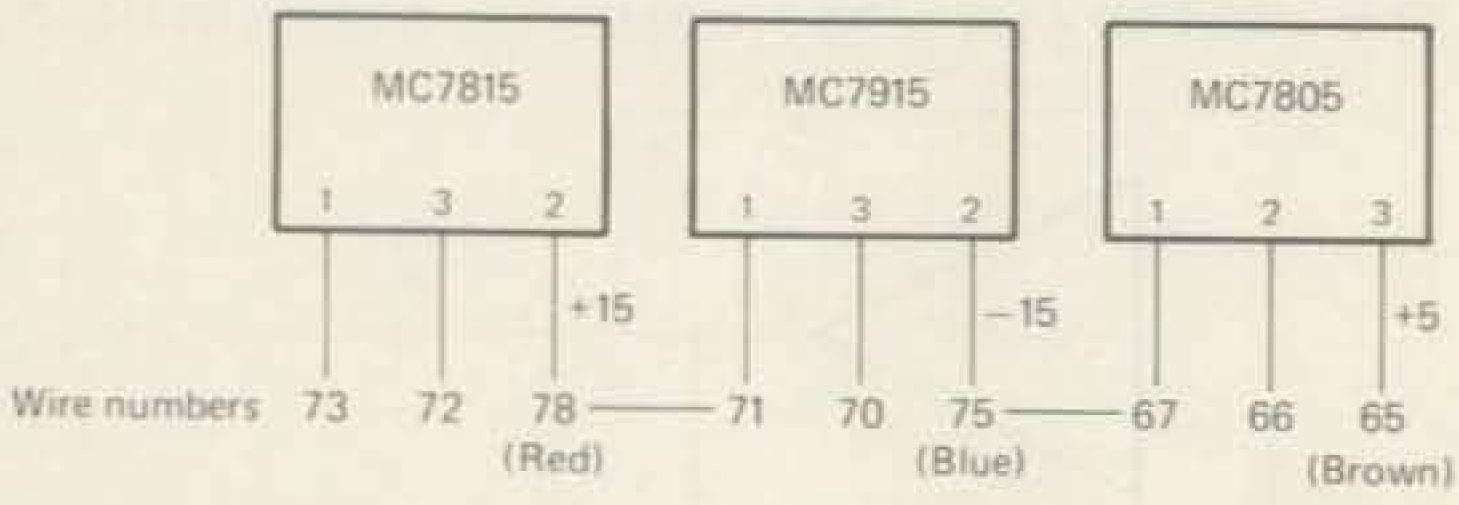


Fig. 7 — Connections for Motorola solid-state regulators.

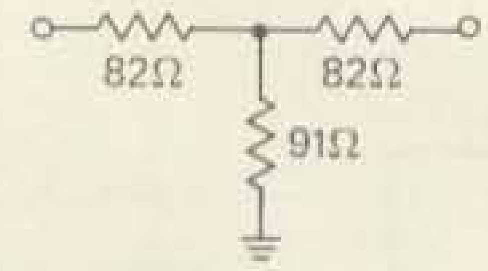


Fig. 8—Resistor pad to replace 8-pole filter. (all resistors are one-half watt).

(**g**) Replace existing R29 with a 7.5-ohm, 10-watt unit.

(**h**) Install an MC7815 in place of Q1, an MC7915 in place of Q2, and an MC7805 in place of Q3. (These units are located on the rear panel.) The The MC7815 and MC7805 are bolted directly to the chassis but MC7915 must be insulated (use insulating hardware that was used with Q2). Use plenty of thermal compound. Wire the new transistors as shown in fig. 7.

(**i**) Install a 5 to 25 uf, 25-volt electrolytic from the low voltage side of R29 to ground. (To prevent MC7805 from oscillating.)

Increased Frequency Response On S.S.B.

Some of the CX7 units exhibit a narrow response in receive, making tuning difficult. This is caused when the two 8-pole filters are not flat. The solution is to remove one of them and replace with the simple pad shown in fig. 8. The removal of one of the filters does not seem to degrade the performance of the unit in any way.

Variable C.W. Sidetone

For those operators who tire of the same sidetone pitch, the addition of a potentiometer and single resistor wired as shown in fig. 9 will provide variable c.w. sidetone. The new potentiometer can be installed as a dual concentric unit with the existing CW Speed control on the front panel.

Although the modifications described were developed for the Signal/One transceiver, they would be useful for other rigs. The use of a small fuse and zener diodes (fig. 2) is an inexpensive way to provide overvoltage protection; the MFJ c.w. filter is an excellent addition to any transceiver; the circuit of fig. 4 is a useful audio amplifier for a variety of applications. Finally, additional cooling is generally indicated for almost every transceiver and will help ensure long-term trouble free performance.

Some simpler schemes for Receiver Incremental Tuning (RIT) have recently come to my attention. Two are described here. The first by K6BE, utilizes

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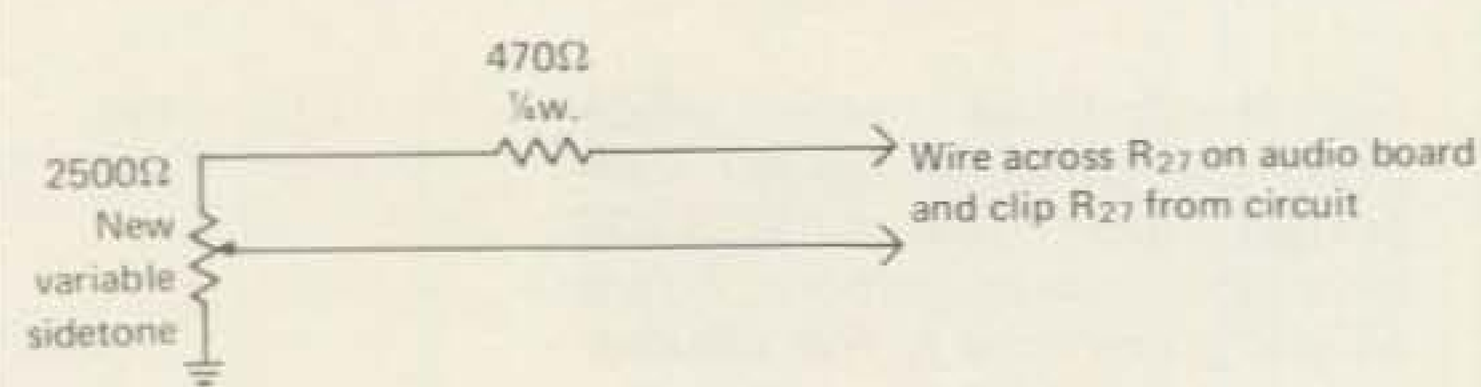

Fig. 9 — Schematic for variable sidetone modification.

This easy to use device will perform some complex jobs around your shack.

A Voltage-to-Frequency Converter IC with Amateur Applications

By JOHN J. SCHULTZ,* K3EZ

The makers of IC's have certainly been supplying radio amateurs with all sorts of new and exciting products recently. Of course, in a sense, none of these IC's really presents anything "new". An IC package brings together in a small space complex circuitry to perform a specific function that formerly might have taken up to dozens of transistors or tubes. But, the price of the little IC package is nothing like the price of the tube or transistor equivalent so even amateurs can afford to apply advanced circuit functions in many areas to their stations' equipment.

A good case in point is analog-to-digital conversion or voltage-to-frequency conversion. This rather high-powered sounding function or technique is really a simple idea. You put into a "converter" device a d.c. voltage of a *specific* value and out comes a square wave with a *specific* frequency. The reverse can also work. You put in a square wave of a specific frequency and out comes a voltage of a specific value. Forgetting for the moment how this "converter" device works, think of the various applications one could find for the technique ranging from the very simple to the sophisticated: c.w. monitor, remote s.w.r. monitoring, converting a counter into a digital voltmeter, remote sensing and alarm of such functions as tube bulb temperature, under and over voltage conditions, transmitter tuning aids for the handicapped, test generators, audible ohmmeter/transistor checker, milliohmmeter, etc.

*Box L, FPO New York 09544

Enter The 4151VFC

A new IC has come along which does make the above described conversion process easy to implement and also makes it affordable. The purpose of this paper is to describe the IC and give some examples of its application. Undoubtedly, once the basic working of the IC is understood, amateurs will find many more applications for the unit than those suggested.

The IC is the Raytheon 4151VFC and what it does is illustrated in fig. 1. You put in any specific voltage between 0 and 10 volts d.c. and for each specific voltage you get out a specific frequency square wave over the range of 0 to 10,000 Hz. Put in 1 volt and out comes 1,000 Hz. 5 volts "in" produces 5,000 Hz output, etc. The unit can also be used in reverse. Put in 5,000 Hz and out comes 5 volts, etc.

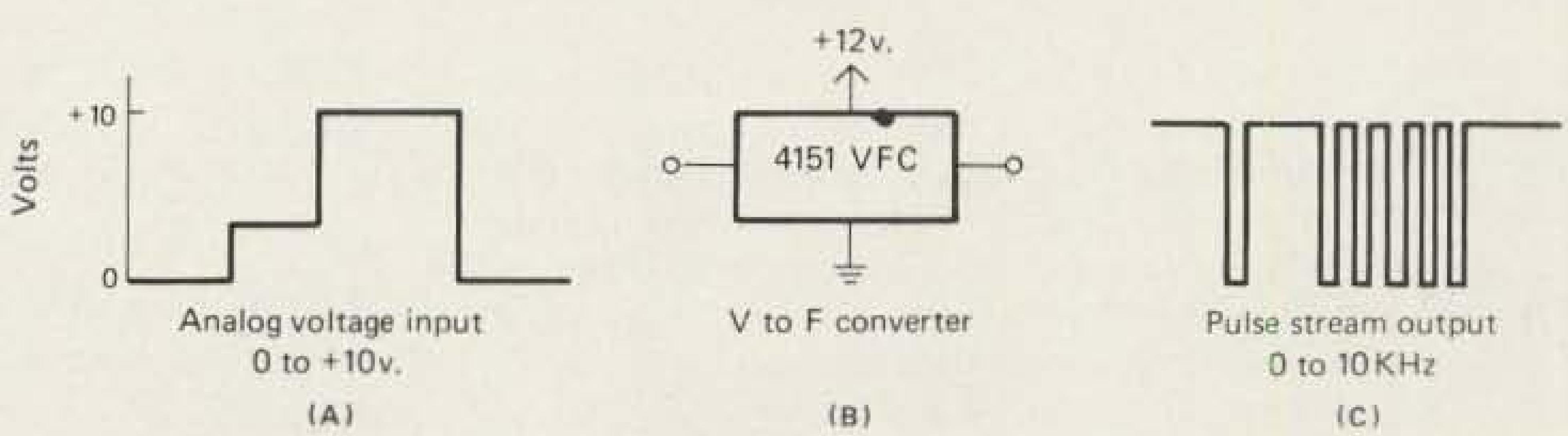

Fig. 1—This is basically what the 4151 IC can do.

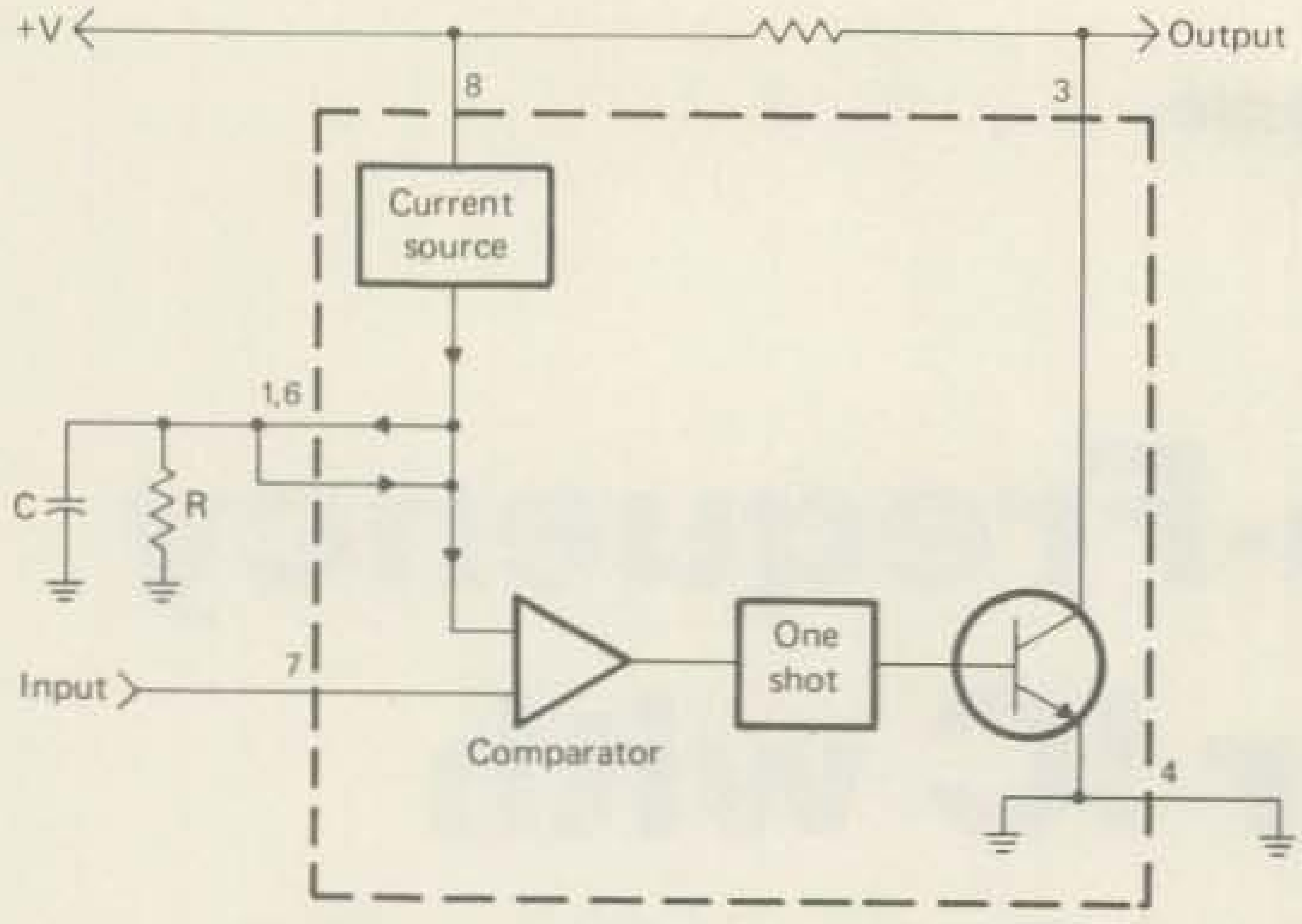

Fig. 2—Functional representation of stages at work inside a 4151.

It can be powered by any single positive supply ranging from 8 to 22 volts and comes in a regular dual-in-line 8 pin housing. Don't confuse this type of IC with a simpler VCO (Voltage Controlled Oscillator). Such chips do not provide a linear voltage to frequency relationship and cannot be used in reverse.

Basic Operation

Although it is not necessary to know the exact theory of operation of the IC, a basic concept of its operation is useful if one wants to adapt it to uses other than those illustrated in this paper. Fig. 2 shows the basic elements in the IC. The input goes to a voltage comparator stage which compares the input voltage to the voltage established across an external RC combination. If the input voltage is higher, the comparator output fires a one-shot multivibrator stage which produces a single pulse output. Simultaneously, a current source is turned on which pumps a charge into the external RC network. If the charge isn't enough to make the voltage across the RC network equal to the input voltage, the comparator fires the one-shot again and the current source is turned on again. This continues until the current source is turned on frequently enough so the voltage across the RC network equals the input voltage. When this point is reached, the current source is not turned on any longer and the voltage across the external RC network will decay until it goes lower than the input voltage and the above cycle repeats itself. The current source, which is turned on by the one-shot stage, is always trying to pump enough current into the external RC network to make the voltage across the network equal to the input voltage. Thus, as the input voltage increases in amplitude, the one-shot has to operate more often and a voltage to frequency conversion is obtained. The output from the one-shot goes to a final output stage which can be represented by the switching transistor shown in fig. 2. When the one-shot fires, this switch is turned on. So, if the collector is connected through a load resistor to the positive supply voltage, the output is a pulse train operating at the frequency of the one-shot stage and going in amplitude from the supply voltage to a fraction of a volt.

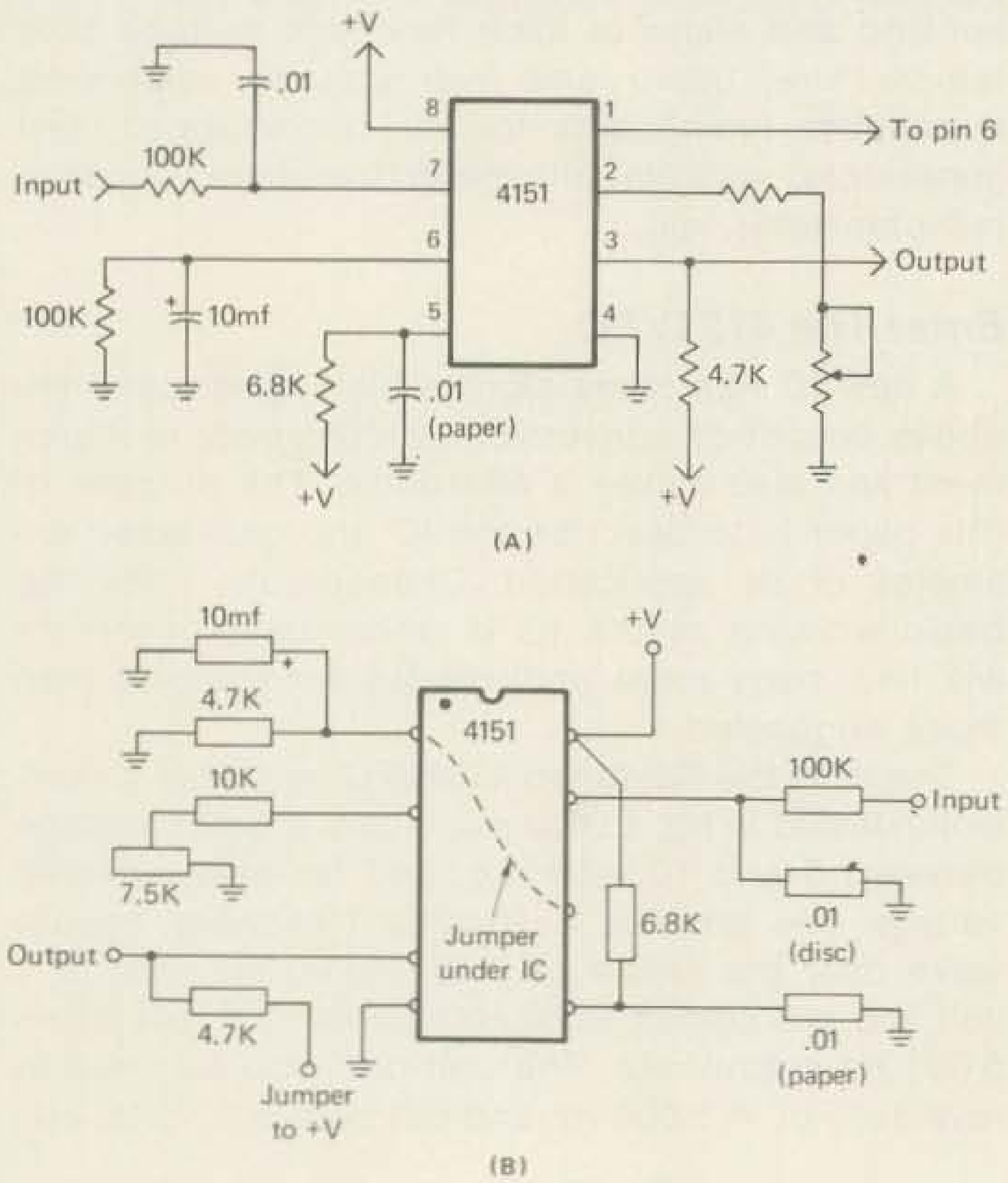

Fig. 3—Schematic (A) of the 4151 as a voltage-to-frequency converter and (B) a suggested parts layout. Components can be wired directly on perforated board stock. The layout also lends itself readily to isolated pad-type construction on a copper-clad board. If the output is used to drive headphones or a speaker, use a 0.1 mF capacitor in series. No capacitor is needed if the output is connected to a counter.

Some Practical Uses

Fig. 3 shows a schematic of the 4151 in its simplest circuit form and Fig. 3 is a suggested parts layout. This simple circuit can be put to a variety of uses. The input voltage range is 0 to 10-volts positive (with a 12-volt supply) and this produces a 0 to 10 kHz output. The output frequency can be tuned by adjusting the 7.5 k potentiometer. Note that the input goes through a 100 K resistor so very little current is drawn from the input voltage source. The circuit can function as a CW monitor by finding any point in a transmitter which goes positive by a few volts with keying. Alternately, use a diode and capacitor to rectify some of the r.f. field around a transmitter and it will function as an off-the-air c.w. monitor. The output from pin 3 is sufficient to drive directly headphones or a small high impedance speaker. If more tone range adjustment is desired than can be obtained with the potentiometer, vary the value of the capacitor from pin 5 to ground. In a typical 4151, supply voltages as low as 3 volts operated the unit in this simple oscillator application.

The circuit of Fig. 2 will function directly as a digital voltmeter when used together with a frequency counter. The potentiometer should be set for 10 kHz with a known 10-volt input source. The lowest voltage that can be read, depends on the low frequency range of the counter used. If the counter goes down to 5 Hz, for example, one can easily read down to 5 millivolts. The 0 to 10-volt input range is very handy when working around transistorized circuits and this single digital voltage range will suffice for most uses. Of course, dividers can be added to the input as in any regular v.o.m. circuit to add different input ranges. If one will accept a bit lower input voltage range, from 0 to about 7.5 volts, the circuit can be powered by a 9-volt transistor radio battery and assembled in a small metal case so one has a complete digital voltage "probe". The 100K input resistance is high enough to avoid loading effects on most transistorized circuits except devices like FET's. The disadvantage of this simple circuit is that its linearity error is about 1%. This is not bad for most work and comparable to a v.o.m. but the instrument is certainly a lot easier to use than trying to read a v.o.m. scale.

Additional Applications

Continuing with the uses for the circuit of fig. 3, it can be used as a milliohmmeter in a variety of ways. Such a capability is useful if one wants to measure resistance below one ohm for meter shunts or to check the quality of grounding connections. One way this can be done is to use the circuit as a digital voltmeter across the resistance to be measured. If the unknown resistance is placed in series with a 10 volt source and a known 100 ohm resistor, the meter will read from 1 to 100 as the unknown resistance varies from .01 to 1.0 ohm. Many other combinations of supply voltage and known series resistor are possible, of course, to cover different ranges or to get greater resolution on the readout.

Another use of the circuit is as a signal injector. Connect the input 100 K resistor to a 5 K potentiometer across the power supply (pin 8). This makes it a simple, tunable square wave signal source (although the output is not a symmetrical square wave). It will produce markers up into the v.h.f. range.

As a tuning aid or temperature sensing device, it can be used in a variety of ways. For instance, it can be connected to the reflected power pickup of an s.w.r. bridge. Tuning a tuner, or the output circuits on a transmitter is then done for the lowest audio pitch. This sort of tuning aid is handy even for a non-handicapped operator if several interacting controls are to be adjusted. It is a lot easier to listen to an audio pitch change, as controls are adjusted with both hands, than constantly have to look at a meter scale. Temperature sensing can be done using a d.c. resistive bridge circuit with a thermistor and the bridge balanced (zero output) at a desired temperature. Then as the temperature changes, the bridge becomes unbalanced and the audio pitch starts to increase. An audible alarm of either under-temperature or over-temperature can be achieved since as the bridge unbalances from under or over temperature, the polarity of its output changes. Connect the 4151 to activate on the change it is desired to sense. An audible alarm of voltage conditions can be created using zener diodes and choosing them so they break down and voltage is delivered to the 4151 when the desired (or undesired) voltage level is reached.

Experimental Applications

The 4151 can also be used as a toy or as a serious anemometer. As a toy connect it to the output of a discarded d.c. tape cassette motor which is equipped with some wind vanes and which functions as a small d.c. voltage generator. As wind speed varies, the generator voltage output increases and the 4151 starts to howl. As a serious instrument, the 4151 output may be connected to a frequency counter which can be calibrated for wind speeds.

Finally, the 4151 can be used in pairs as a complete data transmission system. For instance, say it is desired to remotely monitor some d.c. voltage change such as the output from an s.w.r. bridge located at the antenna/transmission line junction, or some remote control voltage such as the power output level of a remote transmitter. Sending a low level d.c. voltage over long metallic lines is generally very unsatisfactory. Resistance changes in the lines can develop due to weather and to poor connections and a calibrated overall system is very difficult to maintain. However, if the d.c. voltage can be changed into an audio voltage at the remote

(continued on page 75)

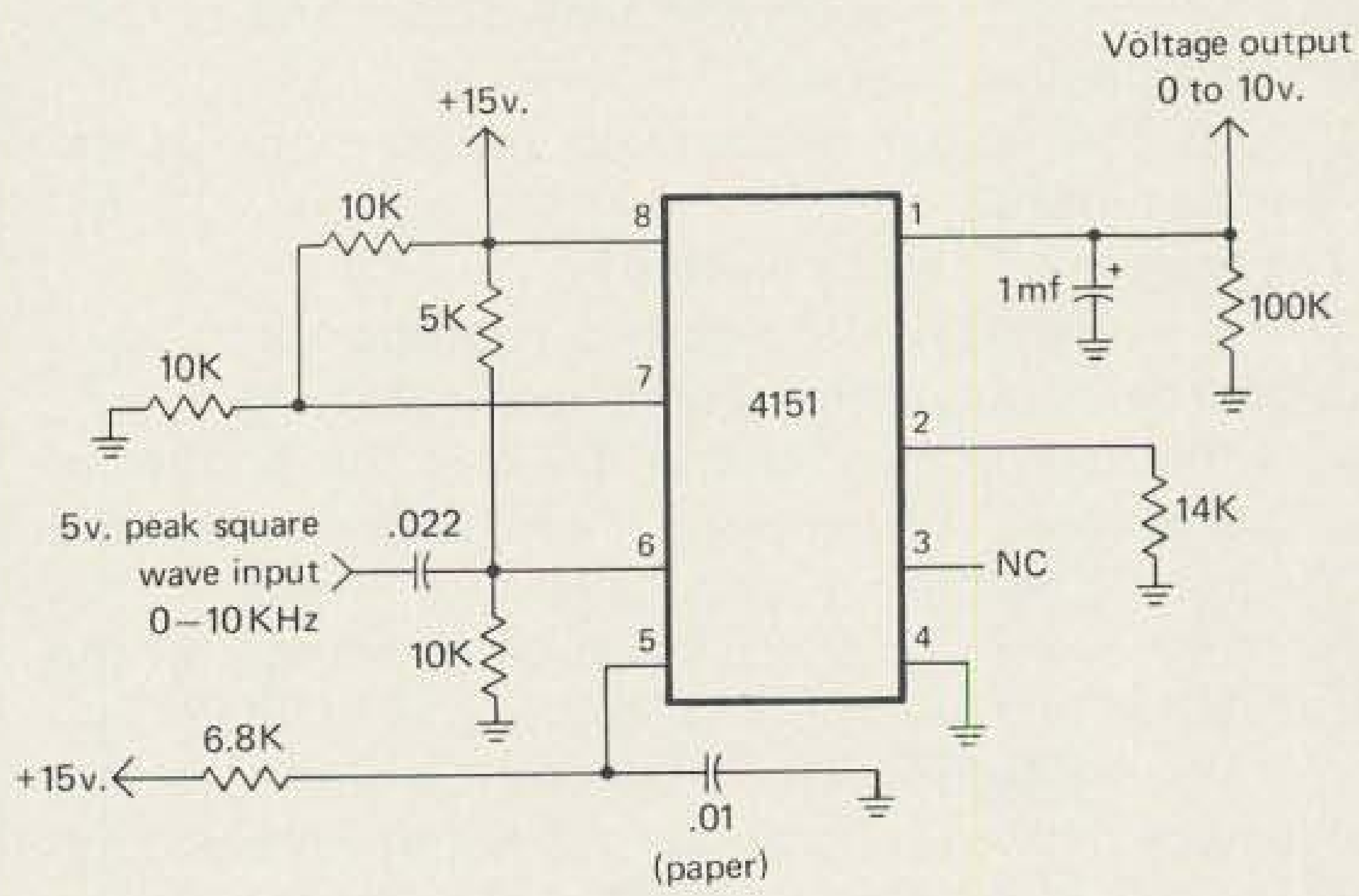

Fig. 4—The 4151 goes the other way too, and will function as a frequency-to-voltage converter. The main use for this capability is if two 4151's are used together as a readout system for a monitoring function, as explained in the text.

How to get safely past the "smoke test"

Making IC Projects Work—Part II

By LEONARD M. BUTSCH, Jr.,* K4CNP

Summary

July CQ magazine (p. 33) carried the first part of this discussion on how the home builder may enhance his chances of making IC projects work successfully. It was assumed that such projects were of the type currently found in various amateur radio publications, ranging from relatively elementary systems to quite sizeable undertakings, such as the WB9LVI scan converter[1]. The chance for successful completion of such projects is vastly improved if the builder employs a systematic approach to his objective. The following steps are helpful in deciding that an amateur IC project is worth the time, effort and cost to the prospective builder.

1. Does the reader understand the purpose of the end product?
2. Is the article clearly written?
3. Are the materials needed (components, p.c. boards, cabinet etc.) readily available?
4. Is the cost known, and is it within the budget of the reader? If unknown, it should be estimated carefully before any purchases are made.
5. In the event that there is doubt about any of the detailed technology, is expert help available? Generally, the author of an article will be glad to render advice. However, such help is not always enough to overcome the nitty gritty problems encountered.
6. Are the proper tools available for constructing and testing the system? This assumes a good working knowledge of how to use the tools needed.

If the answers to the above questions are yes, one may proceed with care. Always question the article and any schematics associated with it. It is a good idea to write the author of an article involving a sizeable project and ask about printing errors. Errors occur in spite of careful editing. When assured as to correctness, and after determining that the system to be constructed is really desired, purchase orders for the components should be placed. I have found that as careful as I may be, I break, or find defective about ten percent of the items I need, so it is wise to order about ten percent spares. For the individual who does not have a well stocked junk box it may be well to order more than ten percent spares of items such as integrated circuits. I find it worthwhile to stock about 25 percent spares on active devices such as diodes, transistors, IC's and power supply components such as rectifiers, regulators and passive components. It is a good rule of thumb to order an extra supply of spares of those parts that are not locally available. There is nothing more frustrating than waiting for two to four weeks for a part that cannot be found locally.

With the components for the project on hand, it is desirable to know that they are within specifications. Passive components are easily tested. The previous paper discussed how to test IC's. The several exam-

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[1]"Slow Scan to Fast Scan TV Converter", Dr. George R. Steber, WB9LVI, QST, May 1976.

ples used were more for the purpose of showing how to set up IC test rigs than how to test those particular IC's selected. The tests discussed were either static or dynamic tests that would only show that the IC's being tested were operable. The final test of an IC is always in the system being constructed. The simple tests described will eliminate almost all of the problems that bad IC's introduce to a system. Final testing of IC's in system operation will be discussed here.

IC Project Outline

Here is a step by step outline that you will find useful in progressing from the idea of building a piece of amateur gear through its completion. Variations of such an outline can be of considerable help in the completion and satisfactory operation of any project.

1. Read and understand the original article or articles describing the system of interest.
2. Follow all possible sources to eliminate printing errors such as: correspond with the author (s.a.s.e. will be appreciated); the publisher, if necessary; and references.
3. Determine that the technology is understood, or if not, that expert assistance is available. This step is essential and it is why many amateur projects wind up in the junk box without ever working.
4. Determine that all components needed are available. Often there is one component in a project that cannot be easily located. Find a source for all components before going ahead with the purchase of any components. The author of the original article is often the best source or reference for "hard to get" parts.
5. Order all components and keep records of all transactions. This record keeping can eventually wind up saving a lot of money as most IC's and other costly components are guaranteed by the seller for a certain period of time. Save the invoices when you receive shipments of parts as invoices are needed to have the seller replace warranted or guaranteed parts which prove defective.
6. Test IC's and active devices such as regulators and other costly items as soon as possible after they are received.
7. Plan the layout of the system to include the mechanical layout of the front panel, printed circuit boards, cabinet, power supply and peripheral units. Use conservative layout methods, especially for the power supply. Consider heat radiation and plan accordingly.
8. Assemble the p.c. boards. Check each board carefully, visually for solder bridges or poor solder connections, and electronically where possible, to determine that it is performing the function(s) required of it. If p.c. boards are not available, circuit subassemblies must first be constructed and tested.
9. Assemble the cabinet, panel and connectors for p.c. boards or other subassemblies.
10. Assemble the power supply. Plan for 100% overcapacity in power supplies to assure cool and smooth long term operation. A smaller tolerance is acceptable, but for small projects the extra cost is generally minimal.
11. Wire up the sub-assemblies of edge connectors and partial units such as power supplies, remote sub systems and cabling for same.
12. Initiate check out procedures. First, visual inspection, then power-off checks, and finally progressive power on-checks. Correct malfunctions progressively as they are discovered.
13. Perform system check-out. Trace signals from the system input to the output. This stage will require initial adjustment of individual parts of the system to bring performance within system limits.
14. Establish a "fine adjustment" method and adjust system performance for optimum results.
15. Complete all cosmetic, or appearance functions such as painting cabinets, installing decals and indicator position markings.
16. Integrate your new unit into the overall station.

The above general steps are intended to serve as a guide to the amateur builder in establishing his own "roadmap" for proceeding from the desire to have a new sophisticated piece of hardware to the fulfillment of that desire. No two outlines need be the same, but all should cover the functions and operations described above. A book could be written with the above outline serving as chapter headings. This paper will discuss each step and a few thoughts involving that step that will hopefully be of use to the reader. Part I of this article covered examples applicable to steps one through six and will not be discussed in this section other than how they might relate to any of the subsequent steps involving the construction of an IC system.

Discussion

The mechanical layout of IC systems can be critical to the success of their operation, especially in those cases where very high switching speeds are encountered. It is very important that lead lengths for high-speed switching circuits be kept as short as practical for both time delay and signal radiation of the switched pulses. Where printed circuit boards have been laid out by professionals in p.c. board design it is good practice to follow the instructions of the p.c. board designer as to board placement and as to radio frequency interference (r.f.i.) filters. In the event that no such information is available with purchased p.c. boards it is good practice to locate all very high speed switching parts of the system and to determine that the lines between p.c. boards are shielded with coaxial cable and/or kept as short as possible. Another excellent practice is

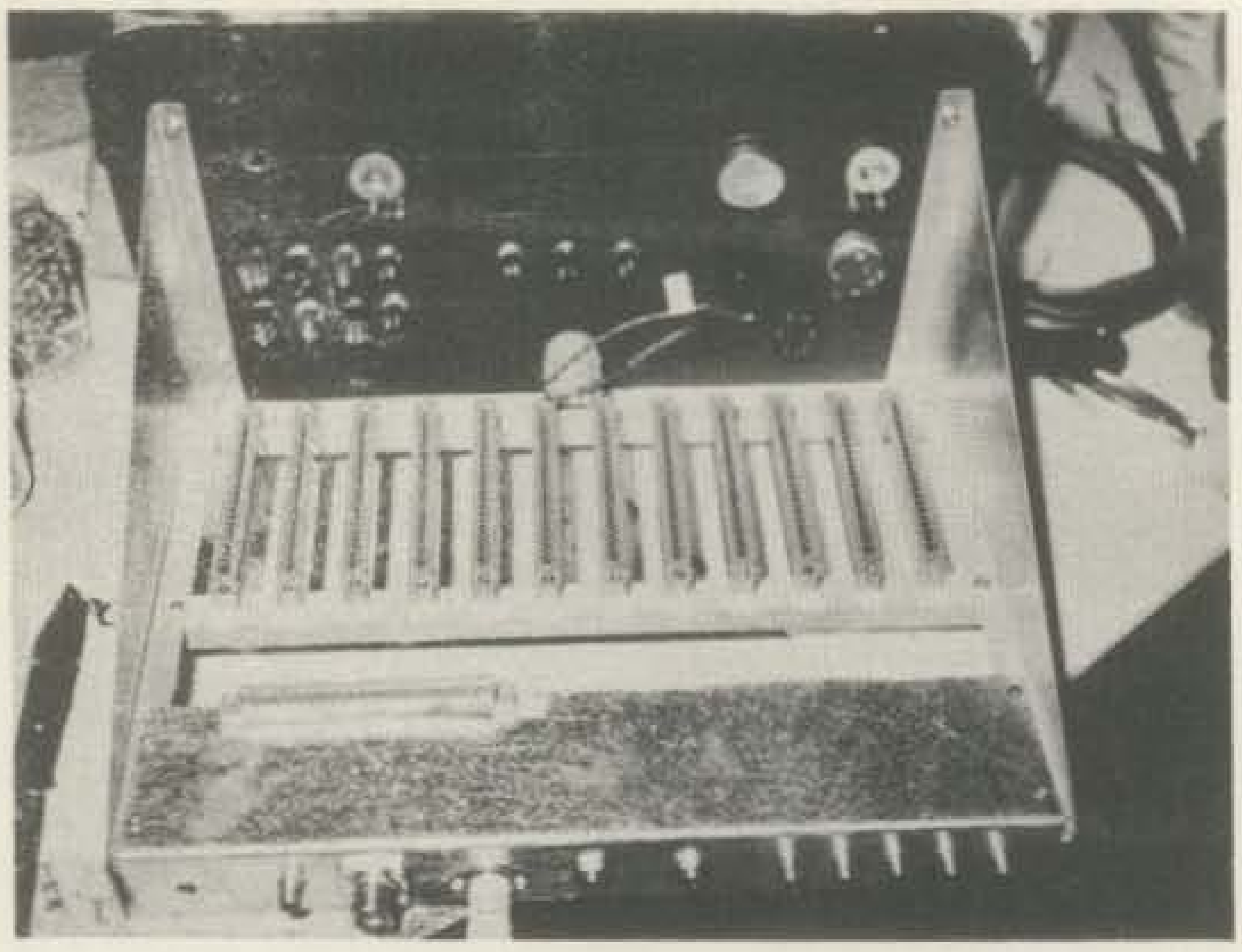


Fig. 1—Use of U channel sections to mount 22 pin edge connectors for printed circuit boards.

to terminate all power inputs to p.c. boards containing high speed switching circuitry with r.f.i. filters consisting of ferrite beads and disc capacitors, preferably on the p.c. board, or if that is not possible, at the junction of the p.c. board and the power supply line feeding the board. Where both analog and digital signals are involved it is good practice to isolate voltage inputs as much as practical. I generally employ separate d.c. regulators to the analog parts of the system, and r.f.i. filters on the digital parts of the system as near the digital source of noise as possible. Noise interference problems can be reduced by careful circuit layout. It is good practice to keep main power supply lines short and of sufficiently heavy gauge so as not to permit appreciable voltage drops in the lines between the power supply and the circuits using the power. This can become a serious factor in digital systems where plus five volts may be used extensively requiring current levels of several amperes. In designing hybrid systems using both digital and analog signals it is generally good practice to isolate the power supply physically from the rest of the electronics. Two reasons apply: first considerable heat is usually generated in power supplies for digital systems, and second, isolated power sources tend to reduce the digital noise between subsystems. The principal reason for isolating the power supply is to keep heat away from the solid state circuitry as solid state devices are often quite heat sensitive. Large systems require either forced-air or conduction cooling to permit the IC's to operate within their specified limits. A third reason for using care in the mechanical layout of the IC project, in addition to controlling digital noise and dissipating heat, is to evolve a system that is convenient to operate and pleasing to the eye.

Mechanical Layout

The mechanical assembly of an IC project may follow many paths. Fig. 1 shows a method that I have found to be convenient and which permits relatively dense packaging of p.c. boards and good heat dissipation. The aluminum U channels employed are available at local hardware stores and are easily workable to fit almost any cabinet available. Such an assembly is readily integrated with a front panel that can be laid out at the choice of the designer. I especially like the U channel layout for mounting many edge connectors as it does not require the laborious business of punching, drilling or otherwise creating the many long narrow holes in a conventional chassis that would be required. Fig. 2 shows the assembly of a group of 22 pin edge connectors with a simple chassis mounted on the rear deck of the assembly and a front panel mounted at the front of the assembly. This particular system is my original layout for the WB9LVI scan converter system that includes slow-to-fast conversion, fast-to-slow conversion, frame-grab video capability and either direct video output or r.f. output to a TV receiver or monitor. The entire assembly, other than the power supply is designed to mount in a Heathkit SB-102 cabinet and thus be compatible with the other Heathkit equipment in my radio shack. It is equally easy to layout the system to fit almost any desired cabinet. Since a good amount of heat is generated by the IC's themselves it is recommended that any cabinet chosen either have good ventilation or an effective means for removing that heat from the interior of the cabinet. A small cooling fan mounted within the cabinet is very effective where a considerable amount of heat is generated. When using a forced-air source provide enough air vents in the cabinet so that air can escape and not be simply circulated around the cabinet.

Printed Circuit Board or Sub-Assembly of Components

The assembly and wiring of the printed circuit

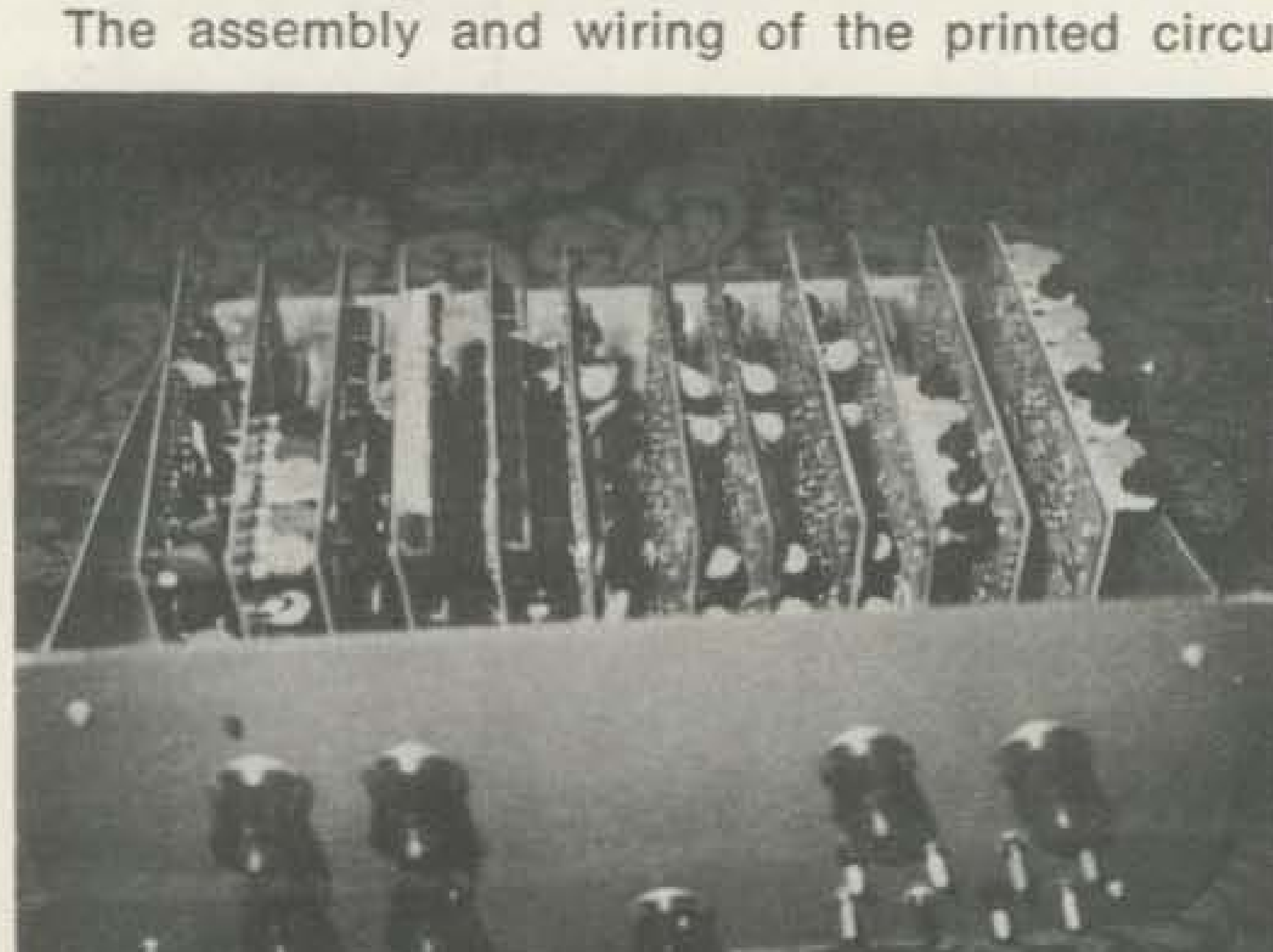


Fig. 2—Completed assembly of WB9LVI scan converter using U channel aluminum sections and sheet metal rear deck.

cards or other electronic sub assemblies marks the point where electronic components are permanently connected together. Extra care in determining that components are soldered properly and in the correct order (diodes are connected in the correct polarity), will save both time and money later. It is wise to test any components that are doubtful before installing them. As an example, one will occasionally find a diode that is marked improperly. Such tests can be very brief, but rewarding. One area that cannot be overemphasized is that of proper soldering technique. Most of the errors I have found on my own equipment, or that of others I have repaired, have been due to bad solder joints, either open, or solder bridges between two points that were not supposed to be connected. I have found that good technique in this area can be substantially aided with a large lighted magnifying lense.[2] Where printed circuit boards are not used, it is very important to double check every hand-wired connection made to insure that it is connected to the proper point and is properly soldered. I have made countless errors connecting DIP IC's by forgetting that when turned over the order of the pins on the board is the mirror image of that on top of the board. Another common error is connecting to the wrong pinout on a multi-pin blank board, either by miscounting, or again forgetting the side of the board to be plugged into a multi-pin connector and connect to the inverse pinout connector. It is very useful to mark all IC socket and pinout multi-connectór pads prior to soldering components and wires to the sub assembly.

Cabinet, Panel And Connector Assembly

This step may well be completed later in the program of building an IC project, but I generally go about completing the "bending of hardware" as early as I can to get the work out of the way. Needless to say, this assembly cannot be accomplished before the layout for all parts is completed. A word of caution. Be certain that every component on the panel of the rear deck is where you'd like it as mistakes at this point in drilling holes can be costly. It is a good idea to recheck that all components will fit in the area behind the front panel, under the chassis, and on the rear panel or deck. It is very disconcerting to find that enough space was not allowed for a potentiometer or switch assembly, after the fact. Before drilling holes and thus making a final committment to the overall structure of the system, be certain that the layout is satisfying to the eye, that sufficient space has been allowed for all components (including the p.c. boards to be installed later), that no hot spots are likely to develop, or if a heat problem is likely, that space is available to install a fan. It is worthwhile to mount subassemblies such as p.c. boards, and the chassis behind the panel, in the cabinet before drilling any holes so as to physically check that all components fit. Once having seen the system in this form the builder has a good idea how everything will go together. A good reference for the mechanical assembly of electronic hardware is "The Handbook of Electronic Packaging", by Charles A. Harper, McGraw-Hill, 1969. This, and other references, can be found in any technical library, and can serve to answer almost any packaging question.[3]

Power Supply Assembly

Power supplies for solid state systems have evolved from quite complex to easily built assemblies, and even may be purchased for a very moderate price. There we will deal only with those problems most likely to arise in home built power supplies. When using the design of another, a moderate amount of double checking may save a lot of grief later. Starting at the power main, here assumed to be 120 v.a.c., 60Hz, it is good practice to fuse the primary line with a safety factor of from 50 to 100% overload. In addition some form of r.f. or line-noise filter should be included at or near the point of entry of the primary power to the chassis. The power transformer is the one item in the power supply that cannot receive too much attention. Assuming that the relatively new three-terminal voltage regulators are to be used to obtain the various levels of d.c. voltage needed, the rectifier is to be one of the low-forward-resistance devices, then the voltage-drop across these items can be readily obtained from specification sheets. With series regulators it is desirable to keep the unfiltered direct current voltage at as low a value as will provide good regulation from the regulators. Thus, if an LM309K is to be used to provide five volts at one ampere, greatest efficiency (and least heat) can be obtained if the unfiltered d.c. voltage under load is on the order of eight to nine volts. Higher voltages may be tolerated but place a greater load on the regulator and the power transformer.

It is not always possible to obtain the ideal combination of power transformer, filter and regulator. Compromises must be made. As an example, an ideal power supply system for a five volt, one ampere regulated power supply using a LM309K three terminal regulator would provide at least seven volts (measured at the lowest point of the a.c. ripple of the unfiltered d.c. voltage). Reference to almost any electronics engineering handbook will show what value of filter capacitance is needed with what level of unfiltered, rectified a.c. voltage to obtain the necessary input voltage to the regulator.[4a] Often, the ideal transformer cannot be obtained economically,

[2] "Swing-O-Lite", Model BBM-9, Burstein-Applebee 1976 Catalog, Page 187.

[3] "Handbook of Electronic Packaging", Charles A. Harper, McGraw-Hill 1969.

and an effective cost efficiency trade-off must be made by using an inexpensive transformer as a power source and a smaller value capacitor for filtering. The LM309K then assumes part of the filtering function along with the capacitor to produce the same result with a slight degradation of efficiency.

As to the power supply design, determine that parasitic suppressing capacitors are used at both the input and output of the regulator. The negative voltage, three terminal regulators require this protection especially (LM320-X series). Calculate the amount of power that must be dissipated in the regulator. Heat-sink the regulator sufficiently to remove that heat. Forced-air cooling may be required. Heat sinks to sink a given amount of heat may be either fabricated or purchased. It is much better to be safe than sorry.

The power transformer is generally the most expensive component, and the most difficult to obtain. Many amateurs wind their own transformers so as to obtain optimum efficiency in their power supplies. It is a good idea to use a power transformer that has at least 100% overload capability. Generally, such a transformer will not cost much more than one having minimum capability but it will operate much more effectively, and cooler. If it is not possible to find the right transformer, the builder may obtain one having sufficient power capability and then remove and rewind the secondary.[4b, c]

After determining that the power supply design is adequate and all components are on hand, assembly is straightforward. Only a few suggestions need be made with regard to location of components. Separate the heat producing sources from the passive items such as capacitors, and force-air cool the heat-producing sources, if needed. Special attention should be paid to the regulators with regard to cooling as they operate less efficiently when overheated. Most new three terminal regulators incorporate short circuit protection. Use connectors between the power supply and the system that are capable of carrying the current required by the system. This current can be high in large IC systems and both connectors and wire leads to the system should be chosen to handle the current.

It is a good idea to inspect the power supply carefully before making any attempt at power checks. This and other checks will be discussed later.

Board One, Analog Demodulator, WB9LVI converter, designated APR 16.

Pinout	To
A	Ground buss
B	+5 volts d.c. (from analog video regulator)
C	SSTV input (RG-174U)
D	Brightness control wiper on panel (R25)
E	Contrast wiper on panel (R27)
F	AM video (SSTV) 17(S)
H	+12 volts
J	—12 volts (from analog video regulator)
K	
L	
M	Contrast pot end (R27)
N	Horizontal sync wiper (R39)
P	
R	
S	
T	26(19) SSTV hor. sync.
U	17(D), 26(210), 27(X)
V	20 (D)
W	
X	20(U)
Y	Horizontal sync to panel-mounted LED indicator.
Z	Ground buss

Indicates signal origination source and to or from contact pinout. Sample indicates that the a.m. video originates on APR 16 and flows from 16 to 17(S) to 17(S) for pinout F above.

Fig. 3—Sample Wiring List.

System Wiring

Interconnection of the various components of the IC system can be made almost foolproof with a few simple aids. The primary aid is a wiring list, as shown in fig. 3. A wiring list has the advantage that it is self checking. Whenever the wiring list indicates that a wire is to be connected from connector a, pin b, to connector b, pin c, that instruction will be repeated when the builder has reached connector b, pin c, and he should be able to trace back the wire previously connected from connector a, pin b to connector b, pin c. Further, when each wire terminal is connected it can be checked off on the wiring list so that if the builder chooses to leave the work for a while he will have a roadmap of just where he has been when he returns to it. The same may be done with a schematic diagram, but it results in a badly marked up schematic. It is very useful to provide a loose leaf folder for all items of paper connected with the construction of any IC project. Thus, the folder starts off with a schematic parts list, then a wire list, p.c. board layout list, all calculations and the various other pieces of paper that will be of use in future debugging and repair to the system. There are always a number of wires going from the p.c. board connectors to the panel controls and the rear deck controls and connectors. It is very useful to identify each of these wires when con-

(continued on page 72)

[4]"Radio Amateurs Handbook", ARRL, 1976.
a. See figure 5-5, pg. 108
b. Copper wire table, page 556
c. Rewinding transformers, page 109

ADRIAN WEISS, K8EEG, ON

QRP

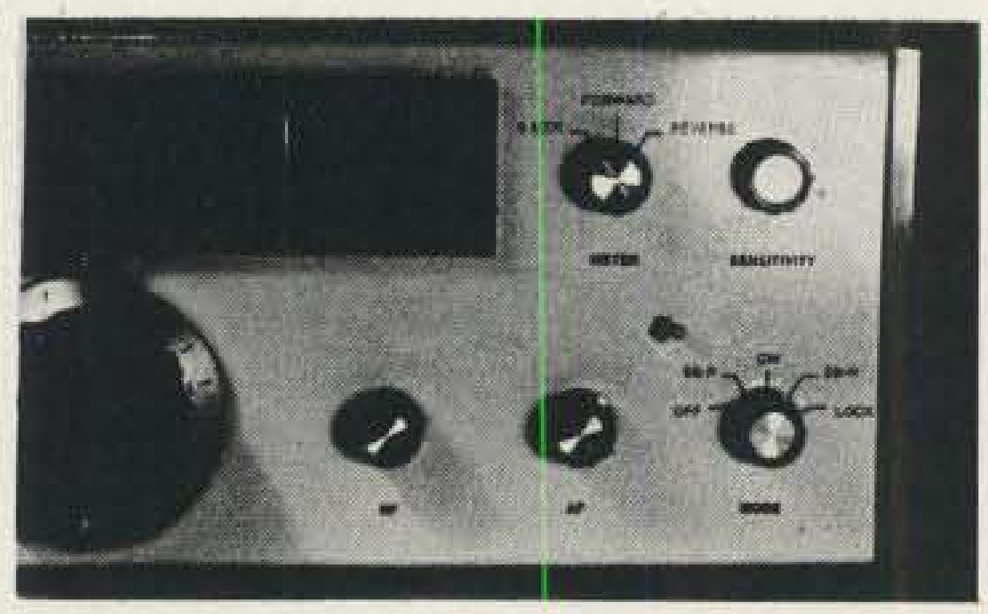
Improving CW Selectivity in the Argonaut

The TenTec Argonaut transceiver has established itself as a classic in its own day. Designed by QRPp operators, it reflects innovative engineering in combination with practical features that make it a dream to operate. Only two drawbacks plague the early "505" model: 1.) frequency instabilities resulting from the nonrigidity of the enclosure; 2.) the lack of adequate selectivity for c.w. operation resulting from the incorporation of a single 2. 4 kHz s.s.b. filter which serves for both s.s.b. and c.w. modes. In terms of the cost of the Argonaut, TenTec's decision to produce the 505 without a c.w. filter is understandable and acceptable, and the transceiver is by no means rendered ineffective by the lack of one. However, anyone who has operated the Argonaut knows that the lack of c.w. selectivity can cause serious hassles under crowded band conditions such as experienced during a contest, or when attempting to copy a weak c.w. signal in the presence of significantly stronger nearby c.w. signals.

The receiver section of the Argonaut is as sensitive as any transceiver on the market, and its c.w. performance can be greatly improved by the rather simple project of adding an active c.w. filter to the i.f. circuit. The project requires no more than the breaking of a single i.f. board connection, mounting a selectivity switch, and making the appropriate power connections. The minor modification raises receiver c.w. selectivity to par with its sensitivity and stability.

Active Audio Filters

Active audio filters with excellent passband characteristics are simple to construct, and require no adjustment beyond a matching of the parts which establish the filter center frequency. A variable passband active filter using bipolar transistors was described in an earlier column (October, 1974, p. 36) and would work well in the following modification as is, or minus the audio output stage. Other active filter designs have appeared periodically in the literature and will work equally well. In undertaking the present project, a ready-wired unit produced by MFJ Enterprises, the CWF-2, was used because of its low cost and truly excellent selectivity in bandwidths of 180 Hz, 110 Hz, and 80 Hz. The



Front view of the Argonaut showing the position of the newly installed selectivity switch. It is under and flush with the chassis horizontal center plate.

CWF-3, with bandwidths of 110 Hz and 180 Hz, has been used in another modification of this type, but

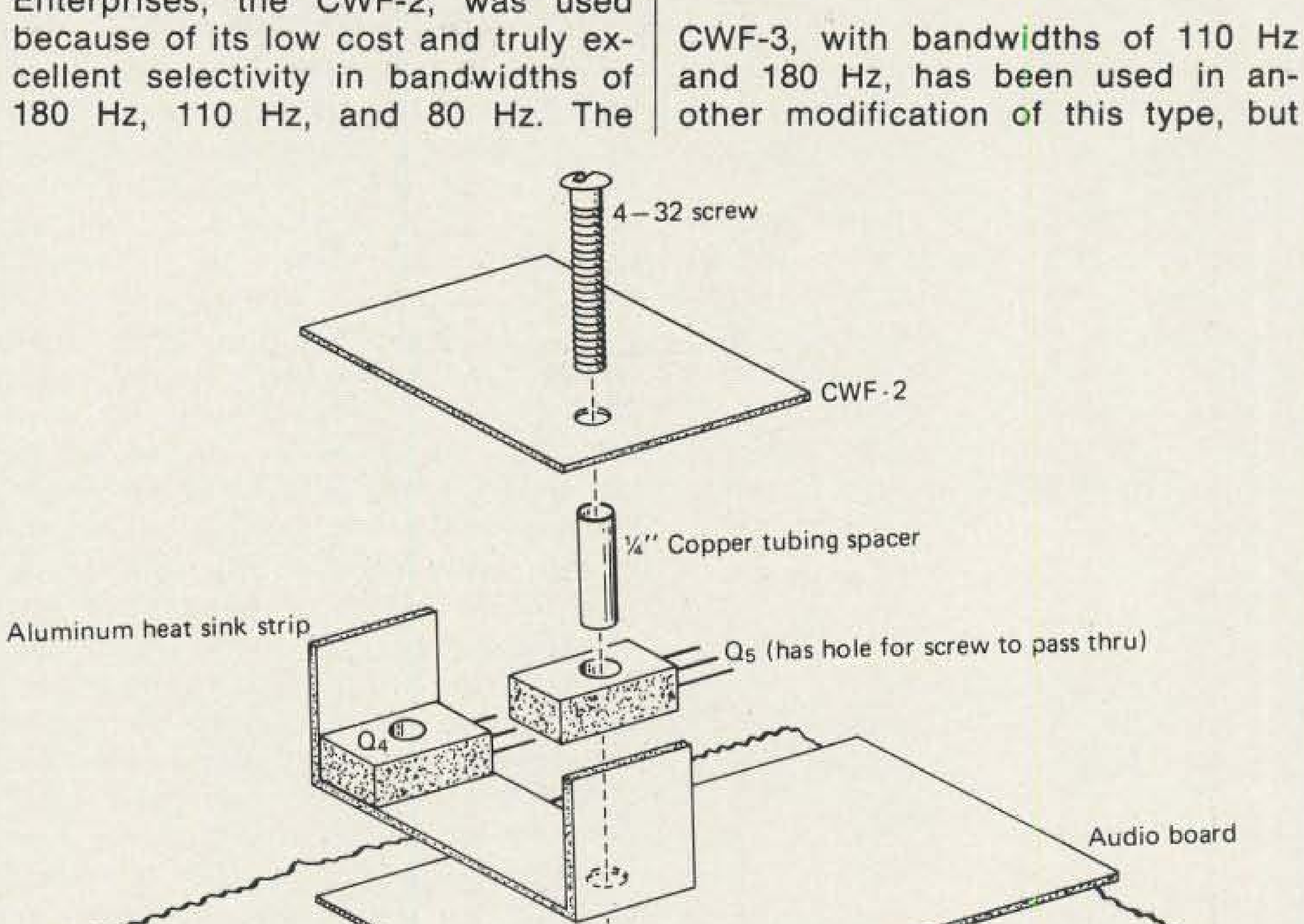
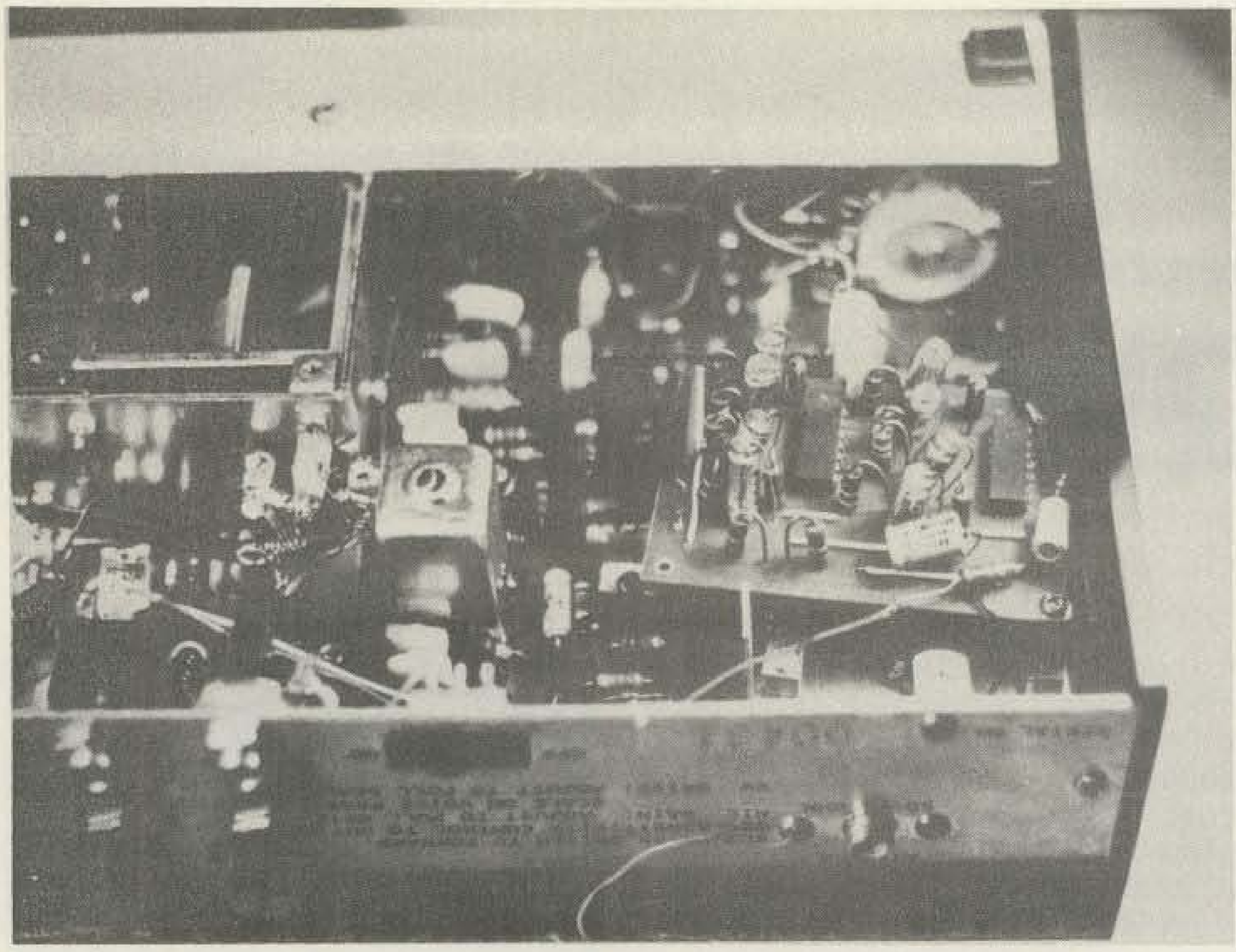


Fig. 1—Mechanical details for mounting the CWF-2 board above the audio circuit board of the Argonaut.

*83 Suburban Estates. Vermillion, SD 57069.



Mounting details for the CWF-2. The metal spacer and 4-32 screw are at the bottom right. Note that the CWF-2 board is lower than the aluminum strip heatsink at the left end of the board and is flush against it. The light lead (wire) leaving the resistor at the bottom right of the board is the B+ lead going to the center pin (B+) of the i.f. board. The black wire emerging from beneath the resistor is the B− lead. Directly above the mounting screw is a 10 mf output coupling capacitor. The white rectangular blur at the top center of the board is the 10 mf output coupling capacitor for output #1.

the 80 Hz bandwidth available in the CWF-2 makes a world of difference and this latter model is recommended.

In the attempt to keep the modification project as simple as possible, I decided to leave the CWF-2 in the circuit at all times, relying upon a single subminiature SPDT switch to choose between the 180 Hz and 80 Hz bandwidths of the filter. The only anticipated problem was the possible

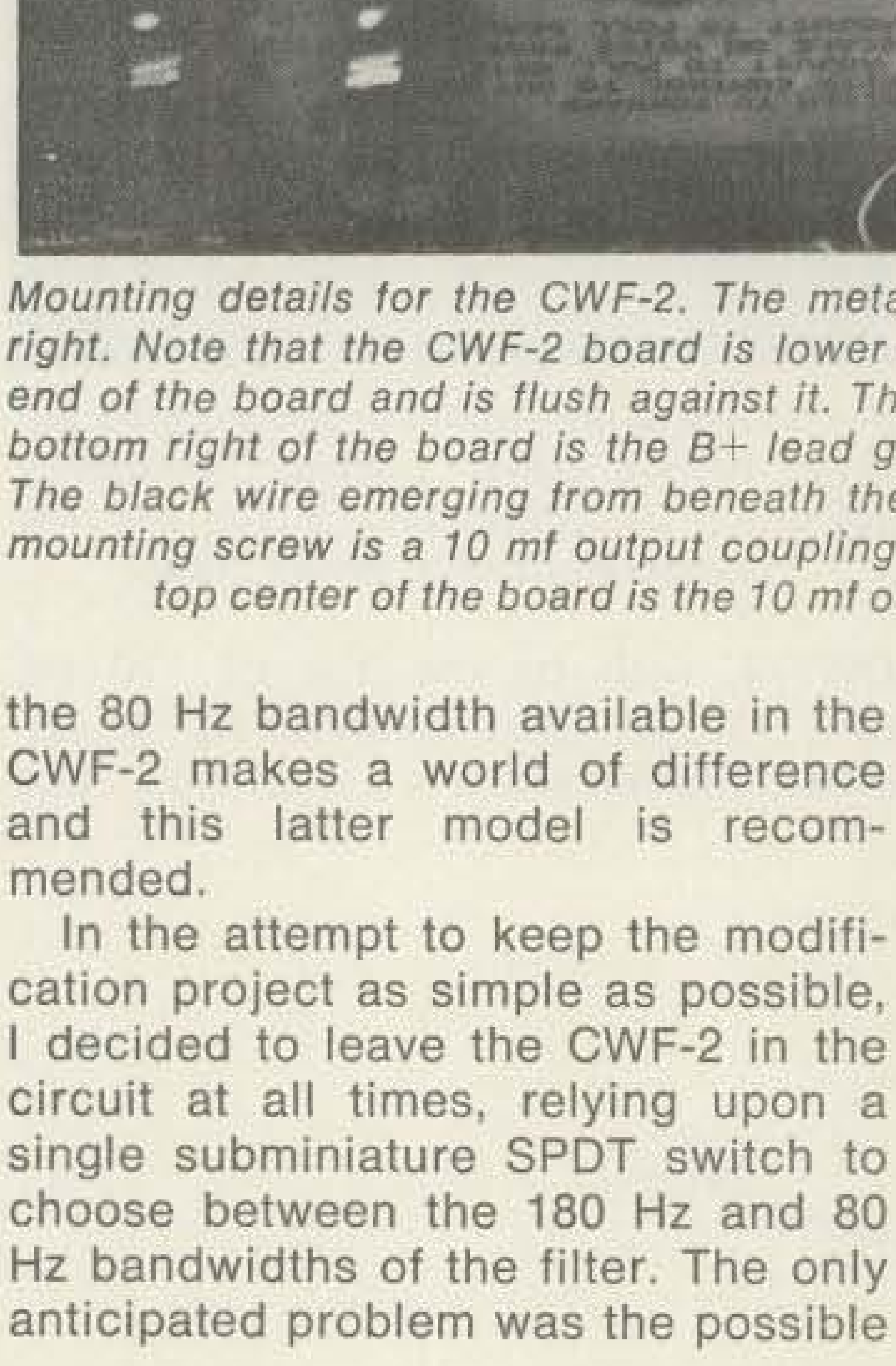


Fig. 2—The selectivity switch position.

degradation of s.s.b. signals passing through the 180 Hz filter bandwidth, but a glance at the skirts of this position suggested a not-intolerable level of distortion of s.s.b. signals. A preliminary test hook-up indicated that distortion was minimal and principally because the filter center frequency is at 700 Hz, rather than being located somewhere in the center of the audio range. Further, while the broad skirts of the 180 Hz position permitted very good intelligibility in the wanted signal, they offered a worthwhile degree of rejection of unwanted s.s.b. signals somewhat removed from frequency. In fact, the effect of the 180 Hz position is hardly distinguishable from that exhibited by MFJ's filter which is designed specifically for s.s.b. In short, my impression is that the 180 Hz filter resulted in a net improvement in s.s.b. copy, at least as far as my ear is concerned. And so, my original plan was followed and the CWF-2 180 Hz position is in the circuit at all times, with the selectivity switch allowing a choice of the 80 Hz position for really tough situations. Needless to say, the experimenter can use other approaches, such as using a four position switch to allow complete removal of the filter from the circuit as well as a choice of each of the three bandwidths of the CWF-2. Or again, the selectivity switch could be mounted on the rear panel.

Insertion Point

Many fellows have used sharp audio filters in an "outboard" position (i.e., fed directly from receiver audio output) with the Argonaut and other transceivers and have been disappointed that no improvement in the copy of weak c.w. signals resulted, or that unacceptable distortion resulted. The explanation for these results is rather simple.

The a.g.c. voltage in the typical transceiver is derived from the signal which has pased through the s.s.b. i.f. filter. As a result, the bandwidth of the i.f. filter, usually on the order of 2.4 KHz, establishes the range across which strong signals can trigger the a.g.c. and reduce overall receiver gain. For example, if an S4 c.w. signal is at 14065 KHz, and an S9 signal at 14066.5 KHz, that strong signal falls well within the s.s.b. filter bandwidth, and hence, will trigger the a.g.c., lowering receiver gain significantly. Given the usual dynamic a.g.c. range, the reduction in gain in the above situation will be enough to render the desired S4 signal inaudible. The solution, then, is to insert the audio filter *before* the point at which the a.g.c. voltage is derived. Then the a.g.c. will respond only to signals in the passband of the audio filter. In the above example, then, the strong unwanted S9 signal 1.5 KHz removed from the S4 wanted signal will be rejected by the audio filter and will have little or no effect upon a.g.c. action, depending, of course, on the audio filter selectivity skirt. With respect to the CWF-2's 80 Hz position, an S9 signal just 100 Hz away from an S4 signal will have no effect whatsoever on the a.g.c. action of the Argonaut.

Distortion resulting from an "outboard" method is usually caused by overloading of the filter input by the receiver output. The output of the audio section of the typical transceiver is usually in excess of the level that the typical active filter can handle without distortion or loss of selectivity. Of course, a buffer stage at the input of the filter can keep input levels to that which can be accommodated by the active filter sections. Also, some distortion usually results in transceiver audio output stages when gained is turned way down. In short, various overloading effects interfere when an active filter is "outboarded." Insertion at the point suggested above usually provides drive-voltage levels which are nearly optimum for the low-level active filter, thus permitting it to perform at full effectiveness.

Construction Details

The accompanying photos show the approach used in mounting the CWF-2 above the audio board. The CWF-2 is secured with a single screw that provides adequate stability, and the underside of the p.c. board, as well as the top of tall exposed parts, are taped over to prevent accidental shorting. A spacer made from ¼" copper tubing is cut so that it positions the CWF-2 board just above the vertical fins of the Q4-Q5 aluminum strip heatsink. A long 4-32 machine screw bolts the CWF-2 and audio board to the chassis, as shown in fig. 1. In order to remove the screw-bolt originally mounting the rear outside corner of the audio board, it is necessary to pull the control board which mounts on the other side of the chassis directly above the audio board. If the pins stick, carefully wedge a screwdriver between the pin holder and receptacle and pry up. The pins can be realigned before remounting if they are bent.

The selectivity switch is mounted on the front panel between the A.F. Gain Control and the Mode switch, and flush with the chassis plate on which the audio board is mounted. Some very careful measuring is necessary in order to line up the hole in the chassis panel and the front panel—otherwise it may be necessary to file out one of the two holes to bring them into alignment. Luckily, I squared them up before drilling and avoided possible scratching of the front panel or enlargement of the original hole.

Electrical hookup is simple. First, remove the i.f. board and locate C15 (0.1mf). Desolder and remove the C15 lead that is common with R18 (150K) and the base of Q4 (2N5133). The TenTec manual picture of the i.f. board will aid in finding C15. Next, solder the 10mf electrolytic coupling capacitor provided by MFJ into the hole vacated by the removal of the C15 lead. Replace the i.f. board.

Filter hookup is next. Mount the CWF-2 board as described above and shown in fig. 1. Connect the INPUT lead of the CWF-2 to the free end of C15. Then connect the 80 Hz and 180 Hz leads from the CWF-2 to the two sides of the selectivity switch, and the pole of the switch to the free end of the 10 mf coupling capacitor which was added to the i.f. board in an earlier step. Finally, connect the B+ lead from the CWF-2 to the B+ pin of the i.f. board by wrapping it a turn or so on the pin, and then soldering it in place. Do likewise for the ground lead from the filter. (Check the manual schematic for proper pin connections: the B+ appears on the middle pin at each end of the i.f. board, while the B−/gnd is at the end pins, either end.)

Results

The installation of the CWF-2 has

(continued on page 78)

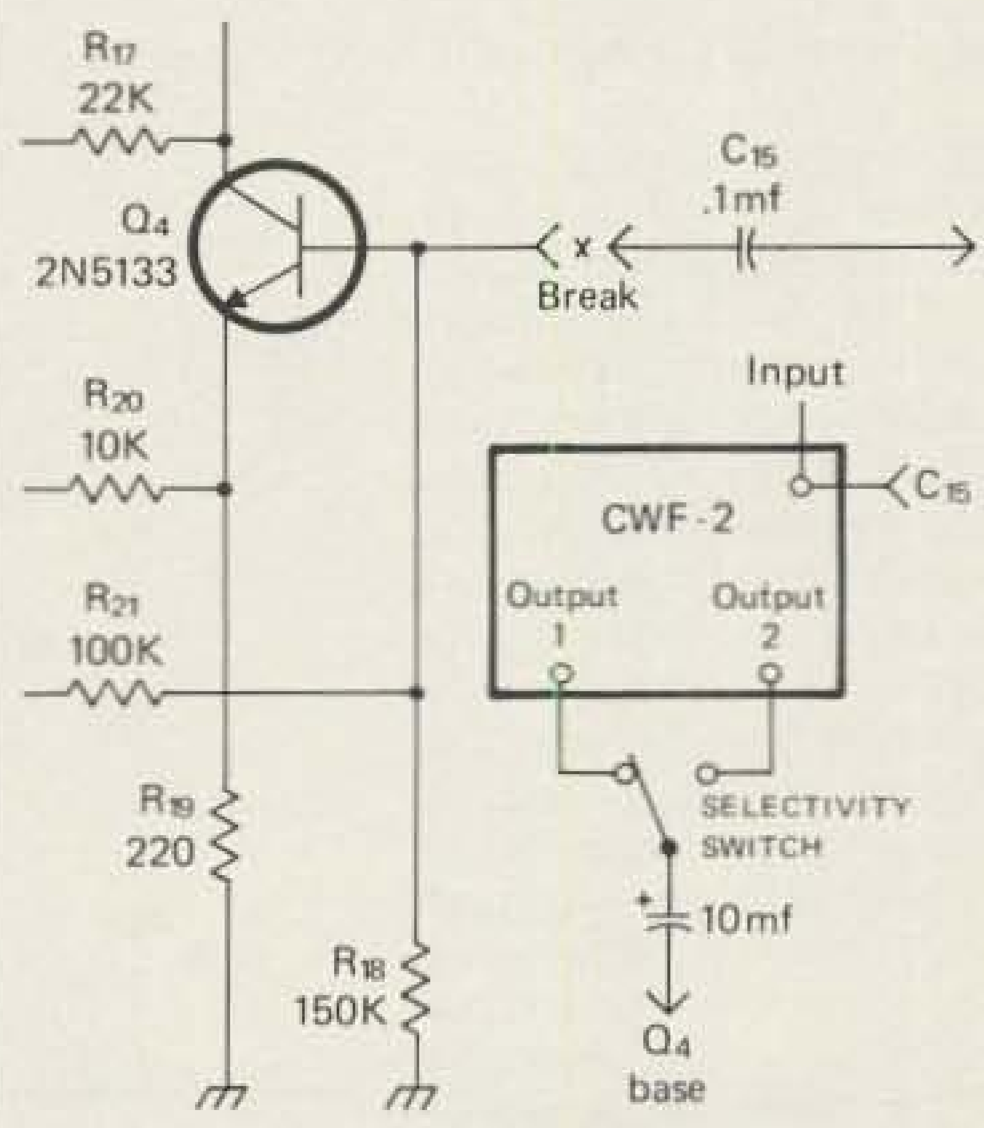


Fig. 3—The filter insertion (i.f. board) point.

WILLIAM I. ORR, W6SAI, ON

Antennas

"What in the world are you doing?", I asked. Pendergast seemed to be half-buried in a collection of books. A large atlas was open on his desk and he was studying it intently.

"Well," he replied, "I'm just looking for new countries. Things have stagnated. The DXCC Honor Roll has over 500 stations in it and the 5-band DXCC Award has over 480 stations in it. Awards that come that easy are garbage as far as I am concerned."

"Yeah?", I replied. "Do you have a better idea?"

Pendergast looked up from the atlas. "No, I don't," he said. "But I think I have discovered a few new "countries" that would get things moving off dead center."

"What are they?", I asked eagerly.

"Well, first of all, how about *Krusenstern Rock*?", Pendergast asked, then proceeded to answer his own question. "This mini-atoll is about half-way between Kure Island and Johnson Island, south of the Hawaiian Islands. That seems like a good candidate for a DX-pedition. Second, how about *Kahoolawe Island* in the Hawaiian group? That's under the control of the U.S. Navy, in the same manner that Midway Island is." He paused, then continued. "The only problem is that Kahoolawe is used as a bombing target. That makes things a little uncomfortable. But, still, the island *isn't* under the jurisdiction of the government of Hawaii."

*48 Campbell Lane, Menlo Park, CA 94025.

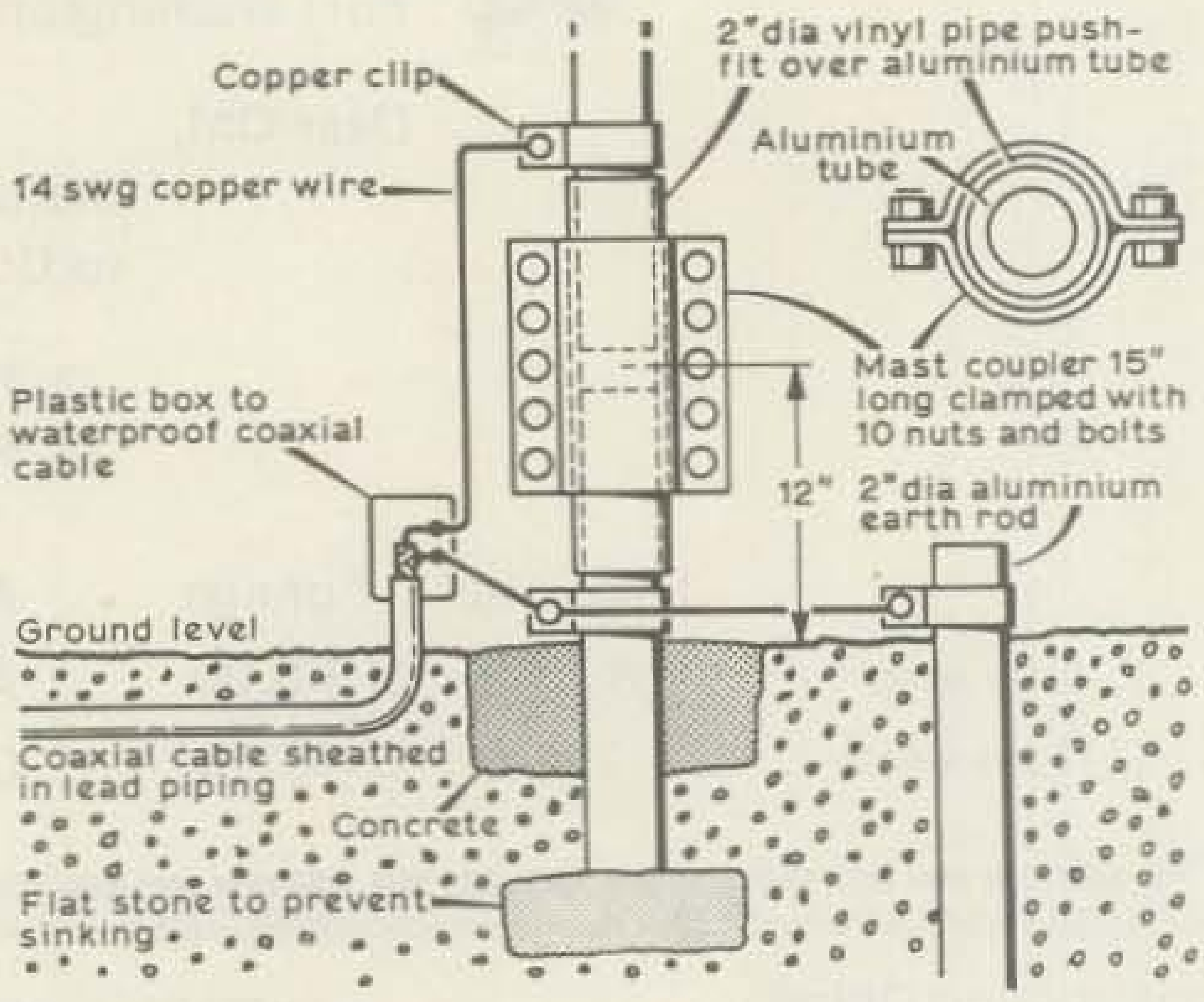


Fig. 2—Base support for the G3NGD vertical antenna. Outer braid of coaxial line is grounded to mast support and multiple ground rods. Base insulator is a clamp made of PVC material.

"Very interesting," I remarked. "Any other great ideas?"

"One more," said my friend. "How about the *Austral Islands*? They are far south of Tahiti, but still part of French Oceania. The great distance between Tahiti and the Austral Islands is the same situation as Clipperton Island. All use the FO8 call letters."

"Well, you may have something," I said. "All you have to do is to convince the "country-creators" that you have a legitimate case."

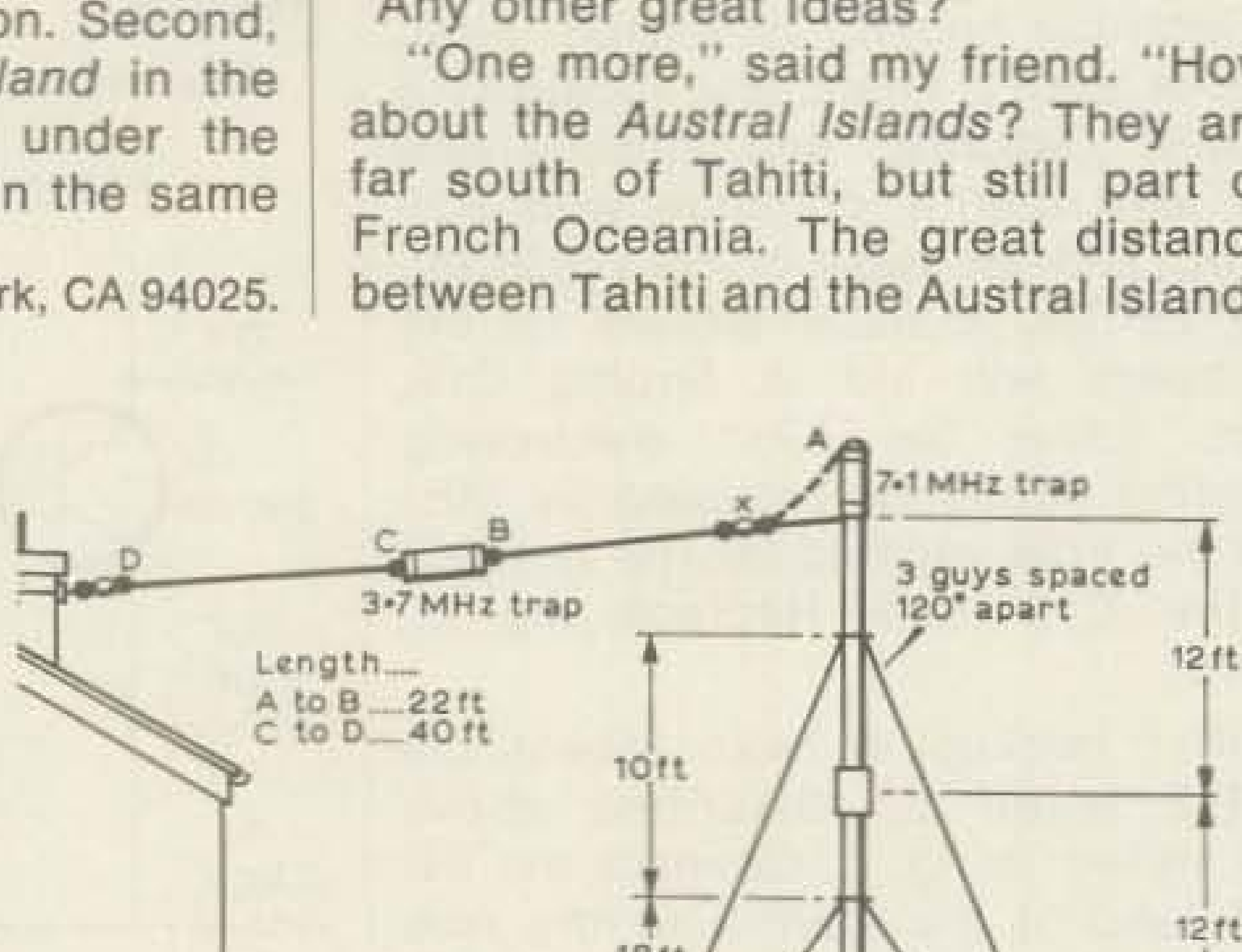
Pendergast sighed. "That'll be the day." He paused, then closed the atlas with a snap, pushing the other books to the corner of his operating desk. "Let's talk antennas," he said. "I'm sure that'll be more productive."

I reached into my jacket pocket. "Have you seen the August issue of *Radio Communication*?", I demanded. "That's the publication of the Radio Society of Great Britain (RSGB). You really should subscribe to it[1].

"Well, G3NGD describes a compact semi-vertical trap antenna for 160, 80 and 40 meters that should be of great interest to those amateurs who haven't much antenna space. The basic antenna is a 33 foot vertical for 40 meters (fig. 1). A 40 meter trap is placed atop the mast, with an wire section (A-B) run off for 80 meter operation. An 80 meter trap (B-C) and an extra section of wire (C-D) provide 160 meter operation.

"The antenna is operated against

Fig. 1—The G3NGD semi-vertical antenna for 40, 80 and 160 meters, as shown in "Radio Communication", the publication of the Radio Society of Great Britain. A 33 foot aluminum mast serves as a vertical antenna for 40 meters. At the top of the mast a 7 MHz trap is mounted and a wire outrigger (A-X-B) tunes the antenna to 80 meters. A second trap, tuned to 80 meters, and an outrigger (C-D) provide resonance for 160 meters. The coaxial cable is run underground to the mast and multiple ground rods are placed near the base of the mast.



[1]Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE, England

ground; multiple ground rods are used. In addition, the coaxial line is run through a section of metal pipe which is buried beneath the ground and used for a ground connection.

"The vertical antenna is made of three sections of 2-inch diameter aluminum tubing. The antenna is supported on a base insulator and is bolted to a section of aluminum pipe held vertically in the ground with concrete (fig. 2). About one foot of the pipe protrudes above ground and a mast coupler is used to mount the antenna to the pipe. The base insulator is a section of PVC plastic pipe pushed over the aluminum tubing. Since this is a low potential point on all bands, the insulation is adequate.

"Although it is not suggested in the article, it is a good idea to wrap the pipe with black vinyl tape to prevent corrosion beneath the ground."

"Very good!", exclaimed Pendergast, "Now, how about the traps?"

"Well, the 40 meter trap is mounted atop the vertical antenna," I replied. "It is quite heavy. The coil is wound with 20 turns of insulated wire, 1½ inches in diameter and on a six inch long form. The capacitor is a 50 pF, 3 kV unit. The trap is dipped to 7.1 MHz before it is installed on the antenna. Fig. 3 gives you details of the trap.

"A vinyl sleeve is passed over the trap to make it waterproof and a Fiberglass end-cap keeps moisture out of the top of the trap. A connection to the top end of the trap is made through the cap to a clamp which holds the loading wire (A-B) shown in fig. 1. A bottom end-piece is turned from a fiberglass or wood block to make a slip-fit into the aluminum tube of the vertical antenna.

"The 80 meter trap (B-C) is similar to the 40 meter one and is shown in fig. 4. The coil is 40 turns of #20 wire, spaced out the wire diameter. A 75 pF, 3kV capacitor is used to resonate the trap to 3.7 MHz. The resonant frequency is adjusted by adding or subtracting the number of turns on the coil."

"Right," exclaimed Pendergast, as he copied the information in his black notebook. "What about the 160 meter extension?"

"The 80 meter extension is 22 feet of wire and is not too critical. The 16 meter extension (C-D) is 40 feet long and is quite critical. The length is trimmed to give the lowest value of s.w.r. at the chosen operating point in the 160 meter band."

"Very interesting," said Pendergast. "This antenna should appeal to the low band enthusiasts who don't have much antenna room in their back yard!"

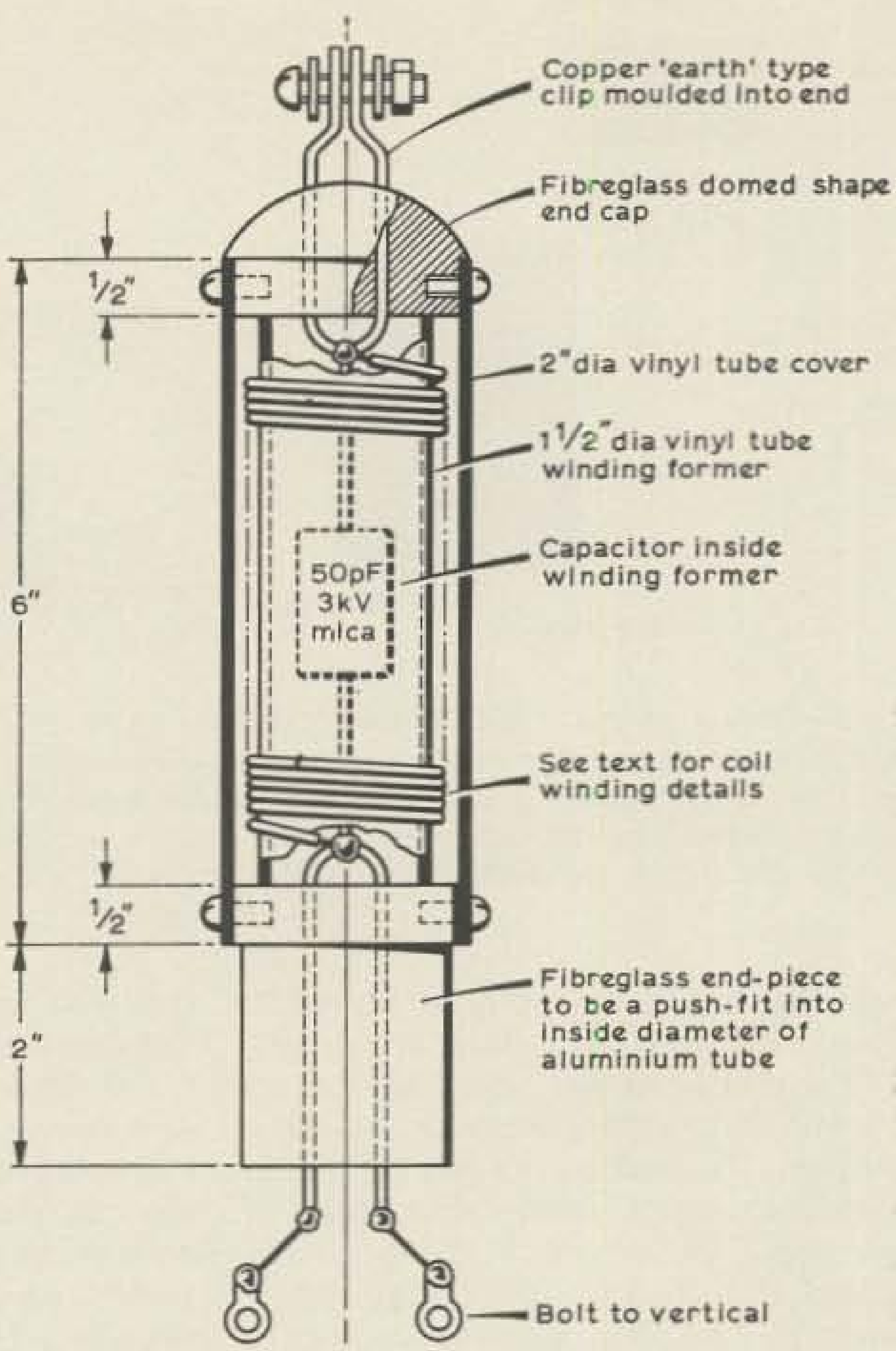


Fig. 3—Details of 40 meter trap. The trap is wound with 20 turns of #16 insulated wire. Before the cover is put on, the trap is dipped on the bench to 7.1 MHz. Turns are adjusted to achieve resonance. A Centralab 5 kV ceramic capacitor may be used for high power. Top of trap has a mechanical clamp to which the outrigger wire is attached.

I pointed to some papers on the table. "Here's some items of interest that came in the mail," I remarked. "A note from Temp, W9YLD, who says that his friend DL3UT/W9 in Chicago had a perplexing antenna problem. He wanted to work his friends in Germany, but lived in an apartment where antennas were *verboten*. The apartment was on the second floor, in a brick and frame building. The solution was to erect a single Quad loop for 15 meters, fed by a gamma match in the lower wire The loop was mounted directly to an outside wall of the building, but on the *inside* of the wall. No one could possibly see the antenna from the outside and it worked quite well. It was not quite square, because of the floor to ceiling height, but it radiated and DL3UT/W9 was able to keep his schedules with Germany, despite the fact that the orientation of the loop was not quite on Europe.

"Temp and DL3UT/W9 next tried a horizontal Quad loop, made of #20 wire, laid right out on the rug of the living room, held down on the corners by books! It had a gamma match, like the other antenna. The first call resulted in a nice QSO with a station in New Orleans, who said—when told about the haywire antenna —"just turn the rug and you have a rotary antenna-HI."

"A great idea!", laughed Pendergast. "You can do a lot with indoor antennas in those buildings which do not have steel frames. You may have to move your antenna about to dodge resonances in the electrical wiring,

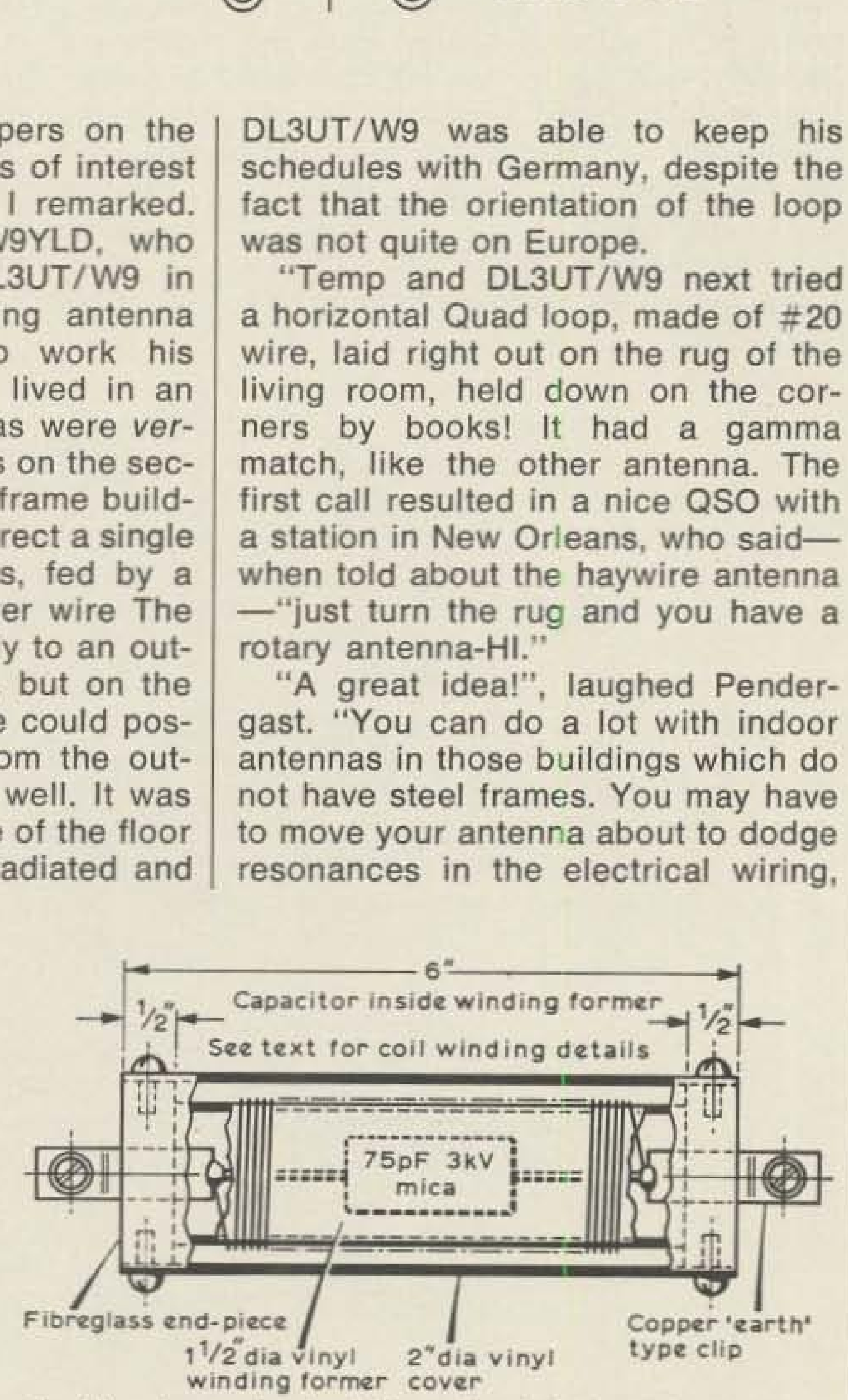


Fig. 4—Details of the 80 meter trap. The trap is wound with 40 turns of #20 enamel wire, spaced out the wire diameter. A Centralab 5 kV capacitor (or two capacitors in parallel) may be used in place of the mica capacitor shown. Turns are adjusted to achieve resonance at 3.7 MHz. Heavy duty lugs are used for terminals. (Photos courtesy of "Radio Communication").

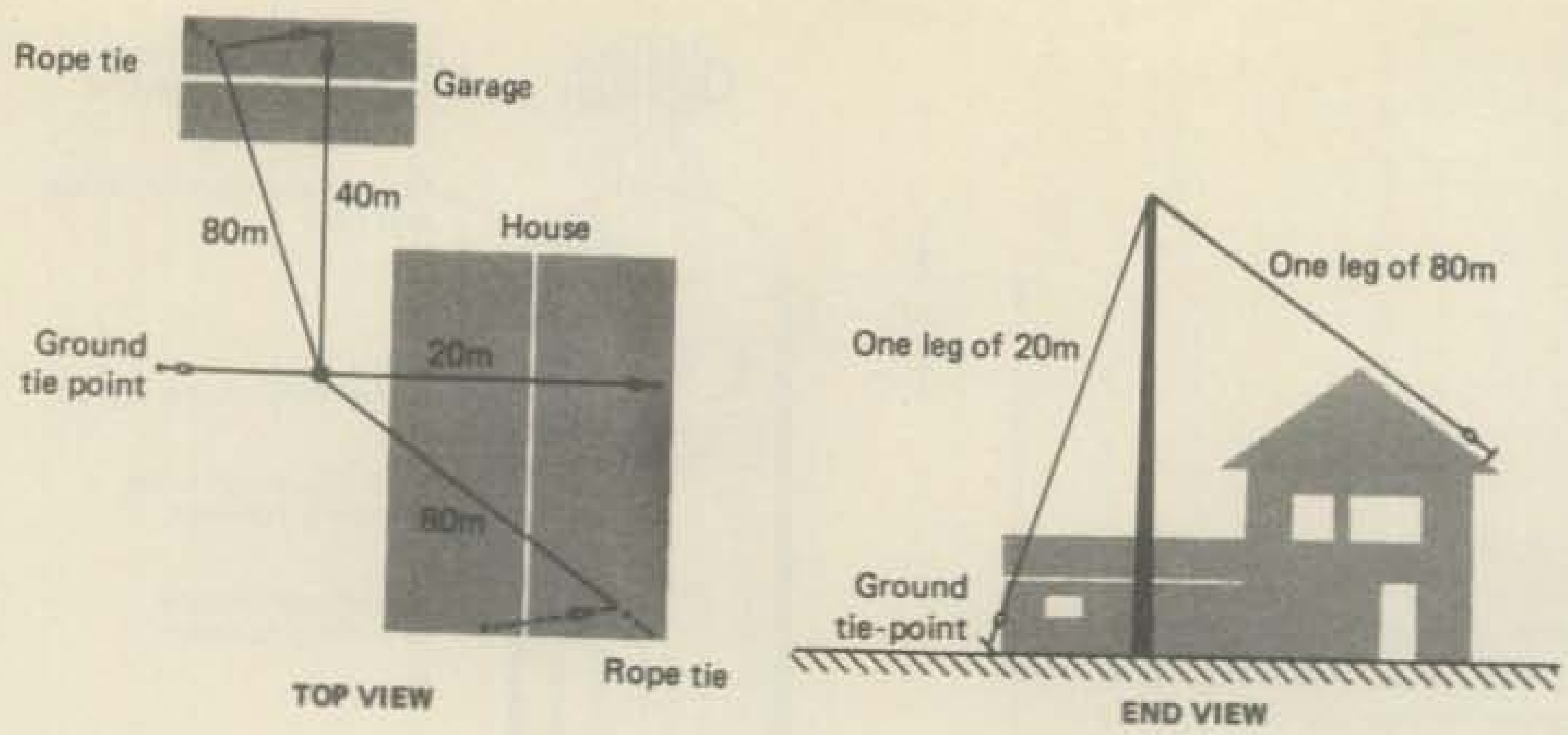


Fig. 5—Details of WA1Y-UZs antenna installation in a housing complex. A TV mast is used for support and is mounted close to the wall of the building. The top view shows the layout of the three dipoles, which act as guy wires for the mast. The end view of the building shows how the 20 meter dipole acts as a back guy for the mast. The three dipoles are fed in parallel at the center insulator which is held up by a rope and pulley arrangement.

or pipes, but it certainly is possible to work DX with an indoor antenna!"

"It's tough, when you live in an apartment, condominium or housing complex. In most cases the landlord, or homeowner's association take a dim view of amateur radio. They equate it with TVI and stereo interference. And the argument that a good, high antenna—away from the building—will cause less interference than one in close proximity to the house wiring, television sets and stereo equipment usually falls on deaf ears."

"Well, Woody, WA1YUZ, had the same problem," remarked my friend. He lived in a duplex in a small housing complex. Space for antennas was quite limited as the yard was small, and power lines ran along the street. He was lucky enough to get permission to erect an outdoor antenna, so he put up a multi-band antenna composed of dipoles for 80, 40 and 20 meters. They were connected together at the feedpoint and fed with a balun. Since it was difficult to attach anything to the building, Woody erected a 40 foot TV mast at the side of the building. A rope and pulley arrangement on the mast permitted him to hoist the center insulator of the multi-band dipoles to the top of the mast (fig. 5).

"The 80 meter dipole runs across the duplex roof and over to a corner of the garage. It is folded back along the far edge of the garage roof, and the opposite end has a dog-leg in it, too. The 40 meter dipole portion of the antenna runs parallel to the face of the duplex and is tied off at one end to the garage roof and at the other end to the duplex roof. The 20 meter dipole runs at right angles to the other two and sort of serves as a set of guy wires to stabilize the 40 foot mast.

"The 80 meter dipole has a bandwidth of nearly 400 kHz between the 2-to-1 s.w.r. points and the 40 and 20 meter dipoles are cut for 7.05 MHz and 14.05 MHz, respectively."

"Aha, Woody is a c.w. operator," exclaimed Pendergast.

"It seems so," I replied. "In any event, he feeds the tri-band antenna with RG-58/U coaxial line. The whole antenna system can come down in seconds for Field Day use, or for repairs. And while the radiation patterns can only be guessed at, Woody seems to be able to work good DX in all directions, as well as short-haul rag-chewing."

"You can't keep a good man down," remarked Pendergast as he stretched luxuriously. "The only thing better than a dipole is a good beam!"

"Yes," I agreed, "But you would be surprised at the relatively large number of amateurs that can't erect a beam because of housing problems. And the number will grow, as more and more families choose to live in multiple unit dwellings."

I reached into a pile of literature on the desk and drew forth a copy of *CQ-ham radio*, the Japanese publication.

"Speaking of beams, you might be interested in this," I remarked.

"This is a field pattern plot of a well-known U.S.-made tri-band beam (fig. 6). The beam is fed directly with a 50 ohm coaxial line, with no balun between the line and the antenna. In

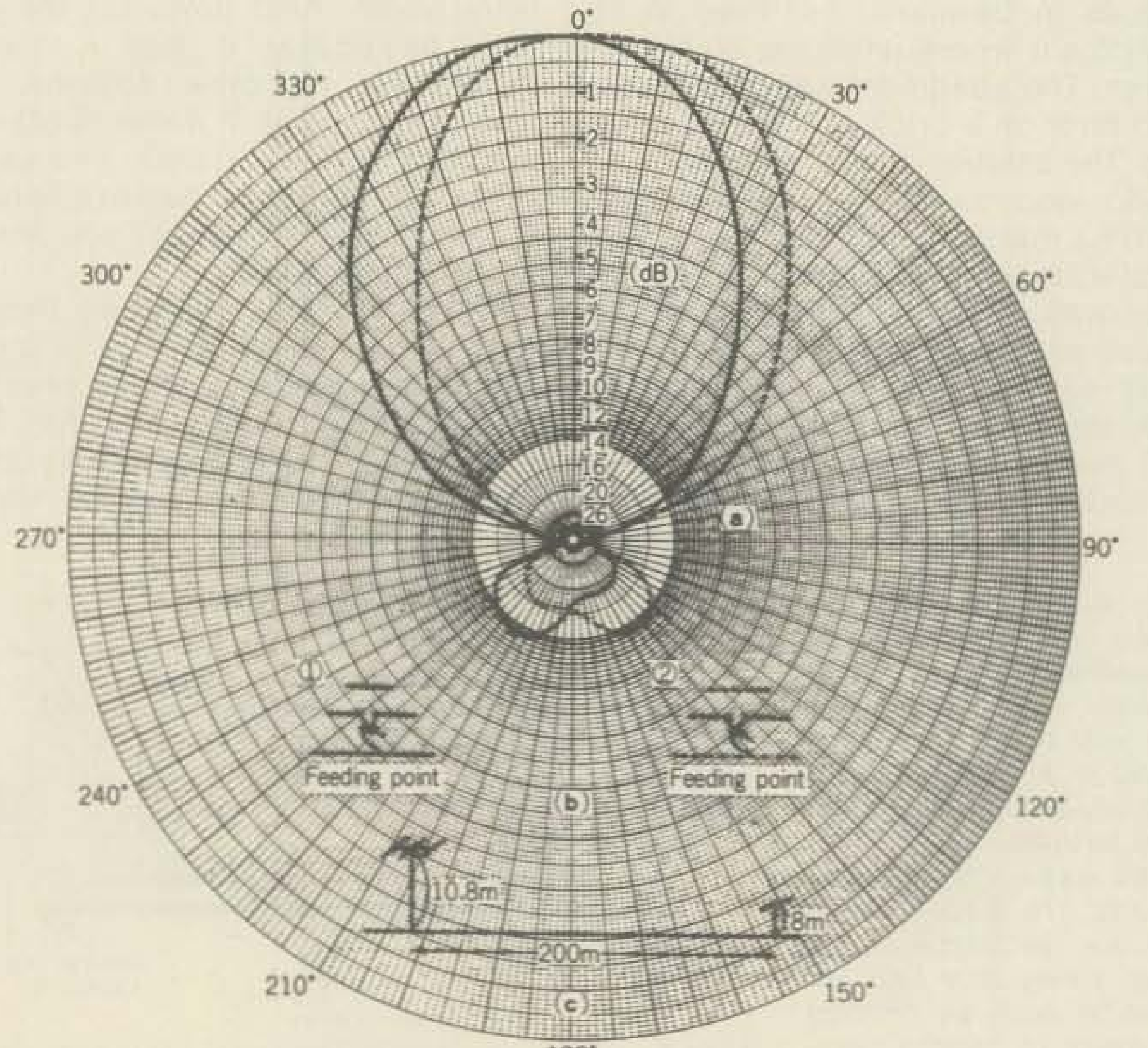


Fig. 6—Field pattern plots of triband Yagi beam the driven element of the beam is fed with a coaxial line. No balun is used. The beam pattern is deflected to the right or the left, depending which side of the driven element is attached to the center conductor of the coaxial line. While the "squint" is minimal, it shows that the beam reacts to the feed conditions. See text for details.

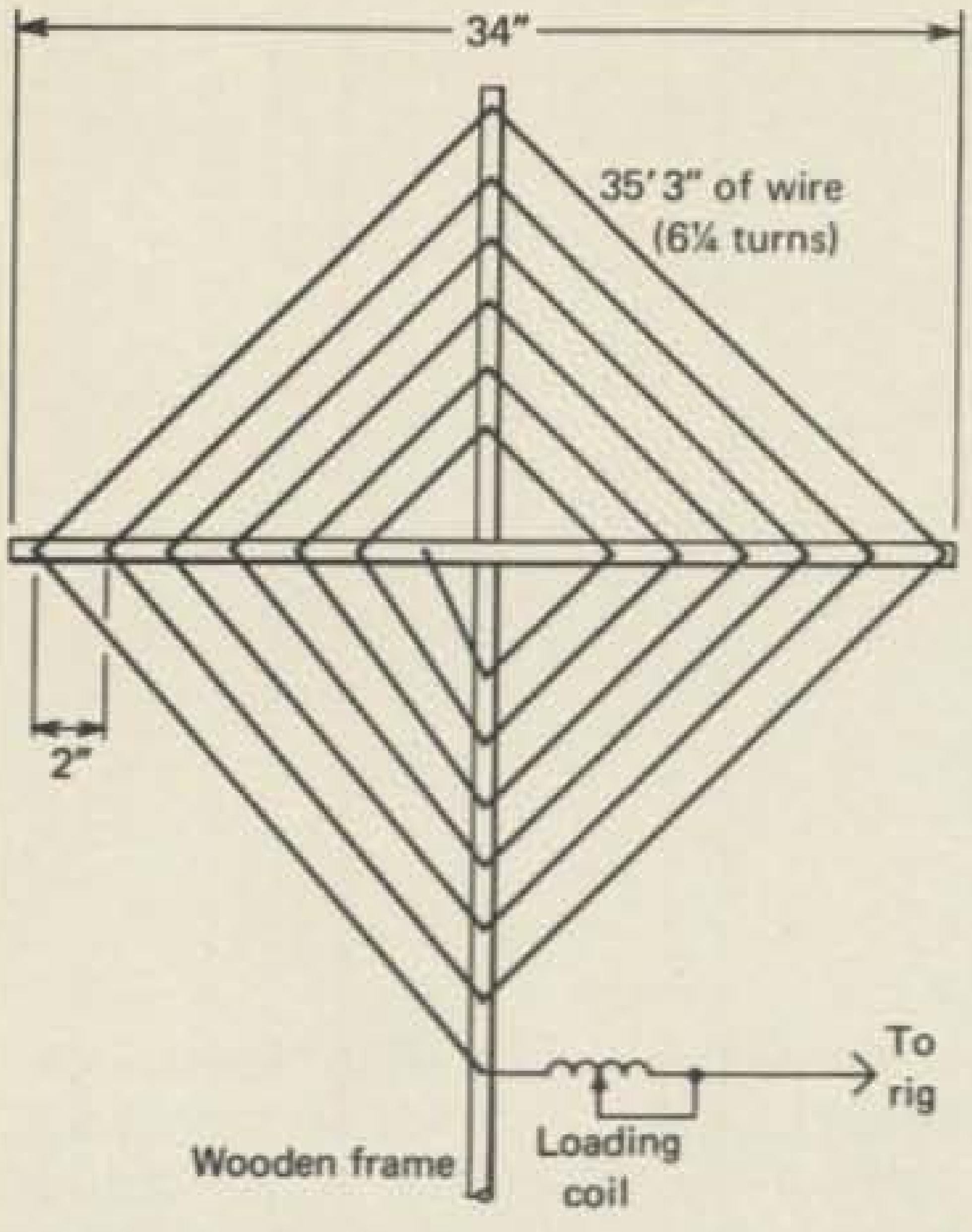


Fig. 7—The K4MD loop antenna for 40 meters is small enough to sit next to the operating table.

other words, no matching system, or balancing system is used at the antenna. Notice the plot! The beam pattern is slewed to the right, or to the left, depending upon how the coaxial line is attached to the antenna element of the beam. The solid line shows the pattern to be slewed to the left of center when the center conductor of the line is connected to the left-hand portion of the driven element. The reverse pattern (the dashed line) is observed when the center of the coaxial line is attached to the right-hand portion of the driven element.

"Some years ago KH6IJ made measurements on a 3-element beam and noted that the r.f. voltages were highest on the side of the beam that was fed with a gamma match. And that the voltages on the opposite side of the beam were much lower. Even so, he did not note any "squint" to the antenna pattern.

"However, these measurements made in Japan show a definite "squint" to the beam pattern when the feed is not symmetrical. In this case, the pattern is slewed to one side about eight degrees."

"That sounds like no big deal," remarked my friend. "The pattern of the antenna is broad enough so that in-line with the beam, there's no difference in field strength, regardless of which side of the driven element is fed."

"Agreed," I replied. "But this warns you that the pattern of a beam antenna can be a function of the feed system. In a high gain beam, such as used on v.h.f., the feed system can seriously disrupt the beam pattern. A good balancing device—a balun, or perhaps a T-match—or something like that can do a lot towards balancing the r.f. voltages on the driven element."

Pendergast said, "I've checked my beam pattern many times and I can't notice any "squint" in it."

"Perhaps not," I agreed. "But the problem can exist, so it is good to know about it."

"Just to change the subject, what do you think of the loop antenna that K4MD is using?", asked my friend.

"Very interesting," I replied. "It looks like a long wire wound up on a frame (fig. 7). Harvey says it is an adaptation of an idea he got from W8OHM. K4MD has only used it on 40 meters so far and has had good results. The loop antenna sits on a table adjacent to his operating position, which is on the ground floor of his home. And with 70 watts into the antenna he's had good contacts all over the eastern part of the U.S. in the early evening hours."

"Did he notice any directional effects?", asked Pendergast eagerly.

"He didn't say," I replied. "The antenna's only been up for a day or two. Resonance is established with a series inductor in the lead to the transmitter. A good ground connection is used on the equipment. And with a 18-turn variable inductor, Harvey hit a 1.5-to-1 s.w.r. with ease. And I would imagine that he could get even a better match if he used an L-network between the loop and the transmitter."

"Small antennas like this are easy to build and a lot of fun to play with," remarked Pendergast. "While this 'sn't a loop, in the true sense of the word, it is certainly a design that demands more study and evaluation. I'd like to try this thing with some loading at the end of the wire. Maybe a capacity hat, or something like that. I think I would feed it at the center point and have the end of the wire on the outside of the loop. Then I could try end loading. And possibly use two loops, working against each other, like the halves of a dipole. You could rotate them independently, or perhaps have one placed horizontally and the other vertically. . . ."

"Hold on!", I interrupted. "You've got enough ideas to keep you busy for a year! When are you going to have the time to do all these good things?"

"I don't know," replied Pendergast ruefully. "I guess it's more fun to *think* about antennas than it is to build them and try them out."

"You'll make a lot less mistakes if you only think about them," I replied. "But you won't have nearly as much fun." ■

In Focus

BY BILL DEWITT, W2DD

1977—A Look Ahead

Elsewhere in this issue, yours truly mentions scan conversion as the key to a dramatically higher level of amateur interest in SSTV. Certainly the 1975/1976 period will in the future be looked upon as a turning point in the history of slow scan.

To Robot Research Inc. must go the credit for bringing scan conversion within the reach of amateurs. To those with a compelling interest in construction, digital scan conversion was available. And, a few amateurs did build storage tube scan converters. But to amateurs with a lesser interest in construction, and the many without the time to devote to building and debugging a complex device—scan conversion was simply too expensive in terms of time or money, or both.

Robot led the way to scan conversion for amateurs with their Model 300 Storage Tube Scan Converter. Now, in a much lower price class, the compact Model 400 Digital Scan Converter with its simplicity of operation is creating new waves of interest in SSTV.

Looking ahead, it is my opinion that slow scan television activity is going to show an exponential increase during 1977. It looks like a facet of amateur radio whose time has come!

*2112 Turk Hill Road, Fairport, N.Y. 14450

Dr. Frank J. Biba, WB5SAJ seated at the console of what must be called "Mission Control"!

SSTV Frequencies, What Do You Suggest?

Yes, 1977 is going to be a good "growing year' for SSTV. Remember the growing years of s.s.b.? Maybe a better name would be "the awkward age of s.s.b.". There was silly grappling and name calling between the a.m. and s.s.b. modes, unproductive, to say the least.

So the time has come to address the problem of how to handle the matter of SSTV frequencies. The A.R.R.L. Board of Directors has just decided that the best thing to do is to leave things as they are. It doesn't follow that what we've been doing is the best thing to do (NOW) because we've always done it that way. But maybe nobody told THEM. So what to do?

A former boss of mine at Kodak used to listen carefully to the outline of a problem and then ask, "WHAT DO YOU PROPOSE?" If we slow scanners don't collectively come up with some positive suggestions, we should expect to live with what somebody else (whose main interest is "C.W. FOREVER"!) hands us.

Let's be constructive. If you have any ideas on this subject, get them down on paper. We should be able to present a positive approach for the future.

Remember, the question is, "What do YOU propose?" This column can be your forum on this important subject, please write! I'm hoping to hear from amateurs in ALL continents on this subject.

What's New—An ATV DX Record?

Last October 3rd, three Ohioans, Bill Parker, W8DMR, of Columbus, Art Towslee, WA8RMC, and Dale Ulmer, WA9ZIG/8, exchanged standard fast scan pictures with Ron Stefanskie, W9ZIH, of Hickory Hills, Ill. about 300 miles away. According to a note received from Bill, W8DMR, this is probably a new distance record for ATV. Congratulations to all concerned!

Ron runs 500 watts into 4-24 element Yagis. Bill is pumping 50 watts into a 48 element colinear array.

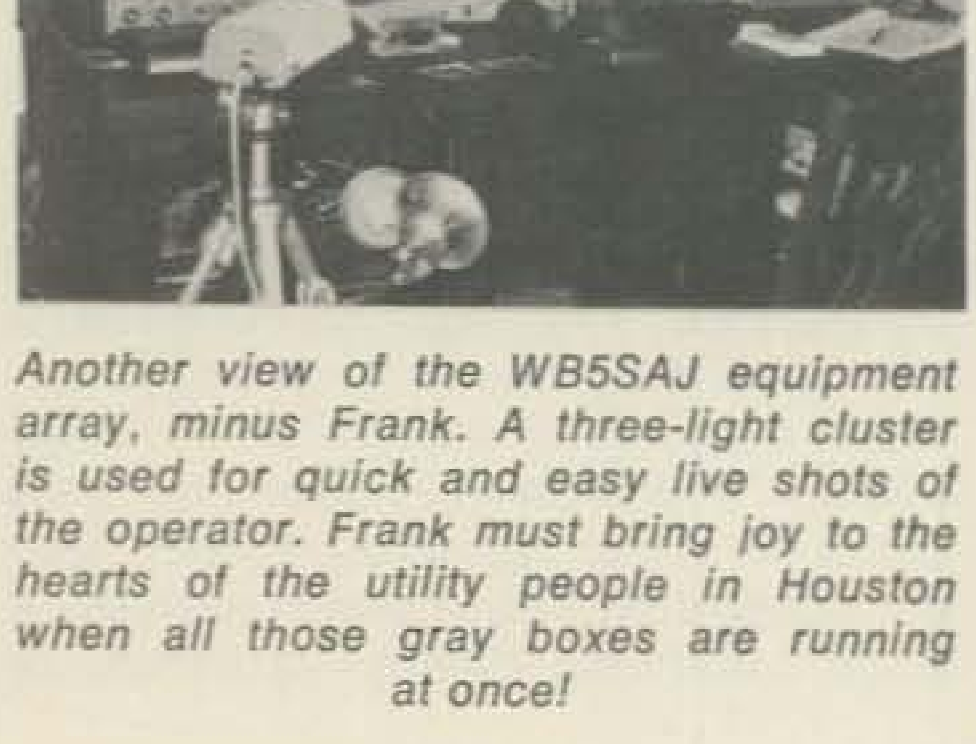
Any challengers out there among you ATV types?

Slow Scan Station of the Month, WB5SAJ

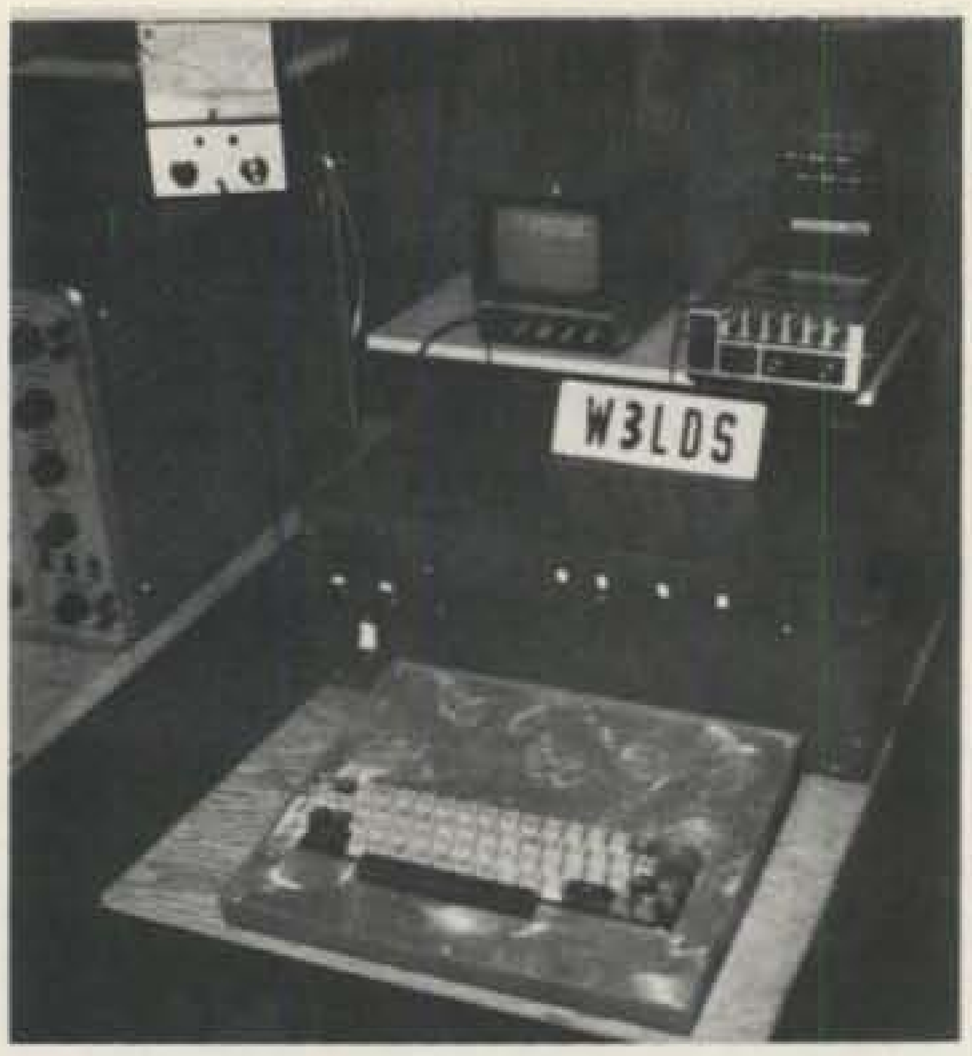
If an ENTHUSIASM AWARD for amateur radio in general, and SSTV in particular existed, my top nomination would go to Dr. Frank J. Biba, WB5SAJ, of Houston Texas.

This 34 year old anesthesiologist was licensed in April of 1976. In about five months on the air he racked up a record of 40 states on SSTV, 82 countries on s.s.b., and may rate third in the U.S.A. in the 1976 Albatross SSTV Contest! As of October, he had been on SSTV for a total of two months!

In addition to this accomplishment,



Another view of the WB5SAJ equipment array, minus Frank. A three-light cluster is used for quick and easy live shots of the operator. Frank must bring joy to the hearts of the utility people in Houston when all those gray boxes are running at once!



Tony Gallo, W3LDS, reports that once a month, his microprocessor set up looks like this. He won't take a picture of what it looks like the rest of the time!

Frank, is partially responsible for some outstanding public relations coverage for amateur radio and SS-TV. Frank, NBC newsman Roy Neal (who is also an amateur), and the gang at the Jet Propulsion Lab Amateur Radio Club, N6V/W6VIO, arranged TODAY SHOW coverage of the Mars photos transmitted by N6V. The SSTV transmissions of Mars pictures by N6V had already been the subject of worldwide newspaper coverage, but the NBC caper really put the frosting on the cake!

Frank was inducted into the SSTV ranks by Bob King, WB5IXK, also of Houston. Perhaps this is why he (too!) has TWO each of all the slow scan goodies—plus two complete transceiver / amplifier combinations! These Texans!

Frank has been practicing anesthesia for three years. He and his attractive wife, Louise, have three boys, Robbie, Paul, and Mike.

As you can see in the accompanying photos, Frank's system for "going live" on video involves a minimum of lighting arrangements, but it sure does work. Pictures of Ye Op that I've seen frequently are excellent.

Just one question to Frank: "If you work all of the states and the rest of the world in the first year you're on the air—THEN what are you going to do?"

Speaking Of Microprocessors

As mentioned here a month or so ago, Tony Gallo, W3LDS, of Ford City, Pa. was an early-early bird on SSTV. Tony is an inveterate, compulsive, determined (and accomplished) builder. Now he's back at it again and the accompanying photos tell the story. I think we can call the Digital Group Microprocessor unit in the close-up picture the main frame of Tony's new gear. The other photo shows a converted keyboard and TV terminal arrangement plus the MP.

Tony reports that so far, he has established good RTTY and c.w. read out on the TV screen. When the Digital Group provides further programming, Tony hopes to use his microprocessor for SSTV/scan conversion purposes.

Amateurs like Tony who start from ground zero and bring this kind of a project to successful completion (whilst working all by themselves) deserve much credit. It takes a lot of knowledge, some darned good test equipment, and stick-to-itiveness!

Some other amateurs who have gone the Digital Group route are, WB2YZL, of Rochester, WA2MFF, of Syracuse, and K2AOU, of Oswego, all in New York State. And that brings up a point.

An Amateur Microprocessor Info Exchange? Why Not?

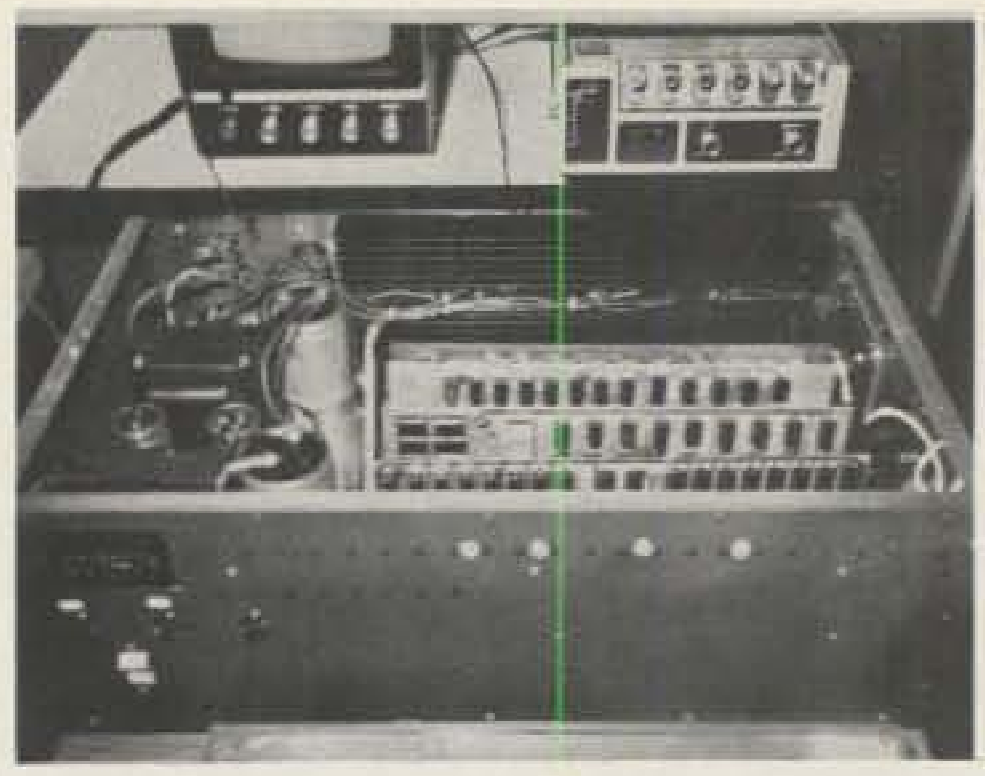
It is a paradox that amateurs who are in possession of good communications equipment—and who are now acquiring equipment with which to process all kinds of information—have no way of finding out who else is interested in what they're doing—no way of getting help from some other individual who may have encountered the same problem, etc., etc.

Isn't it about time that some smart character figured out how to make use of the expensive-effective computers that are in use around the U.S., for instance, so that you could find out if there's a kindred soul with the same interests as yours living practically next door to you? Some kind of a directory and cross reference of amateurs with radio/c.w./rtty/sstv/computer interests is needed. Perhaps a weekly net could be organized.

If you have any suggestions on this subject, write and I'll publish them!

Industrial Applications Of TV Systems

That was the title of a top-notch symposium held at the University of Wisconsin at Milwaukee last November. Included on the program was a talk (I'd like to have heard!) by WB9-LVI, otherwise known as Dr. George R. Steber, Associate Professor of Computer Technology at the Univ. of Wisconsin. George's talk dealt with Image Coding Techniques and covered Pulse Code Modulation, Differential PCM, Transform Techniques, Hybrid Techniques, and Special Display Methods.



Close-up view of the Digital Group microprocessor used by W3LDS for video viewing of c.w. and RTTY. The cabinet was designed and fabricated by W3LDS to house his kit-constructed unit.

Look for an article on the c.w. visual read-out device designed by WB9LVI in *Popular Electronics*, possibly January issue. Sorry I'm not sure of the issue, but it will contain a complete how-to-do-it write-up on the device shown by George at the Dayton Hamvention last Spring. The little read out unit displays one letter at a time, and it's a terrific training aid for those starting to learn the code.

Pictures We Couldn't Resist Department

If you have worked W4MS, you know Eddie's bride, Clyde. The accompanying picture shows Clyde with a "station ID" rug she made for Eddie's newly re-modeled wireless room. Sorry we had to reproduce this picture in black and white. The call letters are bright red against a yellow and blue background. Eddie says it's too pretty to walk on.

Back in the realm of SSTV, W4MS is the owner of Serial Number One of the Robot 400s.

Eddie's bride, Clyde displays her beautiful handwork. Is W4MS suggesting a change in SSTV format?

Something To Look For

Keep an eye out for "clean up sales" of closed circuit TV camera/monitor combinations such as the Sanyo CCTV Lookout System, Model VCA-700. From John Wilson, VK3LM, comes word that some distributors have been cutting their stocks of this very desirable camera and monitor duo because of disappointing sales in the consumer markets field. The monitor uses a nominal 7 inch tube, weighs about 15 pounds, and is attractively packaged. The camera uses a 2/3 inch separate mesh vidicon, has random interlace. Claimed resolution is 400 lines (horiz.) and 300 lines (vert.) at the center area.

These units, or similar combinations made by other manufacturers are ideal for use with scan converters. Some have shown up at the usual price of a CCTV camera alone.

A Never Ending Tape!

It's endless. Ever wish you didn't have a CQ tape on a 60 minute cassette? Getting tired of re-winding and searching for that name-location-rig stuff? There's an easy solution. Get a few endless type cassettes. Most stores don't know that they exist, but they do, and they're made by TDK. Called "Endless Cassettes" (IMAGINE!), they are available in a variety of times. The time per cassette is indicated by the designation, EC1, EC3, EC6, etc. for the number of minutes. Price per cassette is in the $2.50/$3.00 class, and they're worth it for SSTV purposes. After getting a couple of these cassettes, I freed up about six other cassettes that had just a few minutes of SSTV on each! I'd recommend getting a 1, 3, and a 6.

Final-Final, An Appeal To Homebrew Artists

Although many of the photographs published in this column show commercially built equipment, I know that there are thousands of amateurs involved in SSTV who have built their own gear. For the most part, this is excellent equipment that is the functional equivalent of the neatly tailored commercial gray boxes. In almost every case it includes individual capabilities suited to the particular needs of the ham who built it. This is the type of thing that readers of "In Focus" find especially interesting. So here is an appeal to you homebrew-builders of SSTV equipment:

Please send me photographs of your equipment for publication in this column. If you have special design features in your gear, tell how you happened to include those features. And send along a picture of yourself! If you enjoy seeing pictures of other SSTV hams, remember, they want to see what YOU are doing too.

I think that building your own camera, keyboard, scan converter, or monitor is quite an accomplishment, so let's see some more pictures of all that good homebrew gear that I hear and see on the air!

Same old address on the hilltop, 2112 Turk Hill Road, Fairport, N.Y. 14450.

73, Bill, W2DD

Some Things Never Change...

With all the impact of science-fiction at its best, the striking cover of Radio News for February, *1927* carried Hugo Gernsback's conception of an Earth station communicating with the planets. The cover caption queried, "Can We Radio The Planets?"

QST's October cover, with a Zodiacal motif, asked the question, "Radio Astrology—Can The Planets Tell Us About Radio Propagation?" Can it be that ARRL is catching up with Gernsback?—W2DD

Now...more than ever---
the TEMPO line means solid value

Tempo VHF/ONE

the "ONE" you've been waiting for

No need to wait any longer — this is it! Whether you are already on 2-meter and want someting better or you're just thinking of getting into it, the VHF/ONE is the way to go.

• Full 2-meter band coverage (144 to 148 MHz for transmit and receive. • Full phase lock synthesized (PLL) so no channel crystals are required. • Compact and lightweight — 9.5" long x 7" wide x 2.25" high. Weight — About 4.5 lbs. • Provisions for an accessory SSB adaptor. • 5-digit LED receive frequency display. • 5 KHz frequency selection for FM operation. • Automatic repeater split — selectable up or down for normal or reverse operation. • Microphone, power cord and mounting bracket included. • Two built-in programmable channels. • All solid state. • 10 watts output. • Super selectivity with a crystal filter at the first IF and E type ceramic filter at the second IF. • 800 Selectable receive frequencies. • Accessory 9-pin socket. • $495.00

TEMPO SSB/ONE

SSB adapter for the Tempo VHF/One

• Selectable upper or lower sideband. • Plugs directly into the VHF/One with no modification. • Noise blanker built-in. • RIT and VXO for full frequency coverage. • $225.00

TEMPO/CL 146A

. . .a VHF/FM mobile transceiver for the 2 meter amateur band. It is compact, ruggedly built and completely solid state. One channel supplied plus two channels of your choice **FREE**

144 to 148 MHz coverage • Multifrequency spread of 2 MHz • 12 channel possible • Metering of output and receive • Internal speaker, dynamic microphone, mounting bracket and power cord supplied. A Tempo "best buy" at $239.00.

TEMPO POCKET RECEIVERS

MS-2, 4 channel scanning receiver for VHF high band, smallest unit on the market. **MR-2**, same size as MS-2 but has manual selection of 23 channels, VHF high band. **MR-3**, miniature 2-channel VHF high band monitor or paging receiver. **MR-3U**, single channel on the 400 to 512 UHF band. All are low priced, extremely compact and dependable.

TEMPO 100AL10 | **SOLID STATE VHF LINEAR AMPLIFIER.** 144-148 MHz. Power output of 100 watts (nom) with only 10 watts (nom) in. Reliable and compact.

TEMPO/fmh

So much for so little! 2 watt VHF/FM hand held 6 Channel capability, solid state, 12 VDC. 144-148 MHz (any two MHz), includes 2 pair of crystals, built-in charging terminals for ni-cad cells, S-meter, battery level meter, telescoping whip antenna, internal speaker & microphone. $199.00

FMH-MC for Marine & Commercial service also available.

TEMPO 6N2

The Tempo 6N2 meets the demand for a high power six meter and two meter power amplifier. Using a pair of Eimac 8874 tubes it provides 2000 watts PEP input on SSB and 1000 watts input on CW and FM. Completely self-contained in one small desk mount cabinet with internal solid state power supply, built-in blower and RF relative power indicator. $895.00

The Tempo 2002.. 2 meters only $745.00
The Tempo 2006.. 6 meters only $795.00

TEMPO
VHF/UHF AMPLIFIERS

Solid state power amplifiers for use in most base/mobile applications. Increase the range, clarity, reliability and speed of two- way communications.

VHF (135 to 175 MHz)

Drive Power	Output	Model No.	Price
2W	130W	130A02	$199
10W	130W	130A10	$179
30W	130W	130A30	$189
2W	80W	80A02	$169
10W	80W	80A10	$149
30W	80W	80A30	$159

UHF (400 to 512 MHz)

Drive Power	Output	Model No.	Price
2W	70W	70D02	$270
10W	70W	70D10	$250
30W	70W	70D30	$210
2W	40W	40D02	$180
10W	40W	40D10	$145
2W	10W	10D02	$125

FCC Type accepted models also available.

Most of the above products are available at dealers throughout the U.S.

Henry Radio

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

Prices subject to change without notice.

DX

ROD LINKOUS*, W7YBX

1977 promises to be the year of increasing spots and QSL cards; maybe even more countries. With the outgoing QSL bureau operated by ARRL for its members, the promise of more cards for the foreign QSL bureaus is assured.

Big Gun And Big Guy

"Anyone who needs him for a new one, call now," is a familiar phrase to the gang on 14.225 MHz. Many DXers now have BV2B, CR9AJ, VS6BL, KG6RL, 9V1SH, VS5MC, and others as a result of the tight management of the evening net. The net is also the source of news from home for the ex-W operators now in the Orient. To the American servicemen in Japan, Korea and Okinawa it's the hot morning sports report.

The net is known simply as "The W7PHO Net." It meets at 14.225 MHz starting around 2300 GMT. The net is the door to the Far East. The world reknown DXer who runs the net, is a DXer's DXer. Bill Bennett is W7PHO, whose accomplishments include all 322 posible countries and the first WAZ in W7-land. These just start the list for the A-1 operator who is also a member of FOC. Bill has been the top W7 on the DXCC phone honor roll for many years. He was the first U.S. station west of the Mississippi river to win the coveted phone WAZ.

Bill is a lot more than the wall paper accomplishments attest. He is a strict disciplinarian on the air, a trait the QRPer admires. Most of us have waited to work a rare one while the big gun chatted with the needed rare one about their many previous contacts. With short band openings, getting the one who needs him through first is Bill's prime goal. The W7PHO net is one place where the guy who needs him gets to try first.

To make sure you can get a card, QSL management is another of Bill's endeavors. He manages over a dozen stations and has arranged managers for many more. The ARRL outgoing QSL bureau started with the pressure brought by Bill and his close friend

*5632 47th Ave. S.W., Seattle, Washington 98136

The CQ DX Awards Program

S.S.B.	C.W.
456...W9MIJ/4	228...YO6ADM
457...A9XBD	
458...DJ9UI	

S.S.B. Endorsements

WA2RAU...320 W9MIJ/4...275, 250, 200 and 150

C.W. Endorsements

K8YQW...150

Complete rules and application forms for the CQ DX Awards program can be obtained by sending a business size, No. 10, envelope, self-addressed and stamped to: "CQ DX Awards", 5632 47th Avenue S.W., Seattle, Washington 98136.

Bill Bennett, W7PHO, The big man behind the big gun. Since this picture, the "Pot Hangs Over" is a slim and trim DXer. Yet, he still keeps the old phonetics. (Tnxs W7FCB and W7CGL for the photo.)

CQ's new Assistant DX Editor, Rod Linkous, W7YBX. Rod is a professional electronics engineer and has held an Amateur Extra Class license since 1949. Among the calls he has held during his amateur career are KA7HH, KAØIJ, and HL9WK. He has earned WAZ on phone, s.s.b. and c.w., WPX, WAC, 5BWAS, the CQ C.W. DX Award, the CQ S.S.B. DX Award and has 306 countries for DXCC. Rod has won certificates in 3 CQ DX contests and 1 ARRL DX contest.

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. Total number of current countries on the DXCC as of this listing is **322**. Honor Roll listing is automatic when submitting application or endorsements for 275 or more countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be submitted anytime.

CW

W6PT	322	W4YWX	307	W8LY	306	WB4BQY	300	WA8DXA	292
K6EC	318	W9DWQ	307	W6ISQ	303	WA6MWG	298	W6NJU	289
W6ID	317	WA6GLD	307	WØAUB	303	VK3AHQ	297	WA6EPQ	285
ON4QX	316	W4IC	306	K6LEB	301	DL3RK	294	DJ7CX	276
W8KPL	314								

SSB

W2TP	321	I8KDB	313	ZS6LW	308	WB6DXU	300	YV1LA	289
WA2RAU	320	W4IC	313	I8YRK	307	K6AQV	299	DL6KG	288
DL9OH	319	W6YMV	313	K3GKU	307	W4WSF	299	WAØKDI	288
G3FKM	319	K4MQG	312	VE3GMT	307	W6TCQ	299	DJ7CX	287
K2FL	319	W4NJF	312	F9MS	306	WØSFU	299	K1KNQ	287
W3CWG	319	I6FLD	311	K6YRA	306	HP1JC	298	OE3WWB	287
IØAMU	318	K6EC	311	KH6BB	306	WØYDB	298	SP5BSV	287
W9ILW	318	K6WR	311	W9QLD	306	K4HJE	297	DL1MD	286
TI2HP	317	W2QK	311	XE1AE	306	W6FW	297	K8GQG	286
W3AZD	316	W6EUF	311	YV1KZ	306	DK2BI	296	W3CRE	284
W4EEE	316	W6KTE	311	OE2EGL	305	G3RWQ	295	WB4SIJ	283
W9DWQ	316	W6RKP	311	OZ3SK	305	W9OHH	295	DK1FW	282
I8AA	315	WA2EOQ	311	W6NJU	305	YS1O	295	K8PYD	282
VE3MR	315	K9WEH	310	VE2WY	304	VE7CE	294	OK1MP	282
W3DJZ	315	K4RTA	309	W2CNQ	304	VE7WJ	294	WB6PNB	282
W4SSU	315	WA6MWG	309	G3DO	303	W8ZOK	293	WA2VEG	280
W6EL	315	ZL1AGO	309	W6KZS	303	WAØCPX	293	W6HUR	279
W6REH	315	F2MO	308	WA6AHF	303	W6FET	292	W9MIJ/4	279
IT9JT	314	IØZV	308	VE3MJ	302	G3KYF	290	W7YBX	278
SM5SB	314	W9JT	308	G3TJW	301	OE1FF	290	W9YRA	277
SM6CKS	314	W9KRU	308	WA2HSX	301	WB2RLK	290	I1WT	275
W3NKM	314	WA3IKK	308	WA6GLD	301	XE2YP	289	VE7HP	275
F9RM	313	ZL3NS	308	K8DYZ	300				

Bob Thurston W7PGY (ARRL Northwest Director).

The Vietnam situation is now history. Many will remember the final hours when the pull-out was underway. Unknown to most, only one amateur station was authorized to handle the sensitive-people traffic directly out of Vietnam on the amateur bands. You guessed it. With a Swan Mark II linear to a 5-element beam at 60 feet, the big signal was W7PHO (yes, no 4-1000A amplifier). There were other projects too; dental instruments for South America, vegetable seeds for India, and amateur books for Pakistan.

In 1952, chasing DX was a simple enjoyable but demanding hobby. Very few DXers knew each other. So, Bill set out to invite all the local W7's to a dinner. He got the DXCC listing and wrote them all. That dinner was the start of the Northwest DX Convention, now an annual event.

A chat with Joeke, PJ2VD (left) during the PJ9CDC gave Alex W1CDC/PJ9CDC a pleasant break in the pileup.

To help make 20 meters a more enjoyable place to be in the 1952 a.m. days, Bill, with some local help, set up an occasional evening out with the DXers. This was the beginning of the Western Washington DX Club. Bill was to be the president from 1952 until his election to Trustee in 1967. The WWDX Club is now over 250 strong. The club call, W7FR, is in the custody of Bill, so you may hear him on as W7FR.

It is a real pleasure to highlight a little of the background of a great DXer for the readers of *CQ*. The picture of Bill shows the inner man whose love for people the world around has brought credit to DXing.

The WAZ Program

Single Band WAZ

80 Meter Phone

2...K6UA

20 Meter Phone

29...JH1VRQ
30...WA7UVO
31...W7BCT

S.S.B. WAZ

1340...UA9VB
1341...UV8CE
1342...IT9KZW
1343...WA5SDT

C.W.—Phone WAZ

4011...UK3DAA
4012...UW3AW
4013...UAØMO
4014...UB5BAN
4015...UP2BAO
4016...K2KAU
4017...KL7HCN
4018...WØIU

Phone WAZ

522...I5BDE
523...ZL1ALE

The complete rules for all WAZ awards are found in the May, 1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a business-size, self-addressed, stamped envelope to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Stu Meyer, W2GHK/4, General Chairman of DXPO '76 and a "DX Hall of Famer" himself, (#7) presenting the "CQ DX Hall of Fame" plaque to Frank Anzalone, W1-WY, at the National Capitol DX Association's DXPO '76 Convention in Washington, D.C. last September. Frank was the 11th recipient of this award since its inception in 1967. (See August CQ)

It has also added 10 db to his signal. Having been on the other end, I can attest that DX heard W7PHO's call in the pileup regardless of strength. Now you know why Bill has not exercised his option for a two-letter call. He meets all of the requirements. Under that firm exterior you hear on the air is truly one of the fine DXers.

If you ever have the chance to be in Seattle, the DX gang gather at The Dog House for lunch in a special room set aside just for amateurs. You can catch Bill there if the bands aren't open.

The Guns Of Saipan

Another big gun is now in Saipan to help Len Kaufer, KG6SW, with the DX chores. Even with over 15,000 KG6SW QSL cards sent out since 1971, the pileups are still BIG. Dan High, KG6RL (ex W0WWB) is the new Attorney General for the Trust Territories of the Pacific. Dan enjoys c.w. and is a contester. With a Heath-line to 40 foot boom antennas at 70 feet, you won't have any trouble finding him. Dan has antennas for 80 through

Alex's PJ9CDC QSL card shows one way to layout a card so the reader can tell at a glance all about the QSO. The card is printed on one side with colors for highlighting. (Tnxs W1CDC.)

The Mickey Mouse operator of note is Henry Zimmerman, WA7ZLC. While not operating from Tacoma, Washington, Henry is one of the most active maritime mobile DXers in the world. In the last two years he has 246 countries, WAC, WAS and WAZ from the high seas. He was JY9RS while ashore at Amman. Try Henry on c.w.; he has a CW Certificate for 50 (plus) w.p.m.

10. KG6SW used Dan's 80 meter antenna while Dan was stateside to work into W2 and W4-land.

Tricks Of The DX Trade

There are a lot of basic rules for the serious DXer. Rule ONE is PERSISTENCE. I would like to share some lesser known rules with you. (If you know others, share them with us.)

Rule 123.6b. Know someone who works the needed country, i.e. the QSL manager. Operating habits are keys to minimizing the hunt. Write the QSL manager for the information. Most managers are busy guys, so avoid replies taking much of his time. An SASE with a short questionnaire asking him to fill in the blanks with schedule information and/or operating habits usually gets results. It is surprising how many managers regularly meet the DX stations they handle. Join them.

Rule 124.2 DO NOT overwork a QSL manager. (Reference Rule 123.6b.) He remembers and he has priorities too. When sending a QSL card to a manager, insure that it is easy to read. Sending inexpensive cards to a manager with the QSO data in a good clean format gets better results than expensive cards with the data hidden. Two sided cards are okay, *if* your call and the QSO data is on the same side. Date, time (in GMT) and band information should be together. Remember just because it's pretty, expensive, and easy to make out doesn't make it easy for the QSL managers.

Rule 125. Sort QSL's first. DO NOT send QSL cards to bulk mailer *unless* the country has a bureau or the bulk mailer provides special handling. The bulk mailer cannot accomplish the impossible.

Rule 130. Check for a QSL manager *first*. Most DX stations with QSL managers do not QSL direct. Some DX stations do not keep a copy of their logs once in the hands of the QSL manager. Save your postage until you are sure where the QSL will be answered.

Sam Rosen, WA2RAU, at the controls. Sam has 322 on 2 × SSB. Remember Sam's fight with city hall over antennas in the city? (See CQ Nov. 1965.)

The WPX Program

Mixed

542...SM3DMP	547...OE3EVA
543...HA7SQ	548...OE6RP
544...W4DZZ	549...UV3CE
545...W60JW	550...VE3DMC
546...WA4UAZ	

SSB

928...SM3DMP	934...EI9CB
929...G4BYX	935...OE6RP
930...W1DYH	936...UW3RR
931...WA4UAZ	937...UA3HE
932...VE3FFA	938...UK5WAZ
933...IØPSB	939...W6CLM

CW

1523...LZ1XL	1531...UB5ZA
1524...DM2CJJ	1532...UK4FAA
1525...DM3WMJ	1533...UK5IBM
1526...OE6RP	1534...UL7HD
1527...UA1ARQ	1535...UL7TAK
1528...UA3PAW	1536...UL7WI
1529...UA6LBO	1537...UR2IP
1530...UA9NN	

VPX

114...S. Schilde DL/SWL	116...UB5068-227
115...UA3-142-1	117...UB5-073-1

Endorsements

Mixed: 1286 W3PVZ, 1100 WA5VDH, 915 K5DB, 875 JA1AG, 850 W2MB, 802 UV3CE, 754 W6ANB, 731 OE6RP, 705 WA2AUB, 700 K2DNL, 681, WA8TDY, 650 W6CLM, HI8LC, 600 VE3DMC, 507 I3GZI, 504 DK6FT, 500 OE3EVA, 469 WA4UAZ.

SSB: 850 WA5VDH, 608 OE6RP, 586 JA1AG, 550 WA8TDY, 501 WA2AUB, 500 K2DNL, 450 W1DYH, 356 G4YBX, 316 UA3HE, 310 IØPSB, 306 WA4UAZ, 305 UW3RR, 304 VE3FFA, 300 UK5WAZ, W6CLM.

CW: 1006 G2GM, 950 WØAUB, 861 K4IEX, 800 WA5VDH, 719 OK2BLG, 709 JA1AG, 700 UB5WK, 652 UA3GO, 650 WA9UET, 616 UA9NN, 500 G3DPX, OK1DR, 450 UV3DU, UB5WL, 425 OE6RP, 320 UL7WI, 316 UA6LBO, 306 UL7HD, DM3WMJ, 305 UB5ZA, 304 UR2IP, 302 UK5IBM, DM2CJJ, 301 UA3PAW, 300 UA1ARQ, UK4FAA, UL7TAK.

10 Meters: OE6RP 15 Meters: OE6RP

20 Meters: OE6RP

Africa: OE6RP

Asia: DK6FT, OE6RP, UV3DU, UA9NN, G3YBH.

Europe: OE6RP, UV3CE, UW3RR, UK5WAZ, UA1ARQ, UA3PAW, UA9NN, UB5ZA, UK4FAA, UK5IBM, UL7HD, UL7TAK, UL7WI, UR2IP, HAØHW, VE3DMC.

No. America: WA4UAZ, K8YQW, VE3DMC.

So. America: G3YBH.

Complete rules for WPX may be found in the May, 1976 issue of CQ Magazine. Application forms may be obtained by sending a business size self-addressed stamped envelope to: "CQ WPX Awards," 5014 Mindora Dr., Torrance, Ca 90505.

CQ DX Honor Roll

Many will notice changes to the standings. There is a reason. Currently 322 countries are listed on the DXCC countries list! Okino Tori-Shima, 7J, being number 322. The CQ DX awards program recognizes only the current countries. So, when endorsements are processed, a check is run against the current list. Thus, the deleted countries are removed and new countries are added. The new total is listed on the Honor Roll. Once a DXer qualifies for the CQ DX Honor Roll a "Country Needed List" is prepared. If you want to know what you need, cross the magic 275 threshold. A reminder: to remain on the Honor Roll an annual update is required. "No change" correspondence is acceptable. One card at a time is okay together with your SASE.

Top Of The C.W. Stack

Working 322 countries on c.w. seems to be a dream. Over the years,

A total of 316 countries on c.w. have been worked from this impressive shack by its owner Dr. Bob Berge ON4QX. The ON6QX on c.w. is Bob's son.

The WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes, which are submitted by separate application in strict conformance with the CQ Master Prefix List. Scores are based on the current prefix total, regardless of an operators all-time count.

Mixed

W4LRN 1625	YU1BCD ...1182	K4KQB 960	WA1JMP 857	CT1LN 749
WA6MWG ..1453	W8ROC 1181	K6ZDL 957	G3DO 849	WA5LOB 749
F9RM 1430	WB4KZG ...1180	W4IC 950	WAØCPX ...844	PY4AP 735
VE3GCO ...1340	WA2EAH ...1150	I6SF 946	JA1AG 831	KØBLT 733
W2NUT 1333	PAØSNG ...1146	DL1MD 940	WAØKDI 824	K7NHG 719
W3GJY 1305	WA6GLD ...1125	WØAUB 929	W6NJU 811	WA6EPQ 713
W3PVZ 1284	WA5VDH ...1098	K5DB 923	W9WHM 811	PAØVB 706
W4WSF 1275	K6SDR 1037	WØSFU 908	W9ZTD 807	WA8TDY 681
W8LY 1272	W9FD 1035	SM7TV 905	I0JX 803	
ON4QX 1268	W6ISQ 1028	WA6TAX 899	SM6DHU 803	
W4CRW 1251	WB4SIJ 1020	W3YHR 882	IT9AGA 791	
WB2FMK ...1248	YU1AG 1016	YU2OB 882	K2ZRO 782	
W4BQY 1230	YU2DX 995	WA6JVD 875	YU4EBL 782	
DJ7CX 1202	K2AAC 973	DL1CF 872	K8UDJ 750	

SSB

W4UG 1405	I4ZSQ 1021	WA2EAH 900	PY3BXW 808	WB6DXU 708
F9RM 1361	I8YRK 1008	WØYDB 884	DJ7CX 800	CX2CN 702
IØAMU 1257	DK2BI 1003	K2POA 883	W4IC 800	WB2FMK 700
WA6MWG ..1164	HP1JC 954	ZL3NS 874	OE2EGL 780	CR7IK 613
W4WSF 1119	YU1BCD 940	WB4KZG 860	G3DO 765	I4LCK 608
I8KDB 1106	WA6TAX 925	DL1MD 858	YU1AG 764	
W9DWQ ...1083	CT1PK 923	W3YHR 857	OK1MP 763	
IØZV 1067	IT9JT 916	WA5VDH 851	W2EHB 750	
PAØSNG ...1034	F2MO 904	W6RKP 822	WA5LOB 747	
DL9OH 1033	WB4SIJ 904	W3DJZ 818	W6YMV 720	

CW

W8LY 1256	G2GM 939	WA5VDH ...826	VO1KE 750	OK2QX 600
W8KPL 1256	W3ARK 910	IT9AGA 825	WA2EAH 750	
WA6MWG ..1106	DJ7CX 887	W6ISQ 824	I6SF 726	
WB2FMK ..1085	W2HO 885	YU1AG 814	SM5BNX 706	
ON4QX 1081	VO1AW 873	K7ABV 812	OK2DB 693	
W9FD 1053	W4WSF 860	VK3AHQ 809	WB4KZG ...650	
DL1QT 1030	WA2HZR 853	WA6JVD 803	K2ZRO 649	
W2AIW 972	K2AAC 836	W4BYU 768	K1LWI 629	
YU1BCD 962	K6ZDL 833	W4IC 754	VE4OX 600	

Otto Miller, W6PT, has all 322 on c.w. since 1945. Now working on post January 1975.

most rare countries have been on the air on both modes. But, several have been only on phone, because higher rates can be obtained by DXpeditions and the natives prefer the simpler mode. Since 1945, Otto Miller, W6PT, has worked them all. He occupies the top rung on the CQ DX CW Honor Roll. That status has not diminished his enthusiasm. He is now focusing his attention on the DXCC C.W. award which requires the contacts to be after 1 January 1976. While we worry about the ones that got away, Otto is working getting some of the not-so-rare countries on c.w. (ed: I'll take Clipperton or Iraq any old way!)

The 80 Meter Sport

Who says you can't work DX on 80? I'm sure there is more than one skeptic. You will also find rotatable 80 meter yagis. One of the 80 meter men is John Devoldere, ON4UN. With 273 countries on that band he is still hunting for one more. John's antennas include an 85 foot vertical with 75 radials and a 1,000 foot beverage antenna. With a kw plus, he is heard the world over. Remember, he still heard the 273, so output is only half the game. The nice thing about 80 meter DXing is that it takes place from dusk to dawn.

Chip Margelli, K7VPF, at the controls of KG6SW ran up 1951 QSO in the All Asia CW contest for a claimed score of 368,739 points. That is over 65 c.w. QSO's an hour.

DX Hot Spot

Once one of the rare spots in the world, Curacao (PJ-land) is now the hottest location for DXpeditions and DX contesters. Alex Kasevich, W1CDC, made the "Caribe Trek" to the QTH of John Thompson W1BIH/PJ9JT, at sun enriched Santa Martha Bay. The operation as PJ9CDC from 28 July until 6 August gave out over 1,400 QSO's while earning: Bicentennial WAS, WAC, WPX and 78 countries. Unfortunately, the local noise eliminated any contacts on 160 despite three nights of trying. Alex left the DX chores to Joeke, JP2VD and Chet, PJ9EE with a promise to return next year for another go at the pileups.

DX Club—1977 Style

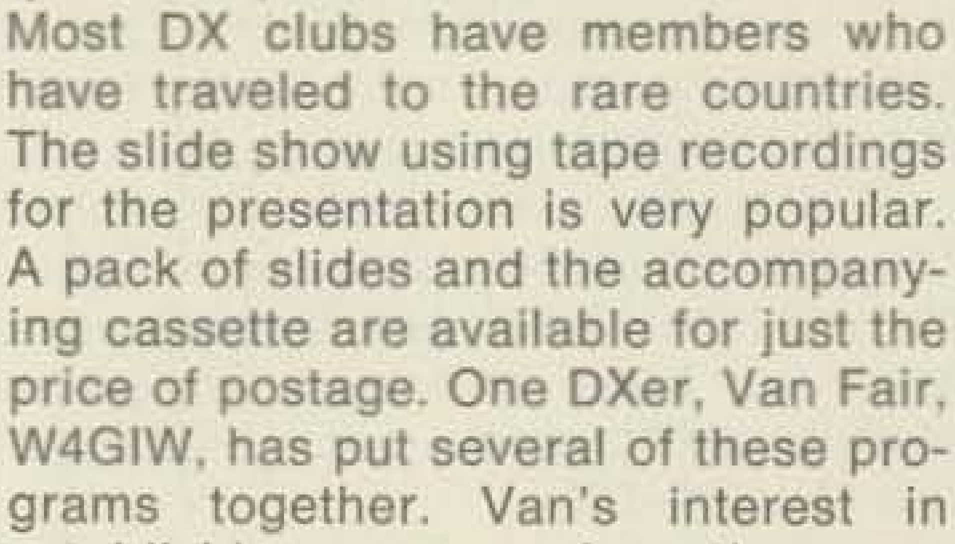
The basic goal that led to formation of DX clubs in the early fifties is still the same—local communication among DX communicators. Switching from am. to s.s.b. gave us a little more room on the bands. Yet, interest outstripped our technological gains. A linear amplifier became a standard hardware item in the sixties. DXpeditions became more popular with the advent of economical jet transportation. A country became active for a week during a DX vacation. The pileups got deeper due to the short period of operation. Then came 5-band DXCC.

The drive to work more DX brought more activity, yet the bands stayed the same size and sunspots waned. The DX club had a revitalization of its original goal. Local communication among DX communicators evolved to keeping peace on the bands The DX club is now a vehicle for DXers to get together socially as well as a means of creating harmony in a very competitive hobby. Clubs keeping to this basic goal have shown tremendous growth.

What makes a successful DX club? The answer is simple—people. People willing to work and build a program to bring everyone together socially and promote our mutual desire to work DX.

The big signal on 80. John Devoldere at the controls of ON4UN.

Meeting and program format is the easy part. Nearly everyone, including the spouse, likes DXpedition programs. The travelogue aspect of DXpeditions also interest the young —tomorrow's DXers. The problem is in getting the programs and announcing the event. If currency is not a requirement, there are a lot of sources. Most DX clubs have members who have traveled to the rare countries. The slide show using tape recordings for the presentation is very popular. A pack of slides and the accompanying cassette are available for just the price of postage. One DXer, Van Fair, W4GIW, has put several of these programs together. Van's interest in establishing sources for other programs makes him a great place to start. If you have program material, let Van, W4GIW, know about it. Several DXpeditions are available on film; Annoban, 3C0AN; Okino Tori Shima, 7J1RL; Navassa, KC4DX; and Curacao, PJ9GIW, are a few. Another program subject of interest to the DXer is antennas. Working DX from a city lot more often than not makes antennas the key.



The consistent signal on 40 c.w. is Ernst Knecht, HB9AUY. He is fast at QSLing too.

Announcing DX club events is a bigger challenge. The postcard technique is often the most economical and the easiest to manage. Club papers or bulletins are another method. The paper takes more than dedication; it takes lots of inputs each time to make it a success. DX news is very volatile. The success of DX bulletins, like the *West Coast DX Bulletin* by WA6AUD is due to commitment, many news sources (worldwide) and a low subscription rate. Unless you can match the dedication and energy of people like Hugh "Cass" Cassidy, WA6AUD, forget about putting out DX news. Devote the paper to club activities and membership news. Everyone likes to read about themselves and other amateurs.

The DX alert nets have come a long way since the 2-meter a.m. days of the SCR-522. With the advent of 2 meter f.m., the DX alert nets are large, thanks to repeaters and within the reach of most. The low cost of an f.m. rig keeps several ears attuned searching for the countries you need. This also gives the DXer with 322 countries a way to still stay in the game—helping newcomers. It is also a way to control the local pileup by remote control. Another benefit is the cross feed of current DX news. To the DXer who travels, it provides a way to meet DXers in a new area. A few clubs with repeaters are:

		In	Out
LIDXA	WR2ABH	147.90	147.30
Long Island, New York			
NNJDXC	WR2ABJ	147.78	147.18
Cedar Grove, New Jersey			
PVRC	WR3AFC	146.40	147.00
Washington, D.C.			
WWDXC	WR7AIN	147.60	147.00
Seattle, Washington			

Meeting time and place can be perplexing. When the club is small these are simple matters. Time is an optional item (regular or occasional). It is impossible to hit a night everyone finds convenient. Start with a given night of the week and stick with it. Surprisingly, people will change their schedules in order to attend the DX club meeting and will hold a specific night open. The place is another matter. If you opt for a

(Continued on page 71)

A. EDWARD HOPPER, W2GT, ON

Awards

The "Story of The Month", for January, as told by Bob is:

Robert C. Holt, GW3NWV

All Counties #138, 10-21-75.

Bob was born in Manchester in July 1910 and was educated at Denstone College, Staffordshire and Manchester University. He qualified as a Solicitor (Lawyer) in 1934 and practiced in Partnership at Manchester until 1961 when he retired due to ill-health. He went to live permanently at "LING CRAG" in March 1965, this had been his vacation retreat since 1954. In 1965 Bob and his Wife took a retirement trip on a Freighter from London via Rotterdam and then the Panama Canal to Los Angeles, San Francisco and Seattle to Vancouver. They then crossed Canada by train, stopping at Lake Louise, Jasper, Banff, Calgary (for the stampede) and Winnipeg. Sailed across Lakes Superior and Huron and spent some time in Toronto and at Niagara Falls before sailing to Liverpool from Montreal on the *Empress of England*.

During the War years from 1939/46 he served in the Royal Artillery, first in the ranks and then Commissioned as a Lieutenant engaged in the anti-aircraft defenses of London and elsewhere.

Bob's interest in amateur radio was aroused when he met George, GW3DIX at Amlwch in 1957 and learned that he had been talking to brother Jeff, GD3GMH in the Isle of Man (Jeff a Silent Key 2-22-75). Jointly they persuaded Bob to have a go at getting his ticket, so after a year at night school at a Manchester Technical College, Bob became GW3-NWV in December 1959. County Hunting came along seriously in 1964 after a spell in Contests. First fixed stations only, then Mobiles when Arnie, W8DCD introduced him to the Independent County Hunters Net.

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

Special Honor Roll
All Counties

#155—Duane L. Walters, WA4CFI 9-4-76

#156 Paul Bugen, WA3TUC 9-7-76

As they have no children, Bob's wife became really sold on his hobby when they met and were entertained by so many amateur friends on the USA/Canada trip. Last year when they were having a snack lunch in one of the "Pubs" in Caernarven (on the mainland), they started a conversation with an elderly lady near them, she and her friend being on a Tour of Europe, and she turned out to be the next door neighbor of VE3UX, whom they had visited in Toronto on their trip in 1965—small world!

Other hobbies have been golf, photography and out-board motor boat racing. Bob and his brothers started the Lancashire Hydroplane Racing Club before World War II and it is still going strong. On one solitary occasion when racing on the River Severn, the three brothers finished 1, 2 and 3-brother Jeff (the Champ) being first over the finish line.

Bob was issued USA-CA-500-AWARD #575 on June 10, 1966 endorsed All S.S.B.—he being the first and only GW to receive any USA-CA and he received #6 All Counties Award to a station outside the USA. He obviously has fine equipment and location and he is still in there knocking them off on his second time around. He wishes to express heartfelt thanks to all the wonderful County Hunters who have been such a great help, and especially to Marv, WB2SJQ, his County Hunter QSL Manager. Oh yes, Bob got some nice publicity (foto and story) in his local newspaper, *Holyhead & Anglesey Chronicle* on November 20, 1975.

USA-CA Honor Roll

3000		2000		1000	
WA7IJN	.174	WA7IJN	.261	WB2LYB	411
WB2LYB	.175	WB2LYB	.262	WA4CFI	.412
W1LQQ	..176	WA4CFI	.263	WA6JZZ	.413
WA4CFI	.177	**1500**		**500**	
WA3TUC	178	WA7IJN	.307	WA7IJN	1124
WBØCQO	179	WB2LYB	.308	W7CUJ	.1125
2500		WA4CFI	.309	WB2LYB	1126
WA7IJN	.222	**1000**		WA4CFI	1127
WB2LYB	.223	WB8RFN	408	WA6JZZ	1128
W1LQQ	.224	WA7IJN	.409	CT1BY	.1129
WA4CFI	.225	W7CUJ	..410		

Awards Issued

Duane "Walt" Walters, WA4CFI (exWA6KHN, WB0CQE) waited until he had them *all* and received USA-CA-500 through USA-CA-3000 endorsed All S.S.B., All Mobiles, All 14 MHz; and *All Counties* endorsed All S.S.B.

Bob Holt, GW3NWV—note the AWARD on the wall.

Paul Bugen, WA3TUC (Story/Foto *CQ* May 1976) added USA-CA-3000 endorsed All S.S.B, All Mobiles; and *All Counties* endorsed All S.S.B., to his fine collection.

Steve Hammerberg, WA7IJN found time for his paper work and was issued USA-CA-500 through USA-CA-2000 endorsed All S.S.B., All Mobiles, All 14 MHz. USA-CA-2500 endorsed All S.S.B., All Mobiles, and USA-CA-3000 Mixed.

Barry Kutner, WB2LYB also did a lot of work to get USA-CA-500 and 1000 endorsed All S.S.B., All Mobiles, All A-1, All 14 MHz, All 7MHz. USA-CA-1500 endorsed All S.S.B., All Mobiles; All 14MHz. USA-CA-2000

Yearly Award/Reward—NJDXA Members on way to Dayton L. to R. Ed., W2MIG; Ed., W2GT; Lou, W2ZZ; Ed, W2FZY; Musty, W2TP; Joe, W2BHM; Beautiful Allegheny Hostess; Geo., W2HZY; Herman, W2MZV; Arnie, W2YD; Bro. Pat, W2GK; and Smitty, WB2BCY (Non-NJDXA-now Silent Key).
(Photograph courtesy of Ed., W2MIG—also a County Hunter)

and 2500 endorsed All S.S.B., All Mobiles; and USA-CA-3000 Mixed.

Charlie Gagnon, W1LQQ is sure doing fine and picked up USA-CA-2500 and USA-CA-3000, endorsed Mixed.

Joe Lindley, WB0CQO (exWA3FED) who keeps plugging away, applied for USA-CA-3000 endorsed All S.S.B.

Larry Mitchelll, WB8RFN (exWA3-LRJ) won USA-CA-1000 endorsed All S.S.B.

Garnet Downing, W7CUJ collected USA-CA-500 and USA-CA-100 endorsed All S.S.B., All 14 MHz.

Rich Darwicki, WA6JZZ gained USA-CA-500 and USA-CA-1000 endorsed Mixed.

Carlos Orlando Rodrigues Almeida, better known as "Charlie", CT1BY was happy to receive USA-CA-500 endorsed All S.S.B. #5 Award to Portugal.

Awards

ARI — Cinquantenario — 1927-1977 Award: This Award is being issued to celebrate the 50th Anniversary of the Founding of ARI (Associazione Radiotecnica Italiana). The Award is available to all radio amateurs or s.w.l.s under the following rules:

a. Italian amateurs/s.w.l.s 120 QSO/heard with Italian stations located in at least 18 Regions of Italy.

b. Amateurs/s.w.l.s of European and coastal Mediterranean Countries: 80 QSOs/heard with Italian stations located in at least 14 Regions of Italy.

c. Amateurs/s.w.l.s of all other Countries: 50 QSOs/heard with Italian stations located in at least 10 Regions of Italy.

Contacts may be made on 3.5, 7, 14, 21, and 28 MHz bands using c.w., s.s.b., RTTY. the same station may be counted only once, which ever band, mode or prefix used. No stickers will be issued for single band or individual mode operation.

All stations must be contacted during the calendar year of 1977, from 0001 GMT January 1st through 2400 GMT December 31.

NO credits will be given for contacts heard/made in Contests, Competitions, Marathons, QSO Parties, etc. . . . of any kind.

Application, with name, call and address of the applicant, shall be sent to: ARI Awards Manager, I8KDB, G. Nucciotti, via Fracanzano, 31, 80127 Napoli, Italy, with a list of claimed contacts/heard giving date, time, band, mode and location of station contacted/heard, with specific reference to the Region. The list shall be certified by two Officers of the ARI Sections or Groups—for Italian applicants, or by the Award Manager (or two other Official Members) of the foreign applicants National Amateur Radio Society.

The Award is free. To cover mailing costs of the Award it is requested that you send 1000 Lira for Italians or U.S. $1.00 or 10 IRCs for foreign applicants.

The list of Awards issued will be published in *Radio Rivista*, the ARI Official Magazine.

Applications shall arrive not later than March 31, 1978.

For any additional information, send s.a.s.e. or s.a.e. plus 1 IRC to I8KDB at the aforementioned QTH.

Region	Provinces	Call Area
Piemonte	AL, AT, CN, NO, TO, VC	I1
Valle D'Aosta	AO	I1
Liguria	GE, IM, SP, SV	I1
Lombardia	BG, BS, CO, CR, MN, MI, PV, SO, VA	I2
Trentino—Alto Adige	BZ, TN	I3
Veneto	BL, BP, RO, TV, VE, VR, VC	I3
Friuli—Venezia Giulia	GO, PN, TS, UD	I3
Emilia—Romagna	BO, FE, FO, MO, PR, PC, RA, RE	I4
Toscana	AR, FI, GR, LI, LU, MS, PI, PT, SI	I5, IA5
Marche	AN, AP, MC, PS	I6
Abruzzo	CH, AQ, PE, TE	I6
Puglia	BA, BR, FG, LE, TA	I7, IL7
Basilicata	Provincia di Matera	I7
Basilicata	Provincia di Potenza	I8
Campania	AV, BN, CE, NA, SA	I8, IC8
Molise	CB, IS	I8
Calabria	CZ, CS, RC	I8
Sicilia	AG, CL, CT, EN, ME, PA, RG, SR, TP	IT9, ID9, IE9, IF9, IG9, IH9
Lazio	FR, LT, RI, ROMA, VT	I0, IB0
Umbria	PG, TR	I0
Sardegna	CA, NU, OR, SS	IS0, IM0

Note: Two letter prefixes are used by stations located on Islands. In January, February and March 1977, Italian stations are authorized to use, at their discretion, the special prefix IK1 through IK0, instead of the regular assigned prefixes.

MARAC MOBILE AWARD (Just one of their fine AWARDS).

The Mobile Amateur Radio Awards Club, Inc. has a fine Awards program, and their AWARDS MANAGER is: Jack Scroggin, 602 Jefferson Street, Lee's Summit, MO. 64030, Oh yes, Jacks active call is, W0SJE.

MARAC Excellent Operator Award: A MARAC Mobile Plaque appropriately engraved will be issued gratis to recipient. Nominations must be by three separate MARAC members and cover excellent performance in all three categories, NET Control, Assistant Net Control and Mobile Operations. Only one person per nomination letter will be acceptable. All nominations will be subject to review by the Awards Committee and substantiating information may be requested. Send nominations to W0SJE.

Cliff Corne, Jr., K9EAB Memorial Award: This Award issued in memory of Cliff Corne, Jr., K9EAB who was the first amateur radio operator to reach the top by working other amateur radio stations in all 3079 counties of the U.S.A. It is awarded for working holders of the USA-CA All Counties Award (Issued by *CQ*/W2GT). The award is given in the following classes:

Basic award	10 Contacts
Class C (Blue Seal)	25 Contacts
Class B (Red Seal)	50 Contacts
Class A (Gold Seal)	75 Contacts
Class AA (Gold Seal)	100 Contacts

RULES:

1. Only contacts after the date the USA-CA 3079/3075 All Counties Award was issued to the holder, will be considered.
2. Submit list showing stations worked, date and USA-CA Award numbers.
3. The list must be certified by two amateurs (Any Class), a Club official, or a Notary Public stating that the cards have been checked and listing is correct. Stations may submit cards in lieu of the certification, but must include sufficient postage for return of the cards.
4. The Award is available to all licensed amateur radio stations and SWLs on a heard basis, throughout the world.
5. The Award will be issued free of charge to USA-CA All Counties Holders upon receipt of information by letter to awards custodian. Free to B/P. Basic award $1.00 or 10 IRCs. Seals for s.a.s.e. or 1 IRC. (IRCs accepted from DX only). Endorsements, all one mode, band or mixed on the basic award only. Send application to W0SJE.

MARAC Mobile Award:

Category 1. This award issued any mobile, including air mobile, for giving out at least one county in each of 15 States. Red Seal for 25 States, Blue Seal for 35 States, Gold Seal for 45 States. MARAC Plaque for 48 States. MARAC Plaque for 49 States. MARAC Plaque for 50 States.

Category 2. Any station, fixed, portable, mobile or combination of such, for working the same mobile one time in 15 States. Red Seal for 25 States, Blue Seal for 35 States, Gold Seal for 45 States. MARAC Plaque for 48th State, MARAC Plaque for 49th State, MARAC Plaque for 50th State.

Category 3. Any mobile, including air mobile, for giving out 100 different Counties. Red Seal for 250 different Counties, Blue Seal for 500 different Counties, Gold Seal for 1000 different Counties. MARAC Plaque for 1500 different Counties. MARAC Plaque for 2000 different Counties. MARAC Plaque for 2500 different Counties. MARAC Plaque for 3000 different Counties. A special MARAC Plaque for All 3079/3075 Counties.

Category 4. Any station, fixed, portable, mobile, or any combination of such, for working same mobile in 100 different Counties. Red Seal for 250 different Counties, Blue Seal for 500 different Counties, Gold Seal for 1000 different Counties. MARAC Plaque for 1500 different Counties, MARAC for 2000 different Counties, MARAC Plaque for 2500 different Counties. MARAC Plaque for 3000 different Counties. A Special Plaque for *All* Counties (3079/3075).

MARAC has many other Awards which I will tell in detail next month—remember Awards Custodian is W0SJE. Membership applications and dues go to Bob Dyson, K0AYO, Rt. 1, Box 230M, De Soto, Kansas 66018. For MARAC Information, QTH changes Independent County Hunter Net information and QSL data—send s.a.s.e. with 35¢ postage on it to: Bertha Eggert, WA4BMC, P.O. Box 6811, So. Boro Station, W. Palm Beach, Florida 33405.

Notes

Sad to report that Bill Helton, WA4LSU (Story/Foto of Bill & Hildred *CQ* Feb. '76) went to the Lord August 24, 1976.

By error, County Hunting QSL manager for CT1BY was listed as WA4CNI in Sept. '76 column, of course it is WA4CHI.

WA3KWD has the rules and information for the German awards as listed in the Sept., Oct./Nov. columns for W/VE amateurs. He has recently moved and his new QTH is: Hartwin E. Weiss, WA3KWD, P.O. Box 440, Halifax, PA. 17032.

Ed. Berzin, W2MIG had the fine idea that the yearly trip by NJDXA members to the Dayton Ham Fest was an Award/Reward for being GOOD husbands during the year—thus the photograph of some of the NJDXA members on the way. Those who also went, but not in the photograph include: Howard, W2AGW; Sam, W2BOK; Vic, WA2DIG; Bill, WA2ELS; John, W2JB; Rich, K2OJD; Bob, W2OKM; Dave, W2QM; Will, W2MJ; Clem, W5VQ and Newt, W8RT.

How was your month?

73, Ed., W2GT.

SEND IN EARLY FOR ALL
CQ CONTEST FORMS
AND LOG SHEETS

GEORGE JACOBS, W3ASK, ON

Propagation

The question I am asked most these days is "When will the new sunspot cycle begin and conditions start improving again?"

I still can't give an "official" answer, since we won't know when the minimum actually occurred until six months after the event has taken place. It takes six months of additional sunspot data in order to look back and establish the date.

I can say this, however, if the minimum has not yet occurred then we are getting very close to it. It is almost certain that a new solar cycle will begin sometime during the New Year, and that 1977 will be a year of rising solar activity. By the end of the New Year there should be a slight, but noticeable improvement in propagation conditions on the amateur h.f. bands.

1976 In Review

The year 1976 started off with a smoothed sunspot number of 16. While complete solar data is not yet available, the cycle dropped to an estimated value of 7 by the end of the year.

Towards the end of 1976, the level of 10 cm solar flux began to increase very slightly, and there were an increasing number of "new cycle" sunspots on the face of the sun. Both of these are indications that a new cycle may have already begun, or is just about ready to begin.

During 1976, low and still declining solar activity resulted in a continued reduction in DX openings on the *10* and *15* meter bands, although some fairly good *15* meter openings were still possible, mainly towards southern and tropical areas during the daytime hours. *Twenty* meters continued to be the best all around DX band during the past year, with openings occurring to most areas of the world from just past sunrise to shortly before sunset, and to as late as Midnight during the spring and summer months. *Twenty* was the optimum band for DX during the daylight hours of 1976.

*11307 Clara St., Silver Spring, MD, 20902

LAST MINUTE FORECAST JAN.

Day-to-Day Conditions Expected For Jan., 1977

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: 3, 15	A	A	B	C
High Normal: 1, 14, 18, 24	A	B	C	C-D
Low Normal: 2, 8-9, 11-13, 16-17, 19, 22-23, 25-28, 30	B	C	D	D-E
Below Normal: 4, 7, 10, 20-21, 29, 31	C	D	D-E	E
Disturbed: 5-6	C-E	D-E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, a path shown in the Charts with a *propagation index* of (3) will be *good* (B) on Jan. 1, *fair* (C) on the 2nd, *excellent* (A) on the 3rd and *poor* (D) on the 4th, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768.

Conditions varied considerably for DX on *40* meters during 1976. They appear to have *improved* considerably from just before sunset, through the hours of darkness and until just after sunrise during the spring and summer months. During the fall and winter months there was a slight improvement noted for short periods around sunset and sunrise, but a considerable *decline* during the hours of full darkness.

Conditions on *80* and *160* meters generally *improve* as solar activity declines, and this was again very evident during the past year. *Eighty* meters opened for DX from sunset, through the hours of darkness and until sunrise throughout most of the year, including the short summer nights. DX conditions on *160* meters during the hours of darkness and the sunrise period also seems to have improved during 1976. During 1976, *40* meters was the best band for DX propagation during the nighttime hours of the spring and summer months, with *80* meters optimum during the other seasons.

Outlook 1977

It now looks almost certain that 1977 will be the year of a new solar cycle and rising solar activity! But it probably won't be until the end of the year before some improvements will be noticeable.

A few more DX openings can be expected on *10* meters during 1977, with the best bet for openings towards southern and tropical areas during the daylight hours. It probably won't be much before 1978 though, before this band begins to really open up again.

Expect an increase in *15* meter DX openings during 1977, with fairly regular openings towards southern and tropical regions during much of the daylight hours. Expect occasional openings towards Europe and Asia this winter and early spring, and a somewhat greater number of openings next fall and winter.

Twenty meters will continue to be the best band for *daytime* DX during 1977. The band should continue to peak for DX during a two-to-three hour "window" just after sunrise, and again during the late afternoon, with DX possible during most of the daylight hours as well. During the spring and summer months, expect the band to remain open well into the hours of darkness, and often until Midnight and later, particularly towards southern and tropical regions.

On *40* meters, expect good world-wide DX openings from about an hour before, to an hour or two after sunset, and again from about an hour or two before, to an hour or so after sunrise. During the late spring, summer and early fall months, the band often should remain open throughout most of the hours of darkness. During the winter months, expect the band to close for DX from an hour or two after sunset until an hour or so before sunrise, except for openings towards the more favorable southern and tropical areas.

Expect DX conditions on *80* and *160* meters to be about the same during the New Year as they were during 1976. *Eighty* meters should open for DX shortly before sunset and remain open to many areas of the world throughout most of the hours of darkness and until shortly after sunrise. During the late fall, winter and early spring months, *80* meters should be the best band for nighttime DX. During the summer months, the optimum nighttime DX band should be *40* meters, with *80* not too far behind.

There should be fairly good DX conditions on *160* meters throughout the hours of darkness and into the sunrise period. Conditions should be best during the early spring, late fall and winter months. Signals usually peak on *160* meters from about an hour or so before sunrise to just after sunrise, at the *eastern* end of a DX path.

During January, *20* meters should be the best band for DX propagation during most of the daylight hours, with some openings also possible on *15* meters, especially when conditions are HIGH NORMAL or better. During the hours of darkness, *80* meters should be the optimum DX band, with *40* meters not far behind when conditions are HIGH NORMAL or better. Be sure to also check *160* meters for some interesting DX openings during the hours of darkness and the sunrise period. Check for the occasional *10* meter opening during the daylight hours when conditions are HIGH NORMAL or better.

V. H.F. Ionospheric Openings

There is a fairly good chance for some meteor-scatter type openings during the *Quadrantids* meteor shower which should take place during the first week of January. This is often a major meteor shower, and it should peak on January 4th with as many as 40 meteors entering the earth's atmosphere each hour.

Not much ionospheric propagation on the v.h.f. bands generally takes place during January. Auroral activity is usually at a seasonal low, and there is little sporadic-E activity expected. Best bet for ionospheric openings are on those days when h.f. conditions are expected to be BELOW NORMAL or DISTURBED. Check the "Last Minute Forecast" at the beginning of this column.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use between distances of approximately 50 and 2300 miles. Special Charts for use between the mainland 48 and Alaska and Hawaii are also included. Instructions for the use of these Charts are given at the beginning of this column. DX Charts for use during January appeared in last month's column.

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (15 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. 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. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *daylight* time is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are in HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in the MDT zone; 5 hours in CDT zone, and 6 hours in the EDT zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *daylight* time in other areas of the USA, *subtract* 7 hours in the PDT zone; 6 hours in the MDT zone; 5 hours in the CDT zone and 4 hours in the EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10db loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

Mail-A-Prop

With day-to-day propagation forecasts no longer available on WWV, Mail-A-Prop forecasts have taken on new and additional importance.

Mail-A-Prop forecasts are based primarily on a detailed analysis of solar, geomagnetic and ionospheric data. They consist of both day-to-day forecasts of general conditions and detailed band predictions for specific major paths to each area of the world from the United States. The forecasts are customized for each time zone in the U.S. The format of the biweekly newsletter changes a bit with each issue, so that over a short period of time, band-by-band, continent-by-continent and major time periods throughout the day are covered with detailed forecasts and analyses. Short-skip forecasts are usually given monthly. The Mail-A-Prop forecasts cover the h.f. amateur bands from 160 through 10 meters, and apply also to adjacent bands used for broadcasting and other services. Mail-A-Prop's subscription list consists of radio amateurs, shortwave listeners and commercial users.

Newsworthy items concerning radio propagation, solar activity, progress of the sunspot cycle, v.h.f. ionospheric openings, schedules of meteor showers, etc., are also included.

Mail-A-Prop is issued every other week, covering a two week period in advance, on a day-to-day basis. The forecast period begins on a Tuesday, and the newsletter is sent via first class mail, or airmail if necessary, to reach subscribers well before the forecast period begins.

Mail-A-Prop is designed primarily for use in the continental USA, Canada and the Caribbean area. There are, however, satisfied subscribers throughout the world. The forecasts have achieved an accuracy close to 90% during the past three years.

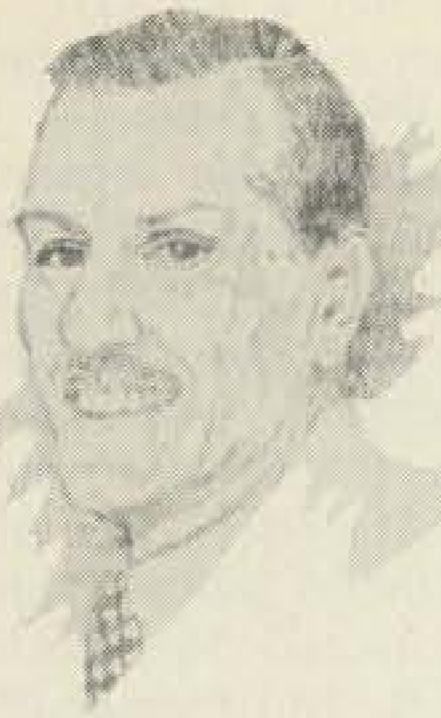
Mail-A-Prop is the most complete propagation forecast now available for the h.f. bands. It is in a convenient and easy to use format, and it is written in plain language so that it can be understood and used with ease. Here's what some subscribers have said about the newsletter:

"The service is great—best thing since the invention of the super-het!" —K4FW.

"Mail-A-Prop has been a big help in our world-wide operations."— Associated Press Communications Dept.

"My observations show that 88% of the Mail-A-Prop forecasts fell into the hit category and you missed only 12%. Congratulations."—W2JGR.

(Continued on page 71)



Contest Calendar

BY FRANK ANZALONE, W1WY

Finally, a decision has been reached as to who will handle the 1976 *CQ* World Wide DX Contest now that Fred Capossela, K6SSS finds it impossible to continue as Director.

The same working group that has done such an admirable job in the past will continue to be the nucleus of the working committee. It will now be directed by Box Cox, K3EST here in the East, and Larry Brockman, WA6EPQ, will be in charge of the Western group.

It is also planned to add some new members so that the mid-section of the country will be represented.

We feel that the working committee should be increased to keep pace with the growth of the contest.

With the change in the publishing dates of the magazine I have lost track of when the current issue will come out. I hope this will be in time for me to extend my best wishes for the Christmas season.

73 for now, Frank, W1WY

YU 80 Meter DX C.W. Contest

Starts: 2100 GMT Saturday, Jan. 8
Ends: 2100 GMT Sunday, Jan. 9

The object of this contest is to stimulate more activity on 80 meter c.w. Both single and multi-operator operation is permitted.

Exchange: RST plus QSO no. (001 etc.)

Scoring: Contacts between stations in the same country 1 point. With other countries on the same continent 2 points. With countries on other continents 5 points. With YU stations 10 points.

Multiplier: Each DXCC country including own and each YU prefix worked.

Final Score: Multiply total QSO points by sum of DX countries and YU prefixes.

Awards: Certificates to the top scorers in each country, 2nd and 3rd place awards where justified. (Call areas in W/K, VE, PY, VK, ZL, JA, UA9 & UA0 will be considered as separate areas for awards.) There are also Trophies for continental leaders.

Include a summary sheet and the usual signed declaration. Check log for duplicate contacts. Taking credit for contacts in excess of 3% of the total made means disqualification.

Mailing deadline is March 1st to: YU DX Club of SRJ, P.O. Box 48, 11001 Belgrade, Yugoslavia.

Calendar of Events

*Dec.	4-5	TOPS 3.5 MHz Contest
*Dec.	4-5	Telephone Pioneers Party
*Dec.	3-5	ARRL 160 Contest
*Dec.	11-12	ARRL 10 Meter Contest
*Dec.	11-12	Hungarian DX Contest
*Dec.	11-12	Spanish C.W. Contest
*Dec.	18-19	S.O.W.P. QSO Party
Jan.	8-9	YU 80 Meter Contest
Jan.	8-9	ARRL VHF Sweepstakes
Jan.	15	"Hunting Lions" Party
Jan.	15-16	DL QRP C.W. Contest
Jan.	15 & 23	RTTY Flash Contest
Jan.	15-16	ARRL CD C.W. Party
Jan.	22-23	ARRL CD Phone Party
Jan.	**28-30**	**CQ WW DX 160 Contest**
Jan.	29-30	French C.W. Contest
Jan.	29-30	Classic Radio Exchange
Feb.	5-6	ARRL DX Phone Contest
Feb.	12-13	QCWA QSO Party
Feb.	19-20	ARRL DX C.W. Contest
Feb.	19-20	YL-OM Phone Contest
Feb.	26-27	French Phone Contest
Mar.	5-6	ARRL DX Phone Contest
Mar.	5-6	YL-OM C.W. Contest
Mar.	19-20	ARRL DX C.W. Contest
Mar.	**26-27**	**CQ WW WPX SSB Contest**
Apr.	12-13	DX-YL to W/VE YL C.W.
Apr.	16-17	ARRL CD C.W. Party
Apr.	23-24	ARRL CD Phone Party
Apr.	26-27	DX-YL to W/VE YL Phone

*Covered last month.

"Hunting Lions" QSO Party

Starts: 1200 GMT Saturday, Jan. 15
Ends: 1200 GMT Sunday, Jan. 16

Sponsored by Lions International and coordinated by the Lions Club of Rio de Janeiro, Brazil, this activity is between Lions and non-Lions. The objective, "to create and foster a spirit of international understanding and cooperation."

Exchange: Name, QTH, QSO no., and the time. Lions will add their Club name.

Scoring: One point per contact, 2 points if its with another country. Contacts between Lions are worth 2 points, and 4 points if member is in another country. There are bonus points for working the Arpoador or the Marumbi Clubs of Brazil. One if within Brazil, two if from another country. (No point value for more than one contact with same station.)

Frequencies: Top 25 kHz of the 40, 20, 15 and 10 meter c.w. and phone bands.

Awards: Will be made for both phone and c.w. A Trophy for 1st place, trophy medallion for 2nd place, and a plaque to the 3rd place. There are also medallions for the 4th thru 10th place winners, and a QSL acknowledgement for all scoring 20 or more points.

It is suggested you write to the Arpoador Club for additional information.

Logs must be submitted no later than 30 days after end of contest to: Lions Club of Rio de Janeiro, (Arpoador) Rua Souza Lima n. 310—Apartmento 802, Rio de Janeiro—20.000 ZC 37, Brazil.

DL QRP Activity C.W. Contest

Starts: 1500 GMT Saturday, Jan. 15
Ends: 1500 GMT Sunday, Jan. 16

The DL QRP Activity Group runs two of these contests each year, one in January and one in July.

Power input is limited to 10 watts or less, single operator and c.w. only. QRO stations may participate but only contacts with QRP stations are valid. Limit your operation to 15 hours. The 9 hours of rest may be taken in two parts. Contacts may be made on any five bands in the 1.8 - 28—MHz group.

Exchange: RST plus QSO no. and power input. Add "X" if crystal controlled. (579001/8x) Stations using more than 10 watts indicate QRO instead of power figure.

Scoring: Contacts with stations in

*14 Sherwood Rd., Stamford, Conn. 06905

same country 1 point. Other countries but same continent 2 points. DX on other continents 3 points. If QSO is with another QRP station add 3 points. (4 to 6 pts. possible)

Stations using less than 3.5 watts get credit for 1 handicap point, and another handicap point if rig is crystal controlled. Double the above points if both stations meet above handicap requirements. (8 to 12 final points possible)

Reducing input power of a commercial rig does not qualify it for handicap bonus.

Multiplier: Each DXCC country worked, 1 if on own continent, 2 if another continent. Plus call areas of JA, PY, VE, VK, W/K and ZS.

Final Score: Total QSO points from all bands times the multiplier from each band. (Scoring for QRO stations same.)

Include a summary sheet showing the scoring and equipment description, and the usual signed declaration.

Mailing deadline Feb. 15th to: Hartmut Weber, DJ7ST, D-3201 Holle, Kleine Ohe 5, West Germany.

(K2KUR was the top world wide scorer, C31DV was 2nd, and DK0GA/p was 3rd in the July contest.)

Giant RTTY Flash Contest

Two Periods
1500-2300 GMT Saturday, Jan. 15
0700-1500 GMT Sunday, Jan. 23

This is the 9th RTTY contest sponsored by the IATG of Italy, called Flash because of the short two periods of operation.

All bands may be used, 3.5 thru 28 MHz and also via Oscar, in that portion of the bands used by RTTY stations. The same station may be worked on each band for exchange points and multiplier credit.

Exchange: Call, RST and CQ Zone.

Scoring: Contacts with stations in own Zone 2 points. With stations outside one's own Zone according to the value in the "exchange point table." Oscar contacts double in point value.

Multiplier: Each DXCC country and W/K, VE and VK call area worked on each band.

Final Score: Total exchange points X total multiplier X number of QSOs made. There is also a handicap of 2% to 12% deducted from the final score based on the position of winners in previous contests.

Awards: Gold medal for 1st place, Silver for 2nd, and Bronze for 3rd. The 4th to 7th place winners will receive a year's subscription to *CQ Electronica* magazine, 8th to 10th place a 6 months subscription.

Points and position achieved in this contest will be included for the World RTTY Championship for 1976. (This is the last for consideration in 1976)

The contest is also open to s.w.l. RTTYers with the same scoring rules.

It is suggested you write to Prof. Fanti for a more detailed rules sheet with a "exchange point table," handicap table and sample forms.

Logs must be received no later than Feb. 28th and go to: Prof. Franco Fanti, via Dallolio 19, 40139 Bologna, Italy.

French DX Contest

C.W.: Jan. 29-30 Phone: Feb. 26-27
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

Contest exchange is not confined to the French European stations only, you can also work DUF countries and the following prefixes. ON, HB, LX, VE2, OD, HH, 3B, 9U, 9Q, 9X. (DA1 and DA2 are F or ON military stations and can also be worked for QSO and multiplier credit.)

Exchange: RS(T) plus QSO number. French stations will also send 2 figures to identify their department. HB and ON will indicate their Canton and Province with a two letter abbreviation.

Points: Each QSO counts 3 points. A contact with F6REF or F8REF is worth 10 points. (Dept. 00)

Multiplier: One point for each French Dept., (95) Swiss Canton, (22) Belgium Prov., (10) and each DUF country. Plus LX, VE2, OD, HH, 3B, 9U, 9Q, 9X worked on each band.

Final score: Total QSO points times the sum of the multiplier from each band. (The same station can be worked on each band for QSO and multiplier credit).

Awards: Certificates to the top scorer in each country and USA call areas. Contest contacts may be applied for the many French awards. DUF, DPF, DDFM, DTA, DNF. These can be added to QSLs for contacts made during past 2 years.

Logs go to: REF Traffic Mgr., Lucien Aubry, F8TM, rue Marceau 53—91120 Palaiseau, France.

Classic Radio Exchange

Starts: 1800 GMT Sunday, Jan. 29
Ends: 0100 GMT Monday, Jan. 30

The Southeast A.R.C. of Cleveland, Ohio is again sponsoring this unusual activity. (Formerly known as "Nostalgia Radio Exchange.")

Object is to restore, operate and enjoy older equipment with like-minded hams. A classic rig is defined as any gear built since 1945, but must be at least 10 years old.

The same station may be worked on each band and mode, but no a.m. phone below 21 MHz.

Exchange: Name, RS(T), state, province or DX country and transmitter type. (i.e.: home brew, 807 final and etc.) Also any other interesting information.

Scoring: Multiply total QSOs by (different xmtrs. + states + provinces + DX countries) worked on each band. Multiply that total by your Classic multiplier. (Total years old of your transmitter and receiver. If transceiver multiply age by two.

Different transmitters and receivers may be used by one station. Figure score separately for each and combine for total score.

Frequencies: C.W.—60 kHz from

John Kanode, W4WSF President of the Potomac Valley Radio Club, accepting the CQ Club Contest Plaque for the top score in the 1975 CQ World Wide DX Contest. The presentation took place at the DXPO-'76 Convention in Washington, D.C. in September. This makes the 13th Plaque won by the PVRC, starting way back in 1960. Since 1964 they have had a consecutive streak, interrupted once only in 1971 when the Frankford Radio Club took top honors. (did I hear "break-up the PVRC?")

Plaque Winners

July VHF Space Net Contest

Class I
1st — WA2AAR — No. N.J.
2nd — AA1KIR — Mass.
3rd — WA1MGC — N. Hamp.

Class II
1st — WA2MMQ — So. N.J.
2nd — W4BAV — Fla.

Class III
1st — WA3ZRE — E. Penn.
2nd — WB6JNN — No. Cal.

Class IV
1st — WB2THT — N.Y.

Club
Mt. Airy VHF Inc. — E. Penn.

low edge of each band. Phone—3910, 7280, 14280, 21380, 28580. Novice—3720, 7120, 21120, 28120.

Awards: Certificates will be awarded for the highest score, longest DX, most equipment combinations, oldest equipment, and "unusual achievements."

Send logs with comments, anecdotes and etc. to: Stu Stephens, W8KAJ, 2386 Queenston Road, Cleveland Heights, Ohio 44118

CQ WW DX 160 Contest

Starts: 2200 GMT Friday, Jan. 28
Ends: 1600 GMT Sunday, Jan. 30

Rules same as in previous years. This is a c.w. contest only, no c.w. to phone permitted.

Exchange: RST plus a three figure QSO number starting with 001, and your state or province. It is not necessary for DX to send their QTH, the call will identify them.

Scoring: For W/VE/VO, 2 points per QSO with other W/VE/VO stations. All DX contacts are worth 10 points. (DXCC country list less W or VE/VO.)

For all other countries, 2 points per QSO with stations insame country, 5 points with stations in other countries. Except for QSOs with W/VE/VO which count 10 points.

Multiplier: For all stations. One (1) for each US state, VE province and DX country worked. (KH6 and KL7 considered DX, the District of Columbia same as Maryland.) VE1 is divided into 3 provinces, New Brunswick, Nova Scotia and Prince Edward Island.

Final Score: Total QSO points multiplied by the sum of the multiplier.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of the contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification.

Awards: Certificates to the top scorers in each state, VE province and DX country. Additional awards if the score or participation warrants.

As an added incentive, Gene Sykes, W4BRB (now W4OO) is donating a Plaque to the highest scoring single operator station.

Log sheets may be obtained from CQ by sending a large s.a.s.e with sufficient postage to cover your needs.

Mailing deadline for contest entries is February 28th to: CQ 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Propagation *(from page 67)*

"I'm a firm believer in Mail-A-Prop. Don't know how I ever did without it."—KH6BZF.

For radio amateurs an *annual* subscription of 26-issues is $25, postpaid. A *two-month* trial subscription of five issues is available for $5, postpaid. Send a legal-sized self-addressed stamped envelope for a *free* sample copy to:

Mail-A-Prop
11307 Clara Street
Silver Spring, Md. 20902

73, George, W3ASK

CQ Short-Skip Propagation Chart
January & February, 1977

Local Standard Time At
Path Mid-Point

Band (Meters)	Distance Between Stations (Miles)			
	50-250	250-750	750-1300	1300-2300
10	*Nil*	*Nil*	10-15 (0-1)	10-15 (1) 15-16 (0-1)
15	*Nil*	10-16 (0-1)	09-10 (0-1) 10-15 (1-2) 15-16 (1) 16-18 (0-1)	09-10 (1) 10-12 (1-2) 12-15 (2-3) 15-16 (1-2) 16-18 (1) 18-19 (0-1)
20	*Nil*	09-10 (0-1) 10-12 (0-2) 12-14 (0-3) 14-16 (0-2) 16-20 (0-1)	07-08 (0-1) 08-09 (0-2) 09-10 (1-4) 10-12 (2-4) 12-14 (3-4) 14-16 (2-4) 16-17 (1-3) 17-18 (1-2) 18-22 (1)	07-08 (1) 08-09 (2-3) 09-11 (4) 11-14 (4-3) 14-16 (4) 16-17 (3-4) 17-18 (2-3) 18-19 (1-2) 19-20 (1)
40	07-09 (0-1) 09-10 (1-3) 10-11 (3) 11-15 (3-4) 15-16 (3) 16-18 (1-2) 18-20 (0-1)	07-08 (1-2) 08-09 (1-3) 09-11 (3-4) 11-15 (4-3) 15-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-02 (0-2)	07-08 (2) 08-09 (3-1) 09-11 (4-1) 11-15 (3-1) 15-16 (4-2) 16-18 (3-4) 18-20 (2-4) 20-02 (2-3)	07-08 (2-1) 08-15 (1-0) 15-16 (2) 16-18 (4-3) 18-20 (4) 20-02 (3-4) 02-04 (2-3) 04-07 (2)
80	07-08 (1-2) 08-09 (3-4) 09-18 (4) 18-19 (2-3) 19-21 (1-2) 21-06 (0-1) 06-07 (0-2)	07-08 (2) 08-10 (4-2) 10-16 (4-1) 16-18 (4-2) 18-19 (3-4) 19-21 (2-3) 21-06 (1-3) 06-07 (2)	07-08 (2-1) 08-10 (2-0) 10-16 (1-0) 16-18 (2-1) 18-19 (4-3) 19-21 (3-4) 21-06 (3) 06-07 (2)	07-08 (1) 08-16 (0) 16-18 (1-0) 18-19 (3-2) 19-21 (4) 21-03 (3) 03-06 (3-2) 06-07 (2-1)
160	17-19 (3-2) 19-05 (4) 05-07 (3) 07-09 (2-1) 09-17 (1-0)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-1) 07-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-1) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (1) 07-08 (1-0)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2) 06-07 (1-0)

ALASKA
January & February, 1977
Openings Given in GMT #

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

See time conversions for use in other time zones in "How To Use Short-Skip Charts" appearing in the box at the beginning of this column.
* Indicates best time for 160 Meter openings.
** Indicates best time for 10 Meter openings.

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

HAWAII
January & February, 1977
Openings Given in Hawaiian
Standard Time #

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

DX *(from page 62)*

dinner meeting, beware of guaranteed attendance; try the buffet route.

Competition is often a key to a cohesive DX club. The DX contests provide good vehicles by which everyone cán contribute to the clubs' team effort. The little guy working for his first hundred countries and the "big gun" operator both become a part of the team. Look at the DX contest club results and you will readily recognize some of the most successful amateur clubs on this list. The CQ Worldwide DX contest DXpedition is one good way to get a group together for a joint venture and great time while adding a big score to the club tally.

Economy has made the club QSL card a bigger success than ever. Pride in using the club's QSL is another reason for this feature. The club QSL card design contest can be a featured event with the resulting product benefiting the entire group.

73's and Good DX! Rod, W7YBX

QSL Information

A4XVK to G4BVH
A6XS to G3SUW
CP1AT to W0GX (post Aug 76)
D6AB to F6CXT
FB8XO to F6CRT
FG7AS to W7RUK
FG7WO to W4KA
FK8BB to DJ9ZB
FO8EX to F6AUS
GC4AA to G3ZQW
HBØNL to HB9NL
HL9TJ to K6VA
JW9WT to LA5NM
JY3ZH to DJ9ZB
KC6DK to K7DDY
KJ6DL to WB5HVY
OHØDX to OH5MJ
OY1AT to W6TCQ
P29EI to W7PHO
PJ9CDC to W1CDC
TA2DX to DJ9ZB
VP2DM to WA9EED
VP2GRN to W4YHB
VP2SAB to W2MIG
VQ9HCS to WA1HAA
VR3AR to W7GQA
VS5MC to DK5JA
WØEXD/KC4 to K0DX/4
WA6EGL/VQ9 to W4FLA
WB4KZG/KC6 to WA7ZTL
WB6KBF/HK0 to K6JR
XT2AG to W1AM
YBØABV to K0DX/4
YBØACP to K6MQG
YK1AAA to OK1AAA
YS1MAE to W2KF
ZE4JH to WA4UPR
ZL4LR/A to ZL4NH
4L1RO to UW1CX
4Z4BG to WB4FSV (post July 76)
4Z4EV to WB4FSV (post July 76)
4Z4PX to WB4FSV (post July 76)
5W1AB to W4KA
5Z4PG to WB9MFC
9G1JX to DL7SI
9J2CJ to DK6XF
9J2WS to W4LF
9V1SH to W7PHO
9Y4SF to WA5GFS
A9XBD—c/o Cable Wireless, Box 14, Bahrain
EL2T—Charles Unglesbee, VOA Liberia, APO NY 09155
KØDX/4—Dr. Dick Brown, 11104 Seaglade Drive, Pensacola, FL 32507
VP2SAG—Box 142, St. Vincent
3D6BK—John Menz, Box 261, Mbabane, Swaziland

Signal/One Improvements *(from page 38)*

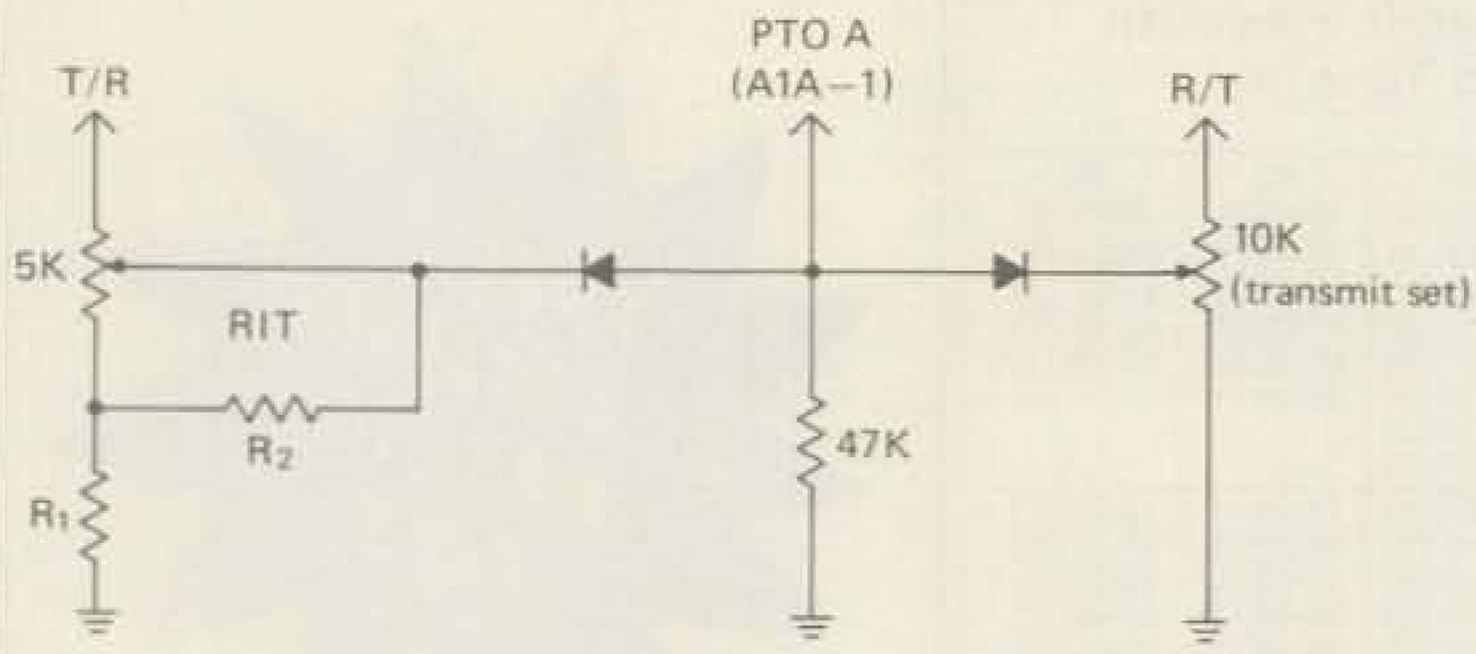


Fig. 10—K6BE RIT scheme.

the existing FSK potentiometer. No switch is used to turn RIT on/off since the total range is ±1 kHz and is resettable to zero (The "I" in "RIT" on the panel!) to within 10 Hz. See circuit below. All components are mounted on a small terminal strip soldered and epoxyed to the rear of the FSK potentiometer. R1 is selected for the range desired and is selected at the low end of PTO range. Range of RIT is slightly more at the higher frequencies. R2 is selected to obtain centering of range at center of RIT control rotation. Typically R1=4700 and R2=1000 for a range of ±1 Khz. The Xmit Set potentiometer is a miniature trimmer type. Diodes are 1N456 or similar.

An RIT scheme, by W7IV, has slightly more range and utilizes a switch mounted in a small external minibox. See circuit below. Connect terminal 1 of VFO A, the FSK varactor, to a pin on external connector J5 (accessories connector on rear panel). Many of the present connections to this connector would never be used, such as Front-end a.g.c. Disconnect one of these to free a pin. All other necessary connections (T/R, R/T, and —15 volts) are already on J5. The RIT potentiometer and components are all assembled into a small minibox and placed near the CX7.

My sincere thanks to all those who have written me with these modification ideas and to those who have reported their experiences with the modifications. Special thanks to K0HHP, W8IPA, W2SIL, W0NVE, and WB4RSK. This article would not have been possible without the efforts of Suzanne Jones who carefuly deciphered my notes and typed the manuscript. ■

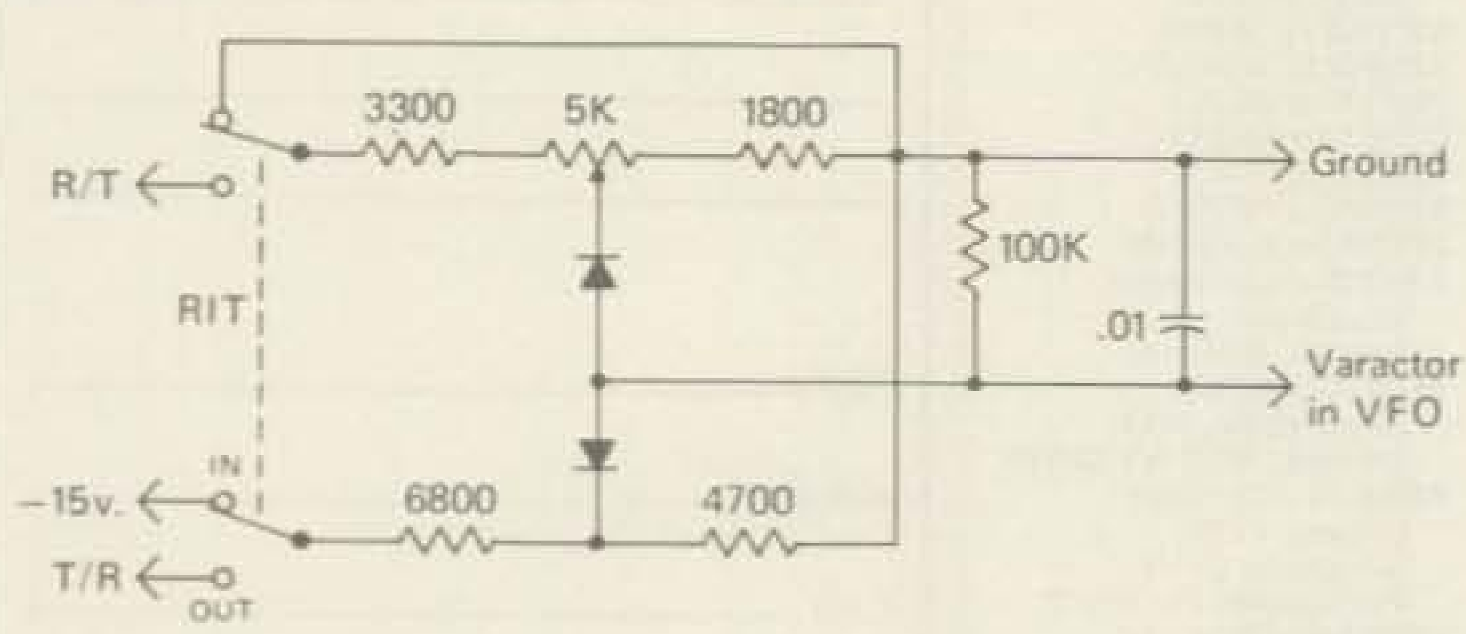


Fig. 11—W7IV RIT scheme.

Making IC Projects Work *(from page 46)*

nected to the p.c. board connectors. Masking tape, or gummed paper tape can be marked and taped to the loose ends of such wires until they are to be connected to the proper external points of the system.

In wiring up the interconnecting subsystems don't forget to allow for the correct wire size in those cases where heavy currents are expected. It is good practice to use heavy buss wire or buss bar for all ground returns. Some of the IC's in use today cause very sharp switching transients, or spikes, on the power lines and ground return. The heavy ground return buss wire will help in minimizing spikes. When running power lines to the various p.c. boards, or subsystems, it is a good idea to use ferrite beads and 0.1 mf. disc capacitors at the point of entry of the d.c. power to each board on which high transient spikes are anticipated. In addition, signal lines and switching lines carrying high speed clock pulses should be coax cable such as RG-174U. Best results occur when both ends of the coax cable are grounded. Noisy interference can be run down with an oscilloscope. This will be covered in the check out procedure which follows. When the power supply is remote from the system, be certain that the cable connecting the two is sufficiently heavy to prevent excessive voltage drop through the cable. Reference to the copper wire table[4b] will indicate the size wire needed in the power cable.

System Checkout

After completing the wiring of the IC system, overall system checkout can be accomplished in an orderly manner by setting up and following a progressive routine. Upon completion of system wiring, it is well to perform a visual inspection of all wiring to ensure that there are no loose or unconnected wires. Where plug-in p.c. boards are used it's suggested that the pinout wires be checked for good solder connection and correctness of interconnection. Install all IC's in their sockets. Be certain that they are installed correctly (many IC's have been lost because they were installed backward). Install all p.c. boards in their corresponding sockets, again being careful that the boards are installed correctly and not backward. Recheck to be certain that the p.c. boards are in the correct sockets and plugged in correctly. To assist in correct installation of p.c. boards that do not have keyways, identify one end of each board with a spot of paint or tape and use the same identifying spot, just below the p.c. board, on the chassis or subassembly. Many IC's have been lost, along with other components, due to reversed installation of p.c. boards. This problem is generally eliminated on commercial systems by the use of keyways to allow installation of the p.c. board in only one direction. After completing the assembly and the visual inspection, resistance checks at strategic locations throughout the system will catch errors and prevent loss of hardware when power is applied. Fig. 4 shows a resistance chart made up for the WB9LVI scan converter built by the author. Note that each of the voltage levels are checked with a common 20,000 ohm-per-volt meter with both positive and negative lead checks. Since IC's contain semi-conductors they will show different resistances when the polarity of the sensing voltage within the ohmmeter is reversed. It is not advisable to use a digital ohmmeter as such an instrument will not sense resistance of semiconductors correctly due to the non linear characteristics of semiconductors and the low sensing voltage employed in digital ohmmeters. A good 20,000 ohm-per-volt meter will have enough internal voltage to overcome this problem. When testing the d.c. resistance of the several d.c. voltage mains in the IC system, it can be expected that the more units tied to the d.c. main, the lower the resistance will be. Often, when the ohmmeter leads are reversed, the value of resistance will be quite low, as indicated in Fig. 4. Resistance checks are useful to indicate shorts before applying power. While checking various points with the ohmmeter it is a good idea to also check each p.c. board ground against the common ground for continuity.

Upon completion of the resistance checks the system is ready to be progressively tested and adjusted under power. The first step is to disconnect the power supply from the rest of the IC system and test each voltage level. When performing this test always place some load across the regulated output voltage being checked. Many of the three terminal regulators in current use will not regulate properly unless a nominal load is placed across their output. As an example, for low voltage regulated outputs of plus or minus 15 volts or less, a 100 ohm five watt resistor will provide enough load to ensure that properly connected regulators will regulate. Check each regulated output voltage from the power supply. If any of the voltages are not within tolerance, check the filtered unregulated input voltage to the regulators to be certain that it is at least three volts higher than the output voltage. If it is, the regulator is not within tolerance or is connected improperly. Once all regulated output voltages are within tolerance and the power supply is checked to be operating without undue heating at any point, a progressive checkout of the IC system may be initiated.

When making a powered check of an system, one should sequentially check everything visually. Check the power supply for proper performance and then check, board by board the p.c. boards and identifiable components of the system. As an example, consider the WB9LVI slow-to-fast-scan converter[1] referred to earlier. Printed circuit boards have been fabricated for that device which correspond rather closely to the schematics in the QST article. The analog demodulator board is on the first p.c. board. This unit should be installed in the rack of 22 pin connectors, and with all other boards removed, R_1 should be adjusted as described in the subject article. When the desired oscilloscope patterns have been obtained, a known test pattern, such as a gray scale, should be used and observed at pin 10 of U6. If satisfactory there, the analog output signal should be checked at pin 10 of U7. When that pattern is successfully obtained the horizontal sync pulse must be obtained by adjustment of the panel-mounted 5000 ohm horizontal sync potentiometer, and finally, the oscilloscope pattern obtained for the vertical sync pulse by adjustment of the 5000 ohm vertical sync pulse potentiometer, mounted on the p.c. board, must be confirmed. Board number two, the analog-to-digital converter, is then installed in its socket and with a white test pattern continu-

Power Supply Disconnected From Converter

Voltage Level and Type	Ohmmeter Negative Lead at Ground	Ohmmeter Positive Lead at Ground
+5 volts, digital	>2000 ohms	>400 ohms
—5 volts, digital (to mem. bds. 1 & 2)	>1500 ohms	>2000 ohms
—5 volts, digital (to mem. bds. 3 & 4)	>1500 ohms	>2000 ohms
—8 volts, digital (to 2 O'clock drivers)	>20k ohms	>2000 ohms
—12 volts, digital (to MM5055's)	>1500 ohms	>10k ohms
—12 volts, analog video	>2000 ohms	>10k ohms
—5 volts, analog	>200 ohms	>15k ohms
+12 volts, all sources	>2000 ohms	100 ohms
+5 volts, analog (APR16, APR25)	>2000 ohms	40 ohms
Power Supply Connected to Scan Converter		
+5 volts, digital	75 ohms	20 ohms
—5 volts, digital	125 ohms	>1500 ohms
—5 volts, digital	125 ohms	>1500 ohms
—8 volts, digital	290 ohms	>1500 ohms
—12 volts, digital	130 ohms	>10k ohms
—12 volts, analog	160 ohms	>5k ohms
—5 volts, analog	160 ohms	>2k ohms
+12 volts, all sources	490 ohms	50 ohms
+5 volts analog	75 ohms	25 ohms

The chart shows the general resistance levels to be anticipated when using three-terminal voltage regulators (LM309K, LM320K, LM340K) with the WB9LVI converter or other IC systems having between fifty and two hundred IC's involved.

> = greater than

Fig. 4—Resistance Chart, WB9LVI Scan Converter, (K4CNP power supply, and power distribution).

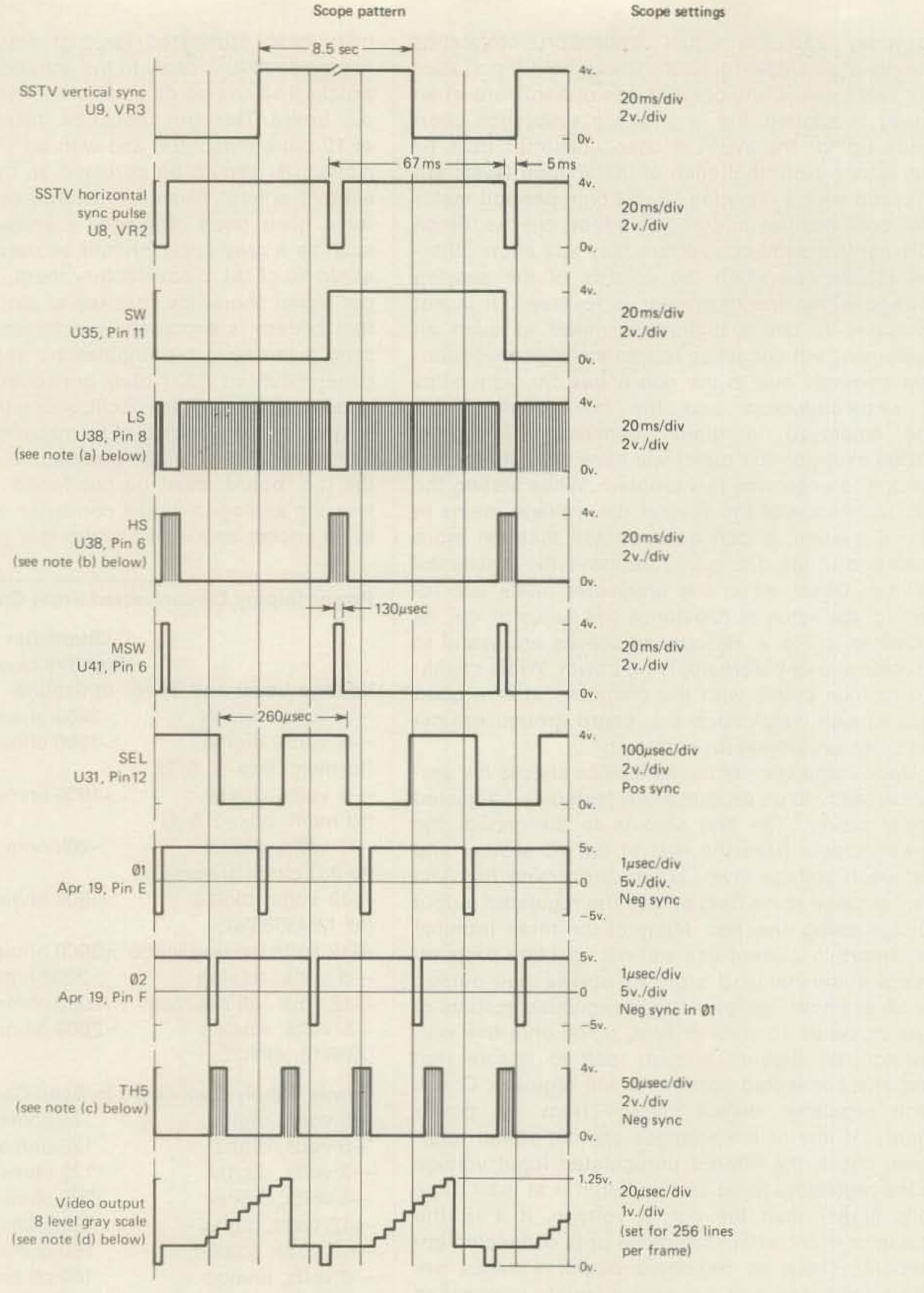


Fig. 6—Typical Timing and Control Signals, WB9LVI Converter.

Note (a): LS consists of 128 pulse groups at approximately 1.92 kHz rate with a 15 Hz group rate. The blanking pulse between groups is ≧ 130 μs. Pulses may be seen by changing to 1 ms/div. or less.

Note (b): HS consists of 128 pulse groups ≈ 0.984 MHz pulse rate with a 15 Hz group rate. Pulses may be seen by changing to 20 μs/div.

Note (c): 128 pulses at 2.9 MHz pulse rate, group rate ≈ 15.4 kHz rate. Individual pulses may be observed with scope set at 2 μs/ div. and positive sync.

Note (d): When converter is set for 128 lines-per-frame, alternate level gray scale patterns are not produced on the oscilloscope.

ously applied to the input of p.c. board 1, R_2 is adjusted until digital pulses are seen with an oscilloscope or counter at all four pins of the binary counter U15. If a counter is available R_2 may be adjusted for a frequency of 130 kHz or higher as stated in the manuscript. In like manner, R_3 on the front panel should be adjusted so that pin 8 of U12 produces a 7.69 kHz signal. With these two boards operating, the next three boards must be installed as they are all required to obtain the counting and control signals needed for the rest of the scan converter. Fig. 5 shows the frequencies that should be obtained at various points in the fast and slow timing chains, and the control pulses obtained to operate the converter. This chart is offered so that the reader might use it to check the specifications of the counters and gates used in this converter and derive the same figures. As an example, the 74161 counter divides by 2, 4, 8 and 16, thus, from the specifications for the 74161, one should expect that the input frequency to pin 2 would be divided by two at pin 14, by four at pin 13, by eight at pin 12 and 16 at pin 11, and also pin 15 which is the carry pin to a following counter. In this manner, the frequencies which are supposed to be available at all points of a divider chain may be easily derived and logged before checkout. Control signals such as SW, MSW, HS, LS and others may be likewise derived, or where derivation is not obvious, checked with an oscilloscope for their presence. Fig. 6 shows a partial diagram of timing and control signals for the WB9LVI scan converter. Most of this diagram can be derived prior to building the system simply by reference to the specification sheets for the IC's used, and will serve as a very useful device when checking out the system. It will show both the frequency and phase relationship of the various control signals. When checking out the physical system, the lack of any of the needed signals will indicate the area in which the system is not operating as it should. It is by this means, step by step that the entire system may be checked out, adjusted and made to operate. The WB9LVI scan converter is used only as an example. The same type of checkout is needed for any IC system, and the larger the system, the more one should layout in

(continued on page 77)

Volt. To Freq. Converter *(from page 41)*

location, sent over the lines, and then converted back to a d.c. voltage at the readout point, a much better system develops. Changes in line characteristics will not change the frequency of the audio voltage. A 4151 can, of course, change a d.c. voltage to an audio pulse train, but how to convert the audio frequency back to the original d.c. voltage level? Guess what? Use another 4151 at the readout end. It hasn't been emphasized yet but the 4151 can also be wired as a frequency to voltage converter. The circuit is shown in fig. 4. So, two 4151's wired back-to-back can make a complete analog-digital-analog transmission system. The circuit of fig. 4 can, of course, be used alone whenever a frequency to voltage conversion scheme is desired. However, it requires a square wave input with preferably a small pulse width. Sine wave signals must be "squared up" by going through a triggering circuit of some sort, first.

The 4151 will, in time, probably become one of the more popular IC's on the market. Other manufacturers are also starting to produce similar one-chip converters. The 4151 should be available now in many of the mail order houses which cater to hobbyists wanting advanced technology IC's. ■

CQ Reviews *(from page 34)*

Input sensitivity is rated at 7 Volts RMS on the low range (5 Hz-35 MHz) and 2 Volts RMS on the high range (30 MHz-200 MHz). Input impedance is switch selectable, either 50 ohms or 1 Megohm. The low impedance range is recommended for use up to 35 MHz to minimize stray pickup. The high impedance input will minimize loading of the circuit.

A neon over range indicator will flash on if the input frequency is greater than 100 kHz, when operating in the kHz position. This is only to alert you to the fact that the full frequency is not being displayed, but may lack the first 3 digits.

Another nice feature of the YC-335D is the capability of operating from either a.c. or d.c. Two power cords are supplied with the unit and a switch on the rear panel selects 117 v.a.c. or 12 v.d.c. The a.c. supply may be rewired for use on 200/220/234V 50/60 Hz if required.

The YC-355D is a well built unit with all circuitry except the power supply built on a sturdy dual clad epoxy board. The attractive steel case has a flip type carrying handle, which serves to elevate the front of the unit when placed on a bench. The YC-355D represents real value in a frequency counter for all around amateur use. ■

SSTV Overview *(from page 21)*

your location, pictures, or whatever on tapes and have them handy for playback whenever you desire. As a matter of fact, many SSTVers do not own a camera, they just use tapes made up for them by someone who DOES own a TV camera.

Equipment Items And Operational Procedures

Next month, Part 2 of SSTV, AN OVERVIEW, will discuss specific pieces of equipment, how they are used, and operating practices.

(To Be Continued)

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SURPLUS COMPONENTS, communication and test equipment. Illustrated catalog .25. E. French, P.O. Box 249, Aurora, IL 60507.

GENERAL RADIO 650A impedance bridge, reconditioned, calibrated, $75 FOB UPS. PhD, 5220 Carlingford, Riverside, CA 92504.

OLD RADIO PROGRAMS ON TAPE - For info send S.A.S.E. to: Tape Trade, 1705 Kaywin Ave., Bethlehem PA 18018.

ANTIQUE RADIOS FOR SALE - $1.00 for list of 150 sets. W2GHF, 45 Allen Dr. Woodstock, N.Y. 12498.

WANTED: National NC-183 Rcvr. in good condition. State price. also schematic for 1939 Atwater Kent Model 559. T.C. Streeper, 5265 Madison Rd. Madison, OH 44057.

MULTILINGUAL college grad, extra class, First Phone, etc., wants challenging job. R. Wilson, 7534 Garnett no. 10, Shawnee, KS 66214.

WANT 2-KW Linear. in good condx. Cash or Swap for Ampex 600 Tape recorder in like new condx. W1LMS, Box 48, Ballardvale, MA 01810.

FOR SALE OR TRADE: QST/73/CQ SASE for list. Guimares, RFD 2, Box 480, Middleboro, MA 02346.

SELL, New W.E. Co. T.T. Pads $7.50 ea., New Hallicrafter mobile mount MR150 $10.00. Joseph Arnone, K2MZE, P.O. Box 455, Valley Stream, N.Y. 11582.

FOR SALE: Yaesu Monitor Scope YO-100 with 9 MHz IF option. Mint condition in original carton. Complete $150.00, Yaesu Landliner phone patch and speaker SP-101PB. Never used. In original carton. Complete $50, G.E. Progline. Mint condition. Just overhauled and peaked for MARS 2-meter VHF, plus 4 amateur VHF repeater channels. Measured output 20 watts. Transister power supply. Installed Ameco pre-amp gives high sensitivity. Complete with all cables for mobile or base installation, $200, plus shipping and insurance Will throw in a GE Progline 50 watt power supply as is. Robert S. Woodbury, 12 Meadowbrook Rd., Dover, MA 02030.

QRPp STATION: Argonaut ssb/cw, S band, transceiver, Aut tuner, power supply & shure mic. $275, Wally Cooledge, W1IOO, 15 Newport Dr., Westford, MA 01886.

FM CONVERTER BY PALOMAR. Convert your Gonset 2 AM or many other 2 AM rigs $40.00, with 5 crystals. Bob Krueger, 8864 Hillside Dr., Hickory Hills, IL 60457.

SELL: Heathkit HW100 Transceiver with AC Power Supply - $270. Hammarlund HQ170 Receiver and spkr. $150. SABO, 2417 - 1st Ave. W., Seattle, WA 98119.

HEATH KIT GR-78, mint cond. six band, $60.00. Selleck 23311 Iris Ave, Torrance, CA 90505.

HEATH HR-10B Receiver Someone certainly wants this nice one for $. Nussbaum, Box 695 Cary Quad, W. Lafayette, IN 47906.

UNSCRAMBLE POLICE CODE with decoders. Works on all scanners and receivers. For prices and brochure, write: Don Nobles, Route 7, Box 265B, Hot Springs, Ark. 71901. (501)623-6027. (Dealers Wanted)

RTTY CLOSEOUT - NS-1A PLL TU while they last. Wired/tested $24.95. Board $3.00. All postpaid. SASE for info. Nat Stinette Electronics, Tavares, FL 32778.

FREE CATALOG - Calculators $4.95 each, ultrasonic devices, digital thermometers, strobe light kits, memories, photographic electronic flash units, rechargeable batteries, LEDS, transistors, IC's, Piezoelectric crystals, toroidal cores, unique components. Chaney's, Box 27038, Denver, CO 80227.

TECH MANUALS for Govt. surplus gear - $6.50 each: SP-600JX, URM-25D, OS-8A/U, PRC-8,9,10. Thousands more available. Send 50 cents (coin) for 22-page list. W&IHD, 7218 Roanne Drive, Washington, DC 20021.

HAMMERLUND HQ129X Receiver original owner never modified good working condition $100 Pick up only. Northridge, Calif. (213) 349-2809.

WORKED CENTRAL AMERICA certificate: Work all 7 countries. Send list and $1. K5-ODZ, 4805 Willowbend Blvd., Houston, TX 77035.

LAMPKIN 205A FM Deviation Meter, FOUR SCALES! Clean, $150 FOB. Shack cleanup, similar, list SASE. W4API, Box 4095, Arlington, VA 22204.

HALLICRAFTERS, SR500, W6PS, A-1 $325. Will trade for Swan 250-C. Russell 19680 Mountville Dr. Maple Hts; OH 44137 (216) 662-2175.

WANTED 136B-2 Collins Noise Blanker. SELL: Mint late Swan 350 xcvr w/acc. W7-KSG 1876 E. 2990 S. Salt Lake City, UT 84106.

WANTED: 2 or 3 el. tribander KW linear, 2 meter rig, cw keyer. Will Roberts, WA4PSL, P.O. Box 907, Roseboro, N.C. 28382. (919) 525-4431.

BUY SELL TRADE - Write for free mailer, give name address, call letters, complete stock of major brands, new and reconditioned equipment. Call for best deals. We buy Collins Drake, Swan, etc. SSB & FM. Associated Radio 8012 Conser, Overland Park, Ks. 66204 913:381-5901.

WANTED: Copy of manual for Collins 32S-1. If you send manual I will xerox and return. Wally Cooledge, W2IOO, 15 Newport Dr. Westford, MA 01886.

SELL: Clegg FM-27B, latest mint, 33 watts out, $280; Swan 14-117 PS, Exc. $79 W4-MGL, 7010 S.W. 16th St., Plantation, FL 33317.

1976 USA Callbook. Like new condx. $7.00 W2JBL, 123 Davis Ave., Hackensack, N.J. 07601.

HT 44 Hallicrafters Exciter with Pwr Supply in working cond. - Pick up only $75.00. Hank Van Handle, 139 Howe Ave., Passaic, N.J. 07055.

DRAKE SW-4 Short Wave Receiver, Excellent condx, $150. WA8VFK (513)-324-3065.

SELL - Swan twins 600-T xmtr, 600-R Rcvr. like new Spkr. incl. $600. C. Jones, (213)888-0479.

SB 34 WANTED FOR PARTS - Describe and Price. Ronald Bryant, W8KUV, 2638 Perdue, Columbus, OH 43211.

COLLINS all round emblem: KWM2A, 312 B5, 516F2 pwr, 30L1 Linear, Complete xtal pack, all cables, manuals. K5CKQ $2500.00. C.D. Hagler, K5CKQ, 1831 Cache Rd., Lawton, OK 73501.

SELL: Touch Tone Pad, CMOS Chip, $25. HR2A $125. Both Shipped. WA9WDB/P5, John Teles, 10511 Tenneco Dr., Houston, TX 77099.

WANTED: Old radio magazines such as Modern Electrics, Radio Broadcast, RADIO, Radio News, Electrical Experimenter, Popular Radio, Popular Electricity. Will pay cash or trade if desired. Erv Rasmussen, 164 Lowell St., Redwood City, CA 94062.

SELL: Hallicrafters FPM 300 MK II Mint $375 firm. Ray, WB9LKC, Rt. 1, Custer, WI 54423. (715) 592-4136.

WANTED: Allied A2516 Ham Receiver. John Savonis, 410 Blake Rd., New Britain, CT 60653.

WANTED - Yaesu FR101 ors must be in good condition. Call collect after 5:30 (419)334-3462. Ohio.

SALE: Tested 1N4150 Diodes, .03 ea - Min QTY 100. 64 Dit Rams (Flat Pk) - Tested .75 ea., Min 10. Plumbicons $50.00 ea. Plumbicon toke - Frm color cam. $50.00. Paul Wentzel, K0GBC, 16266 Finland Ave., Rosemount MINN 55068.

EICO 720 Trans. with 730 mool. $30 both. Heath DXGO a $30. Scott Cronin, WB2IMX, 33 N. Suffolk Dr., Rocky Point, N.Y. 11778.

DXER's Send SASE for List of TX Parts, etc. W6RW 8600 Skyline Dr., Hollywood, CA 90046.

SBE-34 solid state 80-15 AC-12V power mike AC-DC pwr cords, manual; Carl Fissell Jr. 1817 Hickory Bark Lane, Bloomfield Hills, Michigan 48013.

SWAP: BOLEX 16-mm movie camera, 3 lenses on turret, rangefinder viewer, beautiful condition; for 2 Kw Linear or cash. D. Sheehan, Box 48, Ballardvale, MA 01810.

COLLINS KWM-2A and 516-F2 Power Supply $875 firm both round emblem, Jim Dawson W9NNE, 119 Reno, E. Alton, IL 62024.

FOR SALE: Swan 250C NS-1 Noise Blanker 117 xc supply $350. Also Hy Gain 14 AVQ-WB $25 You Ship All. Richard Wagner, K4M-ZE, 1015 Haber Dr. Brentwood, TN 37027.

SELL: Hallicrafter SX111 Good condition $95.00 Ralph H. Emerson, W7WE, 1740 Fairfield Ave. Reno, NV 89509 (702) 322-0265.

GONSET G-50 60Meter xcvr. $85 ppd. Jennings 250 pf vacuum variable - $49. K4EPI, Roland Guard, 235 Nelson Dr., Lavergne, TN 37086.

SELL: Hammarlund Rcvr. model SP600 Tunes 540 k.x. to 54 Mhz. Navy RBA6 Tunes 15 k.c. to 600 k.c. with p.s. make offer or swap equipment. Alan Mark, P.O. Box 372, Pembroke, MA 02359.

SELL: Johnson 275-watt Matchbox plus 250-feet new 450-ohm TV open wire line. $70.00 FOB. E. Stacy, 103 E. Bartlett Ave., Selah, WA, 98942.

KWM2/2A Accessories, MP-1 $75.00 351D-2 $60.00, 136B-2 $75.00 All three for $200.00 Standard Brands dynamic microphones $5.00. Heinlein, 107 Wyoming, Boulder City, NV 89005.

SELL: Heath HW202 2 meter transceiver 52/52 94/94, 16/76, AC supply, tone burst unit. like new, $210. WA9HRN C. Pitcher, 5 Whitehall Court, Buffalo Grove, IL 60090. ph. (312)537-4655.

Making IC Projects Work *(from page 75)*

advance what the various signals should be, from stage to stage. In some systems it may be more effective to begin the "power on" checkout at the output of the system rather than the input. A good example of this method of checkout is described in the WØLMD keyboard.[5] It will not be described here as the original description is quite complete.

In Case Of Trouble

It is very well to describe the various methods of checking out an IC system and how to derive the signals that should occur at strategic points. But what happens when those signals just don't appear where they should. This happens to almost everyone who builds a sizeable IC system. I have run into my fair share of odd things that prevented IC electronic hardware from working as the book or article said it should, and here are just a few of the many "glitches" seen. First, the self-inflicted problems (assuming that I have a proved set of p.c. boards) such as wrong connections, cold solder joints, solder bridges, IC sockets that simply do not have all of the pins soldered to the foil, or IC sockets where one pin has been bent and turned under during insertion in the p.c. board, thus no IC socket pin to solder. In the category of self-inflicted problems is the one of inserting the wrong IC in a socket, or placing it in the right socket, backward (bad for IC's). Also, diodes inserted into the boards backward, or perhaps the marking on the diode was wrong, or the diode was bad. Wrong values of resistance or capacitance are always managing to crop up where they shouldn't. Even with boards that are known to work, I have found errors in the literature accompanying the p.c. boards as to how and where to install the various components. Be suspicious of everything, and it will pay off in the long run. In the category of self-inflicted errors there is the business of shorts or wrong voltages from the power supply. There is no point in dwelling on these mistakes as they invariably catch the attention of the builder very shortly after turning on the power, otherwise known as the smoke test.

The second major area of system problems falls into the category of what one might call built-in, or non self-inflicted mistakes. In this category I have run across open circuits in the foil between two points that should be connected, and no continuity between points where there should be continuity. I have found that it is best, in checking for continuity between IC's to check from the IC pin at one end to the IC pin at the other end of the supposed closed path. This check will catch open circuits in the IC sockets, cold solder joints, breaks in the foil and any and all other faults causing the open circuit. Other causes of system failure that can be considered built-in include components that are marked wrong (here pre-test pays off) and active

(continued on page 80)

[5]"An SSTV KEYboard", Dr. Robert Suding, W0LMD, CQ, September 1974.

Low Speed timing chain[1] (U34-U37)

U34 pin 2—1.92 kHz
pin 15—120 Hz (divide by 16)
U35 pin 11 and 15—7.5 Hz
U36 pin 14—3.75 Hz
pin 13—1.875 Hz
pin 12—0.9375 Hz (1.0667 seconds period)
pin 11—0.46875 Hz (2.133333 seconds period)
pin 15—0.46875 Hz (2.133333 seconds period)
U37 pin 14—0.234375 Hz (4.26667 sec. period)
pin 13—0.1171875 Hz (8.53333 seconds period)

High Speed Timing Chain[1]

U30	pin 2	1.01333 MHz (rate) 0.98333 MHz (with a frequency ctr)
	pin 15	63,333.33 Hz (rate) 61458 Hz (with a frequency counter)
U31	pin 14	31,666.67 Hz (rate) 30729.17 Hz (with counter)
	pin 13	15,883.334 Hz (rate) 15,344.58 Hz (with a counter)
	pin 12	7916.667 Hz (rate) 7682.92 Hz (with a counter)
	pin 11	3958.334 Hz (rate) 3841.12 Hz (with a counter)
	pin 15	same as pin 11 except pulse rather than square wave.
U32	pin 14	1979.167 Hz (rate) 1920.57 Hz (with a counter)
	pin 13	989.833 Hz (rate) 960.29 Hz (with a counter)
	pin 12	494.792 Hz (rate) 480.14 Hz (with a counter)
	pin 11	247.396 Hz (rate) 240.07 Hz (with a counter)
	pin 15	same as pin 11 except pulse rather than square wave.
U33	pin 14	123.698 Hz (rate) 120.04 Hz (with a counter)
	pin 13	61.849 Hz (rate) 60.02 Hz (with a counter)

The reason for the difference between the rate or its reciprocal, period, and that derived with a frequency counter, is due to the circuitry that stops the crystal clock drive pulses during fast-scan vertical retrace. The frequency counter counts all pulses in a given period of time. The rate or period seen on a triggered oscilloscope will be higher as the blanked period will not be observed on the scope.

Fig. 5—Timing Chain Frequencies and Periods, WB9LVI Scan Converter.

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ADVERTISER'S INDEX

QRP *(from page 49)*

resulted in unbelievable improvement in Argo performance on c.w. When in the 80 Hz position, the desired signal is literally "there all alone," except when a vastly stronger signal is very nearby—30 Hz or so. Since I've installed the filter last year, I have encountered hardly a situation where I could not copy the desired signal regardless of QRM and signal strength. The only impossible situation appears to be one in which a much stronger signal is very close to zerobeat with the desired signal. S.s.b. copy remains good, and the rejection of unwanted s.s.b. signals is a worthwhile improvement well worth the small loss of audio fidelity. But what difference does a little loss of fidelity make with respect to s.s.b., once vituperatively referred to as "quacking ducks"? In short, once the filter is working, any motivation to find a better receiver is lost! 73, Ade, K8EEG/O

Novice *(from page 32)*

your call letters prominently in the upper left-hand corner, 13 cents or 24 cents of postage in the upper right-hand corner, and your mailing address in the usual place. Send these envelopes to your call-area QSL bureau, the address of which appears in *QST* each month and at the head of your call-area listing in the *Call Book*. The bureau will distribute your cards about once a month.

If you work only a couple of DX stations a month, the fastest way to send cards is normally to their DX Call Book addresses. For promptest service, you may send your card by airmail and include a return envelope with enough International Postal Reply Coupons to prepay the airmail return postage. These IRC's are purchased at the Post Office. But there is nothing cheap about them. Our personal opinion is that including IRC's with cards may save time, but they do not increase the percentage of replies received appreciably. If the DX station says "QSL via ——," send your card to the specified station accompanied with an addressed return envelope, and your card from the DX station should appear in your mail box as soon as the DX operator sends his QSL manager the necessary information. Some amateurs include an extra stamp or two with their cards to these QSL Managers to help pay their out-of-pocket expenses, although there is no obilgation to do so.

If you work a DX station whose address is not listed in the *Call Book*

(Russian and other Eastern-Bloc countries do not list the addresses of their amateurs), send your card to the station via its National QSL Bureau listed in the *Call Book* or periodically in *QST*. But if you have up to 20 foreign cards to send a month, the new "ARRL Membership Overseas QSL Service," 225 Main St., Newington, Conn. 06111, may be the way to go. See October 1976, *QST* for details. The main objection to sending and receiving foreign QSL cards via bureaus is the time consumed—up to two years for the round trip.

Finally, there are the private QSL Bureaus operated by W3KT, K6QX, W7IZH, and others who offer to forward QSL cards from U.S. to DX stations for five to seven cents a card, using QSL Managers, QSL Bureaus and direct mailings when necessary. Some of these privately-operated bureaus have been in existence for many years and have offered excellent service. Many others have appeared and disappeared in a matter of weeks, especially those who have attempted to forward cards between U.S. amateurs.

News And Views

John Harper, WN6JBD, 7333 Chippewa Circle, Buena Park, Ca. 90620, says that next to the thrill of his first QSO on the air was getting a RST-579 report from Sarasota, Florida, running 2 watts of power. But then John always runs "flea power" with his Heath HW-7 driving a dipole 25 feet high. He has worked 19 states and Canada on 40 and 15 meters in seven months. "If conditions ever get better—look out WAC!" . . . **Ernie Redpenning, WB9TIZ,** 4200 Van Buren, Gary, Ind., 46408, got his Novice ticket on February 16, 1976, passed his General exam on May 28, and got the General ticket on July 16. He started with a Heath HW-16 feeding a coaxial-fed, 40-meter dipole and graduated to a FTDX-560 transceiver, Dentron super antenna tuner, and Heath r.f. wattmeter in March. Ernie had 47 states confirmed as a Novice and now has a Bicentennial WAS and 27 countries worked, mostly on 20 meters, where a 40-meter coaxial-fed dipole is not supposed to work. But, in spite of the high s.w.r. on the coax, the antenna coupler reduces it to 1:1 at the FTDX antenna terminal.

We will be waiting for your pictures, "News And Views," and suggestions. Mail them to: Herbert S. Brier, W9AD, Novice Editor, CQ, 409 So. 14 St., Chesterton, Ind. 46304.

73, Herb, W9AD

Making IC Projects Work *(from page 77)*

components such as IC's that operate properly when tested statically or at low speed, but fail at the speed required in the system. At any rate, both the self-inflicted and the non self-inflicted mistakes can be reduced greatly by careful selection and test. There is always one final source (I hope) in case of trouble, and that is to inquire of the author of the system as to your problems (and please don't forget the self-addressed stamped envelope). In those cases where systems are built up on a series of p.c. boards it may be possible to send your boards to the author or someone else who has the system working so that he may check out your boards in his system. It is a good idea to write first and get the permission of the author before shipping your boards. One could dwell on the area of troubles indefinitely and it seems that no two difficulties are ever exactly the same, but I believe the above guide lines will help to find troubles and eliminate them in even sizeable systems.

System Check Out

In my order of doing things, this phase comes after the system has been made to operate. To continue with the WB9LVI scan converter, once a signal is obtained that is recognizable on the screen of a monitor I prefer to then work from the output back to the input of the system. The video signal should be observed with an oscilloscope. Even a simple scope with a relatively low bandwidth can serve here. It is best to have a recognizeable signal source, such as a gray scale, which may be identified by means of the scope at the video output of the converter. Once that is seen, the output digital-to-analog resistors can be adjusted to provide uniform stair steps. The resistors in the output emitter-follower may be adjusted to provide an optimum video/sync ratio signal. If trouble is encountered in obtaining all eight steps in an eight-step gray-scale signal source, it is well to work back to the memory boards and check them (the four bits) one at a time. It may be that one digital bit is not getting through. In this case the fault can be quickly found by checking the output of each shift register around the board until the faulty one is found. If a smooth 256 line picture is not obtained one may check the output line and pixel doubling section. The output line buffers must be checked to determine that all four digital lines are being transmitted through them, and the adders and latch and multiplexer also checked with a scope for signal continuity. In like manner, the timing circuits and control circuits should be examined to assure that the signals are clean and as they should be. The input circuitry should be examined for correct speed and signal shape and "tweaked" as necessary to enhance the output picture on the screen of the monitor. These steps may require repetition as they often interact on other circuitry requiring readjustment. The picture on the monitor screen is the final factor at this time and adjustments made are subjective and to the taste of the observer.

Final Assembly

My station contains considerable Heath gear, and I enclosed the WB9LVI converter in an SB-102 cabinet and matched up the front panel paint with Heathkit colors. There are a few practices that I have found very useful in making a clean-looking system. Rub-on decals are available from several sources, but they must be protected once applied to the front panel. Good results can be obtained by spraying the entire panel with a thin coat of clear lacquer after rubbing-on the decal information. Care should be taken that the system doesn't overheat when installed in its cabinet. Most builders of the WB9LVI converter build the power supply on an external chassis to reduce the heat problem; however, several systems have been built with the power supply enclosed in the same cabinet with the active components with the assistance of forced-air cooling. Where the power supply is enclosed with the system it is good practice to be very sure that nothing overheats during operation. Many of the IC systems of interest to amateurs use IC's that are being pushed nearly to their specified limits. Excessive heat will show up quickly as a degraded picture, followed by failure due to overheating.

With all of the gloom that is spread throughout this article, I would like to finish with a silver lining to the difficulties of getting an IC system to work. My personal experience has been that once over the hurdles of making the thing "go", it keeps right on going indefinitely. I have had that result with monitors, keyboards, scan converters and other digital circuits. One great advantage in having a working digital system in which the "infant" IC failures have occurred is that it will continue to work as long as the user keeps screwdrivers and such things out. ■

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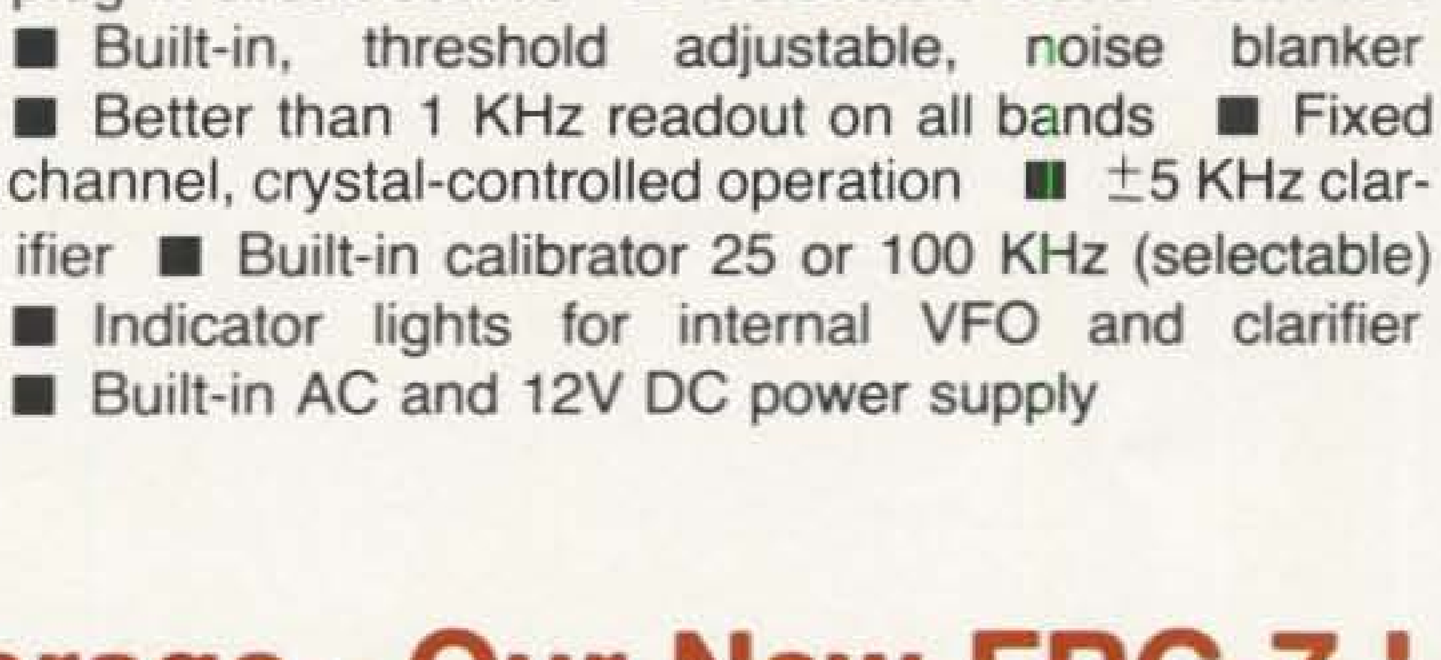

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