CQ

July 1975
$1.00

Microprocessors In The Ham Shack
.... see page 17

Introducing: A New SSTV *Column by* W2DD
.... see page 38

The Radio Amateur's Journal

08240

Heathkit "104"...

...new performance standard for SSB transceivers

A revolutionary "new generation" transceiver. It's completely solid-state and totally broadbanded to eliminate preselector tuning. And the output can be instantly switched from 100 watts to 1 watt. The true digital readout offers resolution down to 100 Hz and outstanding tuning accuracy. Receiver intermodulation distortion has been minimized and there are very few active devices ahead of the highly selective crystal filter. Adjacent channel overload is negligible, yet sensitivity is better than 1 μV (.6 μV typical) and front-end overload is dramatically reduced. The "104" is 12 VDC-powered for mobility and the optional HP-1144 fixed station supply fits inside the SB-604 speaker cabinet. An optional noise blanker can be installed in the "104" and an optional 400 Hz crystal filter improves CW selectivity.

Kit SB-104, 31 lbs., mailable **669.95***
Kit SBA-104-3, 400 Hz CW crystal filter, 1 lb., mailable **34.95***
Kit SBA-104-1, Noise blanker, 1 lb., mailable **24.95***
Kit SBA-104-2, Mobile mount, 6 lbs., mailable **34.95***
Kit HP-1144, Fixed station power supply, 28 lbs., mailable **89.95***

SB-230 — the lowest-cost conduction-cooled linear around

The SB-104's "silent partner." 1200 watts PEP or 1000 watts CW from less than 100 watts drive. It's rated at 400 watts input for slow-scan TV and RTTY. The high-efficiency Eimac 8873 triode is double-shielded to reduce stray RF and a massive heat sink replaces noisy fans and blowers. The "230" assembles in just 15 to 20 hours with no alignment.

Kit SB-230, 40 lbs., mailable **319.95***

SB-634 station console combines 5 convenient accessories

The "634" performs 5 important functions — a 10-minute digital ID timer with visual or visual and audible indicators an RF wattmeter that reads 0-200-or 0-2000 watts with ±10% accuracy, an SWR bridge, a hybrid phone patch that can be used manually or with VOX control, and a 24-hour digital clock that runs independently of all other functions. It's a must for every well equipped station.

Kit SB-634, 14 lbs., mailable **179.95***

SB-614 station monitor shows you how clean your signal is

Highly visible 1½ x 2" CRT detects problems that can reduce the effectiveness of your signal — nonlinearity, insufficient or excessive drive, poor carrier or sideband suppression, regeneration, parasitics and CW key clicks. It monitors SSB, CW and AM signals from 80 to 6 meters. Push-pull drive for keystone free trace; automatic sync sweep generator with 3 ranges from 10 Hz to 10 kHz. Can be used as an ordinary oscilloscope from 10 Hz to 50 kHz.

Kit SB-614, 17 lbs., mailable **139.95***

SB-644 remote VFO

Designed exclusively for the SB-104. It provides split transmit and receive control and you aren't frequency-limited in any way — transmit at one end of the band, receive at the other. The "644" even has two crystal positions for fixed-frequency control. The "644" has a linear dial, but the exact frequency is displayed on the "104's" digital readout. The display automatically changes when switching from transmit to receive.

Kit SB-644, 10 lbs., mailable **119.95***

SB-604 station speaker — response-tailored to SSB

Designed to match the SB-104 in styling and performance. The "604" uses a 5 x 7", 3.2-ohm speaker. And there's room inside for the HP-1144 power supply. With connector cable and plug.

Kit SB-604, 8 lbs., mailable **29.95***

Heathkit "202"...

...top value standard for 2-M transceivers

The HW-202 puts you on "two" at a price you want to pay, with the features you need. It operates on any 2 MHz segment from 143.9 to 148.3 with independent selection of 6 transmit and 6 receive channels, and all 12 can be netted. A solid 10 watts min. transmitter output, a hot 0.5 μV receiver sensitivity. Dual-gate MOSFET front end... IC IF...dual conversion...10.7 MHz crystal filter ...built-in hash filter/voltage regulator...crystals for 146.94 MHz...push-to-talk mike...quick-connect cable for 12 V hookup...antenna coax jack ...quick-release gimbal mount...complete alignment procedures using the front panel meter... and a complete line of accessories to put you on "two" with maximum versatility and low cost.

Kit HW-202, 11 lbs., mailable 179.95*

Crystal Certificates.

Order from Heath, mail certificates to crystal mftr., get the crystals you specify, postpaid.

HWA-202-6, one Transmit Crystal certificate 5.95*

HWA-202-7, one Receive Crystal certificate 5.95*

Tone Burst Encoder.

Put this in your "202" so you don't have to whistle while you work repeaters. 4 tone buttons can be preset to any tone between 1800 and 2500 Hz. Burst duration is adjustable. Stability is ±1% from −30° to +50°C. Mounts behind removable front panel bezel of your "202".

HWA-202-2, 1 lb., mailable 24.95*

AC Supply.

To work your "202" as a fixed station. Delivers 13.8 VDC @ 2.2A. with better than 1% regulation. Circuit breaker protected. Wire it for 120 or 240 VAC. Includes 3-wire line cord and transceiver cables.

HWA-202-1, 7 lbs., mailable 29.95*

40-watt 2-M Amplifier.

Hauls up fringe repeaters by putting out a minimum 40 W from 10 W input. Only 7A battery drain, and so compact (3 x 4¼ x 5½) that it fits anywhere. Internal antenna changeover relay and sensing circuitry for automatic T/R switching. Tuned input/output circuits for low spurs and coverage of any 1.5 MHz portion of 143-149 MHz.

Kit HA-202, 4 lbs., mailable 69.95*

Mobile 2-M antenna; ⅝-wave whip w. rear deck clip mount has 3.4 dB gain over ¼-wave. Inc. 17′ coax.

HWA-202-3, 2 lbs., mailable 19.95*

Fixed 2-M antenna; ⅝-wave vertical w. radials has 3.4 dB gain over ¼-wave; for mast mt.; less coax.

HWA-202-4, 4 lbs., mailable 17.95*

New mobile 2-M colinear; ¼ & ⅝-wave phased radiators; 5.2 dB gain; swivel trunk lip mt. 17′ coax.

HWA-202-9, 4 lbs., mailable 37.95*

New fixed 2-M colinear; two ⅝-wave phased radiators; 6 dB gain; for mast mt. Heavy duty. Less coax.

HWA-202-10, 7 lbs., mailable 47.95*

Send for FREE Catalog

HEATH
Schlumberger

Heath Company,
Dept. 12-07
Benton Harbor, MI 49022

☐ Please send free catalog
☐ Enclosed is ________, please send models ________

NAME ________________
ADDRESS ________________
CITY ________ STATE ________ ZIP ________

*MAIL ORDER PRICES; F.O.B. FACTORY.
PRICES & SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

AM-313

CQ

JULY, 1975 VOL. 31, NO. 7

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class Postage paid at Port Washington, N.Y. and Miami, Florida. Subscription Prices one year, $7.50; two years $13.00; three years, $17.00. Entire contents copyrighted 1975 by Cowan Publishing Corp. CQ does not assume responsibility for unsolicited manuscripts. 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

now...
Your Kenwood line does more

the new TV-502 2 meter transverter

Kenwood engineering scores again. . . the TV-502 transverter now adapts any TS-520 transceiver or T-599/R-599 combination to transmit and receive SSB or CW on the two meter band.

- **All solid-state**
- **144 to 146 MHz**
- **SSB, CW**
- **Output impedance 50 ohms**
- **8 watts power output** (W/AC)
- **Frequency stability ± 200 Hz after warm-up**
- **Styled to match the TS-520**
- **Price $249.00**

the new K-2000 full power linear amplifier

The brand new K-2000 linear amplifier is the perfect companion for your TS-520 or T-599A. It is compact, reliable and priced right. Uses two Eimac 8873 grounded grid triodes cooled thru a large heat sink. The K-2000 offers a full 2 KW PEP input for SSB operation and provides amateur band coverage from 80-10 meters. Provides a built-in solid state power supply, built-in antenna relay, a relative RF power indicator, and built-in quality to match much more expensive amplifiers. The K-2000 comes completely wired and ready for operation.

Amateur Radio's New First Family

The TS-900, TS-520, R-599A, and T-599A in a few short years have established new levels of achievement in communications for amateur radio. Inspired engineering, careful attention to quality, beautiful styling. . . these have become the hallmark of the Kenwood family. Now your Kenwood line does more. The TS-520 or T-599A operated with the new K-2000 amplifier provides the full power capability you need. Combined with the TV-502 they provide the 2 meter performance on SSB or CW which gives you "Oscar" capability and introduces you to the exciting new experience of 2 meter DX.

Available from Kenwood 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.

ZERO BIAS

"The RFI Bill: H.R. 7052"

A Guest Editorial by W4UMF

On May 15, 1975, the Honorable Charles A. Vanik (Ohio) introduced a bill on radio-frequency interference (RFI) into the House of Representatives. Known as H.R. 7052, the bill would give the Federal Communications Commission (FCC) the right to regulate the manufacturers of electronic home-entertainment devices such that the susceptibility of these devices to strong r.f. fields is reduced. Upon its introduction, the bill was referred to the House Committee on Interstate and Foreign Commerce, and specifically to the Subcommittee on Communications.

Before the bill can be sent to the House floor for a vote, it must receive a hearing. To receive a hearing, however, the Subcommittee on Communications must be made aware of our support for such legislation. In short, we must write letters and send telegrams so as to convince the Chairman of the Subcommittee, Mr. Torbert Macdonald, of our support for H.R. 7052.

The letters do not have to be long. Even a note to the effect that you support H.R. 7052 and request an early hearing on this bill would be a valuable contribution to the effort. Those who wish to include background material on their RFI problems are encouraged to do so. What is important is that you do write, and that you do it today. Send your letter or telegram in support of H.R. 7052 to:

The Honorable Torbert H. Macdonald
Chairman
Subcommittee on Communications
Room B331
Rayburn House Office Building
U.S. House of Representatives
Washington, D.C. 20515

It would also be a good idea to write your own Congressman; after all, he will have to vote on the bill when it reaches the House floor.

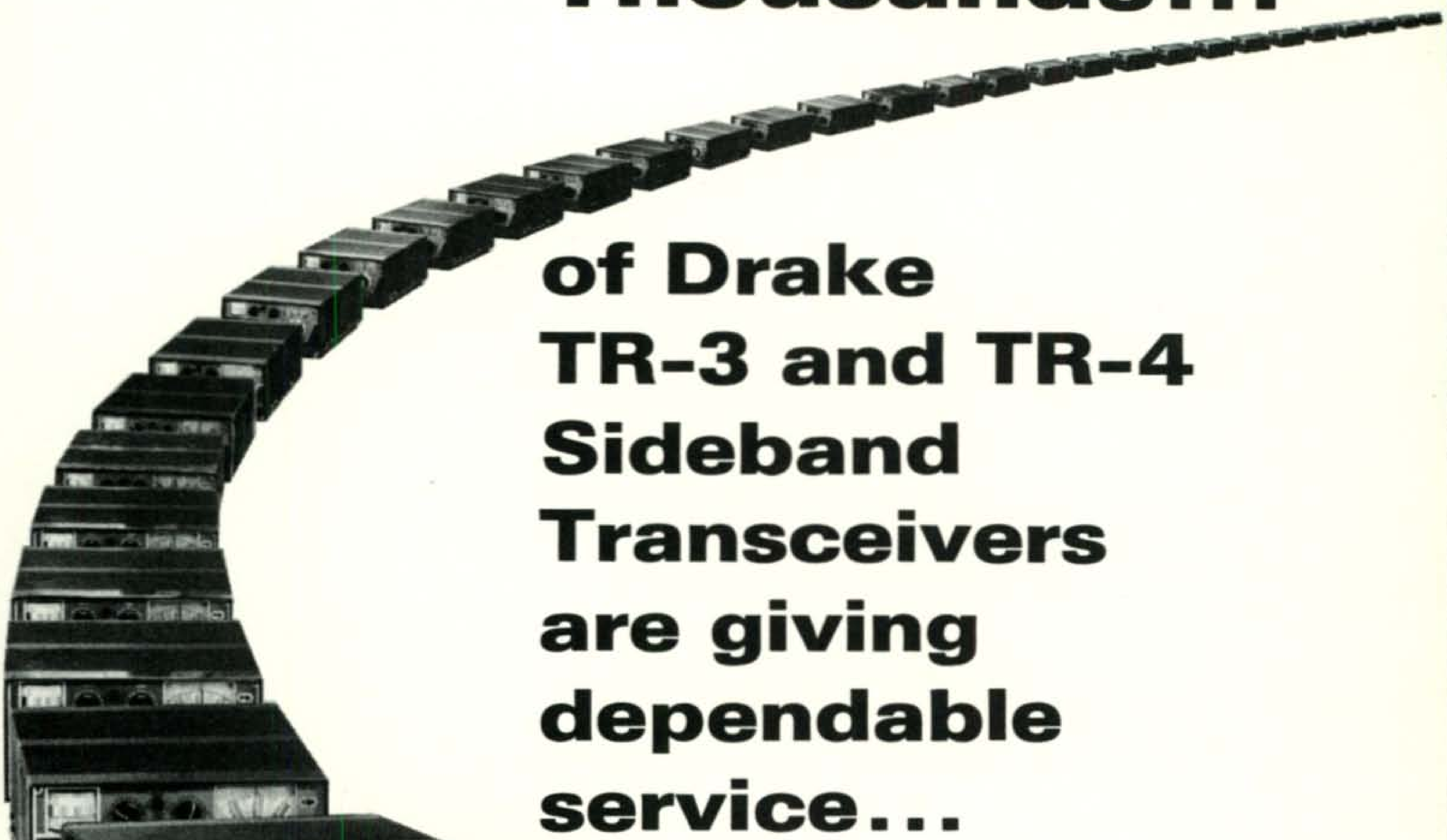
The time is right for legislation such as that proposed by Mr. Vanik. Consumers are becoming increasingly aware of what we Amateurs have known for a long time; that is, that the majority of RFI problems are not due to interference *per se,* but are due to the inadvertent interception of signals by devices which were not designed to receive these signals.

RFI is the biggest black eye we in the Amateur Service have. And we now have the opportunity to do something about the problem. It is up to each of us to let Mr. Macdonald know that the RFI problem must be solved now, and that it must be solved for all time.

Write today! Make your voice heard!

Ted Cohen, W4UMF

Thousands...



of Drake TR-3 and TR-4 Sideband Transceivers are giving dependable service...

many of them
since 1963!

And now the Drake **TR-4C**

is already surpassing their record!

Now at your dealer's

DRAKE®

R. L. DRAKE COMPANY

540 Richard St., Miamisburg, Ohio 45342
Phone: (513) 866-2421 Telex: 288-017

OUR READERS SAY

The Invisible Man

Editor, *CQ*:

Thank you for presenting William Orr's article concerning FCC Docket 20282. That last section, "What Amateurs Can Do" should be run off and a copy sent to all W/K's. The increasing complexity of our hobby practically necessitates a little advice and help along the way. I can think of only one ham that I am aquainted with who made it without the help of an Elmer in one form or another. Orr was right in mentioning the potential of technically-minded CBers, all they need is encouragement. The preservation of amateur radio should be the concern of every licensed ham, with or without Docket 20282.

Wayne P. Kuzelka, WBØFMR
New Prague, MN

Editor, *CQ*:

In response to William Orr's (W6SAI) article in April '75 *"CQ* Amateur Radio - The Invisible Man" His comments on what amateurs can do to help novices and advance amateur radio through in creasing the numbers of amateurs are good solid ideas.

However he's a little off base on his comments on the FCC. True, some offices are in old federal buildings, true, those old buildings have slow, one floor per minute elevators. But those buildings also house other federal agencies. True some FCC personel are indifferent. However, all those other agencies have grim indifferent personel. Walk from FCC to IRS down the hall and a 40 w.p.m. code proficiency award won't help their indifference.

I visited the Dallas FCC office late last year to obtain a 610 form. I was on a business trip to Dallas and thought I'd case the joint. It's located in a multi-million dollar building with brightly lighted halls and an elevator that traveled to the ump-teenth floor applying approximately 2G's to the ole body. Heaven knows if I'd been going for the test I'd have lost at least 5 w.p.m. code ability in that elevator ride.

I walked in on a commercial phone test in progress and thought, "Boy, I've made a grave mistake." When the lady at the desk asked, "May I help you," I thought, I'll just ask her if this is the IRS office.

However, she was so pleasant, I asked if I could get a 610. She gave me the form, then got another, and stated maybe I'd need an extra one. She was so pleasant, I thought, this won't be so bad at all when I come back for the test, provided I can get over the elevator ride.

When leaving, I rode that super shaft up and down several times to get the feel of it.

Mr. Orr's comments on the exams being unrealistic, ambiguous, and poorly worded as related to him by amateurs who had recently taken the exam most certainly come from amateurs who had probably failed a previous test. From experience, I can say that if you are not prepared, the questions do appear just as Mr. Orr stated. I took the Novice test in February and even though I passed it, I spent one hour on 20 questions.

I found out right then, that you don't just walk into a FCC test and knock it out simply because you know enough not to plug your earphones into the microphone jack.

I spent 60 days studying for the General test, and this week I went to Oklahoma City, walked into an old marble floored dimly lit federal building with a very comfortable old slow elevator, took 2 minutes to get to the second floor walked passed the IRS office, peeked in to get in shape for that traveling FCC monster to show up and scare hell out of us.

He showed on schedule with that scarey sinister looking code machine and 50 pounds of forms. Also in his bag of tricks was 5 or 6 dozen pencils. I thought, could it be that the FCC regulations mentioned something about having to use their special pencils and I had missed that section and paragraph? I had brought my ole trusty code copy pencil and wanted to use it! Bad Monster! Well to my relief, I found out he brought those pencils for those so poorly prepared, that they didn't even bring a pencil.

I found out by asking this monster a stupid question, "Can I use my pencil" - No fire came forth from his mouth, only a simple yes. Here at this point, I suppose you might say he was indifferent because he didn't stop to admire my faithful ole code copy pencil. He didn't have time he was answering questions from all sides, all stupid questions, not once did I hear him answer a question that wasn't in the Rules and Regulations. One question popped up when he said the code tape would start off with the word Paris sent 5 times. He had to explain the word Paris was the name of a city in France!

Mr. Orr quoted an amateur in his article as stating in reference to the failure rate, that something was wrong with either the examinee, the examination, or the way the exam is given.

Again from experience, I can say, that preparation is the name of the game. I prepared for the General, however, I thought I was prepared for the Advanced. I passed the General, and flunked the Advanced.

When I go back to fight this monster in about 60 days, my blade will be sharper, and I shall carry that Advanced ticket away only to return a year later for the final stab at the Extra.

I feel your readers deserve this response to Mr. Orr's comments on the FCC and its testing procedures. I was fortunate, as I read the article after I took the exam. I'm sure that a bunch of Novices have read his remarks and he has only added to their nervousness. He remarked in the paragraph titled "The Hazard of the FCC" to wit - "...and woe betide the Novice who attempts to deal with these surly minions. He is doomed to fail, but not because of his own shortcomings." His remark is not consistant with a later remark in his paragraph titled "What Amateurs Can Do!" when he states, "Assign a licensed, General Class (or higher) amateur to be a "Big Brother" to Novices and pre-Novices."

Heaven help the novice he might take under his wing, he is doomed to fail, but not because of his own shortcomings.

C. Don Hagler: WN5OCN Awaiting WB5OCN
Lawton, OK

Announcements

● **Surrey British Colombia** – The Maple Ridge Amateur Radio Club, in Maple Ridge, B.C. will hold its second annual Hamfest on July 11, 12, and 13, 1975 at the Maple Ridge Fairgrounds. There will be displays, contests and technical seminars. Location: 30 miles east of Vancouver on the north side of the Fraser River. Pre-registration, is $6.00 write to the Maple Ridge Amateur Radio Club, 3145 176th St., Surrey, B.C., Canada V3S 4N8. ● **Dunseith, North Dakota and Boisseuain, Manitoba** The 12th Annual International Hamfest is scheduled for July 12th and 13th, 1975 at the International Peace Garden. There will be prizes and various activities. For more information contact John McCann, 1234 Valley View Dr., Minot, ND 58701.

● **Oak Creek, Wisconsin** – The South Milwaukee Amateur Radio Clubs 5th annual Wisconsin Swap-Fest will be held Saturday, July 12, 1975 at Shepard Ave., Oak Creek, WI. Admission is $1.00. Obtain more details from: S.F. Schreiter, W9AKF, 104 Brookdale Dr., South Milwaukee, WI 53172.

● **Atlanta, Georgia** – The 47th Annual Atlanta Ham Festival will take place July 5th and 6th, 1975 For more information write: Atlanta Ham Radio Festival, P.O. Box 76553, Atlanta, Georgia 30328. ● **Harrisburg, PA** – The Harrisburg Radio Amateur Club Hamfest is Sunday July 6, 1975, at the Indian Echo Caverns between Harrisburg and Hershey off Rt. 422-322. Registration $2 at the door. ● **Honolulu, Hawaii** – SAROC will present it's first Hawaiian Convention July 18 and 19, 1975 at the Sheraton-Waikiki Hotel, Honolulu, Hawaii. Exhibits and coctail party will take place. Direct-all inquiries to SAROC, P.O. Box 945, Boulder City Nevada 89005. ● **Palmyra, IL** – The Quad-Co. Amateur Radio Club, Inc., will sponsor the 18th Annual Hamfest of the "Breakfast Club" on July 19 and 20 at Terry Park, 3/4 mile east of Palmyra, IL. There will be games, golfing and fishing. Write "Hamfest", c/o Quad-Co. ARC, Box 81, Chatham, IL 62629. ● **Oak Ridge, Tennessee** – The Oak Ridge Amateur Radio Club, Inc., Annual Crossville Hamfest is July 19-20 at Crossville, TN. Events will be held at the local Holiday Inn and at nearby Cumberland Mountain State Park. ● **Mckees port, Pennsylvania** – The Two Rivers Amateur Radio Club of McKeesport, PA will hold their 11th Annual Hamfest on July 20 1975 at the Green Valley Volunteer Fire Station. For further information, contact Donald J. Mysiewske, K3CHD 359 McMahon Rd., North Huntingdon, PA 15642.

● **Cary, North Carolina** – The Cary ARC will hold the third annual Mid-summer Swapfest, Saturday, July 19, 9am to 3pm. It will be at the Lions Club Shelter, Cary, NC (near Raleigh). For information SASE to K4FBG, 1022 Medlin Dr., Cary, NC 27511 ● **Traverse City, Michigan** – The Cherryland Amateur Radio Club welcomes all Northern Michigan Hams to their picnic July 27th at Whitewater Township Park in Williamsburg (just outside of Traverse City). There will be boating, fishing and swimming. For more details write to W8GI, Box 176, Kingsley, MI 49649. ● **Idaho Falls, Idaho** – The 43rd annual WIMU Hamfest will be held August 1,2, and 3,

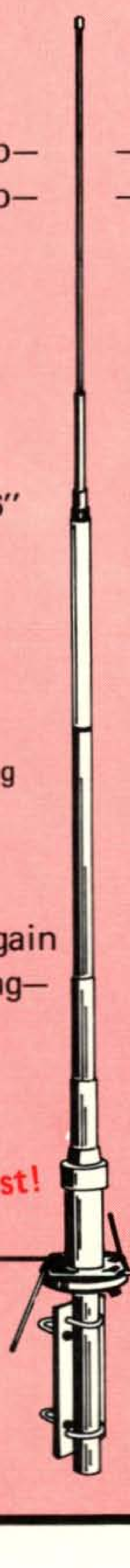
[*Continued on page 71*]

new

HUSTLER®

the real performer! specifically for repeater

...or any **TWO-METER FIXED STATION OPERATION**



With 6 db— —Gain compared to ½ wave dipole
db— —FCC accepted for repeater application

mechanical

Vertical element—117" long, 1-1/8" telescopic to 3/8" OD high strength aluminum

Radials—four, 21" x 3/16" OD aluminum rod

Connector—SO-239

Wind load—26 pounds at 100 mph.

Wind survival—100 mph.

Completely self-supporting

Mounting—fits vertical pipe up to 1-3/4" OD

electrical

6 db. gain over ½ wave dipole

Omnidirectional radiation pattern

Maximum radiation—at horizon

50 ohm feed impedance

Field adjustable—140-150 MHz

SWR at resonance—1.2:1 measured at antenna

Bandwidth—6 MHz for 2:1 or better SWR

Power—one kilowatt FM

Feed—Shunt with D.C. grounding

Radiator—5/8 wave lower section, ¼ wave phasing, 5/8 wave upper section

The gain you gain—you gain transmitting and receiving—get both with Hustler!

Available from all distributors who recognize the best!

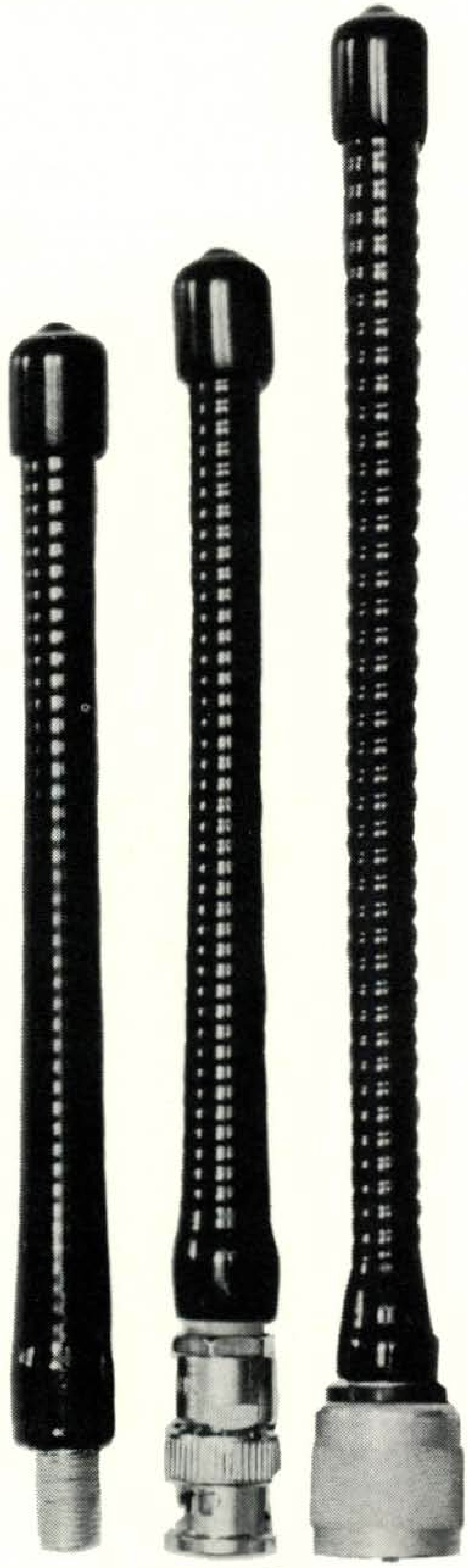
THE HUSTLER MASTER GAINER
MODEL G6-144-A
Shipping Wt.: 6.8 lbs.

new-tronics corporation
15800 commerce park drive, brook park, ohio 44142

Exporter: Roburn Agencies, Inc., New York, N.Y.

hy-gain 2-meter antenna for hand-held transceivers

144-148 MHz



This rubber duckie is one tough antenna!

When the going gets tough, Hy-Gain's flexible 2-meter antenna is the one to have. So short, it goes where whips can't. Continuously loaded for optimum performance and completely insulated with a special vinyl coating, it won't crack or break, no matter how you bend it. Cannot be shorted out accidentally! Designed with the same care and excellence in engineering that produces our superb commercial and mobile antennas. Whether your 2-meter hand-held is one of the fine commercially available units or a beauty you built yourself, this is the antenna that can go where you go!

Available with three connector types and tuned for optimum performance:

Order No. 274 BNC or 'snap' fitting, fits Tempo, Wilson, Ken Product, Clegg and other popular hand-held 2-meter transceivers.

Order No. 275 Accepts SO-239 connector, fits Drake and Motorola.

Order No. 269 Male screw 5/6 x 32, fits Motorola, GE, Johnson, RCA Comco and Standard.

For information on the complete line of fine Hy-Gain Amateur products, see your Hy-Gain distributor or write:

hy-gain

Hy-Gain Electronics Corporation; 8601 Northeast Highway Six; Lincoln, NE 68507; 402/464-9151; Telex 48-6424
Branch Office and Warehouse; 6100 Sepulveda Blvd., #322; Van Nuys, CA 91401; 213/785-4532; Telex 65-1359.
Distributed in Canada by Lectron Radio Sales, Ltd.; 211 Hunter Street West; Peterborough, Ontario.

TEN-TEC ULTRAMATIC KEYER

MODEL KR50

- **SUPERLATIVE "FEEL" 5-50 GRMS PADDLE FORCE**
- **AUTOMATIC OR MANUAL WEIGHTING**
- **DIT AND DAH MEMORIES WITH SEPARATE DEFEATS**
- **"STRAIGHT KEY" OVERRIDE FOR QRS OR TUNE-UP**
- **GUARANTEED FOR LIFE BEARING PIVOTS**

A sparkling new keyer with a host of exciting features. A powerful aid to cleaner, more articulate CW that is relaxing to use and a joy to copy.

The paddle assembly will delight the CW purist as well as the recent graduate from a bug or hand key. The superlative "feel" is attained by a magnetic return force, instantly adjustable to exactly the right touch for you.

Weighting, the ratio of dit and dah (bits) lengths to the spacing between them, is either automatically or manually varied. In the automatic position, it is programmed to lengthen the bits at slow speed for enhanced smoothness and decrease them as you advance the speed, for highest articulation. Or, it can be adjusted to a constant value.

The KR50 is versatile. Dit and dah memories are provided for full iambic (squeeze) keying. Either dit or dah, or both, may be turned off for operation as a conventional type keyer. Self-completing characters at all times.

A convenient "Straight key" is built-in for QRS sending or tune-up. Also an internal side-tone and 115VAC/12VDC operation is provided.

The KR50 is designed to have a permanent place in your shack for the years, perhaps decades, ahead. An investment in the enjoyment of CW.

PRICE $110.00

KR20-A

Paddle has unique principle with excellent feel for rhythmic CW. Characters are self-completing. Bit weighting is optimized for normal speeds. Manual key button conveniently located for hand sending. Side tone signal. Reed relay. Plug-in circuit boards. 115VAC or 6 to 14 VDC. HWD 2½" X 4½" X 8¼", Wt. 2½ lbs.

PRICE $67.50

KR1-A

This is the paddle mechanism used in the KR50. Requires 6-14 VDC for adjustable electro-magnetic paddle return force. Adjustable contact spacing. For iambic or conventional keyers. "Straight key" button. Housed in an attractive metal case with cream front panel, walnut vinyl top. Size: 2" X 4" X 6", Wt. 1½ lbs.

PRICE $25.00

KR5-A

Similar to the KR20A but without monitor signal and AC power supply. A great value. For 6-14 VDC operation. Size HWD 2" X 4" X 6". Weight: 1½ lbs.

PRICE $38.50

KR2-A

The paddle used in the KR20A. Single paddle for non-iambic keyers. "Straight key" button conveniently located, cream aluminum case with walnut vinyl top. Size: 2" X 4" X 6", Weight: 1½ lb.

PRICE $15.00

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862
EXPORT: 5715 LINCOLN AVE., CHICAGO, ILL. 60646

See TEN-TEC Keyers at these dealers • **CALIFORNIA** / Quemont, San Jose • M-Tron, Oakland • Henry Radio, Los Angeles • Western Radio, San Diego • **CONNECTICUT** / Hatry Electronics, Hartford • **FLORIDA** / Amateur Elect. Supply, Orlando • **INDIANA** / Graham, Indianapolis • Van Sickle Radio Supply, Indianapolis • Hoosier, Terre Haute • **IOWA** / Hobby Industry, Council Bluffs • **KANSAS** / Associated Radio Comm., Overland Park • Electronics, Inc., Salina • **KENTUCKY** / Mobile Communications, Louisville • **MASSACHUSETTS** / Tufts Radio Elect., Medford • **MICHIGAN** / Purchase Radio, Ann Arbor • Radio Supply & Eng., Detroit • Electronic Distributors, Muskegon • **MINNESOTA** / Electronic Center, Minneapolis • **MISSOURI** / Ham Radio Center, St. Louis • **MONTANA** / Conley Radio, Billings • **NEW JERSEY** / Arrow Electronics, Totowa • **NEW YORK** / Arrow Electronics, Bayside & New York • Harrison Radio, Farmingdale & Valley Stream • Grand Central, New York • Adirondack Radio, Amsterdam • CFP Enterprises, Lansing • **NORTH CAROLINA** / Vickers, Durham • **OHIO** / Amateur Electronic Supply, Cleveland • Ken-Mar Industries, Alliance • ARC Electronics, Columbus • Challenger Electronics, Middletown • **PENNSYLVANIA** / Electronic Exchange, Souderton • Hamtronics, Trevose • **SOUTH DAKOTA** / Burghardt Amateur Center, Watertown • **TEXAS** / Douglas Electronics, Corpus Christi • Madison Electronics, Houston • Tucker (TECO), Garland • **VIRGINIA** / Arcade Electronics, Annandale • Radio Communications, Roanoke • **WASHINGTON** / Amateur Radio Supply, Seattle • **WISCONSIN** / Amateur Elect. Supply, Milwaukee • **CANADA** / Ray Hunter, Toronto

CLIP OUT AND ORDER NOW

THIS PAGE IS YOUR ORDER BLANK!

ORDER NOW AND SAVE!

Specials at Unbeatable Prices

GENAVE, 4141 Kingman Dr., Indianapolis, IN 46226

HEY, GENAVE! Thanks for the nice prices! Please send me:

☐ 

GTX-200-T
2-meter FM, 100 channels, 30 watts (incl. 146.94 MHz) — Special Introductory Price **$249.95**

☐ 

GTX-200
2-meter FM, 100 channels, 30 watts (Incl. 146.94 MHz) — **was $299.95** — NOW **$199.95**

☐ 

GTX-100
1¼-meter FM, 100 channels, 12 watts (Incl. 223.5 MHz) — **was $309.95** — NOW **$219.95**

☐ 

GTX-10
2-meter FM, 10 channels, 10 watts (Incl. 146.94 MHz) — **was $239.95** — NOW **$169.95**

☐ 

GTX-2
2-meter FM, 10 channels, 30 watts (Incl. 146.94 MHz) — **was $299.95** — NOW **$189.95**

☐ 

GTX-600
6-meter FM, 100 channels, 35 watts (Incl. 52.525 MHz) — **was $309.95** — NOW **$219.95**

	@	$______
☐ **ARX-2 2-M Base Antenna**	@ $29.95	$______
☐ **Lambda/30 2-M Base Antenna**	@ $39.95	$______
☐ **Lambda/4 2-M Trunk Antenna**	@ $29.95	$______
☐ **TE-I Tone Encoder Pad**	@ $59.95	$______
☐ **TE-II Tone Encoder Pad**	@ $44.50	$______
☐ **PSI-9 Port. Power Package** (less batteries)	@ $29.95	$______
☐ **PS-1 AC Power Supply**	@ $59.95	$______

and the following **standard** crystals @ $4.25 each: ______ $______

Non-standard crystals @ $5.75 each: ______ $______
(allow 8 weeks delivery.)

For factory crystal installation add $8.50 per transceiver. Sub-Total: $______

IN residents add 4% sales tax: TOTAL: $______

CA residents add 6% sales tax: *(minimum order $12.00)*

All orders shipped post-paid within continental U.S.

NAME______ AMATEUR CALL______

ADDRESS______ CITY______ STATE & ZIP______

Payment by: ☐ Certified Check/Money Order ☐ Personal Check ☐ C.O.D. Include 20% Down.

Note: Orders accompanied by personal checks will require about two weeks to process.

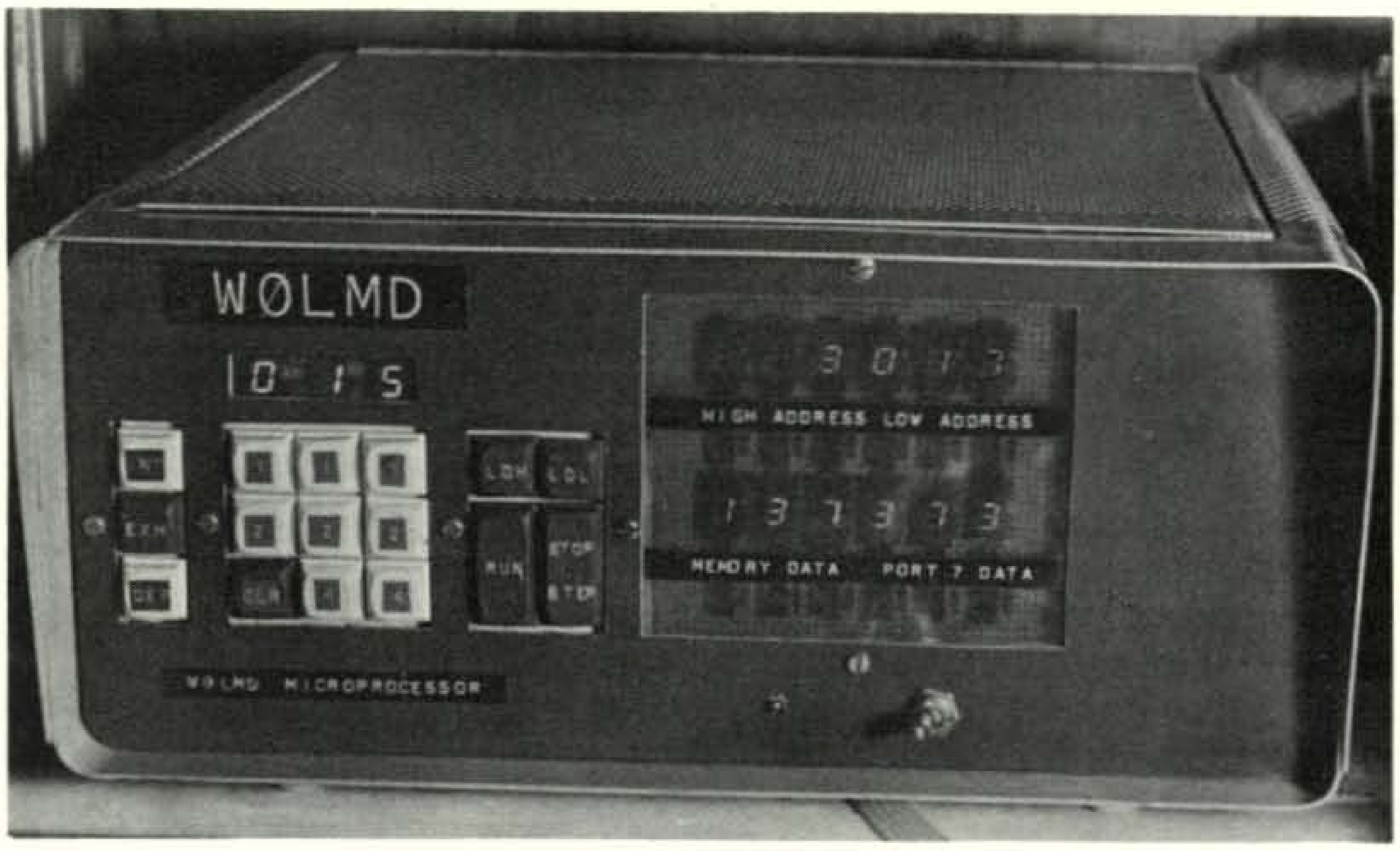
☐ 20% Down Payment Enclosed. Charge Balance To:

☐ BankAmericard #______ Expires______

☐ Master Charge #______ Expires______ Interbank #______

Prices and specifications subject to change without notice.

The WØLMD Microprocessor using an Intel 8008 CPU, 8 bits × 2K of memory, and designed for cassette, keyboard and TV input/output.



The Microprocessor in the Hamshack

BY DR. ROBERT SUDING,* WØLMD

THE recent cost reductions in ICs and the terrific interest of amateurs in using these devices is setting the stage for the next major breakthrough, the computer in the amateur station. Imagine automatic logging, frequency checking, voltage checking, name lookup, and unattended message reception and storage. Type a call and your beam turns toward that station, and a TV set displays his name, QTH and anything special. These things aren't dreams anymore. For considerably less than a kilobuck, you can have your own microcomputer system in your hamshack.

Computers have long been very expensive devices, available only to the largest of companies. Over the past 5 years or so, the size and price has reduced so that even smaller businesses can share in the benefits derived from automated operations. Still, even the cheapest "system" ran around $5,000, so they were not within the reach of the amateur. Enter the microcomputer! This device is a single IC, usually, but within it are many of the same functions that the large full size computers possess. The cost? Some advertisers are asking $28 for one of these microcomputer ICs, the Intel 8008.

The Computer

So what's a computer? Well, the dictionary says that it's an electronic machine which performs calculations. Hmm, not much help. That describes a $16 pocket calculator too. Really, from our point of interest it is a complex assortment of logical elements which can take various input formats, perform some kind of processing on these inputs, and deliver a desired output. The basic operation may be drawn as shown in fig. 1.

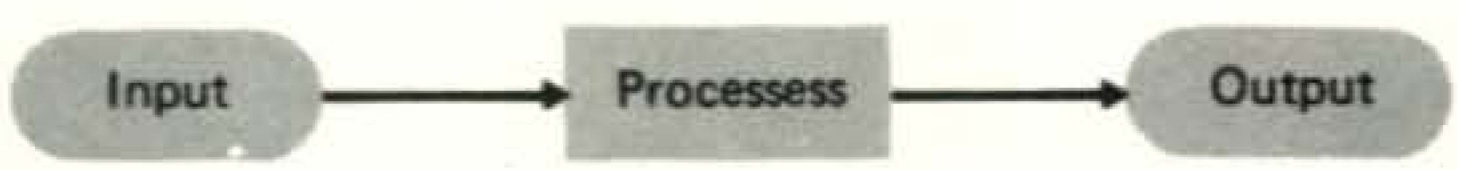


Fig. 1—The basic computer process.

Let's take an example in the ham station. The ham wants a name lookup function to be performed. The microcomputer is instructed how to process the operation, and is given a list of all of the calls, names and other relevant data.

Input	Processes	Output
Call Letters Table of calls, names, etc.	1. Receive & analize call letter input from keyboard. 2. Search Call Table for desired call. 3. Format name area. 4. Format QTH area. 5. Format add'l info area.	Name, QTH, Add'l info. Bearing

Fig. 2—The computer Call-Letter lookup process

*370 South Queen Street, Lakewood, CO 80226

The operator then inputs the call letters by typing them on an attached keyboard. The microcomputer processes this input by searching its memory files for the needed data. When the needed data is found, the microcomputer organizes it and outputs it to a TV set attached to the microcomputer. This example can be written in the fig. 2 format.

Now we have the information at hand. The output may then be used to turn the antenna towards this station. This process uses the previous output bearing as one input and the command "Turn" to initiate the needed processing. The output goes to the antenna rotator. Figure 3 shows this process.

Input	Processes	Output
Type "TURN"	1. Decode command data	Turn rotator.
Bearing	2. Convert to format required by rotator.	

Fig. 3—The computer rotator drive process.

Obviously, we could include both the call/name lookup and rotation in a single processing operation. Fully automatic rotation would not be desirable, however, since group contacts would result in continual turning.

Microcomputer RTTY

Teletype is a natural on the microcomputer, which can replace bushels of ICs. The ham could input the output of his RTTY TU to the micro, inputting the received RTTY to the microcomputer. From here in, it's wide open!

1. The microcomputer can translate the Baudot to ASCII and output it through a TV typewriter.

2. The microcomputer can check the incoming RTTY for your call and only type out your messages.
   - a. If unattended, hardcopy can be produced.
   - b. The microcomputer could accept only messages from certain stations.
   - c. The microcomputer could auto-answer back "I'm listening."

3. The microcomputer could accept input at any speed and return the output at another speed and/or code.
   - a. Uneven typing smoothed.
   - b. 100 w.p.m., etc., stations copied on 60 w.p.m. machines by using memory.
   - c. 60 w.p.m. Baudot delivered to 100 w.p.m. machines.

4. Non-Baudot machines can be used on ham RTTY. 8 level teletype machines can be used unmodified.
   - a. Baudot converted to special code needed, speed changed, on receive.
   - b. Special code converted to Baudot with speed changed on transmit.

5. Library lookup for messages functions and abbreviations.
   - a. Replace paper tape with $20 cassette recorder.
   - b. Send "Customized" canned messages which auto-insert the name and/or call of the station being worked.
   - c. Enter a special character sequence to derive a desired machine function.
   - d. Enter an abbreviated word and get out a completed word or even sentences.

Other Possible Applications

The microcomputer capitalizes on its flexibility. The internal processing operation can be altered to suit another application. This is referred to as "programming the computer." Suppose we decide that we want to use the microcomputer for repeater usage. I really don't know too much about repeaters and their needs, but perhaps I can offer some applications.

1. Repeater access—The microcomputer is given a list of calls who currently have permission (paid their dues) to use. However, emergency operation would override. Visitors would have a limited number of accesses.

2. Repeater logging—Calls, dates, times, exact frequency, total usage, signal strengths, operational trend analysis.

3. Directional Control—Beaming for marginal signals after omnidirectional pickup. Beaming to avoid interference in shared channel areas.

4. ID generation and sequencing.

Make points with the XYL! Record all of her favorite recipes on a cassette. Use the microprocessor to handle the recording operations as a retrieval controller for selective retrieval of data. Suppose she wants to make an entree that uses *XXX*. She loads the recipe cassette, and types *retrieve, supper, XXX*. The system checks through its recipe cassette and outputs the recipe(s) meeting the desired requirements.

The microcomputer also would have many applications in SSTV picture and character generation and sequencing. Strange coded keyboards could be used to input characters, and result in standard ASCII output. Special characters can be generated, as well as digital mixing/generation of video signals.

Test equipment outputs can be sampled and logged. A keyboard could type in the test point number, after which the test probe would be attached. Samples of the voltage, frequency, pulses, logic levels, etc., would be taken and stored. After the desired number were taken, these measurements would then be analyzed on the attached TV set either numerically or graphically.

An extended calculator function has been built which uses one of the new high power calculator chip sets, the Mos Technology 2529, plus the programmable capabilities of the microcomputer. A complete formula needed for a design of some ham gear could be inputted. Test measurements could be mathematically processed and plotted.

As you can see, you are limited only by your imagination as to what you might do with the microprocessor in the ham shack. I would suggest that you think of other applications of the ham microprocessor and send me a copy of your ideas as the basis for a future article on more applications. I would suggest that you put your ideas in the format shown in figures 2 and 3 which emphasize the general processing needs much better than the traditional computer flow charts.

The Microcomputer

The basic design of the microcomputer is usually a single IC called the CPU. Attached to this IC are a number of ICs which provide input, output, memory and control functions as shown in fig. 4.

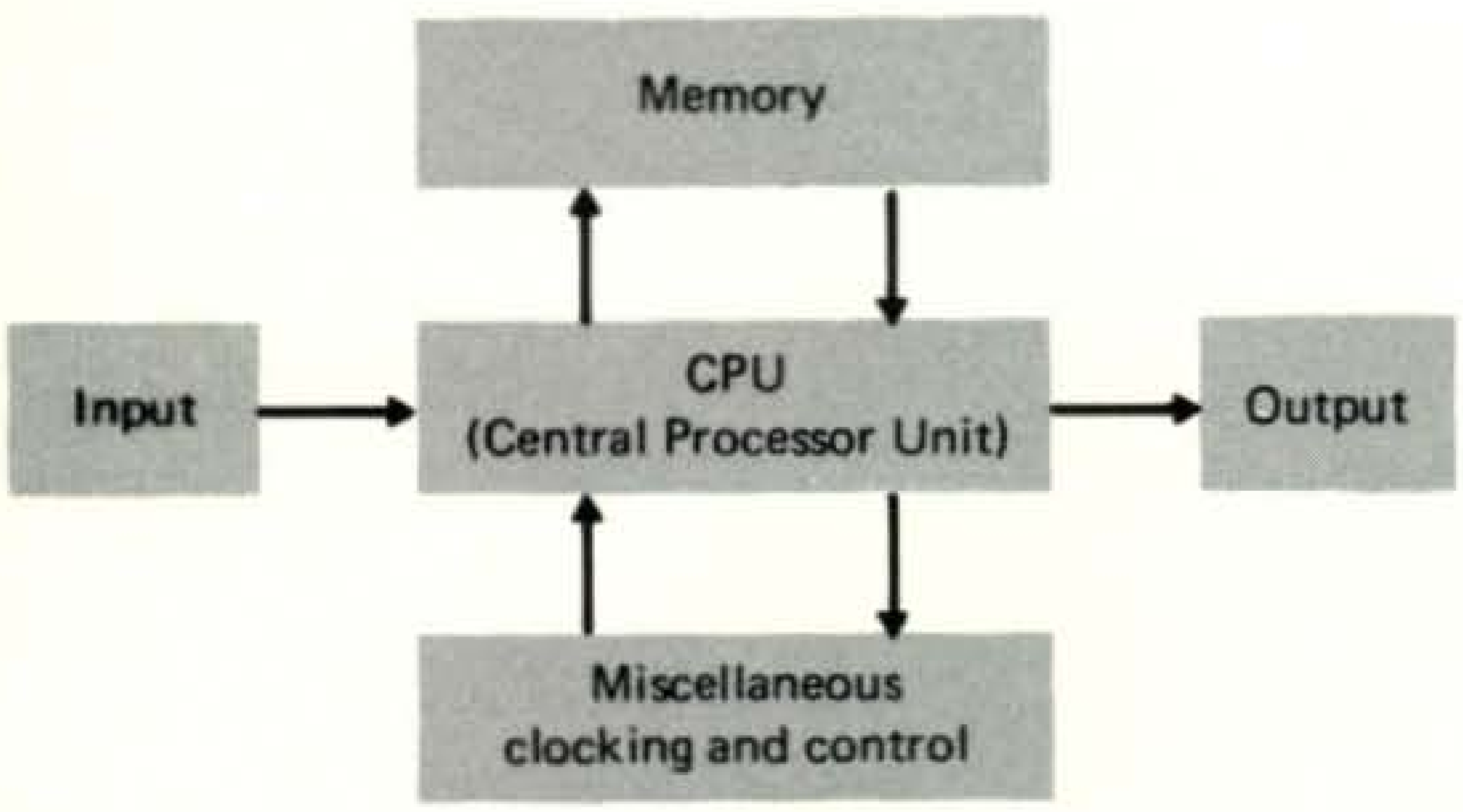


Fig. 4—Basic design of the Microprocessor.

The CPU is the obvious heart of the process. All computers work with some kind of numerical representation of the "outside world." These numerical representations are selected, ignored, combined, re-sequenced, modified, etc., under some kind of control by the operator, generally in the form of a sequence of operations, called a program. Inside the CPU are registers for temporary storage of data being worked on by the microprocessor. Another CPU unit is the ALU (Arithmetic Logic Unit) which performs such operations as add, subtract, move, invert, compare, etc., on a piece or pieces of data. The CPU is able to keep track of what is and was happening, and understand several dozen different types of instructions which may be sent to it.

Some samples of instructions might be:

Add 1 to a number in a certain register.

Subtract 1 from a number in a register.

Put a number into a certain memory location.

Compare one number with another.

Perform an operation only if a certain condition is met.

Wait until something happens.

Sample a certain input port.

Put some data at a specified output port.

The programmer utilizes the computer to control the sequence of operations which must take place for a function to be correctly performed. He keeps the "Input, Processing, and Output" chart in mind, and then figures out all of the logical needs of a correctly operating system. If he has not included all, or has incorrectly specified one or more, the program has "bugs."

Several methods are possible for "programming" a computer, arranged in a hierarchy as shown in fig. 5.

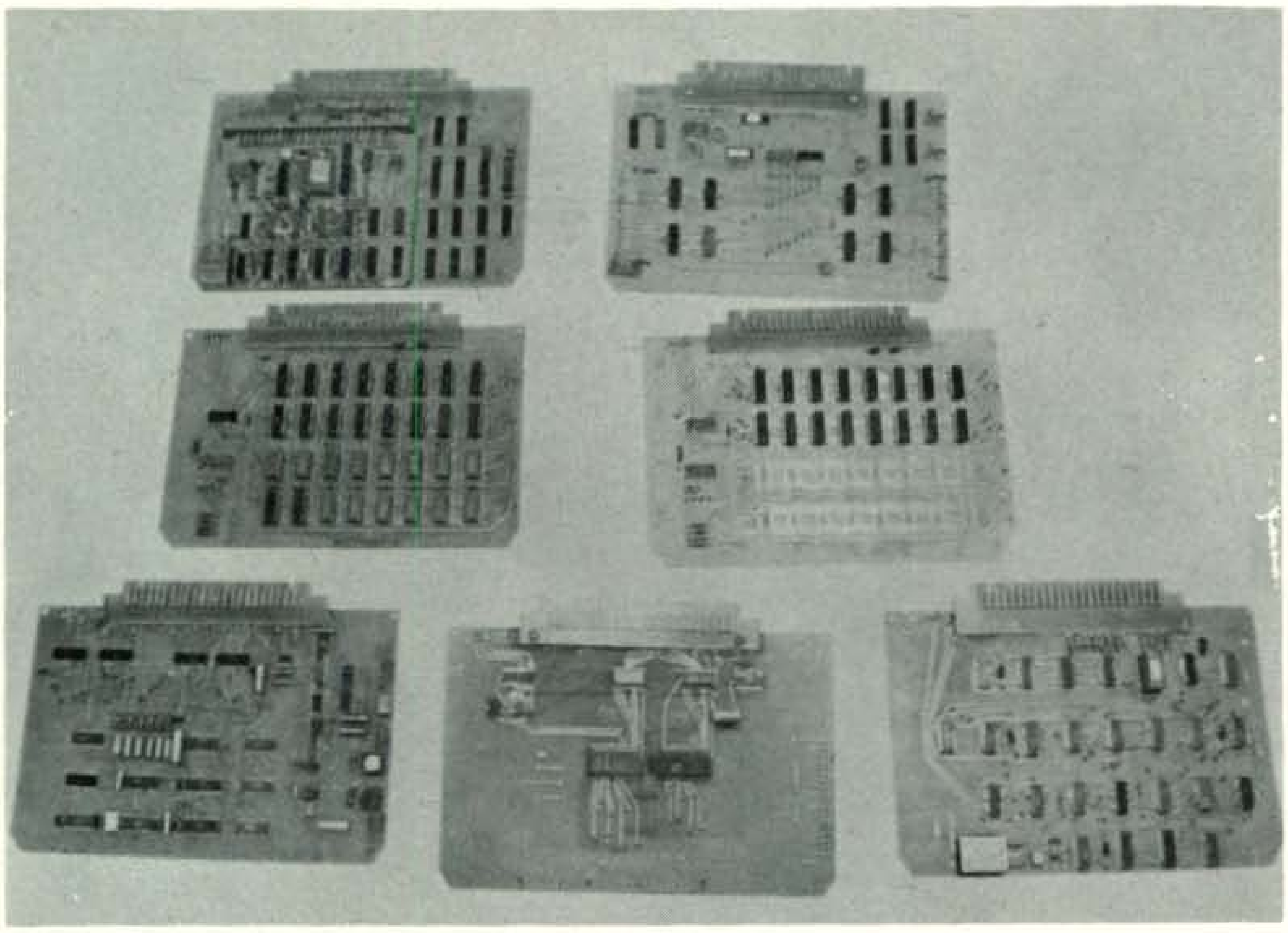
End User Language
↓
Functional Language (Fortran, Cobol, Basic, RPG, etc.)
↓
Macro Language
↓
Assembler Language
↓
Machine Language

Fig. 5—Programming hierarchy.

At the bottom is machine language, at the top, end user language. The machine is only able to directly respond to coded bit streams. The only thing it may understand would be 11001000, for instance. This would tell it to place the character that is now in register A also in register B. Machine language programming consists of building a sequential stack of these instructions, each looking like a block of 0's and 1's, and then telling the CPU to start at the top and have at it.

Talking to the Computer

Trouble is that humans find it very difficult to communicate effectively with only "0 & 1" as the extent of their vocabulary. A simpler (to humans) way was devised using some standard abbreviations which would eventually result in the same operation. *Move B, A* would be a sample command to place the character that is now in register A also in register B, if assembler language were to be used. Unfortunately, the dumb computer doesn't understand assembler, so the manufacturer of the computer provides a special program (in machine language) which allows the computer to accept the assembler language at one of its input ports, and after suitable modification, reduces it to the needed 0's and 1's. Finally the assembler lan-



PC boards used in the WØLMD Microprocessor. Left to right, from the top: TV Readout board, Output board, Memory board 1, Memory board 2, Control/Cassette board, Input board, Intel 8008 CPU board.

guage replaces itself by the new program, and the computer is ready to operate.

Assembler isn't the easiest thing in the world for us mere mortals either. Various systems have been built which avoid all the little "Mickey Mouse" steps, and combine them into a logical block of operations viewed as a complete set, called a "macro." For instance a complete "macro" might be "Read DVM." This macro would have in it all of the trivia in assembler, which would result in the machine language to read the BCD input lines, convert to binary, combine/process, output to CRT, and stop. This building block structure is assembled in many different combinations Tinkertoy fashion as the program requires to fit the application.

Several other programming systems are in popular usage such as "Fortran," "Cobol," "Basic," "RPG," etc. These operate in a manner nearer to the human thought process. The computer programmer again writes out the sequential steps, but this time it is by functional steps from the human viewpoint, rather than the machine viewpoint. The programmer might write:

```
A = 300
B = 5.3
C = A × B
Print C
END
RUN
```

The language compiler takes the programmer's input and reduces it to machine language. The "RUN" instruction tells the machine to start solving the problem, and the answer 1590 is printed on the computer's output device.

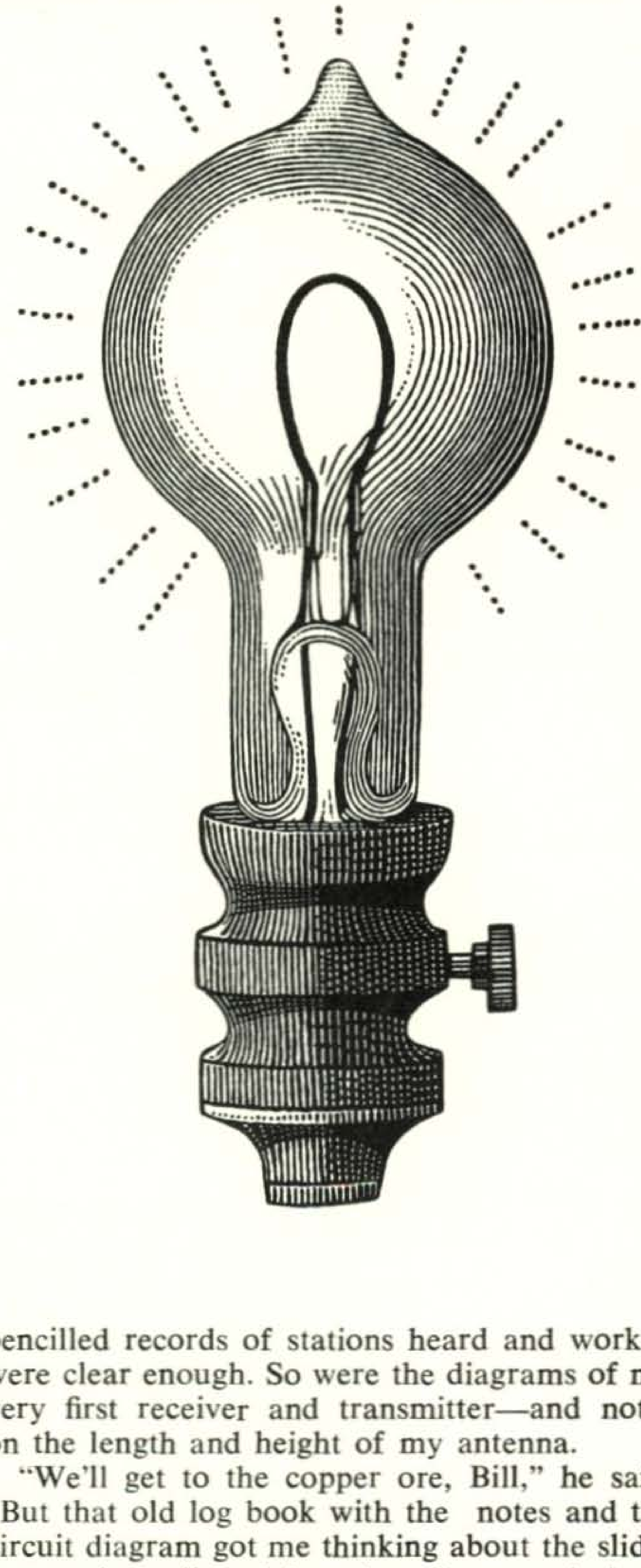
The microprocessor too has its hierarchy of languages. However, there is some problem with the higher levels. They cost lots of money to develop or buy—even more than the rest of the microprocessor. Since extremely complex functions are not needed, machine language, or perhaps better, macro-machine language would be the best answer for the ham.

In the macro-machine language, the ham programmer is a Tinkertoy builder, combining various pretested modules into logical units in the sequence needed for proper machine operation. Which brings up some interesting questions: How do you load in the instructions, and where do they go in and get going when gotten in?

The most basic method of entering data or instructions into the microcomputer is to have a select number of toggle switches which can be set to the desired code. Another set of switches is set to an address in main memory. Pressing a "Load" button changes the data at the selected memory address to the new desired data. It's a tough way to work, since all data and locations are in binary, but it certainly will work. Keeping all of those 0's and 1's straight is the problem, remember. Several possibilities exist to improve the situation. Sets of positions are combined to be either base 8 (octal)—3 switches, or base 16 (hexidecimal)—4 switches. Each has its proponents; I use Octal. Since most of the microcomputers are 8 bit machines, hexidecimal data notation results in only 2 hexidecimal digits per address to remember. Well, it helps a little. But not too much. An obviously much easier way is to have prebuilt programs which can be automatically loaded into the microprocessor's memory. This can take place by using either paper tape, punch cards, magnetic tape, or magnetic discs. Perhaps the best present method for the cost and complexity-conscious ham is cassette magnetic tape, the method used at WØLMD.

[*Continued on page 71*]

The True Essence of Homebrewing



BY BILL DeWITT,* W2DD

I HADN'T seen Benson in years, but last week I recognized him immediately. Gray hair, nearly white, a few wrinkles around the eyes, but yes, it was Benson all right. The underslung pipe billowing small clouds of Prince Albert clinched it.

Benson was the ham who got me started, and there he was standing in the same line at the New York Customs Office. I finger-tapped a "Hi Benson" on my brief case and our long interrupted friendship was renewed. We covered the happenings of thirty odd years over a drink of two before I had a chance to ask him about a remark made by the Customs man.

"I can't resist asking," I said, "just what the devil that Customs character meant when he referred to the smallest shipment of copper ore he'd ever seen?"

Benson's face lit up with a wry grin, and a double-billow of Prince Albert smothered me. "Bill," he said, "it was on January 1st a year ago that I ran across an old log book from the 20s. The pages were loose in the cover, but the pencilled records of stations heard and worked were clear enough. So were the diagrams of my very first receiver and transmitter—and notes on the length and height of my antenna.

"We'll get to the copper ore, Bill," he said. "But that old log book with the notes and the circuit diagram got me thinking about the slider type tuning coil, and the galena detector. A single headphone, I remembered, was all that I could afford in those days. It was all so simple.

"I wound the tuning coil on a Mother's Oats box, fixed up a slider and made an r.f. by-pass condenser† out of tin foil spaced with old glass photographic plates. The detector was a piece of galena in a holder with a spring-wire 'cat whisker' to find the sensitive spot. Everything was connected up via some brass binding posts on the bakelite panel.

"But then, Bill, while I was still looking at the old log, it suddenly came to me that I *really* hadn't homebrewed anything! It was my conscience speaking.

"Oh come on Benson," I said, "You've been

*2112 Turk Hill Road, Fairport, NY 14450.

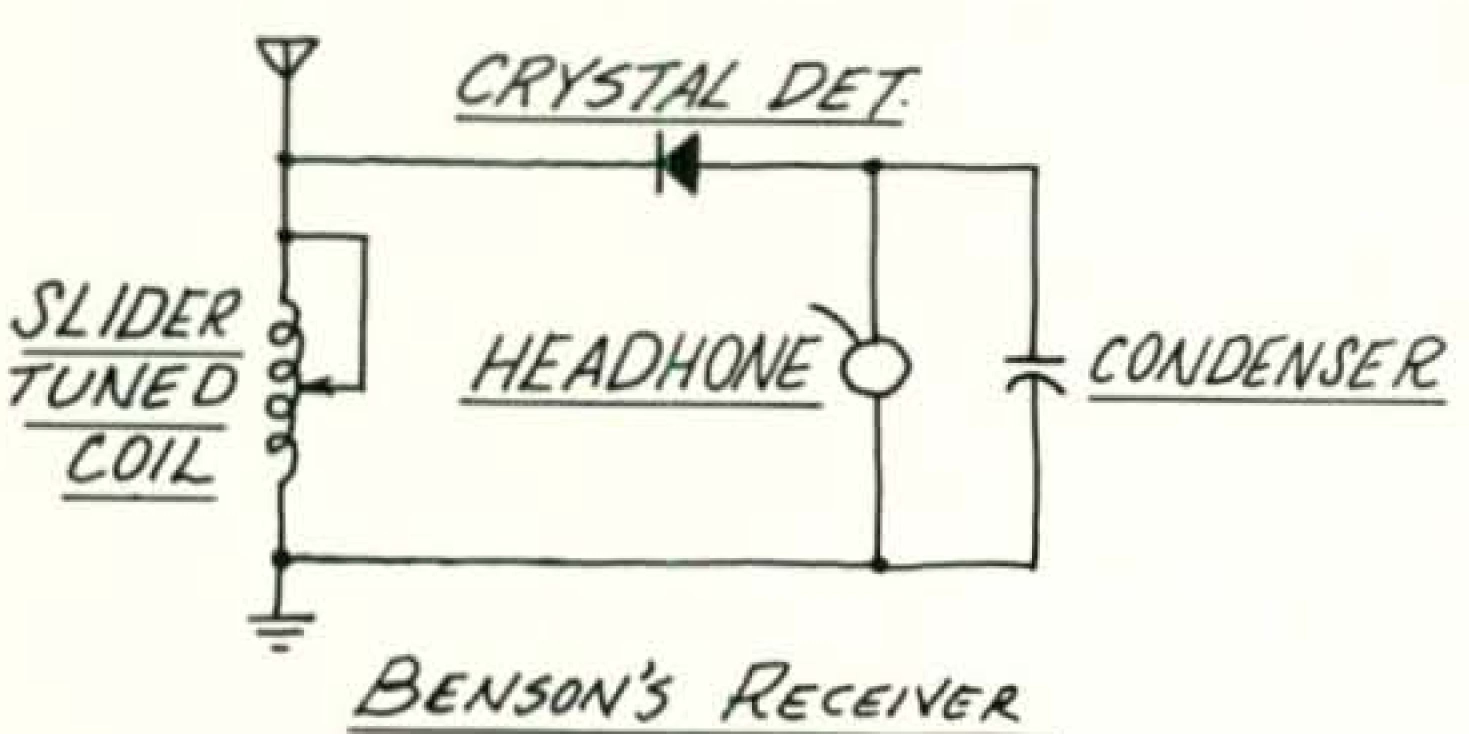
†Note for younger generation: Condensers are now known as capacitors.

homebrewing all your life!"

"No," Benson replied, "I'm serious. I have to admit that although I have designed every feature of every piece of gear that I have used all these years, the parts were always made of directly useable materials. The metals, the dielectrics, the forms—*everything!*

"It was as if suddenly the *True Essence of Homebrewing* had been revealed to me. I was transfixed by the shock of reality. The feeling of guilt engendered by the enjoyment of equipment whose every element I had not derived from its earliest form out of the earth was overwhelming. I thought—even that very first crystal set was not truly homebrew!"

"It was a shock to think that I *bought* the wire. I didn't *mine* the copper ore, refine it, convert it finally to size #24 wire. The thoughts came rushing—I'd never made any glass, mined any galena, or zinc (to be added to the copper to make the brass for the binding posts); and, I'd never mined any tin, nor used Dr. Baeklands formula to make bakelite panels. The thought of the commercially made headphone



made me cringe with shame. I knew that I just couldn't go on as a *Pseudo-Homebrewer!*

"Bill, I wanted to make a new start. I knew that unless I personally wrenched the basic materials from Mother Earth and converted them to the necessary forms for ham radio use, I could not represent myself as a true ham. It dawned on me that I should go right back to that crystal set and *really homebrew* it.

"Wire, I thought, you can't do anything without *wire*. I'll start with copper ore! Well Bill, you have no idea how tough it is to find copper ore that is not on a staked claim. A Chilean ham gave me a tip on an abandoned mine in the Andes. I had a passport within two weeks. After a quick flight out of New York I reached the mine location by helicopter. Packing the ore out on burros was no problem for the natives, but lack of procedural knowledge regarding customs regulations and shipping has been time-consuming. Trucking the ore from the ship to my place at Altamont is quicker but more expensive than rail shipment. If my lawyer can obtain a delay on the neighbors' writ to stop installation of the refining equipment, I think I'll be ready for the first 'pour' within six months at the outside. The bar mill and wire drawing machinery is very slow on delivery, but a little cumshaw may speed that up. I should be able to draw over 600 feet of #24 wire by the end of this year. The insulated stuff will just have to wait."

"Benson," I said, "just when do you think you'll finish up your truly homebrewed crystal set?"

He smiled and rapped his underslung pipe on the edge of the table. "Bill," he said, "it's going to be a few years. I don't have a source of tin yet, but I have a Bolivian ham friend who's trying to help me. I was going to substitute aluminum for the tin foil, but that seemed intellectually dishonest. I don't think that galena will be too difficult to find, and alloying the copper to make the brass is easily done according to books on metallurgy. I think I can get the zinc along with the tin. Perhaps I can coat out a slab of bakelite in an Adult Educational program. That leaves the core for the coil, and the headphones.

"Last week I worked a K4 who has a stand of pines he'd like cut down, but I'm getting worried about the cost of the macerating machine to make the pulp. Sulphite seems plentiful, so my biggest problem may turn out to be meeting EPA standards for discharge into the sewer. I figure that the paper machine should be saleable after the project is complete—along with the other heavy equipment.

"My time goal for the whole project is just under 5 years, and maybe I'll have to fudge on the headphone to make it."

Well, I just sat there and basked in reflected glory. I had always admired Benson, but now the sheer brilliance of his approach to the *True Essence of Homebrewing* gave me a feeling of inner pride. My early days idol had become my latter day guru!

Of course, I was a little amused too. You see, Benson never asked *me* what I was doing in that Customs Office line. I could have told him that I was picking up a small box of germanium ore that I had chipped out of a cave in Yugoslavia earlier in the year. Judging from a first look at the available patents, Bell Lab Journals, and recent correspondence with Texas Instruments, I should be able to perfect my doping techniques in a year or so—but my work on Homebrewed CCDs§ will be contingent upon getting some lab assistance on the spectralphotoelectric response of the source material I found while searching for Mode 2 selenium. I wish I could get Benson to help me, but I have a feeling that he's going to be just too busy. ■

§Note for older generation: CCD means a charge coupled device, OK?

Modification of the Heath HW-202 2-Meter FM Transceiver

BY LEONARD DUSCHENCHUK,* WA2KHK

LIVING in the Long Island/New York City area with the many 2-meter repeaters in use could be troublesome, particularly if an adjacent repeater is only 15 kHz away. Just such a situation existed at my QTH and with more and more repeaters going into operation I'm sure other areas of the country are also affected, especially in metropolitan areas.

The specifications on the Heath HW-202 2-meter rig, which I use, list the 6-db nominal bandwidth as 22 kHz. This was much too wide as every time the adjacent repeater keyed up it would break squelch and be audible. Depending on the bandwidth of the keying station the signal would either be intelligible or just garble. I might add the interfering repeater station was clean and linear, *i.e.*, narrow band came out narrow; wide band came out wide. To even be more bothersome to me, it uses high power and the antenna is several hundred feet in the air.

Reviewing the HW-202 schematic diagram, it became apparent to me that adding an additional filter (now called FL_{103}) would narrow the passband skirts and thus reduce the receiver sensitivity to adjacent channel interference. Not knowing exactly what was in the filter and to preserve circuit symmetry an additional capacitor, 0.56 pf was added as shown in fig. 1.

The entire modification took less than 2 hours to implement, with most of the time devoted to figuring iut where to place the components. The new filter and capacitor were mounted above the HW-202 receiver circuit board standing up on their leads. Small pieces of insulating tubing

*255 Stewart Ave., Bethpage, NY 11714.

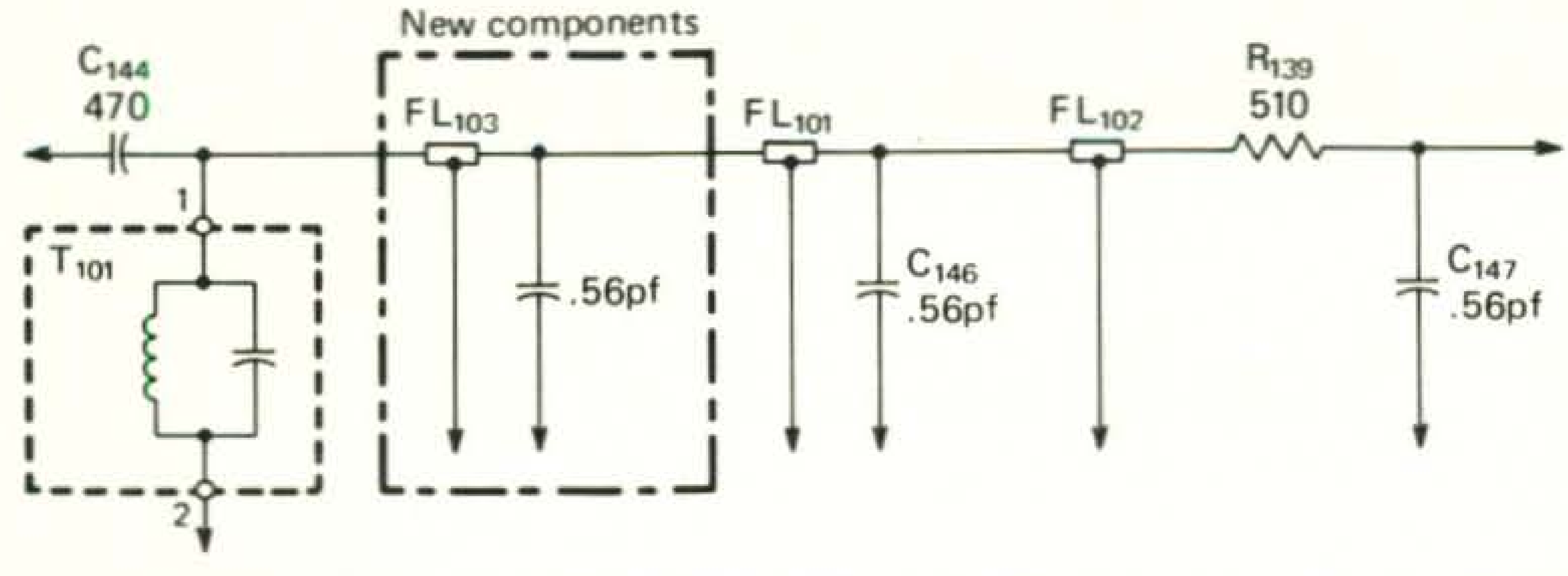


Fig. 1—Schematic diagram of the modified 10.7 MHz i.f. filter portion of the Heath HW-202 2-meter f.m. transceiver. The addition of a third ceramic i.f. filter *(FL_{103})* and a .56 pf ceramic capacitor provide enough reduction of the i.f. bandwidth to eliminate severe adjacent channel interference. FL_{103} is Heath part number 404-535 ($6.55 from Heath); the .56 pf capacitor is Heath part number 28-3 ($.15 from Heath).

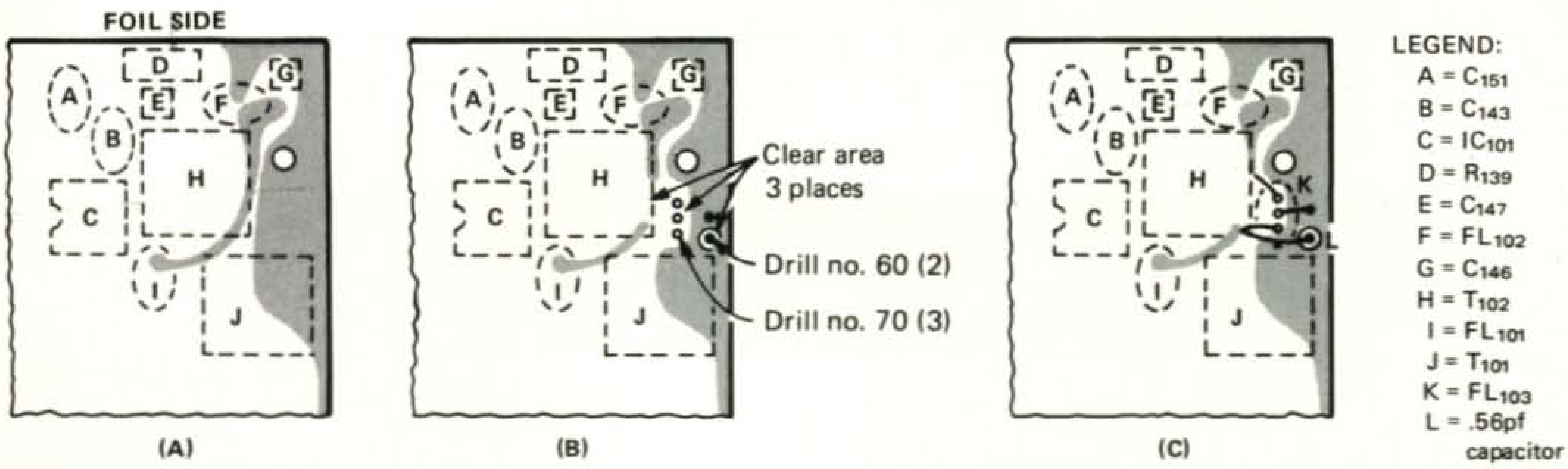


Fig. 2—Receiver circuit board shown from foil side. (A) Before modification. (B) Foil is trimmed as shown and new holes drilled. (C) New filter and capacitor are mounted on component side of board and wiring is completed as shown.

were placed on the filter leads to raise the filter can above the circuit board, thus allowing for a slight rotation of the filter and permitting the circuit board retaining nut to be replaced.

Step-by-step Modification

1—Remove 4 nuts securing receiver circuit board to chassis and disconnect short lead to PA circuit board. Turn over circuit board to foil side.

2—Using X-acto knife cut foil between FL_{101} and FL_{102} approximately ¼ in. as shown in fig. 2(B).

3—Cut rectangular area in ground foil ⅛"× ¼" as shown in fig. 2(B).

4—Cut out foil approximately ⅛" dia. in area shown.

5—Drill 3 holes (#70) 1/16" apart as shown in ground foil cutout.

6—Drill 2 holes (#60) in ground foil ⅛" apart as shown, for capacitor.

7—Place thin tubing (3/16" long) over each of the three filter leads and insert leads in their respective holes.

8—Solder the center lead to the ground foil. Scrape coating on foil prior to soldering. Cut lead as necessary. See fig. 2(C).

9—Solder the two outer leads to the ends of the cut foil.

10—Insert capacitor standing up through the two holes provided.

11—Solder one capacitor lead to the ground foil; connect the other lead to the foil lead going to FL_{101} as shown.

12—Inspect for no solder bridging. Replace 4 nuts and reconnect the short lead to PA board.

Performance

A typical before and after filter response curve is shown in fig. 2. A signal generator and a frequency counter with 1 kHz resolution was used and the front panel signal strength meter was used to measure output levels. These curves can probably be taken as typical.

I might add that a signal generator tuned to the adjacent repeater channel (15 kHz away) does not move the meter pointer at all. A signal 10 kHz off our repeater channel indicates a 1 on the meter. With the squelch control set normally (receiver just quiets) I cannot hear the repeater when the station identifies itself unless the squelch control is advanced so that it is in the noise region. Under these conditions, I can see my signal strength meter move only when the wider f.m. boys come on the adjacent repeater. An occasional click is heard on extreme audio peaks, but advancing the squelch control slightly eliminates all clicks. It's now a pleasure to listen to our low power repeater without the annoying garble I had before, and for a cost of less than seven dollars you can't go wrong. See you on the repeater. ■

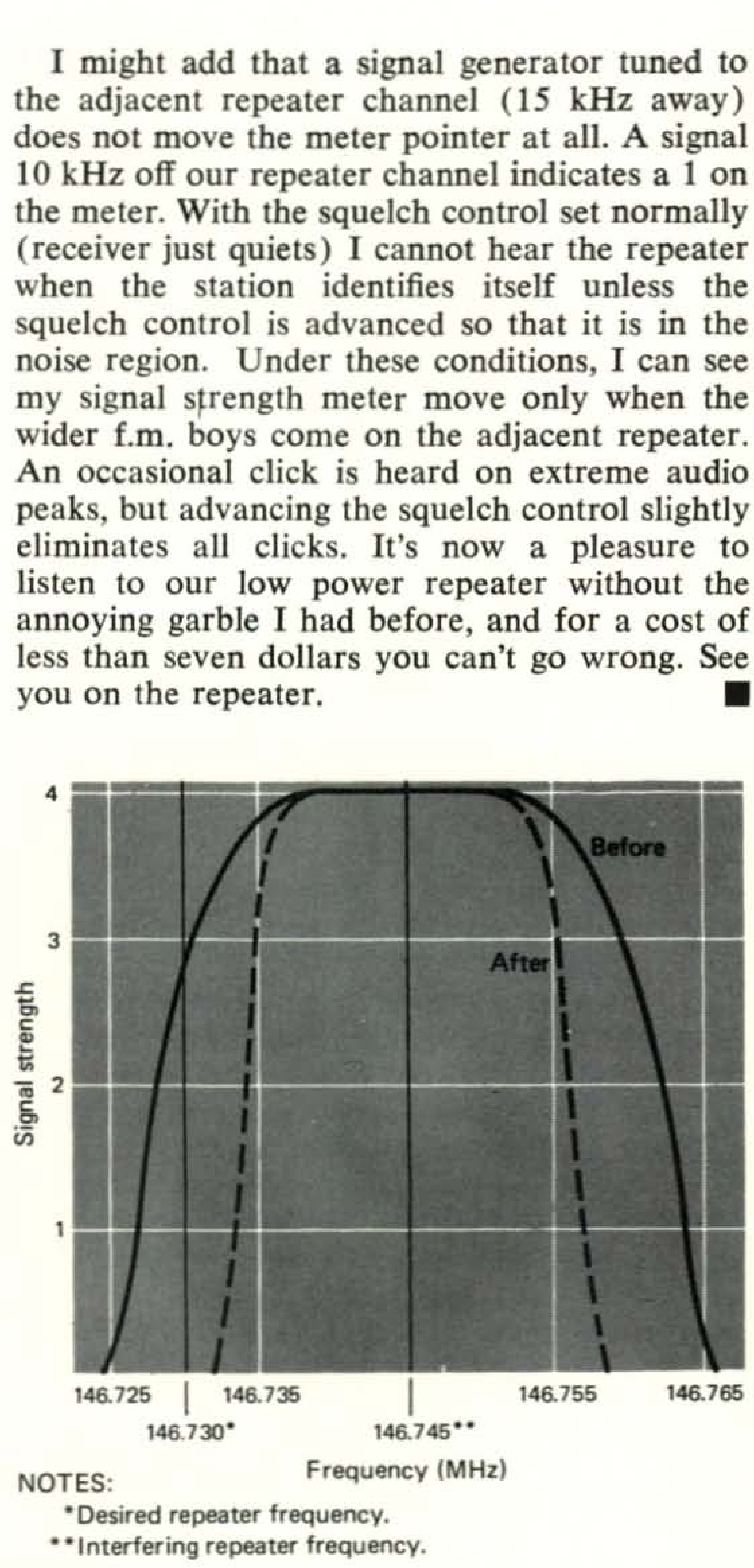


Fig. 3—Typical before and after overall response curves.

The Function Generator

BY HANK OLSON,* W6GXN

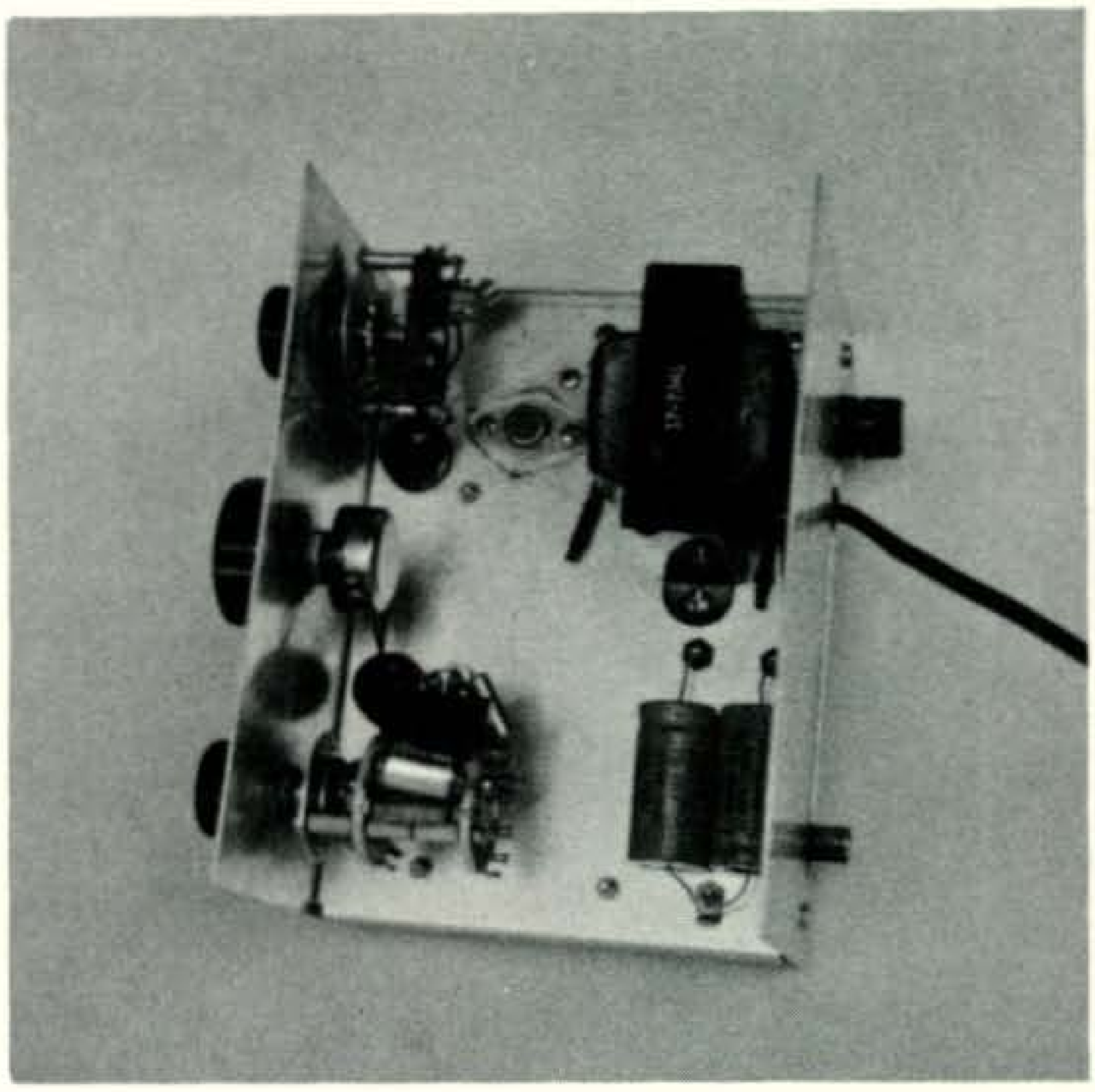
THE function generator as we know it today did not exist until relatively recently in test equipment history. While there have been numerous sine wave generators and a fair number of square wave generators available as pieces of test gear, it was not until the mid-60's that a single generator combining sine, square, and triangular outputs was marketed under the name "Function Generator." The original function generator by *Wavetek* was immediately siezed upon by engineers—especially servo engineers—as a compact answer to their audio and subaudio testing needs. Although Wavetek is still a major producer in the function generator field, several competitors market these pieces of test equipment, and function generator kits are available from *Heathkit*† and *South West Technical Products*§. The Heathkit IG-1271 at $114.95 and the South West Technical Products #205-C at $39.95 represent low cost kits available for those who would do their own construction, but want a finished unit.

*P.O. Box 339, Menlo Park, CA 94025.

†Heath Kit Company, Benton Harbor, Michigan 49022.

§South West Tech. Products, 219 W. Rhapsody, San Antonio, Texas 78216.

The front panel of the function generator contains all necessary operating controls. At the top left is the Function switch, with the Fine Frequency pot and Minimum Frequency switch to the right. Along the bottom row are: On-Off push-button switch/pilot light, D.C. Offset pot, Synch Output connector, Output Level pot and Output connector.



Top view of the function generator shows the uncrowded interior with the power supply constructed along the rear of the chassis. The Raytheon RC4194TR regulator is mounted to the chassis just forward of the power transformer.

For those interested in constructing their own function generators from scratch, there are several application notes available from the semiconductor manufacturers on how to build function generators around the I.C.'s and other devices that they make. An application note by Motorola (AN510A)[1] is one of the basic such technical papers on function generators. This technical paper supersedes the earlier AN510 (which had a few printing errors in the circuits) and shows how conventional components such as op amps, voltage comparators, and diode switches can be combined into a function generator.

A later application note by *National Semiconductor* also shows a function generator built of conventional op amps and other standard I.C.'s.[2] The circuit in this application note is unusual in

[1]Botos, R., "A Low-Cost, Solid-State Function Generator," Motorola Application Note AN-510A, July 1971.

[2]Dobkin, R., "Wide Range Function Generator," National Semiconductor Application Note AN-115, July 1974.

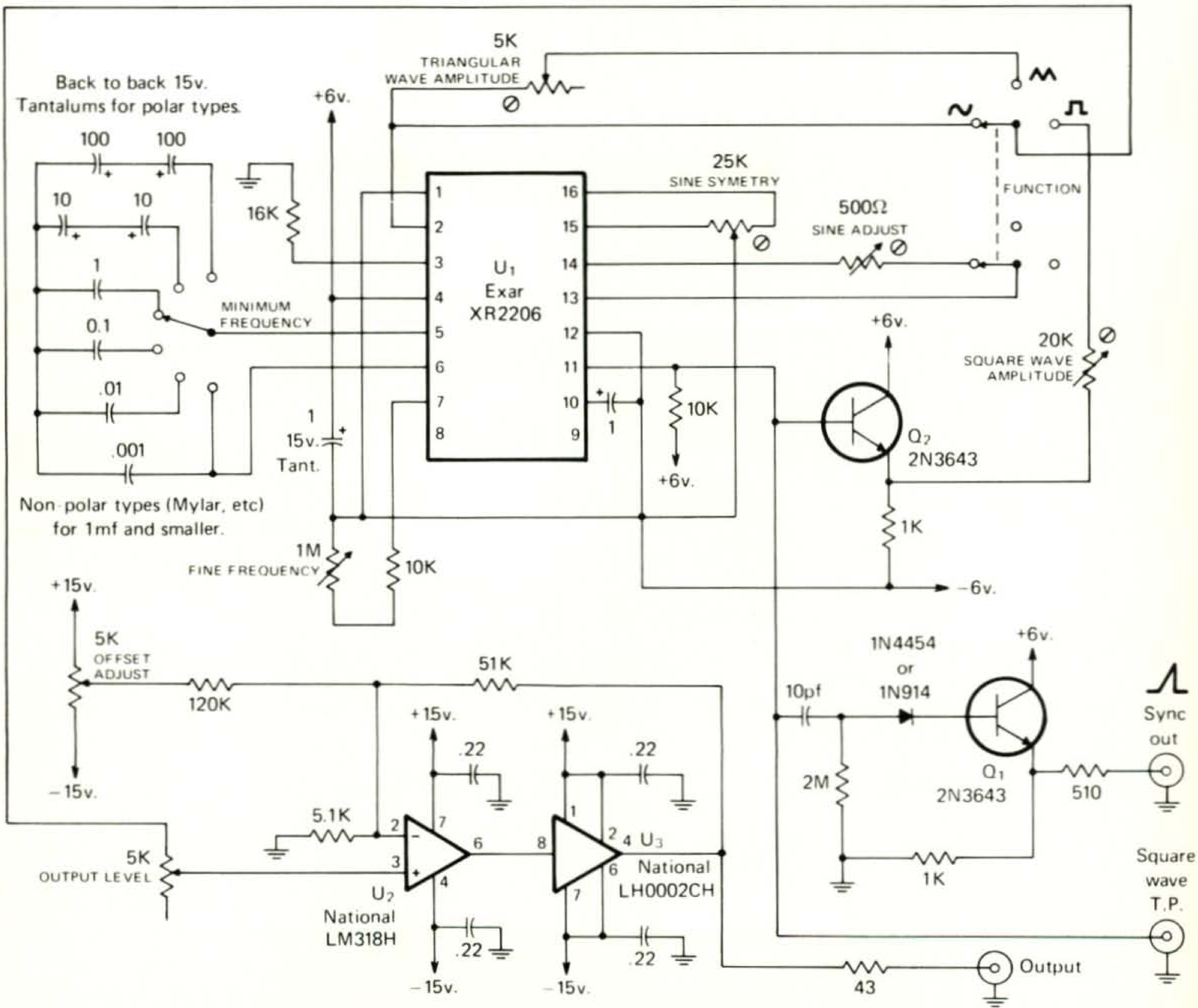


Fig. 1—Schematic diagram of the waveform circuitry of the function generator. All capacitors are in mf unless otherwise specified. All resistors are ½ w. or less.

that the function generator is designed to have a single sweep of the frequency control pot vary the output frequency from 10 Hz to 1 MHz (five decades). For the average user, this would probably mean that a 10-turn pot should be used for frequency control. This application note provides a P.C. layout which simplifies construction (including power supply).

There are at least two companies that make special purpose I.C.'s that are specifically designed as function generators. *Intersil* makes the 8038 which has been relatively widely used by authors in the ham-experimenter magazines as the basis of construction articles.[3,4] The Intersil 8038 is also the I.C. used in the South West Technical Products #205-C kit.

A second I.C. manufacturer, *Exar,* has a couple of monolithic function generator chips. The XR205 and XR2206 are these I.C.'s. The later XR2206 is the I.C. recommended for new designs.[5] This I.C. is the one that has been chosen, around which to construct the function generator described here. The choice was made on the basis of the sine wave purity of the XR2206, which in the author's limited experience was the best function generator I.C. tried.

The circuit of the function generator, built around the XR2206, is shown in fig. 1, which shows the signal portion, and fig. 2 which shows the regulated power supply section. Since the XR2206 is a special purpose I.C., the circuit in which it is used follows the connection recommended in the XR2206 specification sheet, to a great degree. In this circuit ±6 volts is used to power the I.C. so that the output waveforms

[3] Leon, G.; Paul, J.; and Rico, L., "Build the Super Audio Sweep Generator," *Popular Electronics,* Oct. 1973, p. 29.

[4] Megirian, R., "Integrated Circuit Function Generator," *Ham Radio Magazine,* June 1974, p. 22.

[5] Grebene, A., "Generate Waveforms with a Single I.C.," *Electronic Design,* Sept. 13, 1974, p. 132.

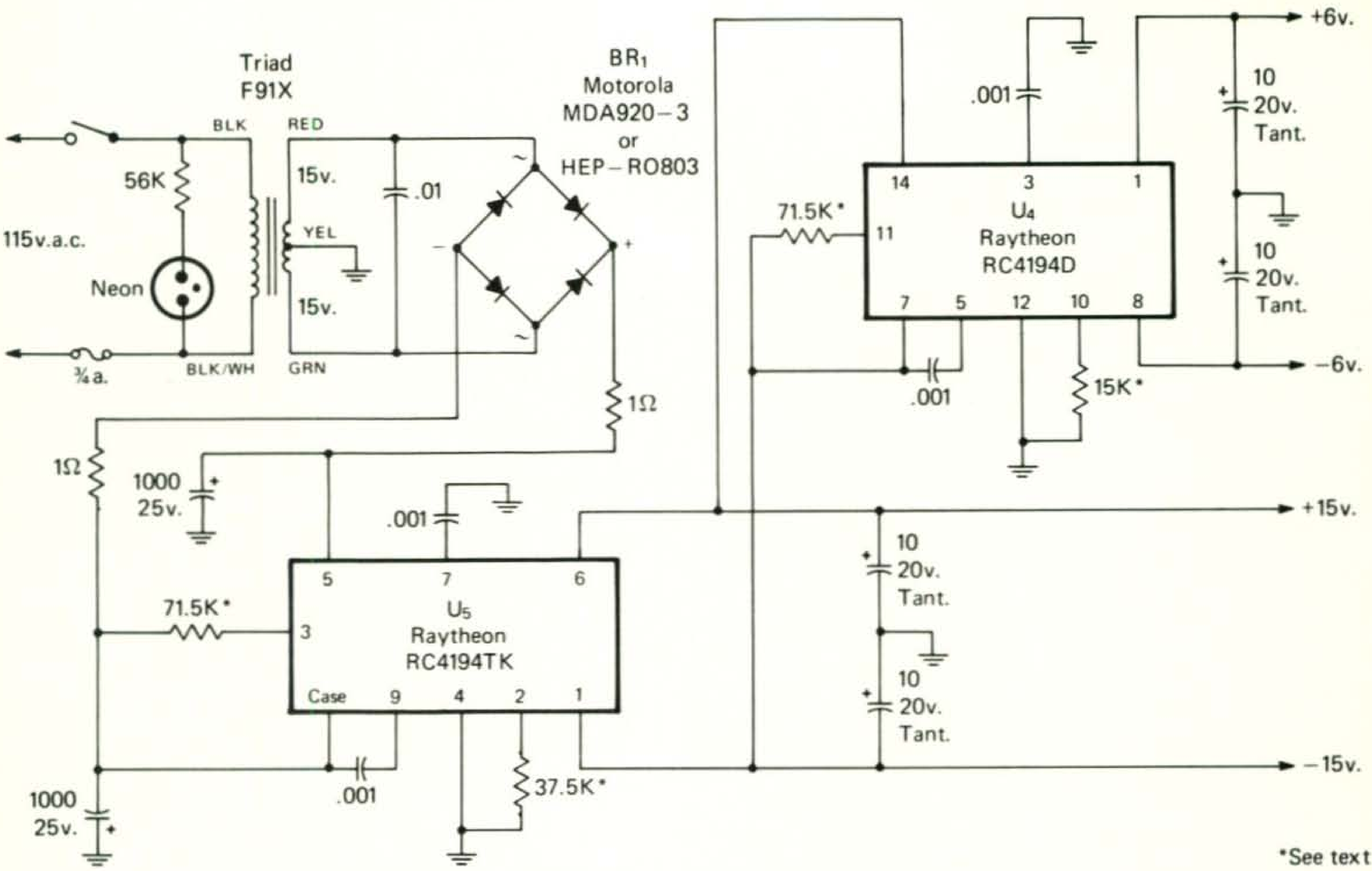
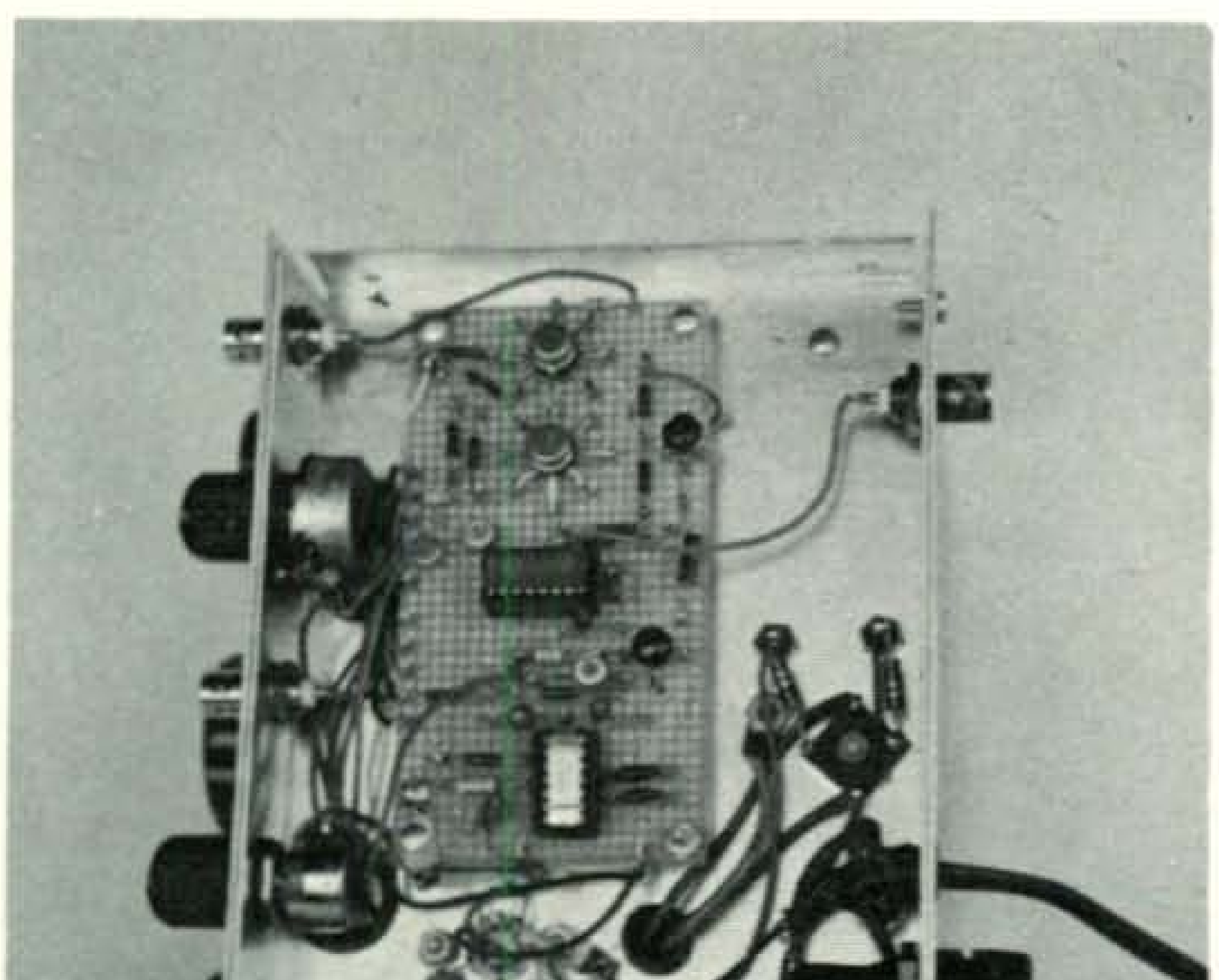


Fig. 2—Power supply for the XR2206 function generator. All capacitors are in mf.

will have their average value near zero volts. That is, the waveforms swing both positive and negative. Relative to this point, there is an op amp—buffer stage that amplifies the output of the XR2206, which has a variable d.c. offset.



Underchassis view of the function generator. A single piece of perf board mounts most waveform and voltage regulator circuitry with the exception of the coarse frequency determining capacitors, which are mounted on their associated switch, and the various controls. On the rear edge are a fuse post and the square wave testpoint connector.

With this offset control one may adjust the average value of the waveform to be any arbitrary plus or minus value within the range of the op amp voltage swing capability. This op amp-buffer stage has an 8Ω output impedance; a 43Ω resistor is placed in series with the buffer so as to match fifty ohms. The maximum voltage gain of the op amp-buffer stage is eleven; the buffer stage is included *inside* the operational feedback loop.

A simple differentiator, emitter-follower has been added to provide positive-going impulse output at the "sync" output, corresponding to the positive going zero-crossing (for no d.c. offset) of the waveform. This sync impulse is less than 0.5 μsec, and about 1 volt level. It is often difficult to see on the scope especially at lower frequency repetition rates, but it does provide a solid sync signal for a 'scope.

Because the square wave output (pin #11) of the XR2206 has a much larger output impedance than the corresponding sine and triangular wave outputs, it is buffered by a simple emitter-follower. This emitter-follower consists of Q_2 and a 1K resistor. The square-wave and triangular wave lines to the function switch each have a series variable resistor to reduce the corresponding waveform level to be equal to the peak-to-peak level of the sine wave output.

The regulated power supply uses two of the newer Raytheon RC4194 dual regulator I.C.'s. The RC4194D, (U_4) is in a dual-inline package

[*Continued on page 71*]

antennas

BY WILLIAM I. ORR,* W6SAI

"You foxy fellow," exclaimed Pendergast. "You didn't tell me everything about the multiband dipole that you described in the June issue of *CQ*. "You are holding things back."

"Well, there is more to it," I admitted. "The design I described was a center-fed antenna having an overall length of about 55 feet, including the insulators (fig. 1). The antenna wire was broken at points equidistant from the center for the inclusion of matching networks. With a pair of tuned traps, the antenna provided resonance on 40 and 20 meters, and with a pair of loading coils (L_3) the antenna provided operation over a narrow segment of the 80 meter band.

"Since the antenna is quite small compared to an 80 meter dipole, the impedance at the feedpoint in the center is quite low and some form of matching network is required. A simple matching coil (L_4) placed across the antenna feedpoint does the trick, bringing the impedance that the balun and transmission line 'look into' to about 50 ohms.

"When the traps are used, the operational bandwidth, that is, the bandwidth between the 2 to 1 s.w.r. points, covers the 20 meter band, and covers about half of the 40 meter band. For 80 meter operation the bandwidth, under the same conditions, is about 40 kHz."

"That's right," interrupted Pendergast. "All this information is discussed in your June article, in detail. But I understand that it is possible to achieve good 20 meter operation with the 80 meter loaded dipole. Is that correct? You didn't mention *that* in your article."

"*No*, I didn't mention it, and *yes*, you are correct," I replied.

"Interestingly enough, the 80 meter loading coils act somewhat as high impedance r.f. chokes at 20 meters, providing an excellent degree of isolation between the outer tips of the antenna and the inner, 20 meter dipole portion. The coil is about 63 microhenries. . . ."

"Your June article said 50 microhenries," said Pendergast stiffly.

*48 Campbell Lane, Menlo Park, CA 94025.

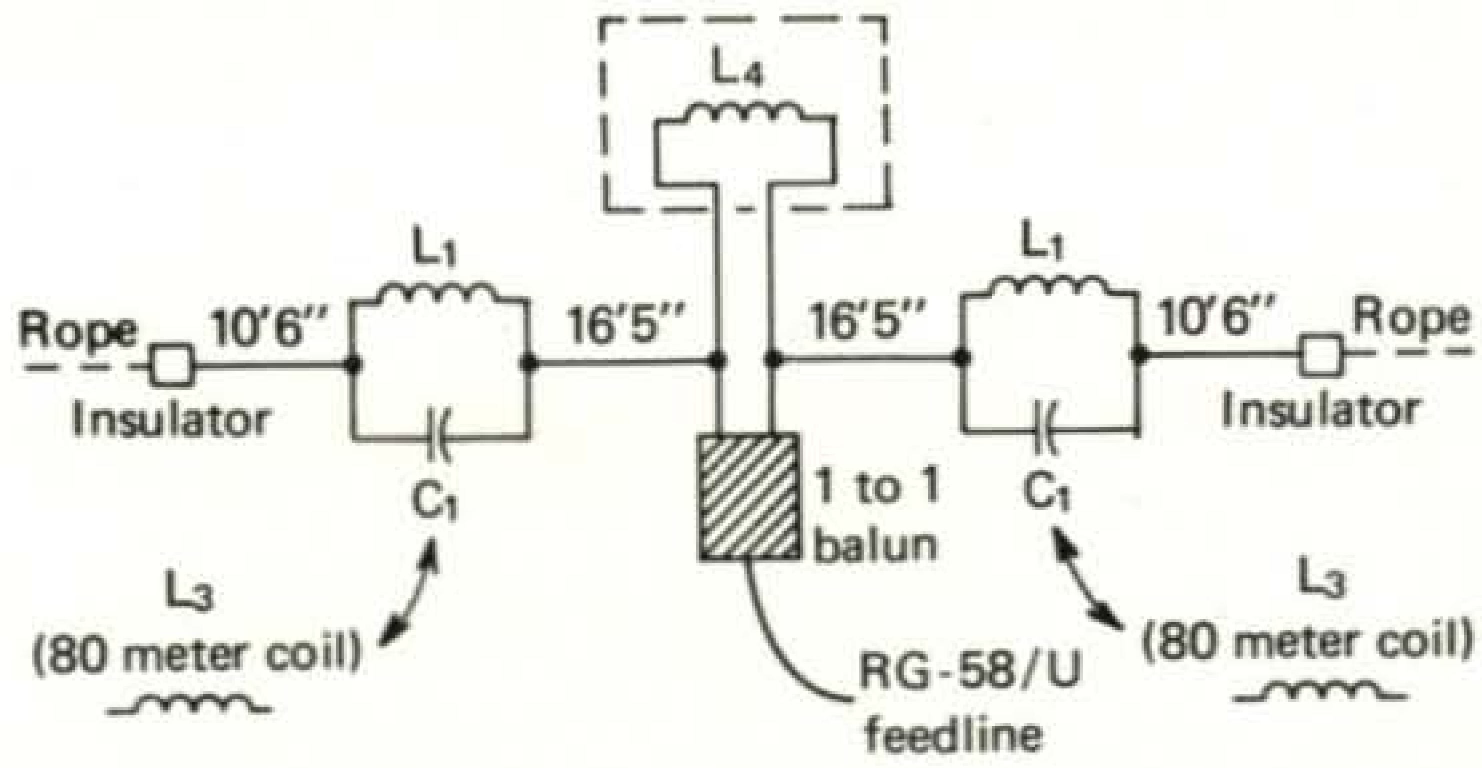


Fig. 1—The 40-20 meter trapped, two-band dipole. A 1-to-1 balun is placed at the feedpoint. Dimensions are given for resonance at 7.25 MHz and 14.1 MHz. If the tuned traps (L_1-C_1) are removed and loading coil L_3 substituted in each case, the antenna is sharply resonant in the 80 meter band. As this article explains, the 80 meter loaded dipole is also resonant on 20 meters. The 20-40 meter trap consists of a 9 turn coil, 2½" diameter and 1½" long wound of #12 wire (B&W 3905-1, or equivalent) in shunt with a 25 pf, 7.5 kv capacitor (Centralab type 850S). The trap is self-resonant at 13.9 MHz. The 80 meter loading coils (L_3) are 38 turns, 3" diameter, 10 turns per inch of #14 wire. The coils are trimmed for resonance at the desired 80 meter operating frequency. Bandwidth is about 40 kHz. The matching coil (L_4) consists of 12 turns, 6 turns per inch, 1¼" diameter of #14 gage wire. L_4 is trimmed, a turn at a time, for best s.w.r. at resonance on the 80 meter band. Antenna will also work well on 20 meters, as described in the text.

"That was a first-order guess," I replied. "Sixty-three microhenries is more nearly correct. The number of turns in the loading coils determined actual antenna resonance, and the number varies by about six turns in each coil from one end of the band to the other. But you distract me. Let's get back to 20 meter operation of the 80 meter antenna.

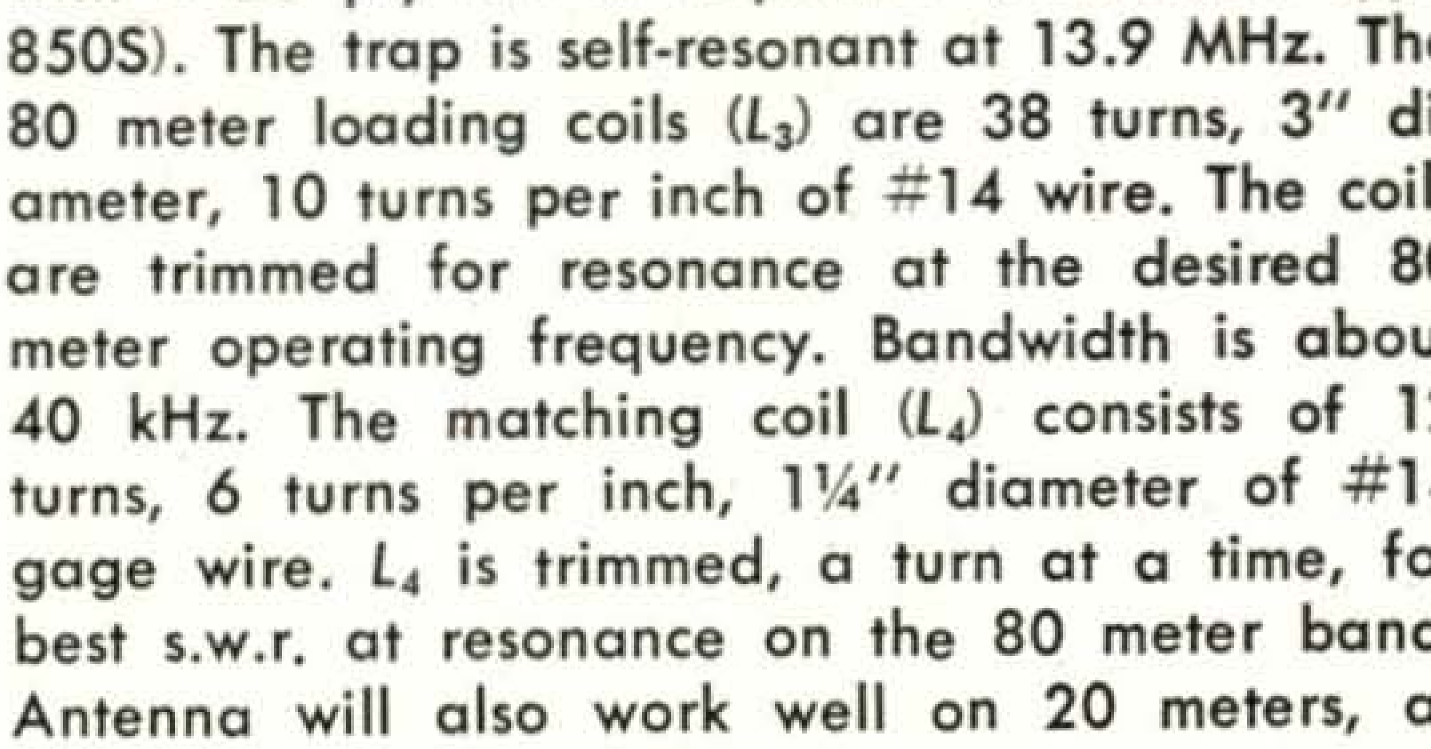


Fig. 2—Operation of 80 meter dipole on 20 meters compares favorably with operation of 20 meter dipole. The harmonic of the 80 meter loaded dipole falls very close to 14.0 MHz, as shown by the s.w.r. plot. This simple antenna, then, provides a choice of 80/20 or 40/20 meter operation by the use of either traps or loading coils. Not bad for a simple 55 foot long antenna!

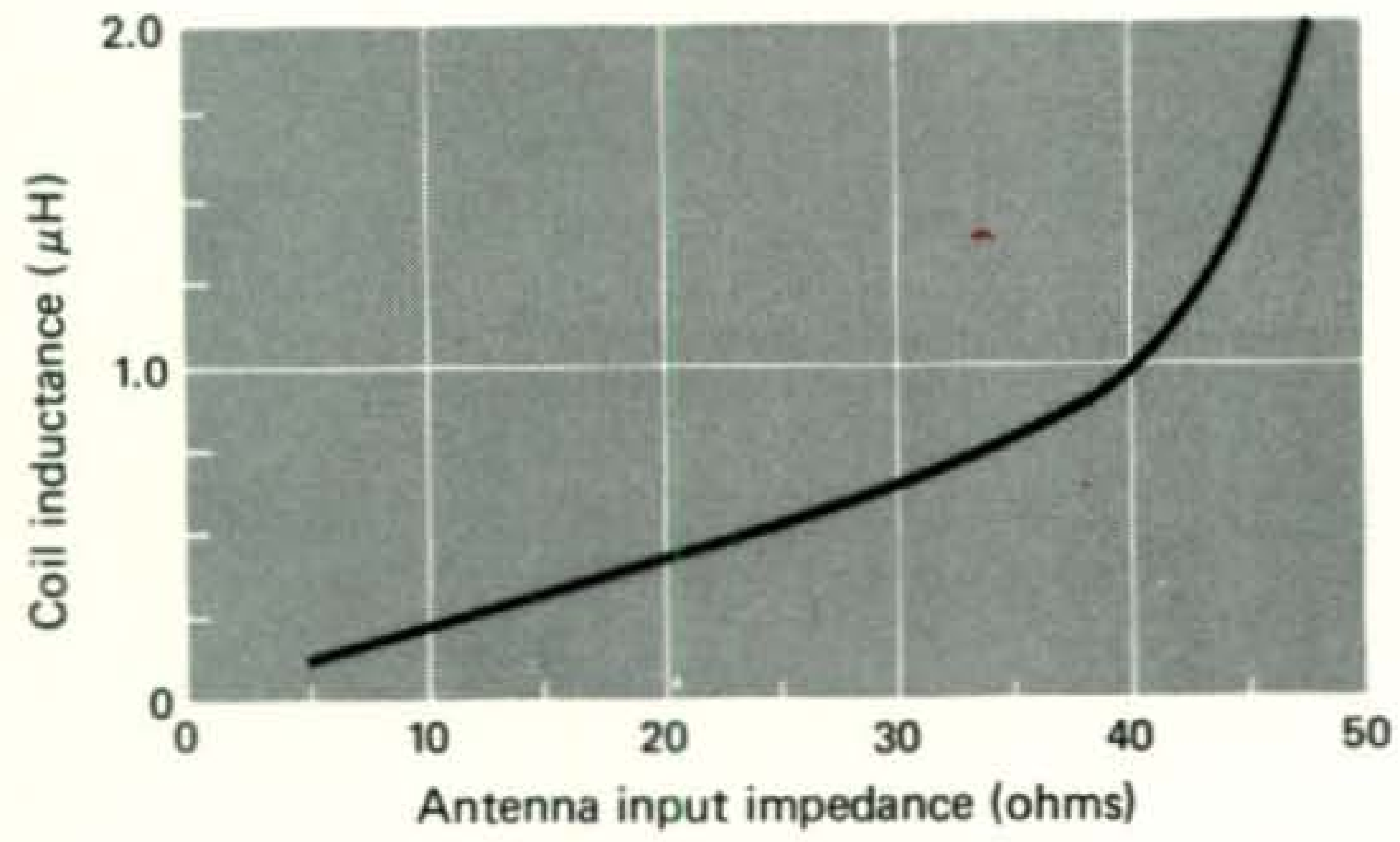


Fig. 3—Inductance of center impedance matching coil as a function of antenna input impedance. Start with maximum inductance in the coil and short out a turn at a time until lowest value of s.w.r. is achieved on the transmission line.

"The loading coils, as I have said, act as r.f chokes on frequencies higher than antenna resonance, and at some higher frequency, permit a second resonance to occur. The point of second resonance is a function of coil inductance and the length of the inner sections of the dipole. In this case, the inner sections were intentionally cut for 20 meters. Now, *if* the loading coils really act as r.f. chokes at 20 meters, you do in fact have a 20 meter dipole. And the s.w.r. measurements tend to prove just that (fig. 2). Here's a s.w.r. plot of the 20 meter dipole with the end sections disconnected and a plot of the operation of the 80 meter loaded dipole on 20 meters."

Pendergast looked closely at the sketch. "It looks to me as if the second-order resonant frequency of the loaded 80 meter antenna falls very close to 14.0 MHz," he stated.

"It certainly does," I replied. "By itself, the inner, 20 meter, portion of the antenna has a self-resonant frequency of about 14.1 MHz, so it looks as if the loading coils disturb the resonant frequency by only about 100 kHz. That's not bad.

"You'll note that the slope of the two s.w.r. curves is nearly identical, so the bandwidth of the two antenna types is just about the same."

"Was the 80 meter center impedance matching coil left in the circuit for 20 meter operation?", asked Pendergast.

"Yes," I replied. "I saw no reason to remove it. As you can see from the s.w.r. curves, the antenna exhibits a good s.w.r. curve on 20 meters. The little center matching coil doesn't affect 20 meter performance to any degree."

I reached up to the high bookshelf and took down a bound volume of *QSTs*. "Here's an interesting article by W4JRW in the April, 1961 issue of *QST*," I said. "It's entitled *'Multiband Antennas Using Loading Coils.'* The author describes a loaded 80 meter antenna that also resonates on 40 meters. He claims the idea is an old one, being described in the *Bureau of Standards Circular C74, Radio Instruments and Measurements*, published in 1924. The circular describes loaded antennas and states that 'the harmonic frequencies are no longer integral multiples of the fundamental, as in the case of the simple antenna.'

"W4JRW took that idea and used high inductance loading coils—about 120 microhenries —to make up a two-band dipole for 80 and 40 meter operation. He hinted that using "various lengths of wire" and "various values of coils" that antennas could be built for 80 and 20 meters, 80 and 15 meters and other such combinations."

"Did he show any designs of that type?" asked Pendergast.

"No," I replied. "And I must admit I had forgotten about the article. I only remembered it after I had tried the loaded 80 meter dipole on 20 meters. Then a bell rang, and I spent an

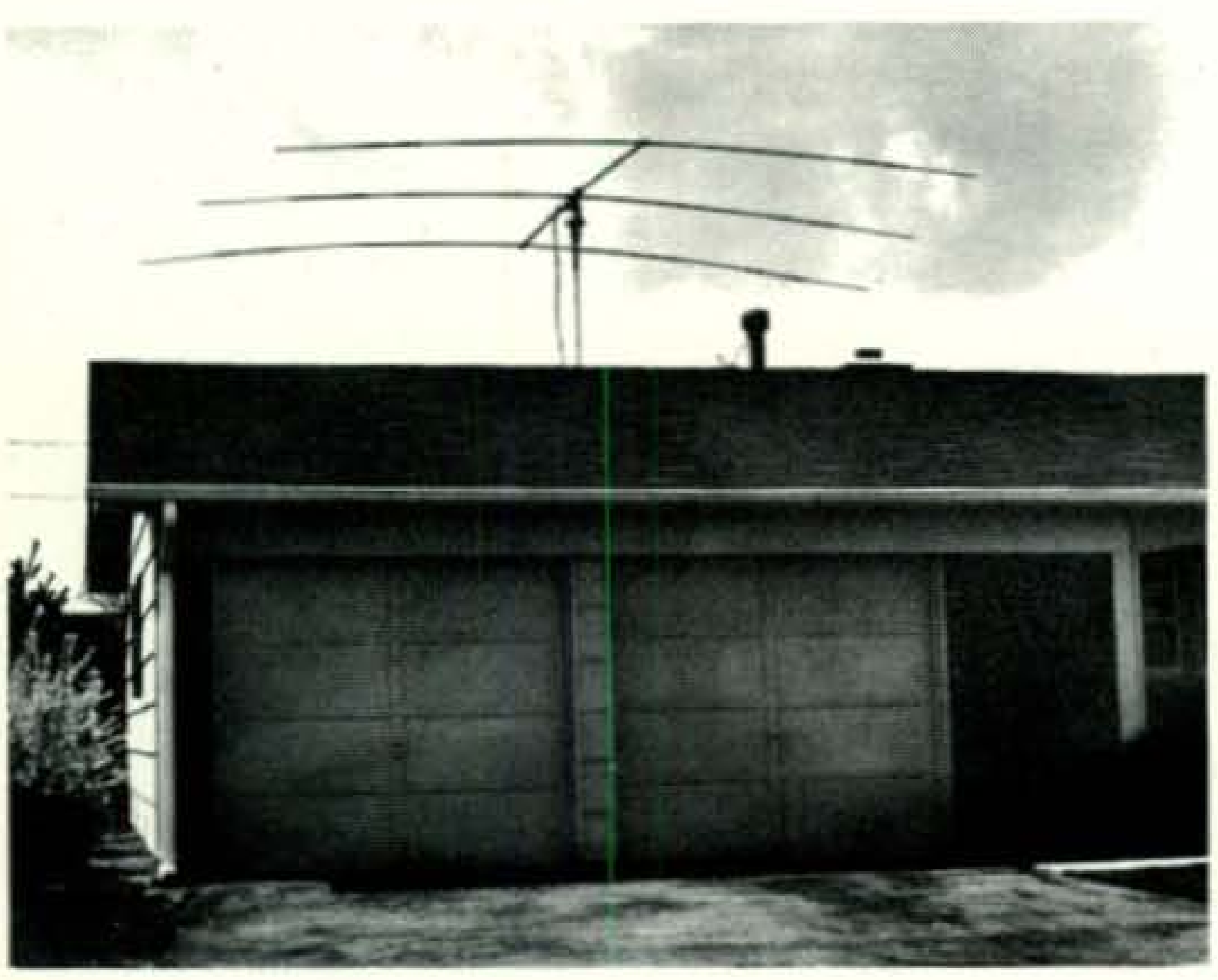


Fig. 4—The rotary beam antenna of WA3HDU. Tribander beam and rotor are mounted atop the mast, all set to work DX! But what if a neighbor complains the antenna is an eyesore?

Fig. 5—The disappearing antenna of WA3HDU. By means of a clever hoisting mechanism, WA3-HDU lowers his beam below rooftop when it is not in use.

hour or two looking through back issues of *QST* until I found the W4JRW article. So I guess I sort of re-invented the wheel."

"Well, that's interesting," said Pendergast, suppressing a yawn.

"I guess W4JRW beat you to the punch."

"Yes," I admitted. "Great minds think along the same channel."

"In any event," said Pendergast, "Between you and W4JRW, it has been proven that a loaded dipole can be made to work on two frequencies and that by proper placement and size of the loading coils, the two frequencies can be any two high frequency amateur bands, such as 80 and 40 meters, 80 and 20 meters, or the like."

"That's right," I replied. "I suggest you obtain the April, 1961 issue of *QST* and read the original article. There's a lot of food for thought in it. It may be possible to make up a compact, 80 meter beam—or to make a 20 meter beam work on 80 meters—by using this principle. Perhaps some smart lad will carry these little experiments further."

"Any remarks you would care to make about the center loading coil?" asked my friend as he made quick, pencil sketches in his notebook.

"Well," I replied, "This is a good matching scheme which is not well known among amateurs, although the idea is used every day in commercial practice. Take the case of the usual 80 meter dipole, or inverted-V antenna. In most cases, the antenna is quite close to the ground, in terms of wavelengths of height. A typical 80 meter dipole may be 30 feet in the air. That's equivalent to an electrical height of only 0.115 wavelength. At that low height the feed point impedance could be as low as 10 to 15 ohms, depending upon ground conduction. The fellow that erects an 80 meter dipole at a reasonable height, then, finds out that the s.w.r. curve on a 50 ohm transmission line is terrible. At resonance, the s.w.r. could be as high as 5 to 1, and it becomes even worse off-resonance."

Pendergast sniffed. "I have an 80 meter dipole about 40 feet high and the s.w.r. at resonance is about 1.5 to 1. I cut it for 3800 kHz." He paused a bit, then said, "I'll have to admit that loading it up is a tricky process and when I operate off-frequency, the loading on my transceiver seems very odd to me."

"Could be," I admitted. "The feed-point impedance figures given for a low dipole are either computed, or measured over a perfect ground. In a real-life situation, with an imperfect ground, and with nearby conducting objects, such as telephone and light lines, the input impedance could be something else again. A few years ago I made careful measurements on an 80 meter dipole that was about 35 feet high and came to the conclusion that the input

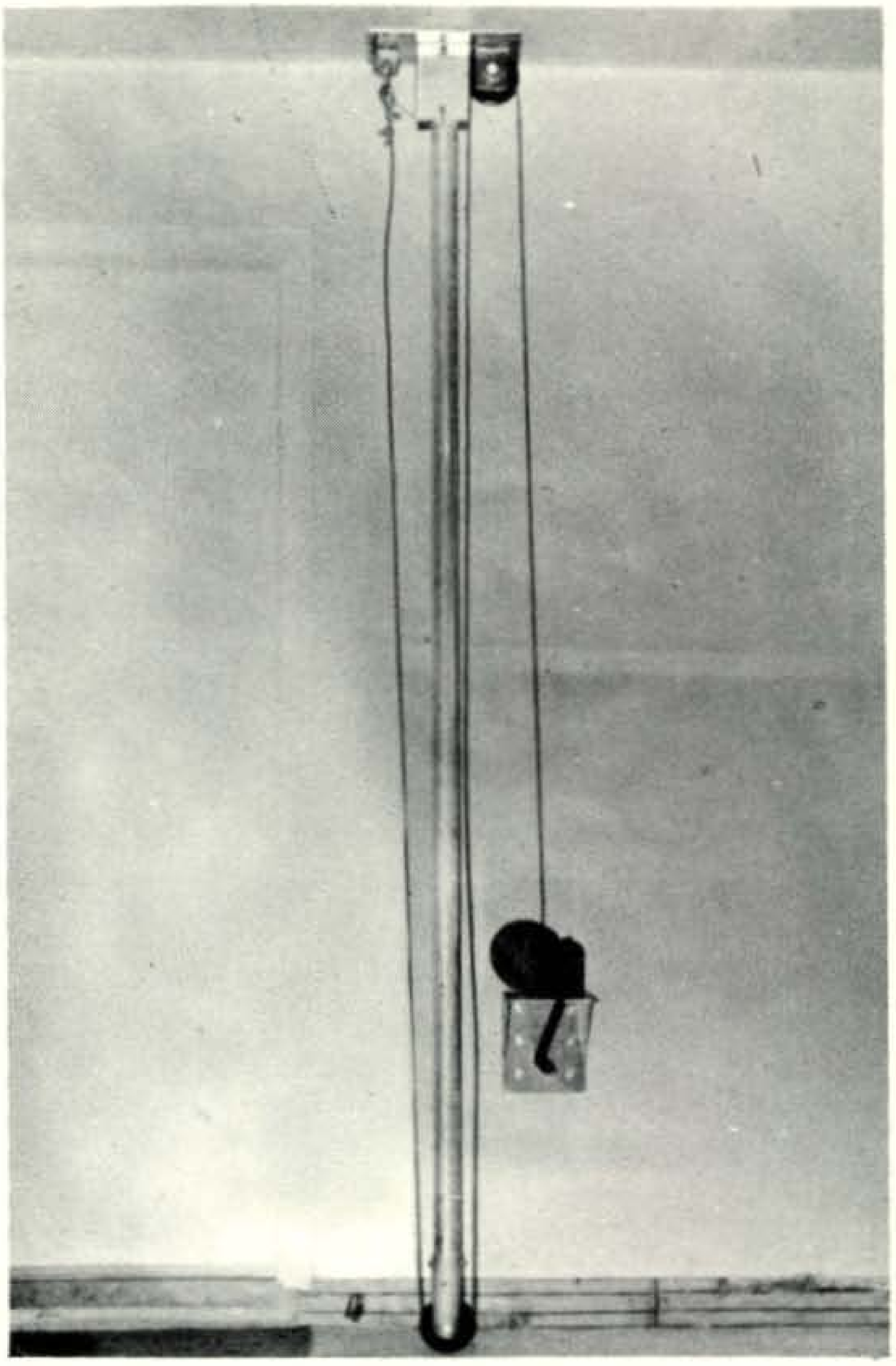


Fig. 6—Inside the garage the secret is exposed. WA3HDU has a periscope arrangement, driven by a cable and a winch. The mast is a section of 2" diameter aluminum tubing and the vertical travel is about 7 feet. A bushing in the ceiling of the garage and another in the roof steady the mast. Anti-rotation pins are built in the mast in the extended and retracted positions to prevent the mast from turning.

impedance at resonance was about 20 ohms."

"Well," replied Pendergast, "In any event, it seems much lower than 50 ohms, at least up to heights approaching 0.2 wavelength, and that's over 50 feet."

"That's right," I said. "And the simplest solution to this little problem is to place a matching coil at the center of the dipole, right across the feed point. All that needs to be done is to adjust the turns in the coil for the lowest value of s.w.r. on the transmission line. This is a simple form of L-network, as I discussed in the June *CQ* antenna column. My discussion applied only to the compact, loaded dipole, but the impedance matching scheme applies equally well to the full-size dipole, as its input impedance is still quite low, because of its low height, in terms of wavelengths."

"The solution is very simple. Place an impedance matching coil across the center of the dipole and adjust the number of turns in the

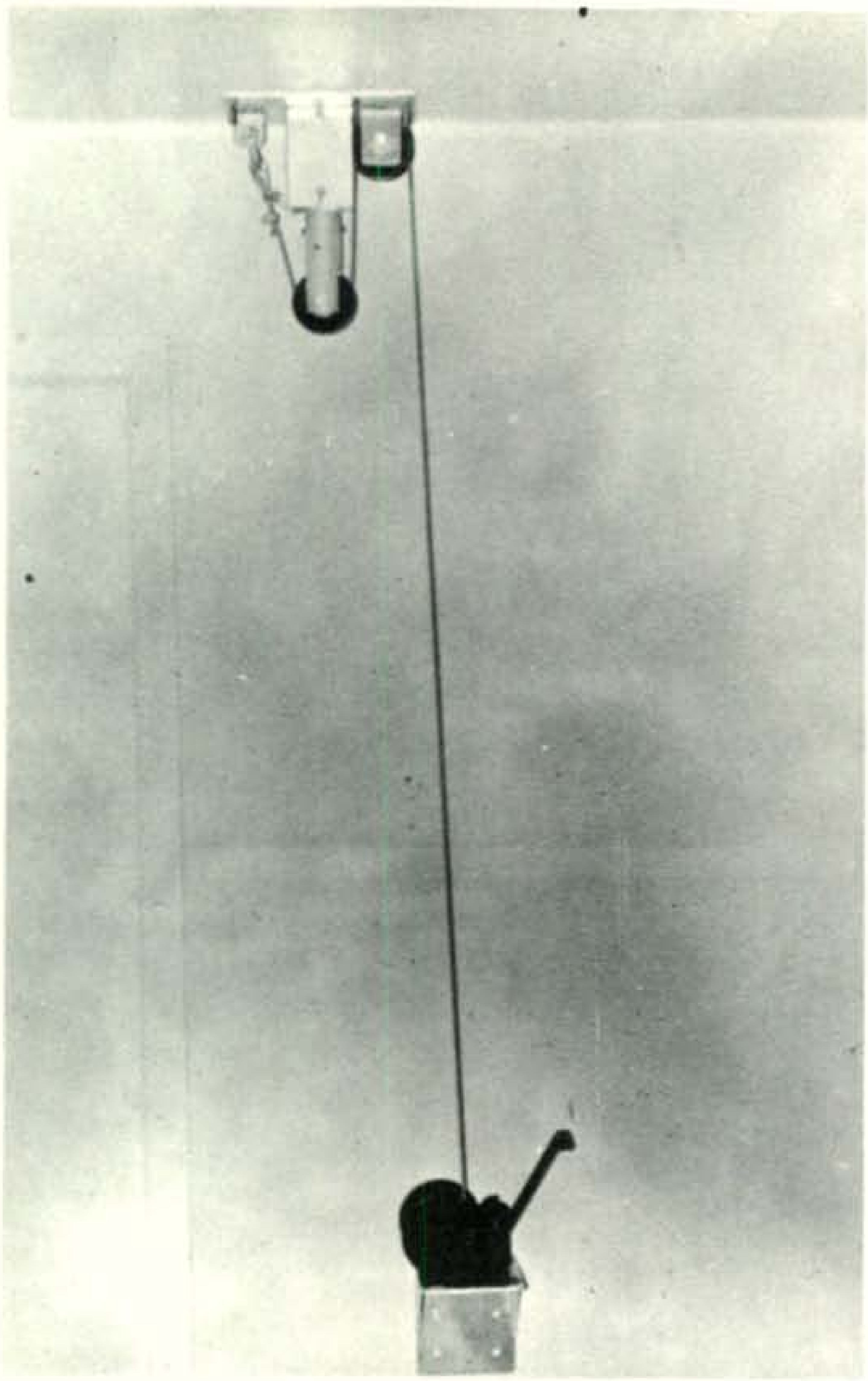


Fig. 7—The WA3HDU mast fully extended. The wall-mounted hoist has taken in the cable, pulling the telescoping mast to full height. The antenna is all ready to work DX!

coil for the lowest s.w.r. at the resonant frequency of the antenna. The impedance range you are interested in lies between approximately 30 ohms and 10 ohms. Above 30 ohms, the coil really isn't necessary. To achieve a good match to a 50 ohm line, the coil inductance should be as shown in fig. 3. If you don't know the input impedance of the antenna, you can start with the full coil in the circuit and gradually reduce it a turn at a time until you get a good match. A 3 microhenry coil is about right. A coil composed of 17 turns of #14 wire, one inch in diameter and two inches long will do the job. Wind it on a short length of plastic PVC pipe. The coil, in fact, will serve as the center insulator for the antenna. With a jumper, short out a turn at a time until you achieve a satisfactory value of s.w.r. at the resonant frequency of the antenna. For most antennas, you'll end up with about 8 or 9 turns in the circuit."

"Simple enough," said Pendergast. "I suppose the idea works whether or not you use a balun at the center of the dipole?"

"Correct," I replied. "I usually use a balun, but many fellows do not. It is strictly a matter of preference, I think."

Pendergast paused and looked over at the operating desk as I replaced the bound volume of *QST* in the bookcase. "Any interesting mail?" he asked.

"Yes," I admitted. "I received an especially interesting letter from Fred Hock, WA3HDU. Fred lives in a planned community where radio antennas are disallowed." He designed a disappearing antenna installation that received the approval of the Architectural Committee and he was kind enough to send me the information on it."

"Most Architectural Committees have a heart as cold as a Well Digger's boot," interrupted Pendergast." Its not easy to get approval of a ham antenna through those boys."

"WA3HDU did it with a disappearing tower. Look at the pictures (figures 4 through 7). Here's what Fred says: 'After working with antennas in the attic and fighting the detuning effects of air ducts and house wiring, I got the idea of a periscoping beam antenna. The antenna itself is a HY-Gain TH3, Jr., the smallest beam I could find. The main mast is 2-inch diameter aluminum tubing and vertical travel is about 7 feet. Along with a winch and cable, there are two bushings, one in the ceiling of the garage and the other in the roof. There is an anti-rotation pin for the mast built-in in both the extended and also in the fully retracted position. When erected, the antenna can rotate 360 degrees and has withstood winds up to 40 miles per hour.

'The crank-up beam was finally approved after 5 years (!) by the Architectural Committee. To the best of my knowledge, it is the first such approval here in Columbia, Maryland, which has a population of about 30,000 people, of which there are about 20 amateurs.

'I hope my experience in this precedence case might help others in some way and would be pleased to answer any questions on the subject.'

"Great!" exclaimed Pendergast. "It is a pleasure to see that an amateur met the antenna problem head-on and achieved a solution that was satisfactory to the City Fathers and to himself. Here's wishing plenty of DX for WA3-HDU and his telescoping antenna!"

73, Bill, W6SAI

Measurement of Capacitance Using a High Impedance Vacuum Tube Voltmeter

BY GEORGE MOYNAHAN, JR., W6AXT

ALTHOUGH it is often desirable to be able to measure the value of large capacitors, in the range of .05 microfarads to several hundred microfarads or even thousands of microfarads, very few of us have measuring equipment intended for this purpose. It may come as a surprise to many amateurs who have high impedance vacuum tube voltmeters or similar instruments that they have just the right equipment for such measurements. The only other things needed are a battery of other source of voltage, a watch or clock with a sweep hand and a few resistors of known value.

The method to be described is very simple and is based upon the manner in which a capacitor discharges through a resistor. If a capacitor of C farads is connected in parallel with a resistor of R ohms and then charged to a voltage V_o, using a battery or other voltage source, the capacitor discharges with a time constant $T = RC$ seconds so that the voltage V across the terminals of the capacitor after t seconds is

$$V = V_o e^{-t/RC}$$

where $e = 2.7183$

Suppose, to see how this works, we examine the discharge of a capacitor of known value through a known resistor. Let us connect an 8.0 mf (8.0×10^{-6} farad) in parallel with a 2.0 megohm resistor. Then, keeping the leads of a high-impedance v.t.v.m. across the combination charge the capacitor to 50 volts. The time constant of the resistor-capacitor combination is $T = (8 \times 10^{-6}) \times (2 \times 10^{6})$ or 16 seconds. A plot of the voltage across the capacitor, as a function of time will look like fig. 1.

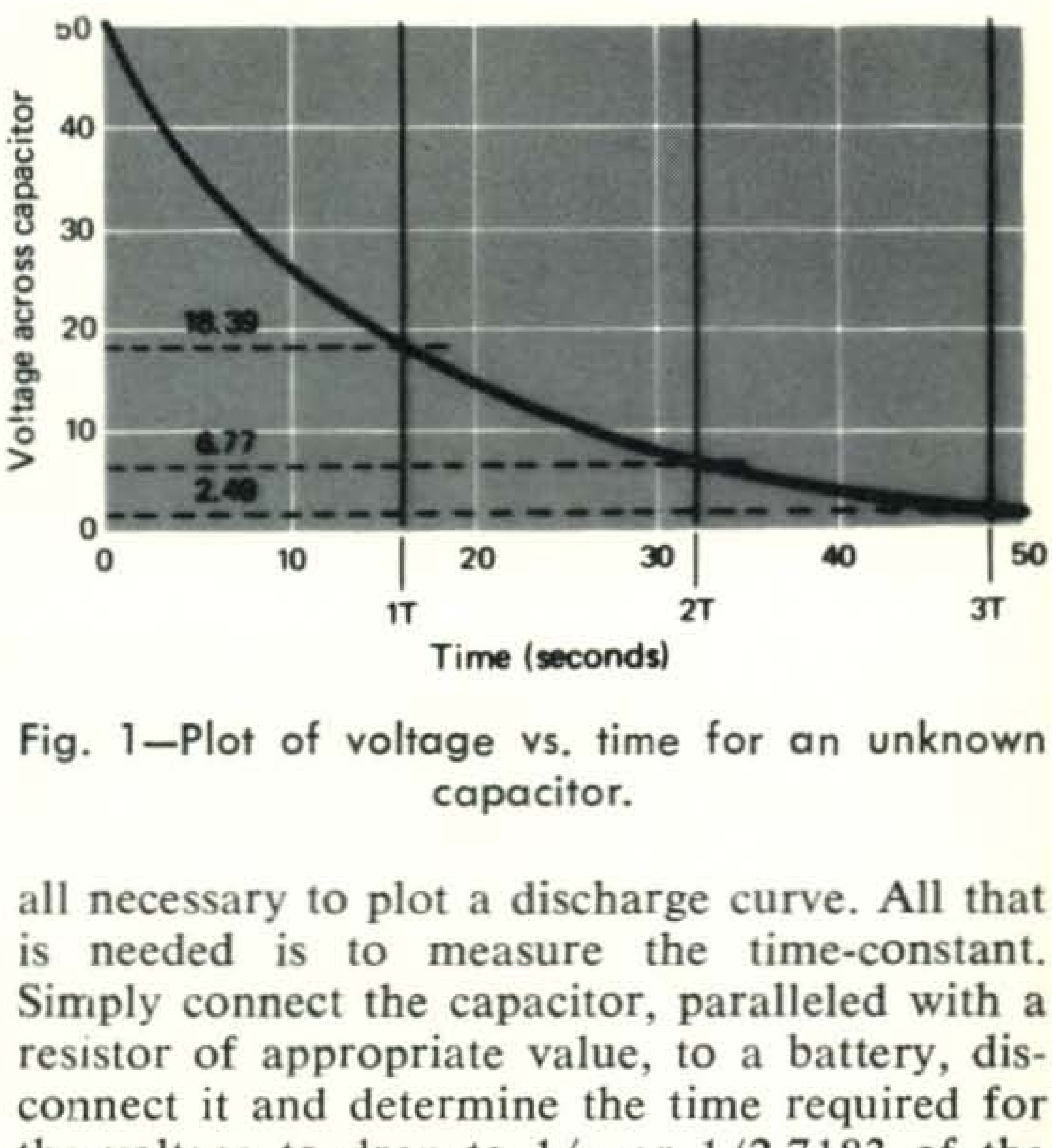


Fig. 1—Plot of voltage vs. time for an unknown capacitor.

Now, in using the time-constant method to measure the value of capacitance, it is not at all necessary to plot a discharge curve. All that is needed is to measure the time-constant. Simply connect the capacitor, paralleled with a resistor of appropriate value, to a battery, disconnect it and determine the time required for the voltage to drop to $1/e$ or $1/2.7183$ of the original value. This is the time constant $T = RC$. Capacitance is then found by dividing T by R.

If, for example, a capacitor is charged to 22.5 volts and is found to require 13 seconds to discharge through a 1.50 megohm resistor to a voltage of 22.5/2.7183 or 8.28 volts, its capacitance is:

$$C = \frac{13}{1.50 \times 10^6} = 8.67 \times 10^{-6} \text{ farads}$$

$$\text{or } C = 8.67 \text{ mf}$$

Of course, this method also works the other way around and one can find the value of an unknown resistor by placing it in parallel with a known capacitance.

The limiting factors involved in this method of measurement are the shunt resistance of the

[Continued on page 72]

*1224 Mary Ave., Sunnyvale, CA 94087.

An Electronic Hidden Word Puzzle

BY JOHN D. PETRIKAS, WA9TUI

So you think you're pretty good at digging the weak ones out of the QRM, eh? Well then, try your hand at digging 21 fairly common electronic terms out of the alphabetic QRM below. They may be spelled horizontally, vertically, diagonally, forward or backward. Average time for finding them all is 25 minutes. To make your life a little easier we've even listed 20 of the 21 words below. Good luck!

Answer is on page 72.

PROPAGATION	ELECTRONIC	RESISTANCE	TELETYPE
FREQUENCY	MICROWAVE	SUN SPOTS	REFRACTION
MODULATION	CAPACITANCE	RELUCTANCE	MAGNETISM
IONOSPHERE	MULTIPATH	SIDEBAND	TELEGRAPH
AMPLITUDE	REFLECTION	RADIATION	REACTANCE

F	L	R	O	C	T	I	O	N	M	S	I	T	E	N	G	A	M	N	P
Q	R	E	R	E	E	C	N	A	T	I	C	A	P	A	C	L	I	D	R
Y	X	E	W	L	R	A	I	P	D	K	A	I	J	C	Z	H	C	B	T
O	M	F	F	G	M	O	D	U	L	A	T	I	O	N	V	G	R	D	I
P	Y	N	W	L	I	O	M	V	O	K	I	G	C	E	I	G	O	F	K
R	H	X	B	H	E	N	C	E	D	U	O	I	C	B	W	S	W	E	O
E	N	O	I	T	A	C	I	N	U	M	M	O	C	M	E	D	A	L	N
L	Z	F	T	E	S	O	T	E	L	E	G	R	A	P	H	R	V	E	O
U	F	C	J	D	H	Z	I	I	O	N	O	S	P	H	E	R	E	N	A
C	R	N	X	U	A	R	O	V	O	J	E	L	K	F	E	B	A	O	J
T	E	I	O	T	I	O	N	Q	L	N	L	Y	R	G	E	N	Q	I	L
A	Q	H	M	I	D	N	U	N	S	K	U	A	D	A	C	O	I	T	V
N	U	P	Y	L	Q	Z	O	I	O	S	C	T	A	M	N	E	H	A	Q
C	E	X	S	P	T	I	D	K	R	T	I	O	N	T	A	P	O	G	E
E	N	T	J	M	T	E	R	T	I	O	N	V	F	W	T	Y	O	A	N
I	C	Y	R	A	B	V	I	O	X	P	O	W	D	I	C	T	N	P	C
L	Y	C	I	A	Z	E	N	C	E	S	E	S	B	C	A	E	E	O	R
R	A	D	N	O	J	B	E	C	I	N	O	R	T	C	E	L	E	R	T
U	A	D	H	T	A	P	I	T	L	U	M	Q	P	D	R	E	G	P	R
R	E	S	I	S	T	A	N	C	E	S	A	C	P	E	A	T	E	B	I
E	R	M	K	J	R	O	S	T	I	O	N	K	I	T	Y	A	N	C	E

Accuracy and Calibration of SWR Meters

BY DONALD E. WILLIAMSON,* K4HVI AND
W. HARRISON FAULKNER, JR., W4DO

Much has been written about the importance of maintaining a low standing wave ratio (s.w.r.) at the transmission line feed point and the desirability of a low s.w.r. at the antenna feed point. The tolerance of the transmitter final to high values of s.w.r. is a characteristic of the particular transmitter. The only important factor of an s.w.r. greater than 1:1 is concerned with the amount of power absorbed by losses in the transmission line and the failure of the transmitter to deliver its rated power, since all the power put out by the transmitter has either got to be radiated by the antenna or used up as heat in the transmission line.

Whereas s.w.r. meters are readily available and are frequently built into some part of the transmitting equipment, the authors have found no information as to the accuracy to be expected from these devices or how they may be calibrated. While "reading the mail" on our two meter repeater, we hear s.w.r. readings quoted with pride and joy with the implied assurance that the numbers are meaningful.

Two types of s.w.r. meters were available to the authors, representing about seven different instruments. Among these seven there was very little agreement. The readings were a function of both the applied power and the frequency. Two of the instruments were those built into the Collins 312B-4/5 in which the values of forward and reflected power are read and the s.w.r. determined from the familiar charts which somehow seem singularly difficult to interpret. This difficulty will be discussed later. Three of the instruments were the common Japanese-made meters that measure 2 × 2¼ × 4¾ inches and can be purchased with either a single meter and a switch to change from forward to reflected power, or with two meters so that switching is unnecessary. Aside from the choice of the single or double meter arrangement, all of this type that we have examined are identical in construction and consist essentially of a square trough-line coax with a straight-through center conductor of reasonable dimension. Calculation of the impedance from the dimension of the square and the diameter of the center conductor comes reasonably close to 50 ohms. Two parallel rods within the square are used to pick up energy for the forward and reflected power, one of the rods having its diode at one end and the other having the diode at the opposite end.

These direct-reading meters are available under such a variety of names, that to identify a single one by name would be meaningless. They will hereafter be identified as "trough-line direct reading" meters.

Method

With such motley and inconsistent measurements of s.w.r. from this variety of equipment, it was decided to perform individual calibrations of each of the instruments. The scheme selected by one of us (W4DO) was to arrange a calibrated variable air capacitor that could be closely coupled in parallel with a 50 ohm dummy load. A 300 pf linear capacitance Hammarlund air capacior was fitted with a dial and pointer and supplied with a short length of RG-8U terminating in a PL-259 connector. This could be placed in parallel with a 50 ohm dummy load by the use of a "T" connector. A schematic of the arrangement is shown in fig. 1.

The capacitance of the air capacitor (including the short length of coax and PL-259 connector) was calibrated using a General Radio Type 1656 Impedance Bridge using its biult-in 1000 Hz generator. The capacitor could readily be measured to three significant figures and was found to have a range from 25 pf to 336 pf.

Assuming that the impedance of the transmission line is 50 ohms and that the resistance of the

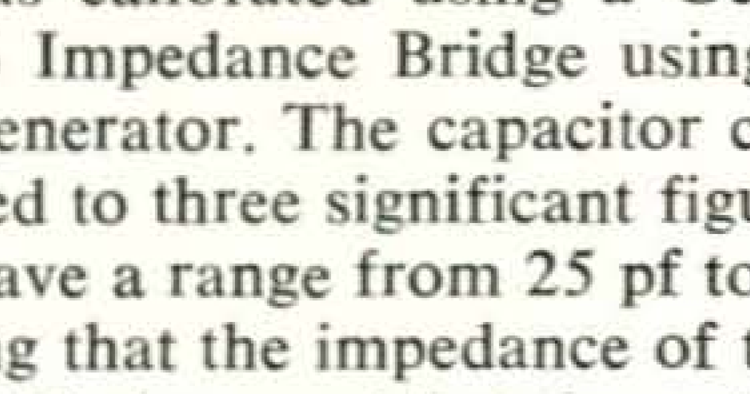


Fig. 1—Schematic of the test circuit. The s.w.r. meter under test is inserted in the line as closely as possible to terminals A-B.

*13001 Old Cutler Road, Miami, FL 33156.

dummy load is also 50 ohms, the standing wave ratio at the feed point of the dummy load-capacitor can be easily calculated from the formula:

$$S.W.R. = \frac{\sqrt{1+4\left(\frac{Xc}{R}\right)^2}+1}{\sqrt{1+4\left(\frac{Xc}{R}\right)^2}-1}$$

where X_c is the capacitive reactance of the air capacitor and R is the impedance of the transmission line and the dummy load which are assumed to be equal and with a value of 50 ohms resistive.

In order to save time and energy, this formula was fed into a computer and s.w.r. values for various settings of the capacitor were calculated for frequencies of 3.8, 7.2, 14.2, 21.27, 28.5, and 146 MHz. Selected values from this printout are shown in Table 1, where frequency is in megahertz (MHz) and capacitance is in picofarads (pf).

The values of capacitance were chosen to be the points on the dial where the calibration was made, thereby avoiding the inaccuracy and inconvenience of reading a graph of dial reading *vs.* capacitance.

Table 1—Capacitance vs. s.w.r. for various frequencies

Freq.	*Capacitance*	*S.W.R.*
3.80	77.	1.10
3.80	143.	1.19
3.80	208.	1.28
3.80	274.	1.38
3.80	336.	1.49
7.20	77.	1.19
7.20	110.	1.28
7.20	1.43	1.38
7.20	175.	1.48
7.20	307.	1.98
14.20	25.	1.12
14.20	46.	1.23
14.20	77.	1.41
14.20	110.	1.63
14.20	175.	2.14
14.20	274.	3.18
14.20	336.	4.00
21.27	25.	1.18
21.27	46.	1.36
21.27	110.	2.05
21.27	143.	2.52
21.27	175.	3.04
21.27	241.	4.36
28.50	25.	1.25
28.50	46.	1.51
28.50	77.	1.97
28.50	110.	2.58
28.50	143.	3.34
28.50	175.	4.22
146.00	25.	2.98

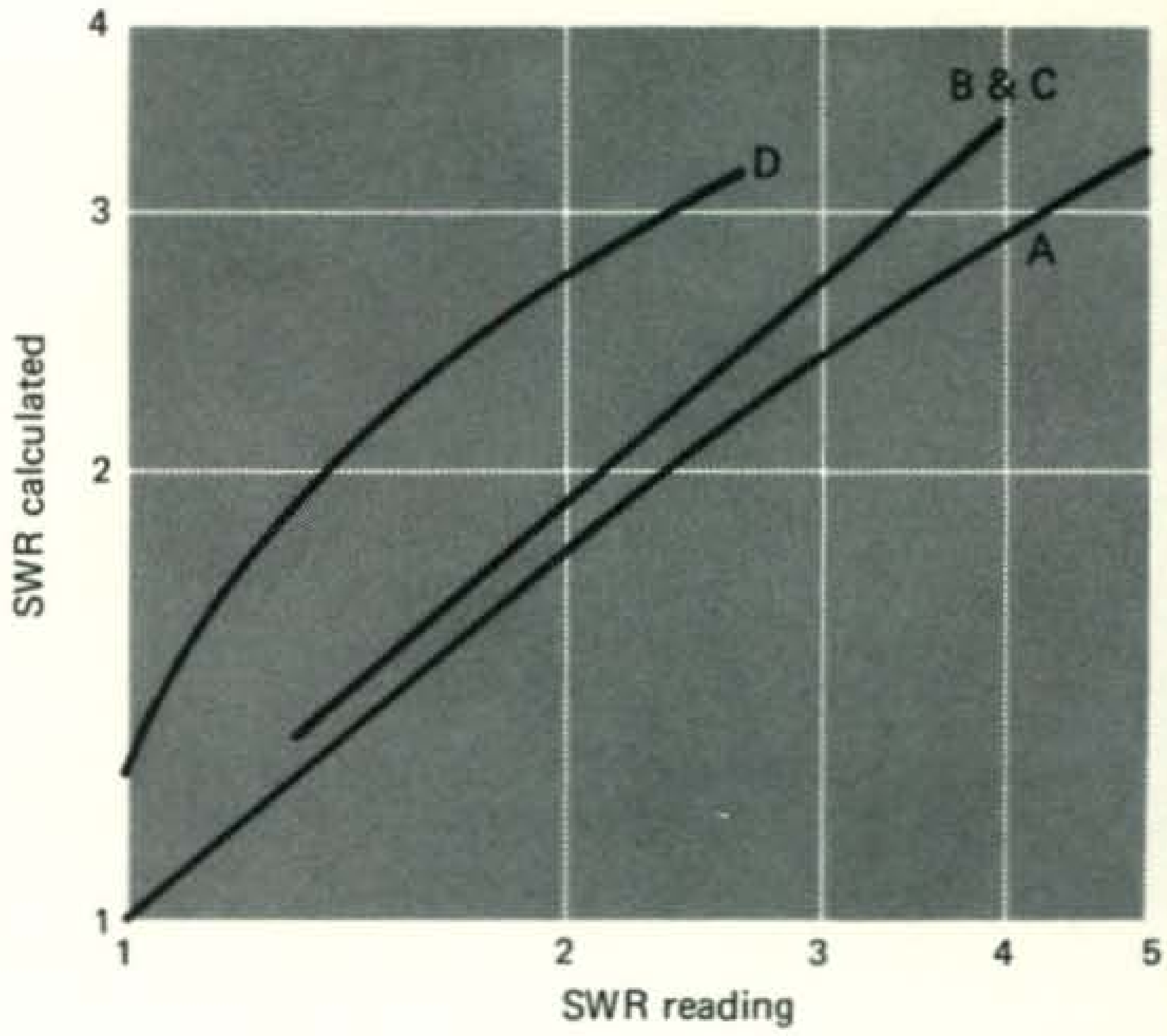


Fig. 2—S.w.r. readings *vs.* calculated values at 28.5 MHz Curve A is from the Collins 312B-4/5 at 200 watts forward power. Curves B and C are coincident and combine two sets of data from a trough-line direct reading meter at both 20 and 100 watts forward power. Curve D is the same meter at the minimum power required to drive the forward power meter to full scale.

Results

A plot of the s.w.r. readings of the various meters *vs.* the calculated s.w.r. resulted in curves that are literally all over the place. Using the trough-line s.w.r. meters, driven with a Clegg FM-27B, the numbers are essentially worthless. For instance, a calculated value of 2.98 resulted in a nearly full scale deflection of the s.w.r. meter. The possibility exists that at this frequency a systematic error in the test set-cp could have been largely responsible for the discrepancy. Four curves are reproduced in fig. 2 to illustrate the kind of results that were obtained at frequencies of 28.5 MHz and below. The power source used was either the Collins 32S-1 or KWM-2 since with this equipment it is possible to adjust forward power to any desired value. The reading of forward power by the 312B-4/5 set on the 200 watt scale was assumed to be correct.

It is seen from fig. 2 that the reading of the Collins (Curve A) was consistently high at 28.5 MHz with 200 watts of forward power. (At 14.2 MHz the readings were slightly better and were almost correct, particularly below S.w.r. = 2.) Curves B and C were made on one of the trough-line s.w.r. meters having both a forward and reflected power meter, the latter being calibrated in s.w.r. This curve is actually two curves, one made at 20 watts and the other made at 100 watts forward power as read by the Collins wattmeter, the frequency being 28.5 MHz. The readings at these two power settings were virtually identical. This meter was actually the best of those tested when operated on 14.2 MHz at 20 watts. To illustrate the effect of power, Curve D was with the same trough-line unit operated at 28.5 MHz but with the minimum amount of power necessary to attain full scale reading on the forward power meter. The discrepancy is explained as resulting from the characteristics of the diode in the reflected power circuit at low power levels. The measuring circuit of the trough-line meter used to obtain Curves B, C, and D of fig. 2 consists of a 100 microamp meter having an internal resistance of about 300 ohms. This is in series with a germanium diode connected to one end of one of the parallel rods, the other side of the meter being returned to ground. The other end of the same rod is provided with a 150 ohm "matching" resistor which is returned to ground. With the "gain control" turned all the way up,there are 10,000 ohms across the meter. If the circuit is broken at the 150 ohm resistor and a d.c. potential applied, it requires 0.28 volt to drive the meter full scale. Under these conditions the forward drop across the diode is 0.17 volts. In other words, in the most "sensitive" setting, more than half of the voltage available to indicate s.w.r. is used up in the diode drop. Since the s.w.r. meter is expected to read less than half scale (S.w.r. = 3), it is clear that extreme non-linearity will result for this reason alone.

The conclusion that we have reached is that at best an s.w.r. reading is only an approximation and that there is a great difference between instruments of different manufacture. Only one thing seems certain and that is that when the meter reading goes up the s.w.r. also goes up and vice versa. It should be emphasized that at low values of s.w.r., a reflected power meter may not give meaningful readings or may give no reading at all. Thus a reading of unity does not necessarily mean that this is the standing wave ratio and in fact the measurement of s.w.r. betwen 1.0 and 1.2 would be very difficult to accomplish.

To examine this last statement and to explain the difficulty in reading the charts of forward and reflected power versus s.w.r. three plots were made of the formula:

$$\text{s.w.r.} = \frac{1+\sqrt{\frac{\text{Reflected Power}}{\text{Forward Power}}}}{1-\sqrt{\frac{\text{Reflected Power}}{\text{Forward Power}}}}$$

These plots were made assuming a forward power of 200 watts with reflected power being the independent variable. Figure 3 is a plot of reflected power versus s.w.r. Note in particular the sudden dropoff in s.w.r. at low values of reflected power and that the curve is essentially a straight line between s.w.r. values of 1.4 and 4. This was confirmed by another plot which expanded that region of the curve but is not reproduced here. Figure 4 shows a still further expanded plot showing the shape of the curve below s.w.r.=1.2. It is clear from this that the measurement of reflected power would have to be extremely precise in order to make meaningful measurements in this region.

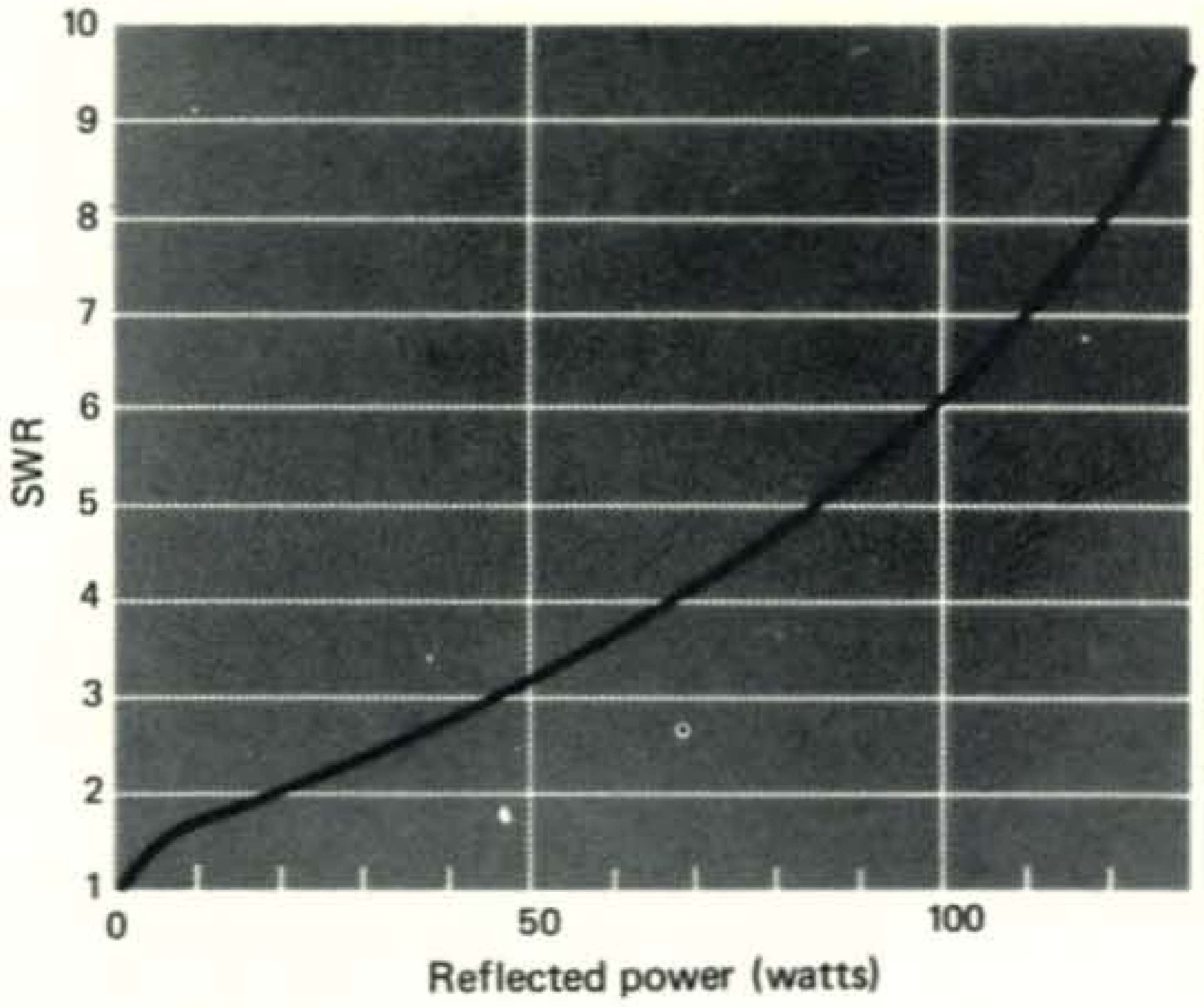


Fig. 3—Reflected power *vs.* s.w.r. with 200 watts forward power. Note the linear relationship between s.w.r. values of 1.4 and 4.

Conclusions

So for what it may be worth and in spite of the unhappiness that may result from what one of our colleagues refers to as "the tyranny of the small numbers," we can draw four conclusions from these experiments.

1. Over a reasonable range of frequencies, particularly the low bands, the reading accuracy may not be much better than ±20% in the vicinity of 2 or 3 (s.w.r.).

2. Given a dummy load and transmission line that you believe in and having at hand a single good quality capacitor, accurately measured and properly installed, a single calibration point on each of the bands of interest is not difficult to obtain.

[*Continued on page 71*]

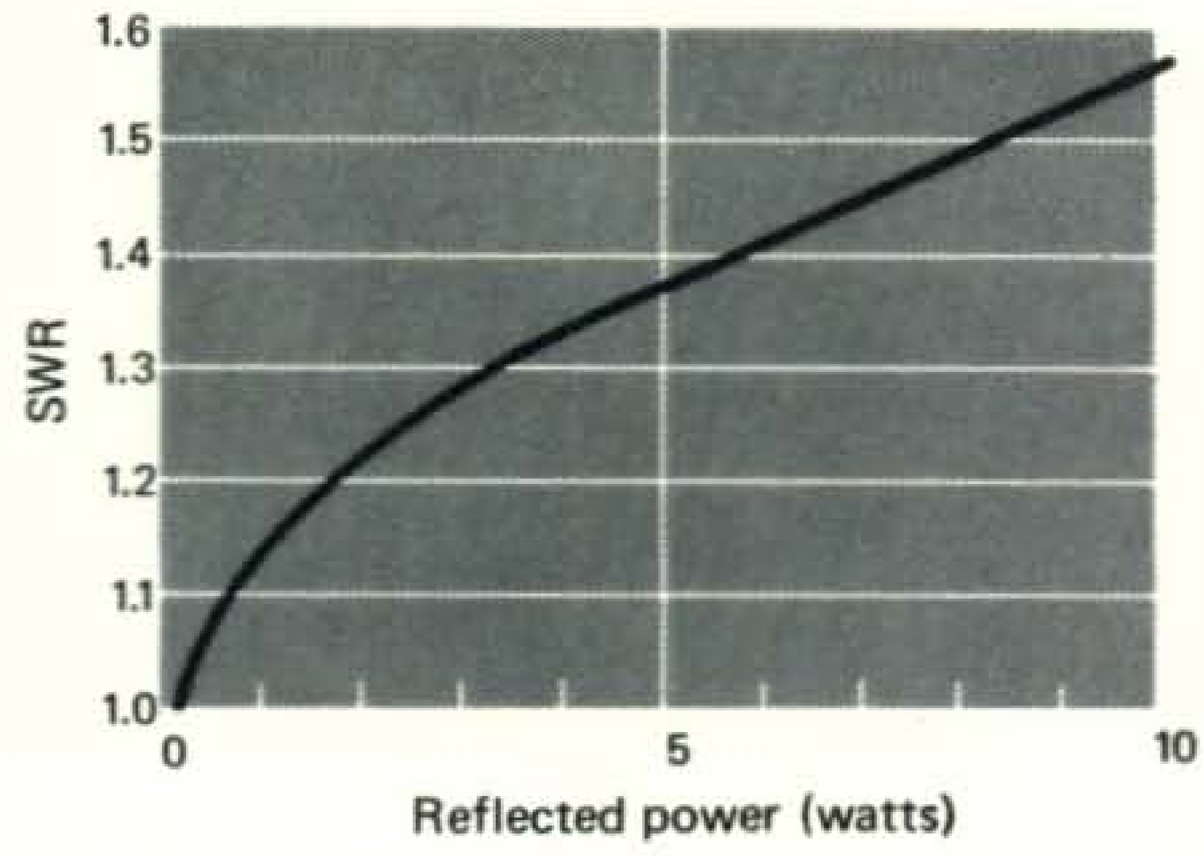


Fig. 4—Expanded curve of reflected power *vs.* s.w.r. at 200 watts forward power. Note the sudden drop in the curve at s.w.r. values less than 1.2, making measurements extremely difficult in this range.

DeWitt — In Focus

BY BILL DeWITT,* W2DD

I CAN think of no more appropriate way to begin this column than to congratulate Cop MacDonald on the fine job he has done as *CQ's* SSTV Editor. Every slow scanner owes Cop a debt of gratitude for his inventive and pioneering efforts in the first place, but in his *CQ* column he has also done an outstanding job of coherently explaining virtually every phase of SSTV to *CQ*'s readers. Perhaps of equal importance is the way that Cop has repeatedly demonstrated the practical usefulness of SSTV as a means of exchanging non-alphanumeric information. Picture Transmission represents the prime usefulness of SSTV, and I shall do my best to emulate Cop's example of encouraging Picture Transmission.

It's a bit late for a story on SSTV happenings at the Dayton Hamvention. However, since I think "Dayton '75" represents a benchmark in SSTV progress, here's a mini-report.

It was clear from the papers presented, and the announcement of Robot's new equipment (see photo) that scan conversion is not only on its way, it's here to stay! The second era of SSTV has begun.

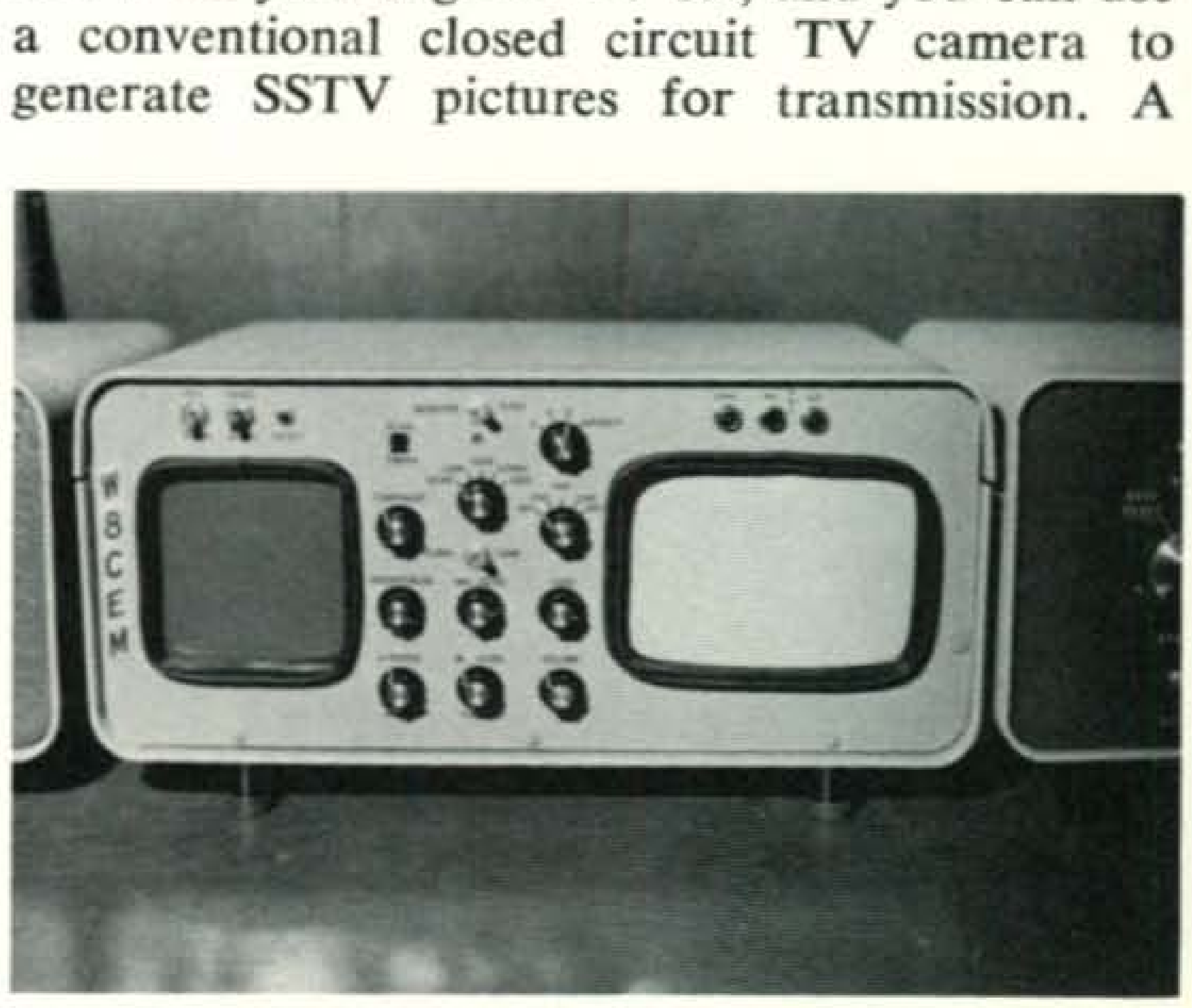
A friendly, informative, and stimulating seminar on the first evening of the 'vention was rated "best ever" by all who attended. Dr. Don Miller, W9NTP, did a superb job of chairing this session which included informal resumés (and demonstrations) of several papers presented formally the next day. But this was a down-to-earth, nitty gritty discussion—the value of which is hard to over-estimate. Everybody joined in. Incidentally, those masters of circuit-boardology, Russ Sievert, W8OZA, and Phil Howlett, WA9UHV, were on hand to help maintain the practicality of the seminar session. They also added a bit of humor with their comments on Dr. Robert Suding's Mark I, Mark II, etc. "mods"!

The papers and demonstrations by Dr. George Steber, WB9LVI, Dr. Don Miller, Dr. Robert Suding, WØLMD, Dr. Robert Schloeman, WA7MOV, Dr. Ralph Taggart, WB8DQT, and Mike Tallent, W6MXV forecast a bright future for SSTV. The mindboggling presentations of color slow scan (on a conventional color set) and image processing techniques to enhance apparent detail represent giant steps in slow scan technology. The proposed use of micro-processing techniques opens another fascinating area of investigation not limited to SSTV applications. It was a rewarding three days for the slow scanners attending.

In next month's column I hope to have some firm proposals for an SSTV test pattern and/or resolution chart. This is a long-needed means of comparison that just doesn't exist for slow scan. The 1:1 aspect ratio of SSTV creates a primary problem in regard to the use of standard broadcast TV charts, and the resolving capability of our system calls for additional changes. Looking at the various demonstrations at Dayton, I was struck by the fact that there was absolutely no quantitative basis available for intercomparison of the several fine systems shown. True, there were pictures to be viewed on each monitor, but every demonstration had its own supply of original material, and its own tape recorder input. No one should interpret these comments as derogatory of the excellent demonstrations, I am simply pointing out the fact that the excellence of the results warrants an objective means of measuring the true capability of the systems. All suggestions regarding the make-up of an effective test pattern for SSTV purposes will be welcomed at the address listed below.

In the next few months, *CQ* will bring you detailed reviews of both Sumner Electronics and Engrg. and Robot equipment. In the meantime, a few comments on the present scene. Robot's Model 300 Scan Converter and Sumner's Model HCV-3KB Keyboard were the attention getters at Dayton.

The Robot Model 300 Scan Converter puts SSTV on your regular TV set, and you can use a conventional closed circuit TV camera to generate SSTV pictures for transmission. A



Combination fast and slow scan monitor designed and built by W8CEM.

*2112 Turk Hill Road, Fairport, NY 14450.

W2DD photographs himself on Robot Monitor as Dave Smith of Robot Research adjusts fast scan camera input to Model 300 Scan Converter. (Photo taken at Dayton Hamvention.)

double-ended storage tube is the heart of Robot's system. This tube "writes in" TV pictures from the camera at 30 frames per second—525 lines, and "reads out" at 128 lines (or at your option, 256 lines) with a frame rate of 8 seconds (or 34 seconds for the 256 line frame). All viewing is done on a conventional TV set/monitor. Individual received frames are viewed as black and white images either as complete frames "frozen" for extended viewing, or in sequence as received.

Robot's introduction of a 256 line picture capability offers an improvement in resolution. Until other gear is modified to accept the 256 line frame, Mode 300 users will be limited to exchanging higher resolution pictures with other Model 300 owners. PLEASE NOTE: The Model 300 also operates at current standards for picture exchange with all existing SSTV stations.

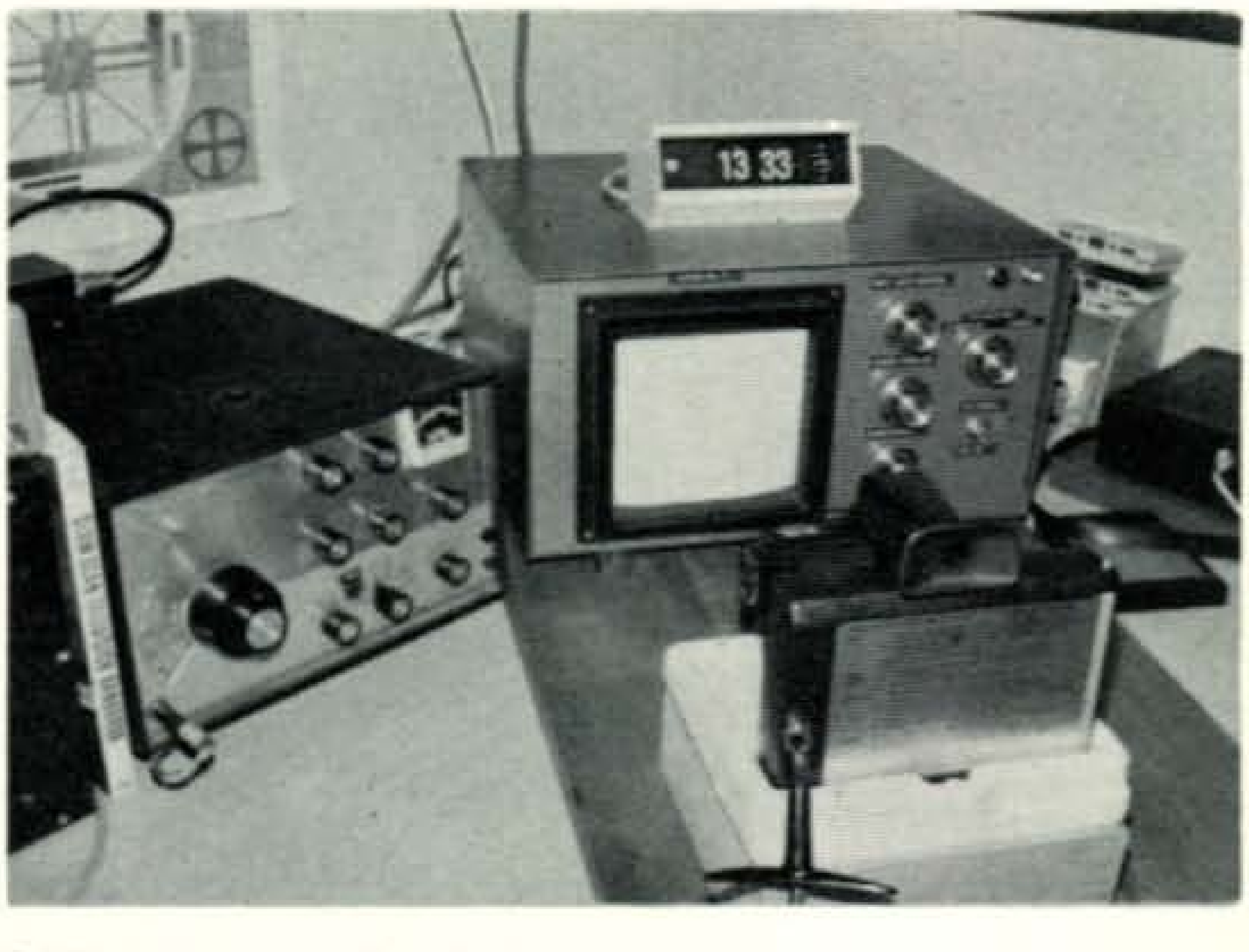
Probably the best kept secret in the ham radio field (ever) was Robot's Model 300 unit with the double-ended storage tube. Since early in '72, yours truly has been pushing for some form of scan conversion. Experience with the Hughes Model MSC-1 Storage Tube Scan Converter convinced me that this was the way to go. At the risk of offending digital afficionados, I feel that some form of analog storage is superior to discrete-incremental digital storage. This is a generalization based on currently proposed storage capabilities for digital systems. There are so many bases upon which one can compare the storage tube versus the digital storage approach that I suppose the question becomes moot, but here again is demonstrated the need for a quantitative basis of comparison. Sometime in the next five years the arguments over both the cost and relative merits of the various approaches to scan conversion will probably simmer down to a dull roar. Right now, none of the methods are what you'd call cheap! Starting from no parts at all, I think it's a fair guess that you could spend about $900 to build both fast to slow and slow to fast scan converters. Robot's Model 300 is priced at $1295, and I have no recent quotes on CCDs. But the interest is there, and my guess is that the market for both kits and complete units will grow rapidly.

Speaking of CCDs, it's rumored that Sumner is bringing out a ham version of their commercial scan converter which uses a CCD array. No word on how soon, but Sumner's Dr. Jim Thomas is known to have had considerable experience in the CCD field.

At the Dayton SSTV seminar mentioned earlier, it was suggested that all hams possessing early SSTV gear in any form should be sure to hang onto it and give consideration to placing it in a museum. This applies to correspondence and any tapes made in the early days. To encourage action along this line, Robert "Gervie" Gervenack, W7FEN, has offered to act as a clearing house for information. If you have any early SSTV gear or data as noted, please write to Gervie at 19701 320th Ave. N.E. Duvall, Wash. 98019. Don't send any gear to him, just tell him what you have. He is going to prepare an index of who has what so that museums can be contacted in an effort to preserve these items of real historical value. Cop MacDonald, I hope you are a "pack rat"!

Some other seminar discussion items worth considering: Want more action on the 40 meter band? Try calling *CQ* instead of listening. This bad offers good opportunities for "short haul" contacts without the distraction of multi-path effects during most of the daylight hours. Don't just listen, let's get some action going!

It was also mentioned that spreading out a bit on 20 meters would be a good idea. A good share of the QRM experienced by slow scanners on this band is generated by other SSTV stations. We can all help the situation by moving to other frequencies for those interminable clinical discussions of our latest problems whether related to SSTV or not. There is no



SSTV Monitor built by VK3LM per Robot design.

ZS6PP, Peter Towers of Johannesburg, South Africa.

particular magic associated with 14230 kHz, so whynot use a greater span of the allowable frequencies?

Each month, In Focus will bring you news and pictures of the many friends you have on SSTV. We're starting off with some call letters familiar to practically everyone who owns a monitor.

A few years ago, one of the most frequently heard SSTV stations was ZS6PP. Peter Towers, who signs that call, is seen in the accompanying photo. Although Peter and his family do quite a bit of traveling in a four-wheel drive recreational vehicle, he still finds time to get on the air. ZS6PP can be heard using a Yaesu FT-75B (transistorized low power s.s.b. rig) from the "station break" now and then, but he is still keeping his hand in on construction projects. Peter confesses to some diabolical thoughts regarding the WØLMD scan converter seen in this picture! Apparently he has run into "a few bugs." Dr. Robert, would a South African mercy mission interest you?

As you can see in the other two photos, "homebrewers" can do wonderful things. The monitor with the clock on top was built by John Wilson, VK3LM, of Ringwood East, near Melbourne, Australia. It is as nearly direct a copy of a Robot Model 70 monitor as can be produced, with the exception of the tube. John was instrumental in persuading a Melbourne firm to re-phosphor a small TV tube with a mixture of phosphors that yields a yellowish image, and is not excited (as is the P-7) by high levels of ambient light. Note the simple pedestal-like set up John uses when photographing the monitor screen.

John is one of Australia's leading SSTV amateurs. He is the author of almost innumerable articles on SSTV, and has recently completed a directory of all VK and ZL SSTV stations. (There are about 125 VK and 20 ZL stations equipped for two way operation, additional stations with monitors only.)

The head of the Television and Audio Visual Department of Collingwood Technical College, John is married. He and his wife Joan have three children.

According to John, no special license is required for SSTV operation in VKland. About 95 percent of all SSTV gear used in Australia is homebrew. Very little commercially made equipment is imported because of the high import duty involved.

Some time ago, John and I had the pleasure of conducting the first two-way exchange of color slow scan between the USA and Australia. Now I have trouble finding VKs on 20—will this blasted sunspot cycle ever improve?

The monitor with two screens is a combination fast and slow scan job designed and built by Chuck Perry, W8ECM, of North Olmsted, Ohio. Chuck's design meets every conceivable need. Switching between fast and slow, keyboard input, gray scale, you name it, it's built-in! A very nifty job, Chuck.

In the interest of self-edification and further appreciation of the finer things in life, I commend your attention to the recently published ARRL book, *Specialized Techniques for the Radio Amateur*. It contains basic information on ATV, SSTV, FAX, RTTY, Space Communications, and strangely enough for an ARRL publication, no articles on automatic keyers. A pretty good little book to give you a look-see at what those other fellows on the bands are doing.

Cop MacDonald is a hard act to follow! "In Focus" will be a bit different than "Cop's Column," but I hope you'll like it. The title is a clue to my intentions. I hope to bring a wide range of subjects into focus for a closer look. If you wish, In Focus can be a forum for the exchange of information. So, if you have information that you would like to share, or need help on a problem, please write to my home address, 2112 Turk Hill Rd., Fairport, N.Y. 14450.

73, Bill, W2DD

AMSAT-OSCAR 6 Orbital Data Calendar

In cooperation with AMSAT, Skip Reymann, W6PAJ has published an AMSAT-OSCAR orbital data calendar containing all orbits for 1975 for both AMSAT-OSCAR 6 and AMSAT-OSCAR 7. Designed so that it may be hung on the wall, the calendar includes information on the operating schedules and frequencies for both spacecraft, and also the telemetry decoding equations. Also included is step-by-step information on how to determine times of passage of the satellites.

The orbital data calendar is available postpaid for $3.00 US or 20 IRC's. Overseas orders will be shipped via airmail. Order from: Skip Reymann, W6PAJ, P.O. Box 374, San Dimas, CA 91773.

All excess receipts over costs will be donated to the AMSAT-OSCAR space program.

CQ BOOK SHOP

CQ Binders
Convenient and economical are the words for CQ's beautiful maroon and gold binders. Individual issues can be removed quickly and easily without damage to the magazine. Save precious time as reference copies are within immediate reach in this handy binder. $5.00

The New RTTY Handbook
A treasury of vital and "hard-to-get" information, this book is loaded with valuable equipment schematics, adjustment procedures, etc. A boon to beginner and pro. A special section on getting started, written by Byron Kretzman, W2JTP, a well-known authority in the field. $3.95

Antenna Roundup I
Edited by Art Seidman, a 160 page mass of antenna information directed at answering a multitude of questions surrounding the mysterious antenna. $3.00

Antenna Roundup II
Ten big theory articles backed up by 82 detailed and illustrated construction projects from VLF to microwave, long wires to 17 element beams and Sterba Curtain arrays. $4.00

Shop & Shack Shortcuts
A volume packed with hundreds of hints & shortcuts collected by Don Stoner, this will help anyone to dress up his shack, improve shop techniques and increase efficiency and equipment. $3.95

Antenna Handbook I
All new information on transmission line theory, Attenuation, Impedance, Standing waves, Resonant and nonresonant lines, current distribution, free space 3 dimensional patterns of long wires of all practical length and much, much more by Ken Glanzer. $4.00

The New DX Handbook
Don Miller's 200 pages of valuable technical information and operating aids, most of which has never been published before and can be found in no other volume contains Great Circle Bearing Charts. $5.00

CQ Anthology II
1952-1959 250 pages of more recent but still hard-to-get important articles from glorious yesteryear. $3.00

Surplus Conversion Handbook
Compiled by Tom Kneitel, WB2AAI, this contains 192 pages of conversion articles, covering almost every piece of surplus gear worth the effort to convert to ham use. $4.50

Electronic Circuit Handbook I
Written by Tom Kneitel, WB2AAI, this details 150 of the most often needed circuits in 11 great chapters. Invaluable for beginners and old-timers alike. $3.00

Electronic Circuit Handbook II
Tom Kneitel's own sequel to Vol 1, this volume delivers 159 additional circuits that will appeal to all amateurs. Each circuit is fully described in text with complete schematics. $3.00

RTTY From A To Z
This new RTTY Classic has been produced to fill the gaps in RTTY knowledge among amateurs and professionals alike. 16 chapters and 224 pages. This book is a must in your technical library. $5.00

USA-CA Record Book
The official application and Record book for the coveted United States of America Counties Award issued by CQ. Contains room for simple entry of all data required to apply, plus rules and endorsement application. Two copies recommended: one for application, one for your records. Per copy price: $1.00.

Vertical Antenna Handbook
Compiling in one reference source 22-years-worth of material by Capt. Paul H. Lee on vertical antenna theory, design, installation, construction. Every aspect of vertical antennas is covered by the author including the most commonly asked questions about them and the answers gleaned from years of professional and amateur experience.

- ☐ CQ Anthology II $3.00
- ☐ CQ Binders $5.00
- ☐ New RTTY Handbook $3.95
- ☐ Antenna Roundup I $3.00
- ☐ Antenna Roundup II $4.00
- ☐ USA-CA Record Book $1.00
- ☐ Vertical Antenna Handbook $5.00
- ☐ Shop & Shack Shortcuts $3.95
- ☐ Electronic Circuits Handbook I $3.00
- ☐ Electronic Circuits Handbook II $3.00
- ☐ Surplus Conversion Handbook $4.50
- ☐ Antenna Handbook I $4.00
- ☐ New DX Handbook $5.00
- ☐ RTTY From A To Z $5.00

NAME ____________________

ADDRESS ____________________

CITY ____________________

STATE ____________________ ZIP ____________________

New York City and State residents must add sales tax applicable to your area.

COWAN PUBLISHING CORP. Book Div.
14 Vanderventer Avenue • Port Washington, L.I., N.Y: 11050

Cheap Selectivity for the Hammarlund HQ-215 and Other 455 kHz I.F. Receivers

BY JOHN R. WINE,* KH6GMM

I SOMETIMES construct receivers or transmitters only to find that receivers are and were my first and greatest love . . . all kinds of smooth operating receiving gear, from the lowliest regenerative one-tuber to the multi-transistor Nationals or Hammarlunds. My current pet is not very old. About three years ago I was tickled pink to unwrap the Henry Radio air express Hammarlund HQ-215 superhet. It has everything I enjoy on s.s.b.: a long-enough dial to make it appear to be a drum-dial with light numerals on a black ground, solid state with low drift and little current drain. The lack of a c.w. filter was disconcerting in pile-ups. So I pined for a 500 or a 300 cycle filter, but the price was way out of sight for me.

B and F Enterprise's catalog last year announced some new surplus filters as "Collins Mechanical Filters." I had a few reservations but ordered one intending to try it out in my HQ-215. Upon receipt, the label said it was a crystal filter.[1] Not widely known are the Collins crystal filters of excellent quality; much less famous than the mechanical filters associated closely with the Collins name. For anyone planning to duplicate my project it must be noted that the physical size of the Collins filter is greater than the Hammarlund filter and one of the hold-down screws and posts must be removed to get the new filter into its space under the board of the HQ-215. You can save the two screws and metal post for resale time.

To install, remove the bottom cover by taking out the three screws on back lip of bottom cover and sliding off the bottom plate only. Solder four insulated #22 or 24 wires to the four terminals of the filter using little heat from a 25 watt pencil iron. Firmly insert the four wires into the four active pins on the in and out sockets of FL-203. Place a short ½" × 1¼" strip of Scotch electrical tape along the case of the filter to prevent shorting with the Filter Switch levers. Press the filter gently into position and anchor with the scrap strip of polyurethane foam about 1" × 4". The grounded "base" pin of the filter socket is not used, only the active pins being connected.

It appears that the Hammarlund X-Ray printed board view in my 1968 HQ-215 Manual has a reversed label on FL201 and FL203. FL203 should be labelled as the c.w. filter position to agree with the schematic.

[*Continued on page 71*]

*P.O. Box 3136, Honolulu, Hawaii 96802.

[1] Part #526 7073 009, Collins type #X455KF-300, advertised as "Collins Mechanical Filter" by B & F Enterprises, 119 Foster St., Peabody, Mass. 01960. Price $14.75.

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

The "Giant Flea" QRPP Transmitter

Ever since MFJ Enterprises came out with their QRPp transmitter module and v.f.o. for 7 MHz, I've been toying with the idea of combining the two units in a really miniature QRPp transmitter that packs quite a bit more punch than the usual miniature transmitter. You all know the process—you turn the project over in your mind periodically, and then something happens that sparks it into a concrete reality. The spark came when I was wandering around a local electronics distributor and a small gray chassis box caught my eye. The next evening the miniature rig was pumping a healthy 2.5 watts into the 40 meter dipole. Those of you who visited the *CQ* booth at Dayton have seen the little beast in person. It's a dandy all right.

Interest was so intense in the little rig that it merits an entire column. Check out the accompanying photos to see what we're talking about. The p.c. boards come wired and tested from MFJ Enterprises[1] and construction of the rig shouldn't take more than an evening. It's a great beginner's project requiring only a few drill bits, pliers, files, screwdrivers, and soldering iron. Read on!

Mechanical Construction

The following steps can be followed in preparing the chassis box. The specific box used here is a Calectro 4⅛" x 2⅛" x 1⅛" size that can be found in most radio shops. The p.c. boards and hardware fit neatly into this size without too much cramming. One difficulty showed up that was unexpected. Due to the close tolerances between the front and top of the box, the oscillator tank circuit is affected and a small loss of oscillator drive power occurs when the lid is in place. Output without the lid is 2.5 watts, 2 watts with the lid in place. A larger box would permit full power with the lid in place. It isn't enough power loss to worry about though.

Construction Steps

1. Figure 1 shows the approximate locations of the holes for mounting the p.c. boards, variable capacitor, output phono jack, and terminal posts. One-half inch 4/32 screws are used for mounting the boards—three to each board to avoid introducing stress because of uneven spacers. The rear panel posts for B voltage and for key lead are half-inch 6/32 screws—the B+ and key posts are insulated from the box with insulating washers.

2. The v.f.o. tuning capacitor supplied by MFJ requires a slight modification in order to fit in this size box. This consists merely of removing two plates from both stator and rotar with a sharp hacksaw. Use firm, short, but gentle strokes to avoid damaging the variable. Once both plates are off, check to make sure that there is proper clearance between remaining plates and that no shorting is occurring. The variable is mounted directly on the front panel.

3. Next, cut a rectangular shield from small aluminum stock. The length of the shield should correspond to the width of the box at the bottom—the sides of the box lean inward in order to clamp the lid in place. File the shield for a snug fit—it is held in place by pressure from the front and rear panels. Drill two holes in the shield—one for B+ and one for the v.f.o. output lead.

4. The output phono jack should be cut (if if has a round flange of insulating material) across the bottom to allow for clearance for the screw which mounts the final transistor to the chassis box. In my version, the outside screw mounting the phono jack to the box is insulated and serves as the output post for the T-R diode switch to the receiver antenna input.

5. A s.p.s.t. slide switch is mounted at the rear of the v.f.o. and hooked up to the v.f.o.

The Giant Flea dwarfs a postage stamp as an illustration of its size. Frequency tuning knob and homebrew dial shown. Each point is a 10 kHz marker.

*213 Forest Av., Vermillion, SD 57069.

[1]PO BOX 494, Mississippi State, MS 39762. The v.f.o. and transmitter units come wired and tested, with vernier and tuning capacitor, plus hardware, for $15.95 each, postpaid. The *Giant Flea* is available as a kit for $39.95, including wired and tested boards, chassis box, tuning capacitor, and all hardware and parts.

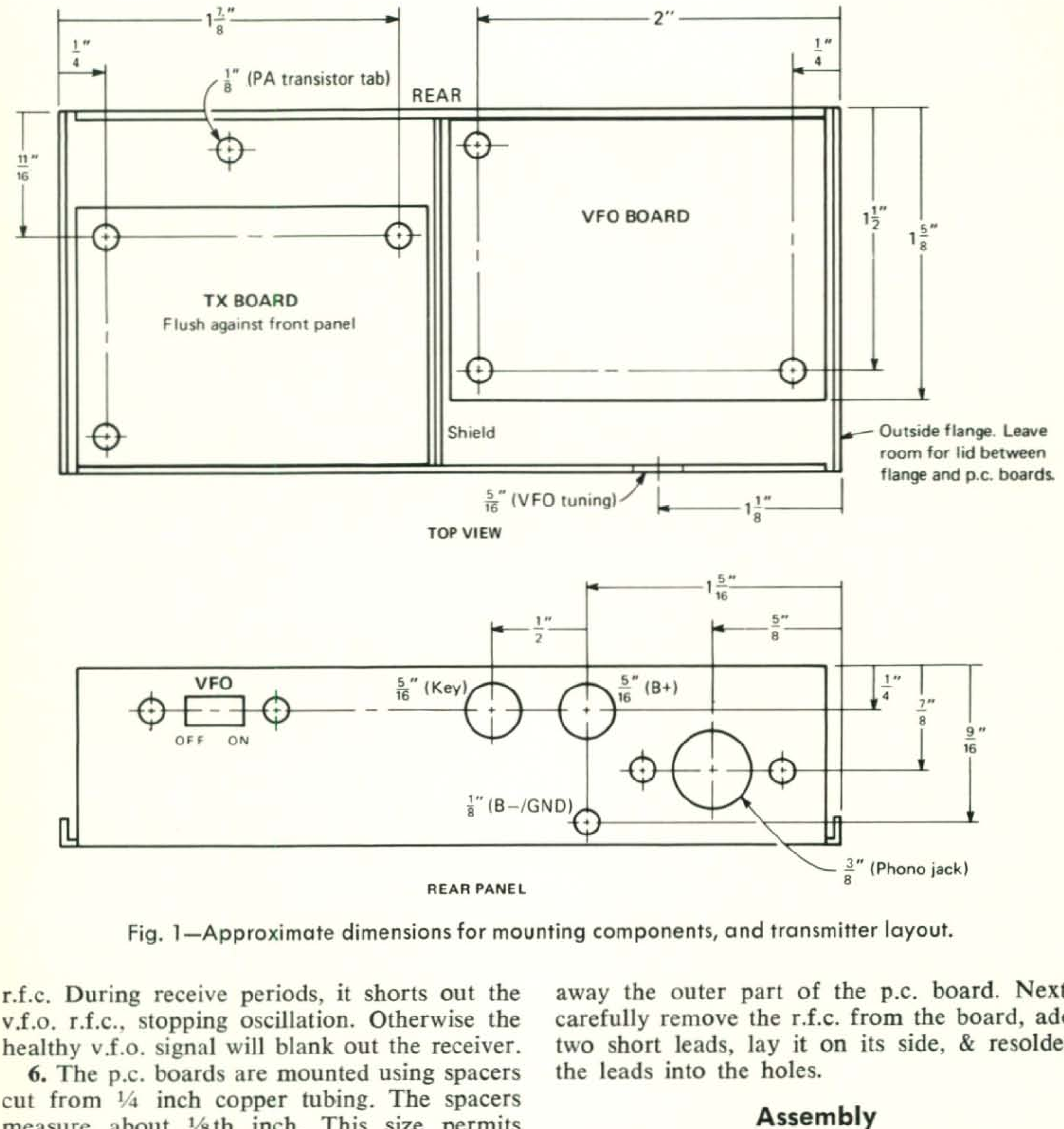


Fig. 1—Approximate dimensions for mounting components, and transmitter layout.

r.f.c. During receive periods, it shorts out the v.f.o. r.f.c., stopping oscillation. Otherwise the healthy v.f.o. signal will blank out the receiver.

6. The p.c. boards are mounted using spacers cut from ¼ inch copper tubing. The spacers measure about ⅛th inch. This size permits sufficient clearance between the top of the p.c. board parts and the lid. The final hole to be drilled is that through which the tab of the final transistor is mounted on the bottom of the box, which serves as heatsink.

7. Before proceeding with assembly, first test the v.f.o. and transmitter for proper operation. If you have a 7 MHz crystal, insert it in the socket and fire up the transmitter into a dummy load. Output should be about 2 watts; peak the driver tank slug-tuned coil for best output. Then use the v.f.o. to drive the transmitter after tuning the v.f.o. to 7 MHz by locating the signal on a receiver. Output should be close to what is obtained with the crystal

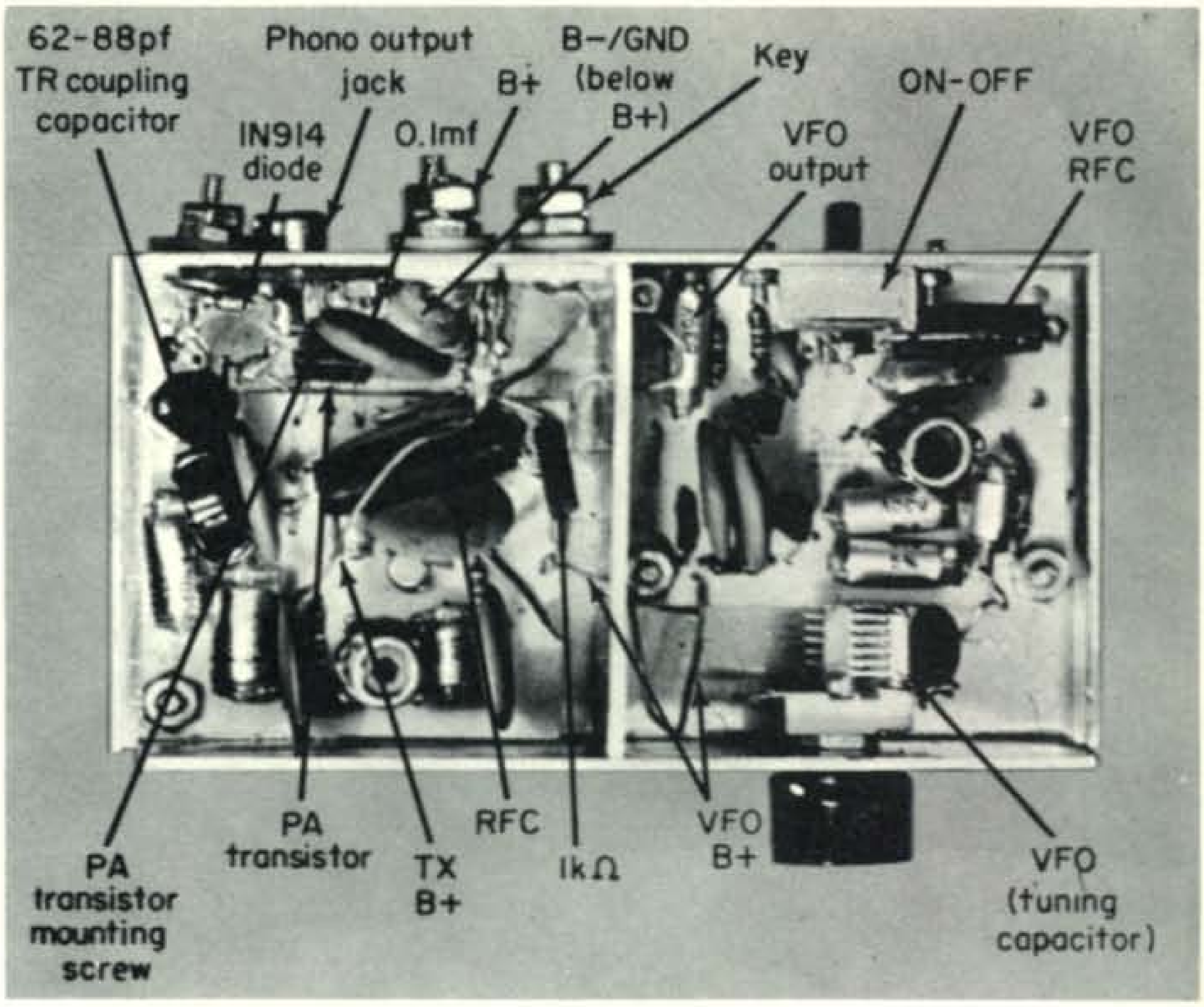
8. Next, remove the crystal socket from the transmitter board by first unsoldering the four mounting lugs, and then pulling the socket out. Draw a line through the two inner soles in which the socket was mounted, and hacksaw away the outer part of the p.c. board. Next, carefully remove the r.f.c. from the board, add two short leads, lay it on its side, & resolder the leads into the holes.

Assembly

9. Mount the v.f.o. p.c. board, on-off switch, and tuning capacitor. In my unit, a 33pf NPO (or mica) is connected in series with the tuning capacitor and allows 90 kHz bandspread. A larger size can be used if greater spread is desired. The capacitor is soldered to the stator lug of the tuning capacitor—the rotor is connected simply via chassis ground. Hook up the B+ voltage temporarily, and retune the v.f.o. to the 7 MHz band. If it is operating, solder the v.f.o. output lead to the transmitter input hole.

10. Mount the transmitter p.c. board, and then carefully bend the final transistor over the side of the p.c. board until the tab reaches the bottom of the box. *DO NOT BEND THE FINAL LEADS AT THE BASE OF THE PLASTIC CASE OR THEY WILL SNAP!* Bend the copper tab so that it will lay flush against the bottom. Mark the hole spot, re-

V.F.O. board on right, with tuning capacitor and knob on front panel, v.f.o. on-off switch on rear panel. B+ lead visible left front beside mounting screw; output lead just below left rear mounting screw. Aluminum shield center of box. Transmitter board on left. Rear panel, r-l: key post showing insulating washer; top edge of two-terminal strip mounted vertically, bottom lug bent down, top lug B+ lead to tx and 1k resistor to v.f.o. B+ lead. Phono jack output, with 68pf mica capacitor and 1N914 switching diodes to soldering lug on outside mounting screw. Final transistor center rear of p.c. board with three leads visible and mounting screw with white thermal grease.



move the board, and drill the hole for the screw attaching the final tab to the bottom. Re-install the transmitter p.c. board, then connect the final transistor tab to the box. Use mica washers to insulate both mounting screw and box from the tab. Use thermal grease to insure best heat transfer (if you have some—otherwise request a little from MFJ when ordering—just a little dab'll do ya!)

11. Mount the B–/ground post at the bottom rear panel. Attach a two-terminal strip on the inside with this same screw.

12. Mount the B+ post on the rear panel using insulating washers. Connect a short wire to the unused lug on the terminal strip (#11). Connect the B+ lead from the transmitter to this lug. Connect a 1000 ohm resistor to the lug, with the v.f.o. B+ lead to the other end of the resistor.

13. Mount the key post using insulated washers. Connect the key lead to the screw post. with the inner screw and connect the output

14. Mount the phono jack transmitter output lead. The outer mounting screw is provided with a soldering lug and insulated from the chassis box. Solder the diode T-R switch as shown in fig. 2. This outside mounting screw provides the receiver connection to the antenna. The diode T-R switch permits full break-in operation.

15. Solder a 0.1μf disc across the B+ leg to the ground lug of the two-terminal strip of #11. Finally, solder two leads from the v.f.o. on-off switch to the two ends of the v.f.o. r.f.c. (actually, could be done before mounting the v.f.o.). This completes assembly of the rig.

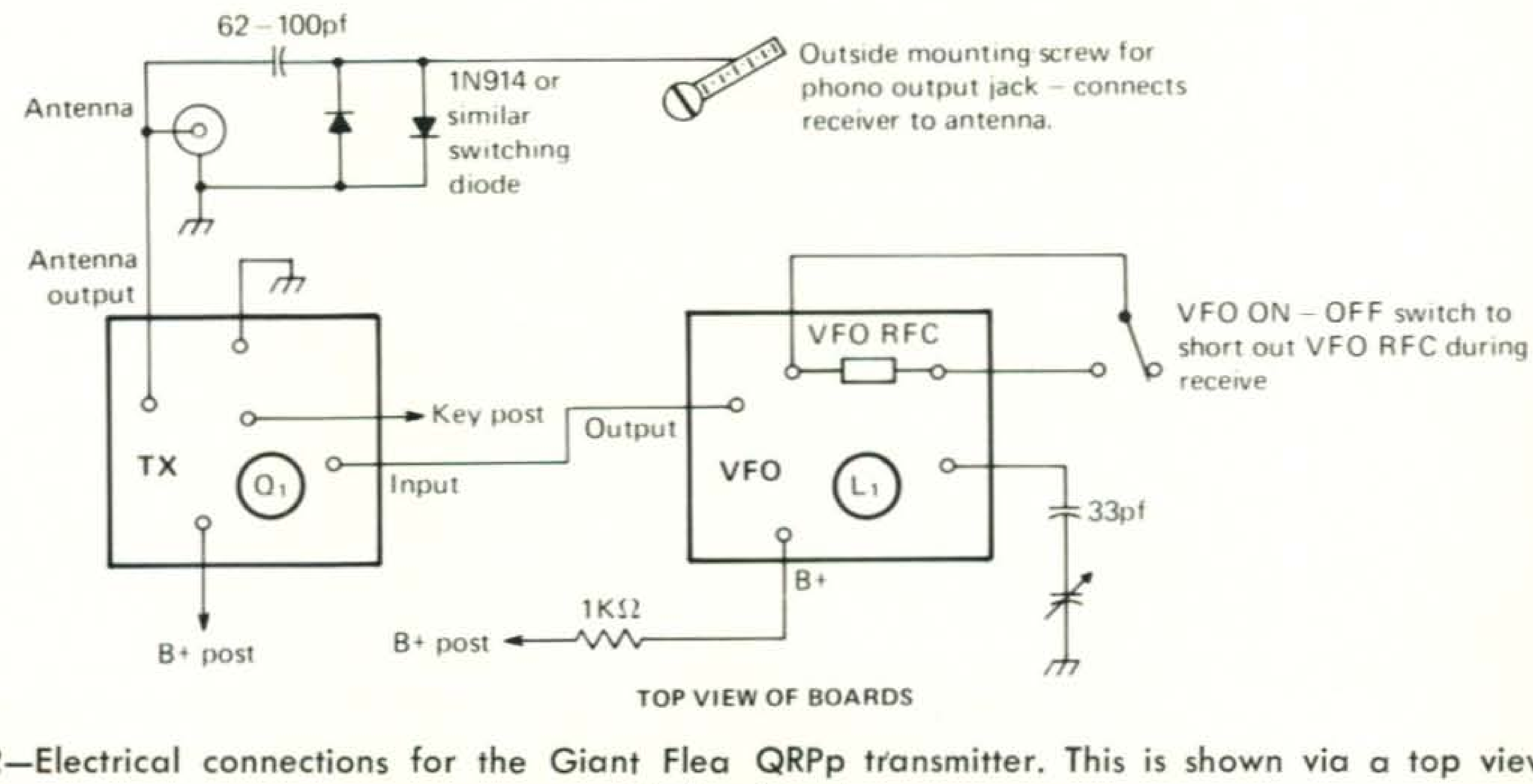


Fig. 2—Electrical connections for the Giant Flea QRPp transmitter. This is shown via a top view of the two boards.

Testing and Operation

Before hooking up the rig to the power supply, which can be batteries or a.c. type, recheck all connections and test for possible short circuits. If all is clear, hook up a dummy load (50 ohm) or output meter (such as described in the December, 1973, QRPp column) and key, and turn the rig on. Locate the v.f.o. signal in a receiver, and then hit the key. Output should be about the same as during pre-assembly testing. Sweep the receiver above and below the transmitter frequency for about 100 kHz to make sure no parasitics or hash is being generated. If everything checks out, the rig can be hooked up to the antenna and you can hunt for the first QSO with it! During receive periods, keep the v.f.o. switch in the off position to avoid blanking or overloading the receiver. No drift should occur after turn-on because the oscillator transistor is drawing current during off periods. Sometimes output to the antenna can be increased by compressing or moving apart the turns on the output toroid. With my version, v.f.o. pull was about 300 Hz upward —a good amount for this type of rig.

One final adjustment must be made to the v.f.o. calibration before operating the rig with the lid on. When the lid is in place, the v.f.o. frequency is shifted upward about 60 kHz from the frequency point with the lid off. In calibrating, set the receiver 60 kHz or so below the desired frequency with the tuning capacitor fully meshed, and adjust the v.f.o. slug until the signal is heard at that point. (Example: desired full mesh point = 7000 kHz: set receiver to 6040 kHz, adjust slug). Replace the lid, and tune the receiver to the desired full mesh frequency—the v.f.o. should be near by. A little experimenting will determine how much v.f.o. shift is caused in your unit by putting the lid on.

Output is as follows: 12Vcc = 1.85w (lid off), 1.5w (lid on); 13.6Vcc = 2.5w (lid off), 2.1w (lid on). Base of final shows 0.6Vrms (1meg probe); collector of driver shows 7.8-Vrms; v.f.o. output is 0.7Vrms (open circuit).

That's it! There is really something different about making contacts with something that fits into your pocket.

Odds and Ends

The 80 meter QRP Net is the victim. May it R.I.P. until October or so. The action is now on 20, Saturday, 1600Z, and 40, Saturday, 1700Z. It will be a double-header for the QRPp gang. Check in sometime! If things are really popping on 20, we'll try a QSY to the s.s.b. end for Argonauters.

We're always looking for pix for the column, so snap one and let the world know what you look like! Till next month . . .

73 Ade K8EEG/Ø

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

I'd like to start this month's column with a sort of belated review of two products presently being offered by the Heath Company. These are the HA-201 and HA-202 VHF Amplifiers, delivering approximately 10 watts output and 40 watts output respectively in the two meter band.

According to Heath, both are quite popular but have some minor, easy to correct problems which I feel ought to be relayed to those of our readers owning one or the other.

The HA-201 is a relatively straightforward unit employing a Motorola 2N5590 or equivalent r.f. power transistor in a standard v.h.f. amplifier circuit. It was designed to be driven by the many small 1-2 watt transceivers presently on the market by simply connecting it in series with the antenna. Operation is from 12 volts d.c. (13.6V maximum) and maximum current drawn is approximately 2.5 amperes. Switching the antenna between transmit and receive is completely automatic and is accomplished in a clear way as shown in figure 1.

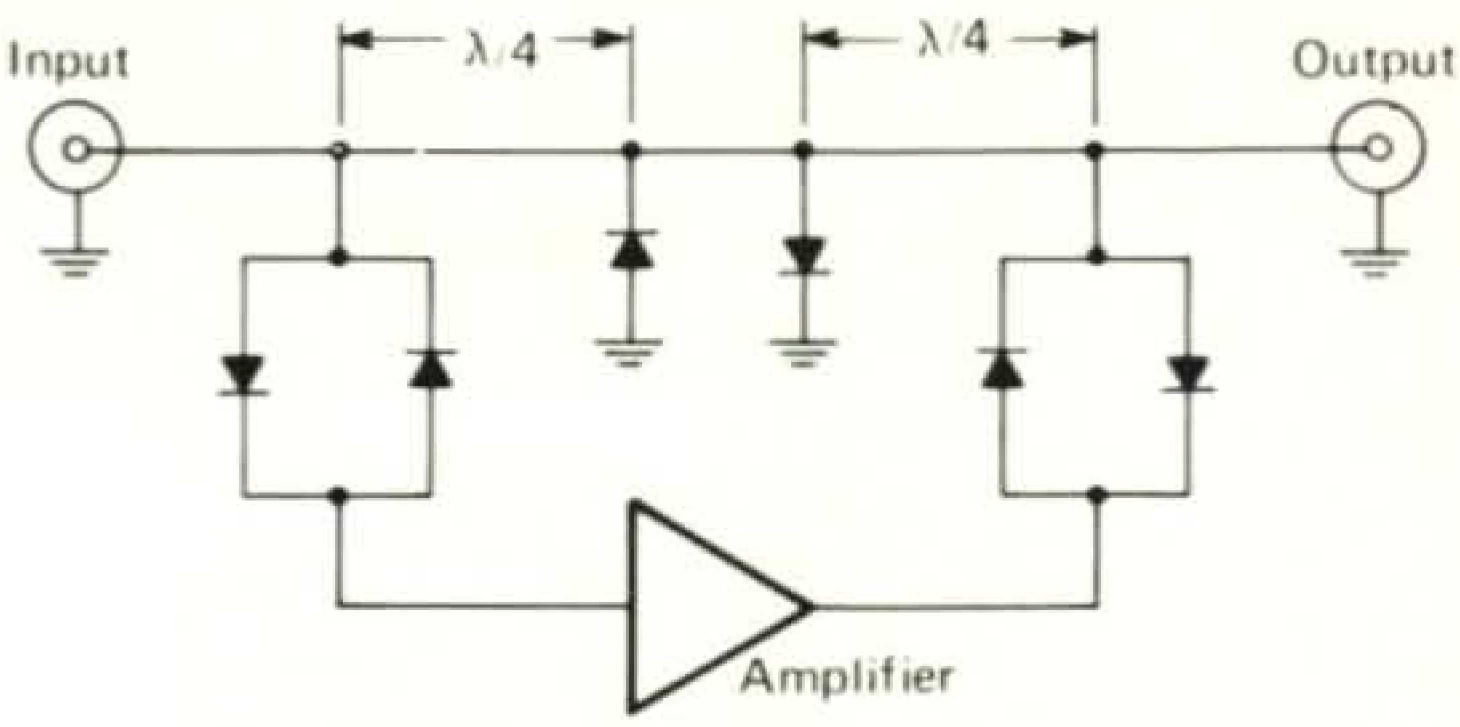


Fig. 1—The HA-201 switching scheme.

When in the receive mode, the signal levels are smaller than any of the diode thresholds and they do not conduct. Signals from the antenna pass through two ¼ wavelength pieces of coax directly to the transceiver.

When transmitting however, r.f. energy from the transmitter causes the diodes to all conduct. This produces a low impedance into the amplifier and a low impedance path from the amplifier output into the antenna. Also, the diodes at the junction of the two ¼ wave sections also conduct, causing the two sections to become shorted ¼ wave transmission lines.

According to theory, such shorted lines are the equivalent of parallel tuned circuits and offer very high impedances so that any path from input to output is effectively blocked. This scheme, by the way, works quite well.

There are two precautions in using this unit that should be considered. The first is that the cable going from the transceiver to the amplifier's input be an even multiple of a quarter wavelength at the operating frequency and the second is that the alignment procedure be followed exactly. All of the pre-set trimmer positions as stated in the manual must be observed and the final adjustment points must be within ± ½ to 1 turn of the initial points.

In addition, some transceivers, particularly the ones employing v.s.w.r. protection circuitry will not operate properly unless a 150 ohm 1 watt 10% carbon resistor is connected across the input connector of the amplifier. This modification should make all of the TR-22C owners quite happy. After adding the resistor, realign the unit according to the instruction manual and your problems should be over (according to Heath). The resistor lowers the input impedance changes that have been causing the automatic v.s.w.r. circuitry of the transceiver to "squeegee" all over the band.

The HA-202 40 watt amplifier is also a straightforward v.h.f. r.f. design employing two Motorola 2N5591's or CTC B25-12 transistors in a parallel confiuration. It was originally designed to be driven by the HW-202 transceiver although it works fine when driven at any level from 8 to about 12 watts or so. To this date we have not heard of any rigs that have had trouble driving the unit.

As in the HA-201 switching is fully automatic. A relay is used in this unit however and it is switched as shown in figure 2. R.f. is rectified filtered and drive Q_3 which in turn drives the relay. The only probem we have heard of from Heath (and incidently the only one we had) was a faulty C_{16} trimmer capacitor. It seems that the mica insulator used in some trimmers was faulty and caused the capacitor to break down after 1-2 hours of operation. The solution is to either send the bad components back to Heath for replacement or, as in our case, replace the unit with a good qual-

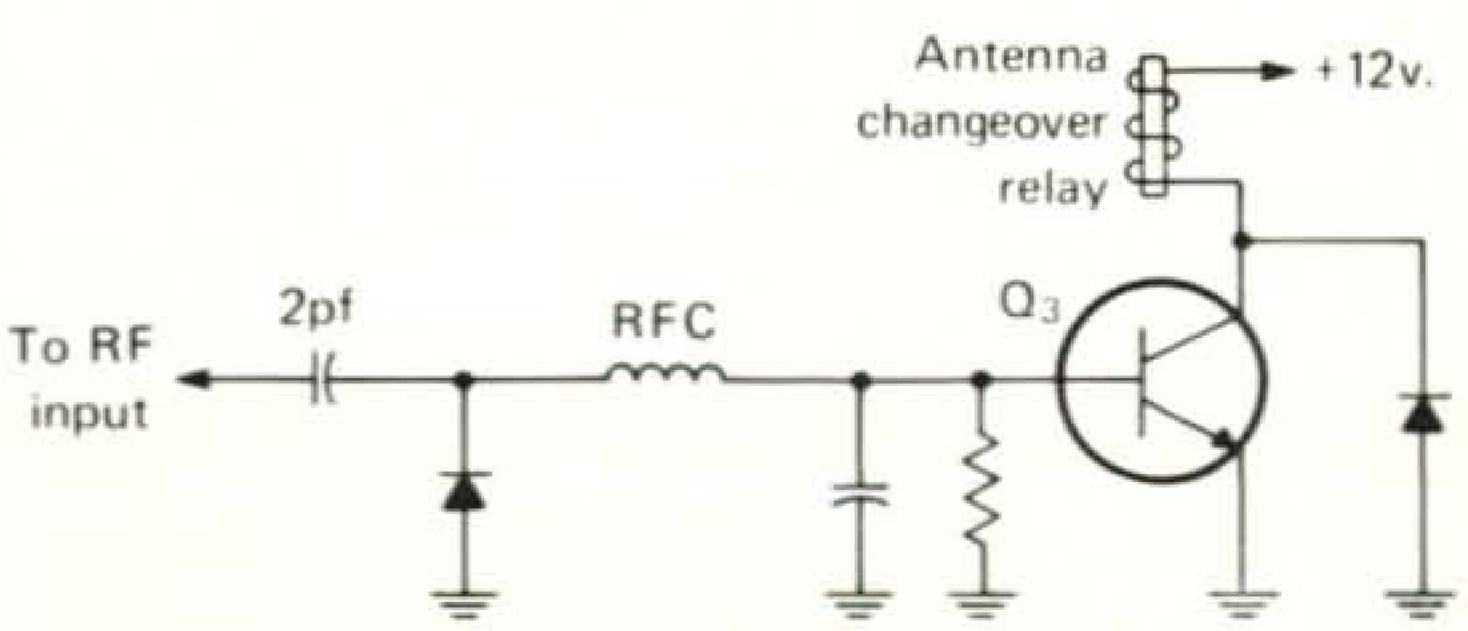


Fig. 2—The HA-202 switching scheme.

*5 Melville Lane, Great Neck, N.Y. 11023.

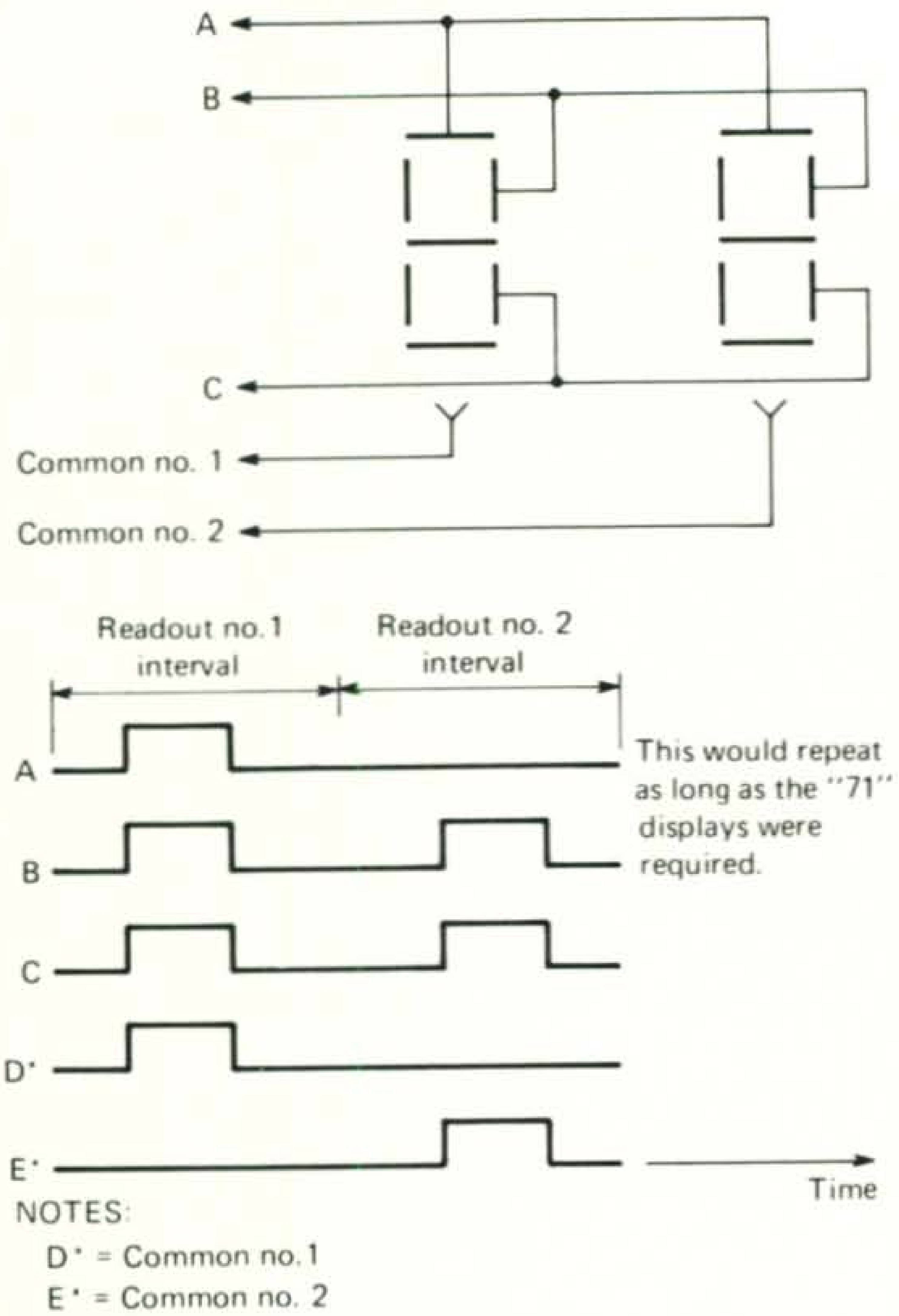


Fig. 3—The multiplexed display method discussed in the text. Each readout is only turned on for a fraction of a second. This is long enough for the persistence of vision to give the illusion of a continuous display. Note that the waveshapes are for clarity in explanation only and are not necessarily of the correct polarity.

ity 8-50 pf ceramic trimmer such as Centralab type 822-AN. Bending the leads close to the body of the 822-AN trimmer will allow it to be mounted in the same holes as the old trimmer but be sure to mount the rotor lug (center lug) in the ground hold or you will have all kinds of alignment difficulty.

Many thanks to Mike Elliot of Heath for much of the preceding information and to Steve Williams WA2LOA for his much appreciated help in testing both amplifiers.

By the way the output of the HA-201 was 10 watts with 1¼ watts of drive at 12 volts and 2.1 amperes and output of the HA-202 was 41 watts with 11.2 watts of drive and a current drain of 7.1 amperes at 12 volts.

There is a new product available at this time that I think would be of interest to the many digital-readout fans of this column. Pantek, P.O. Box 587, Lewiston, Pennsylvania 17044 now has available a line of cold-cathode seven segment displays that are quite inexpensive, even in small quantities and, unlike many surplus offerings, brand new—fully within specifications, and warranted for one year.

The major difference between these units and other readouts that may be more familiar to most amateurs, is that those must operate by multiplexing rather than direct activation of each number segment.

An example of how these are used is shown in figure 3. Here two digits are shown with the number seven displayed on the 1st and the number 1 on the second. The proper waveshapes to achieve this are also shown on the diagram.

If one feels that this type of logic is more costly than direct operation consider the following prices for the readouts.

ARO4450—4 digits in digital clock format, $8.00

ARO9250—9 ¼" high digits with decimal points, $8.00

ARO9450—9 .4" high digits with decimal points, $9.50

AR11450—11 .4" high digits with decimal points, $11.00

AR13451—12 .4" high digits with decimal points and a special symbol, $16.00

All prices are for quantities of 1 through 99. At roughly $1 per digit the added driving circuitry become negligible—especially for 9 digits.

If you are interested, write to Pantek for data sheets and typical operating methods. Incidently, all readouts operate from 165 to 120 volts d.c. like the well known Nixies, and are MOS compatable.

Before concluding, I would like to indicate that MFJ Enterprises, P.O. Box 494, Mississippi State, Miss. 39762, has made available a new, free catalog of their entire line of amateur-related products. Included in this catalog is a very extensive line of reasonably priced audio filters, both bandpass and their famous "razor sharp" units as well as other specialized types. In addition, several items that will be of interest to the QRP'er such as a v.f.o. and complete transmitter are also described. Applications for some items as well as actual methods of use are also described. Check the QRP Column this month. See you next month.

73, Irv, WA2NDM

NOVICE SHACK

HERBERT S. BRIER,* W9EGQ

How Legal is Your Station?

Does your station and the way you operate it meet FCC amateur regulations #97.73 and #97.75? In essence #97.73 says *Spurious radiations from amateur transmitters below 144 MHz shall not be of sufficient intensity to cause interference in receivers of good engineering design tuned to frequencies outside the frequency band of emission being employed by the amateur station. Spurious emissions include harmonics and subharmonics, key clicks, and spurious oscillations. The frequency of the emitted carrier shall be as constant as the state of the art permits.* #97.75 says: *"The licensee of an amateur station shall provide for measurement of the emitted carrier frequency or frequencies and shall establish procedure for making such measurement regularly. The measurement of the emitted carrier frequency or frequencies shall be made by means independent of the means used to control the radio frequency or frequencies generated by the transmitting apparatus and shall be of sufficient accuracy to assure operation within the amateur frequency band being used."*

The first of a recent series of phone calls was from an operator 10 miles away. He was using a second-hand Heathkit HW-16 transceiver and wanted me to listen for him on 7148 kHz in the 40-meter Novice band. He had been trying to make contacts on that frequency for over a week without success. I could not hear on 7148 kHz, but he was strong on 7152 kHz in the 40-meter Phone band. He was lucky, though; besides being off frequency, his crystal was such a slow starter that it oscillated only on dashes. Consequently, his sending was completely unreadable, which made it impossible for anyone to send him unwelcome mail. The next caller was not so lucky.

He was an Advanced class operator who called from Washington, D.C. He had received an official FCC notice of violation of regulation #97.75 for operating on 7.024,674 MHz, 326 Hz inside of the 40-meter Extra-class band, forbidden territory for an Advanced class licensee. We assured the caller that, as it was his first offense, the FCC would accept almost any reasonable explanation for the violation provided that he answered it within the 10-day deadline. But he would invite a possible fine or license suspension by neglecting to answer it.

As we were writing the previous paragraph, the phone rang again. This call was from an operator who was getting reports of key clicks and key chirps. The significant point about two of these incidents is that the operators involved were depending on someone else to tell them that something was wrong with their signals. In fact, the HW-16 user did not know that he could check his own transmitting frequency with it until we told him!

Measuring Your Transmitting Frequency on a HW-16

Although the Heathkit HW-16 transceiver manual does not stress the fact, after its receiver dial is calibrated as described in the manual, the receiver may be used to check the frequency of the transmitter and the purity of its note. Advance the R.F. and AUDIO GAIN controls to maximum, press the transmitting key, and tune the receiver dial in the normal manner until the transmitter signal is heard in the speaker or phones under the signal from the built-in audio signal from the keying monitor.

The monitoring signal can be temporarily interrupted by disconnecting the green wire be-

Bill Petersen, WN6WTT, 2577 Clarebank Way, San Jose, Calif. 95121, teaching his son Christopher the code. His Heathkit HW-101 transceiver is the first kit he ever built. It has gotten QSL cards from 46 states and 14 countries with the help of a Ten-tec KR-5 keyer and a Hustler 4-BTV, roof-mounted vertical antenna. We are sending WN6WTT a 1-year subscription to CQ for sending this winning picture in our monthly contest. If you wish to try your luck, send a clear photograph of yourself and your station (preferably black and white). Include some details of your radio career, and mail to: CQ Novice Shack Photo Contest, Herbert S. Brier, W9EGQ, c/o 144 Richter, Chesterton, Ind. 46304. Suitable non-winners will be published as space permits.

*c/o 144 Richter, Chesterton, Ind. 46304

Carl Rubin, WN2UOQ, (14) Chappaqua, N.Y. proves he likes to "ragchew" with an ARRL Ragchewer's Certificate (RCC) earned by the "dawn's early light," his favorite operating time.

tween point *C* on the circuit board and pin *8* of accessory socket *BF* in pictorial 13 in the manual. These points may be connected to two unused pins on the accessory socket to accommodate an external s.p.s.t. switch used to disable the keying monitor if desired when spotting the transmitter signal. The original wiring may be restored at any time. Tune in the transmitter signal for loudest beat note and read the transmitter frequency on the receiver dial to the accuracy with which the dial is calibrated.

A separate receiver is required to check harmonic radiation from a standard transceiver. If you do not have one, ask a local amateur or shortwave listener within five miles or so to listen for the second and third harmonics of your transmitter frequencies. Between 7.4 and 7.5 MHz and 11.1 and 11.25 MHz are the danger zones for the 3.7-MHz Novice band and between 14.2 and 14.3 MHz for the 7.1-MHz band. Between 14.067 and 14.132 MHz, the second harmonic shadow of 7.033 to 7.067 MHz frequencies usually tripled into the 21 MHz band should also be checked. To be safe, any harmonic heard should be at least 40 dB (7 or 8 S units) weaker than the strength of the fundamental signal.

CE∅AE—A New Country Especially For Novices

Would you like to work CE∅AE the only amateur station on Easter Island in the South Pacific? So would most of the world's DX chasers. Starting July 15, Novices will have a rare opportunity to work this DX jewel. On the 15th and 30th of the month until further notice, Dave, CE∅AE, will devote his operating time to working Novices. He will have a day off in February. Because his duties as a priest sometimes interfere with his time on the air, Dave cannot set up a rigorous schedule; however, he will start the day on 28.1-28.2 MHz when conditions are favorable. When 10 is out, he will transfer operations to 21.1-21.2 MHz, and to 7.1- and 3.7 MHz after dark, although he has never been able to raise any Novice he has called on the latter two bands.

Dave will send "CQ WN DE CE∅AE" a number of times on a frequency that is reasonably clear of interference and listen for Novice replies on that frequency, plus and minus 3 kHz. Call him "CE∅AE DE WN9EGQ BK" (His calletters and yours once only). He will answer at the same speed that you used with "WN9EGQ DE CE∅AE R RST57N or 5NN," etc., (N for 9) twice if conditions are poor. "My name is Dave BK" You reply "BK R" (once only) RST5NN in Ind. My name is Herb 73 CE∅AE DE W9EGQ SK" Dave will respond "R Herb 73 WN9EGQ DE CE∅AE QRZ?" and listen for other calls. Mail your QSL card and a stamped addressed return envelope to CE∅AE's QSL Manager, Mary A. Crider, WA3HUP, 212 Clark St., Le Moyne, Pa. 17043, who will forward Dave's QSL card to you promptly.

Dave and the NOVICE SHACK hopes that other DX operators will follow his lead and set aside regular times to work Novices.

News And Views

Ed Munsel, K6CL, 3452 Colonial Ave., Los Angeles, Calif. 90066, an ARRL Official Observer (00), reports a local Novice receiving an official FCC citation for being 200 Hz outside of the 40-meter Novice band. Ed recommends a 100-kHz crystal calibrator to mark the band edges. Even better for the 3.7 and 7-MHz bands are calibrators that generate 100, 50, or 25 kHz pips across the band at the flip of a switch . . . **Carl Rubin, WN2UOQ,** 6-Kitchawan Dr., Chappaqua, N.Y. 10514, is probably haunting the mailbox waiting for the arrival of his General ticket about now. Carl uses a Tempo-1 s.s.b./c.w. transceiver cranked down to 75 watts to drive a vertical antenna on 15 and 80 meters. He likes to ragchew and work DX. He also enjoys cross-mode contacts with Canadian s.s.b. phone stations who operate in the U.S. Novice bands. The Canadians put it a little differently. They say U.S. Novices operate in part of the Canadian phone band.

Dan Veseth, WN8STZ, P.O. Box 277, Escanaba, Michigan 49829, says there is only one other ham (WN8STY), but *she* is so busy with other things that she doesn't get on the air. Dan uses an old Heathkit DX-100 transmitter and an MR-1 receiver with separate 80- and 40-meter inverted-V antennas. He has worked 26 states and three foreign countries. He likes to ragchew at 6:00 A.M., when interference is low.

Arthur C. Ford, W2HAE, 56 Gildare Drive, East Northport, N.Y. 11731, says "I am glad to know that WN3VLA has become so proficient that he doesn't need the help of the more experienced 'Generals.' From my observation, the example of one Novice working another is often the blind leading the blind with little to be gained by either. I spend most of my operating time in the 40-meter Novice segment trying to help Novices with their code. A few of them obviously do not know any code so they cannot communicate with anybody. Others I find who plug along at 5 w.p.m., month after month, are capable of using higher speeds. Why not use the higher speed for faster progress toward a higher class license? Then we find the wise guy who calls at three times the speed he can copy and falls apart when the other operator sends to him at the same speed. Also, I find that much poor sending in the Novice bands is due to the senders not monitoring their own 'fists.' The sending of some of them is so bad that they don't make any contacts and finally quit the game in disgust. 73, Art, W2-HAE."

We invite you to mail your "News And Views", gripes, and pictures—anything of interest to you and your fellow amateurs to *your* Column. The address is on the first page of the column. 73, Herb, W9EGQ

Using The E-Model Pathsounder

BY GAYLE SABONAITIS,* WA1OPN

THE E-Model Pathsounder is a device used by blind and deaf-blind people to travel independently. It should be closely evaluated as no two people react to it alike; the user has to undergo a rigorous training period. I am at present taking this mobility program whereby the Pathsounder is being tried on me in order to increase my mobility range, which was very limited all my life.

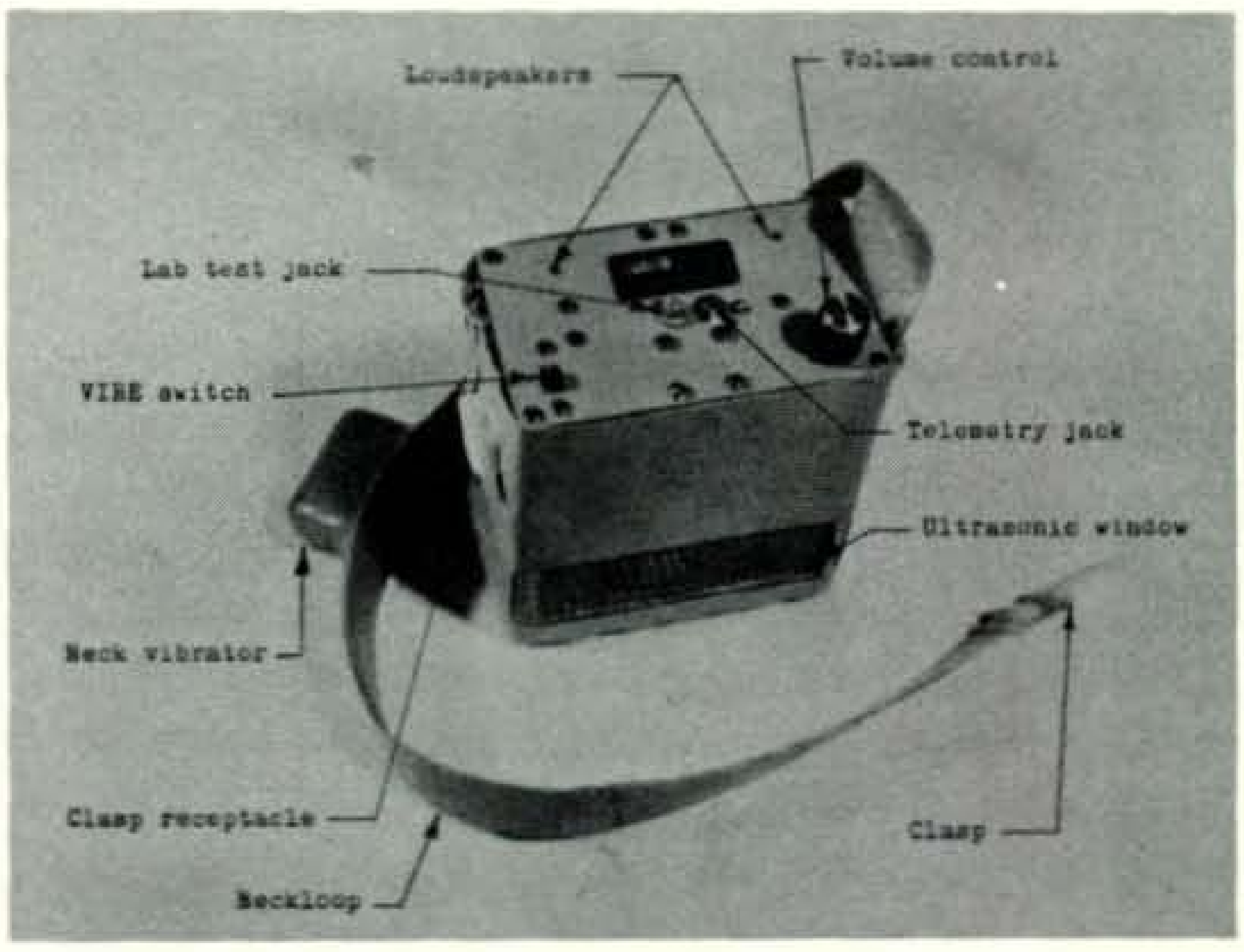
The Pathsounder was invented in New Zealand and costs $1,000 as it is individually and not mass produced. It has the appearance of a transistor radio and is worn or hung around the neck. When an object comes within six feet of the wearer, the transmitter on the chest of the wearer vibrates. When an object comes within thirty-two inches, a tiny vibrator on the back of the neck is activated and this tells the user not to crash into objects. That vibration is for deaf-blind people since blind people need only use the audio display, whereby a low buzzing sound emitted at six feet changes to a high beep at thirty-two inches. The vibratory display is very strong and easy for deaf-blind people to feel on the chest and neck.

I have used this instrument to get to different classes at school. I strongly disapprove of its use on streets because deaf-blind people cannot tell moving cars from pedestrians and even if they tried to steer away from any cars they sensed, they could still get knocked down. Therefore I recommend its use on blocks, in big buildings, on school grounds, etc. It is better to get a guide for traveling on streets. Being deaf-blind myself I feel this approach is the better way.

I do not have the circuit of the Pathsounder handy. However it is being built at Massachusetts Institute of Technology at the Sensor Aids Evaluation and Development Center. If anyone wishes more information, contact MIT at this center (617-253-5332). They are made to order and are expensive so that they are used primarily for training purposes.

This instrument is battery powered and can be re-charged every night. With the nickel-cadmium battery it is possible to use it often and re-charge the batteries many many times. I prefer and use an automatic battery charger and have had no problems with charging. I use the automatic charger over the manual one so that I don't have to time the charging process manually and run the risk of overcharging the batteries and ruining the instrument.

I can tell when the unit is charged by looking at the "ready" light. There are two lights—a red "charging" one and a white "ready" light. I am able to see light well enough although I am totally deaf and legally blind. If a person is totally deaf-blind or totally blind he can still tell whether the battery is "ready" or not by feeling the top of the bulb. Whichever light is on will give off a steady warmth and a steady glow. ■



The E-Model Pathsounder.

*11 Maxwell St., Worcester, Mass. 01607.

DX

BY JOHN A. ATTAWAY,* K4IIF

THE life's blood of any monthly DX column is composed of the regular DX bulletins and magazines which make up its chief sources of information. Even if an editor stays on the air full time collecting DX news, he can't begin to hear of every upcoming DXpedition or other event in this branch of a hobby which constitutes a *worldwide* activity by definition. However, with the weekly bulletins he can stay reasonably current, as almost every planned DXpedition advises at least one of the bulletins in advance, and the news is quickly picked up by the other bulletins and widely disseminated.

Not only are these bulletins essential to a DX editor such as myself, they are also very valuable to every serious DXer. If you wish to keep up on all future events you definitely should subscribe to one or more of the weekly bulletins. Naturally we hope you will continue to read this column for the overall perspective it presents, but we go to press too far ahead to help you with the very *latest* news.

We would like to recognize the bulletins we presently receive, and their long-suffering editors, as follows:

DXer's Magazine, Gus Browning, W4BPD Editor, P.O. Drawer DX, Cordova, S.C. 29039.

DX News-Sheet, Geoff Watts, Editor, 62 Belmore Rd., Norwich, Norfolk, England.

DX'-press, A. J. Dijkshoorn, PAØTO Editor, Jan van Gelderdreef 11, Voorschoten, The Netherlands.

Long Island DX Association Bulletin, Robert Barden, WA2RJZ Editor, 416 Victory Drive, Lake Ronkonkoma, N.Y. 11779

West Coast DX Bulletin, Hugh Cassidy, WA6AUD Editor, 77 Coleman Drive, San Rafael, CA 94901.

Monthly club bulletins, which contain news of group activities and personal glimpses of club members, are also helpful to us and we would like to acknowledge the following who send us the latest issue each month:

Long Skip, the Canadian DX Association Bulletin, Alan Leith, VE1AL/3 Editor, P.O. Box 452, Don Mills, Ontario, Canada.

Southern California DX Club Bulletin, Harvey Hetland, WA6KZI Editor, P.O. Box 73, Altadena, California 91001.

The DXer, Bob Thompson, K6SSJ Editor. Published by the Northern California DX Club and circulated *only* to club members.

De Extra

What's The Best C.W. Rig For DXing?: In the aftermath of the transceiver deluge which has saturated the amateur market over the past decade, the venerable and respected art of c.w.

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

Carlos R. H. Silvero, PY2FRW/ZY2ITU, is known on the bands as "Carl." His rig includes the Yaesu FRDX 400SD and FLDX 400, a 1 kilowatt "Delta 1000" linear, dipoles for 80 and 40 meters and a 3-element yagi for 10, 15 and 20. Carl can usually be found on the low end of 20 and 40 meter c.w.

The WPX Program

Mixed

480 YU1NPF	484 I8CPK
481 WAØTKJ	485 W3HCW
482 K7RSC	486 I3GZI
483 YU3DQ	487 WB2FVT

C.W.

1388 OK3RKA
1389 W4BTZ

2XSSB

843 K7RSC	846 I6ICD
844 JA3AEV	847 IØZG
845 DK7NL	848 IØMBX

WPNX

81 WN8RUO

Endorsements

Mixed: YU3DQ-650, WAØTKJ, K7RSC, W3HCW-450.
CW: WA5VDH-650, ON4XG-500, LA7FJ-450, W1EWD-400.
2XSSB: I8YRK-900, DK2BI-850, K7RSC, ON4XG-450, IØZG-350.
VPX: W4-10646-650, WDX5FEB-600, OE1-101171-450.
Asia: JA3AEV, YU3DQ.
Europe: DL7PD, DK7NL, YU3DQ.
North America: OK1MP.

Complete rules for WPX may be found on page 67 of the February 1972 issue of *CQ.* Application forms and reprints of the rules may be obtained by sending a business size, self-addressed envelope. to WPX Manager, P.O. Box 1271, Covina, CA 91722—USA.

CQ DX AWARD HONOR ROLL

The CQ DX Award 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. The total number of current countries on the DXCC list as of this listing is 321.

C.W.

W6PT 320	W8LY 310	ON4QX 304	W4BQY 299	K1SHN 289
K6EC 316	W4IC 309	WØAUB 304	DL3RK 298	WA6EPQ 288
W6ID 316	W6ISQ 305	K6LEB 302	W6NJU 294	WA8DXA 287
W8KPL 314	W9DWQ 305	VK3AHQ 301	WA6MWG 293	DJ7CX 281
W4YWX 312				

2XSSB

TI2HP 320	VE3MR 314	WA6MWG 309	WB6DXU 300	XE2YP 289
W2TP 320	W6EL 314	SM6CWK 308	K8DYZ 300	YV1LA 289
W2RGV 319	W6KTE 314	W9KRU 308	K6AQV 299	WAØKDI 288
DL9OH 318	W9DWQ 314	VE3GMT 307	HP1JC 298	DJ7CX 287
G3FKM 318	W9JT 314	K3GKU 307	WØYDB 298	K1KNQ 287
IØAMU 318	F9RM 313	K6EC 307	K4HJE 297	SP5BSV 287
WA2RAU 318	WA2EOQ 313	F9MS 306	W6FW 297	DL1MD 286
W3NKM 318	W2QK 313	WA3IKK 306	DK2BI 296	OE3WWB 286
W9ILW 318	W6RKP 313	W9QLD 306	YV1KZ 296	K8GQG 286
K2FL 317	K6WR 313	XE1AE 306	G3RWQ 295	W3CRE 284
W4NJF 317	W6YMV 313	OE2EGL 305	W9OHH 295	DK1FW 282
W4EEE 316	K4MQG 312	OZ3SK 305	YS1O 295	OK1MP 282
SM5SB 315	F2MO 311	K9WEH 305	K1SHN 294	VA7WJ 282
W3AZD 315	IØZV 311	ZL1AGO 305	W8ZOK 293	WB6PNB 282
W4IC 315	I8YRK 310	VE2WY 304	WAØCPX 293	W6TCQ 282
W4SSU 315	K4RTA 309	W2CNQ 304	DL6KG 292	K8PYD 282
W6EUF 315	W6NJU 310	G3DO 303	WØSFU 291	WA2VEG 280
W6REH 315	ZL3NS 310	WA6AHF 303	G3KYF 290	W6HUR 279
I8AA 314	ZS6LW 310	W6KZS 303	OE1FF 290	W9YRA 277
I8KDB 314	KH6BB 309	VE3MJ 302	WB2RLK 290	T1WT 275
IT9JT 314	W3DJZ 309	WA2HSX 301	W6FET 290	VE7HP 275
SM6CKS 314				

operation has been pushed to the back burner in many ham shacks. Most transceivers are designed with s.s.b. operation in mind.

We don't care to debate the relative merits of s.s.b. and c.w.; each has its eager partisans, but it is a fact that a DXer who limits himself or herself to one or the other limits the DX he or she can work. De Extra would like to see more DXers get back on c.w. and more information available on good c.w. gear.

At this shack we're of the old school and have for many years preferred a 75A-4 receiver with a 500 kHz filter for serious c.w. DXing. Our "ideal rig" is a KWM-2 or equivalent transceiver with the 75A-4 so that we can cover both transceive and split frequency operation. For contest operation, particularly outside the U.S., we like the Drake twins because of the 6-band coverage. For a good contest score you need those 160 meter contacts.

To be perfectly honest we've never operated with the later generation gear such as the newest Heathkits, Kenwood, Tempo and Yaesu, or the latest entry, Atlas, which is currently receiving such a big play. Therefore, we're interested in

The WAZ Program

S.S.B. WAZ

1259 ... WA4NRE	1262 ... F6BFH
1260 ... WA4YJJ	1263 ... LA3YQ
1261 ... G3TOE	

C.W.—Phone WAZ

3837 ... OZ4HW	3840 ... W6IVZ
3838 ... OK2BEC	3841 ... I2VDX
3839 ... HA5KKB	3842 ... W3SQ

Complete rules for the Single Band WAZ program appear on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ are found beginning on pg. 46 of the April, 1975 issue. Application blanks and reprints of the rules for all WAZ awards may be obtained by sending a self-addressed, stamped envelope to the Assistant DX Editor, P.O. Box 205, Winter Haven, Florida 33880.

Will Gennaro Casaburi, I8YRK, be the first DXer in the world to make Single Band WAZ on 15 meters? On Feb. 10 Gennaro advised us that he had 34 zones confirmed on 21 MHz. His station consists of a complete Drake line, a Henry 2K linear and a Hy-Gain 2-element quad at 50 feet.

Jorn, PY1ZBG, at his rig in Rio de Janeiro, consisting of a Drake C-line, Yaesu FT-101B and FL-2100 linear. Antenna is only a 12AVQ, but on top of a 14 story building it gives good results. Jorn, who is a Danish diplomat, was TG9GZ 1961-'66, and from October 1975 will be QRV for a while from his home country Denmark as OZ9GZ.

your experiences, particularly with regard to the transceiver you have found to have the best design for c.w. operation. Please drop us a line to Box 205, Winter Haven, Florida. If we get some interesting comments which we can pass on to the readers we will do so. There's no intent to endorse anyone's gear or knock anyone's gear so please emphasize the good points for *c.w.* operation, and let us here from you.

DX Clubs

Some of the best fun in DX is to be found in a DX Club where you can talk over your latest experiences on the bands and compare notes on gear with other DXers in your area. DX Clubs are also important in providing an outlet to speak on policy matters relating to ARRL and FCC and to work together in local activities. They also provide a framework for cooperation between DXers of one area and another.

At this time *CQ* would like to recognize the officers of some of the major DX Clubs. These are amateurs who donate a lot of their own time and energies to working for their fellow DXers:

Northern California DX Club: Jack Troster, W6ISQ, President; Ken Anderson, K6CQF, Vice-President; E. Howrd Hale, W6SC, Secretary; John Brand, K6RXZ, Treasurer; and Don Schliesser, W6MAV, Robert Smithwick, W6JZU, and Bob Thompson, K6SSJ, Directors.

Southern California DX Club: Irv Emig, W6GC, President; John Cashen, W6KNC, Vice-President; Wayne Spring, W6IRD, Secretary; Cleyon Yowell, WB6EHT, Treasurer; and Wayne Gingerich, W6EUF, Larry Weaver, W6JPH, and Dick Reimer, W6OSU, Directors.

Canadian DX Association: Barry Garratt, VE3CDX, President; Paul Hicks, VE3BBH, 1st Vice-President; Robert Nash, VE3KZ, 2nd Vice-President; James Montagnes, VE3BIF, Secretary-Treasurer and Manager of Outgoing QSL Bureau; Chris Lyons, VE3GUS, Recording Secretary; Martin Rosenthal, VE3MR, Dennis Ratcliffe, VE3DDR, and Yuri Blanarovich, VE3BMV, Directors; Ron Nickle, VE3BIZ, Awards Manager; and Jack Reed, VE3GMT, Public Relations.

Long Island DX Association: Michael Hacker, WA2BVU, President; Dave Ferrier, W2GKZ, Vice-President; and Gerry Offenberg, WB2-HXD, Secretary and Treasurer.

If your club would like this recognition for your officers, please send us a list of your current slate.

The CQ DX Award Program

C.W.

176 DL8VV
177 OK1KYS
178 WA2LJM

2XSSB

393 K7RSC
394 KH6GHZ
395 WA7OBH
396 K6SMF
397 WB4BER

Endorsements

CW: DJ4IT—150 countries.
2XSSB: W6YMV, K4RTA-310, K7RSC-200, K6SMF, K7RSC-150.
28MHz: K4ZYU, WB2GUB.

Complete rules and application forms for the *CQ* DX Award program may be obtained by sending a business size, self-addressed stamped envelope to DX Editor, P.O. Box 1271, Covina, CA 91722 USA.

Here and There in the World of DX

160 Meters—Herb, KV4FZ, worked TI9DX for his 100th country on top band since 1969. Each year for a number of years now, Herb has taken first place in the *CQ* 160 Meter Contest and he is second only to W1BB in the number of countries worked from a single QTH on 160.

Siberian Zones—Jim, WA4APG, in Georgia reports working UAØFGM, UKØLAB and UKØZAB between 7025 and 7030 kHz using a simple, quarter-wave vertical antenna. The contacts were made during the early morning hours.

Jerry, W2KZL, in New Jersey has worked a long and impressive list of Siberian stations on 40 and 20 meters. His recent contacts, *just* in rare Zone 18, include UK9HAB, UK9HAC, UK9HAD, UA9HL, UA9HM, UA9HN, UA9-IB, UA9ID, UA9IF, UA9IQ, UA9IZ, UW9OA, UT9OBI, UA9OV, UA9PG, UW9PJ, UV9PS, UA9PX, UA9UAB, UA9UAR, UA9UAW, UA-9UDR, UA9UGA, UA9UN, UA9US, UA9VL, UW9VH, UK9YAD, UT9YAI, UK9YAM, UK-9YAQ, UA9YAT, UA9YL, YA9YR, and UW9YS.

Stamps for S.A.S.E.—The DX Stamp Service operated by W2AZX, 83 Roder Parkway, Ontario, N.Y. 14519, can sell you stamps from most of the world's countries. It will really boost your QSL return to enclose a s.a.s.e. already stamped with the stamps of the country where it will be mailed. Its much easier for the DX station or QSL Manager than turning in IRC's and stamping the envelope himself.

On-The-Air Bulletin—The Southern California DX Club's on-the-air bulletin has changed to 0200 GMT on Thursdays to allow east coast stations to hear the latest news. The frequency remains the same, 14265 kHz.

Some Good Prefixes for WPX

BV2—Tim, BV2B, has been worked frequently on Fridays around 2300 GMT on 14225, 14218 or 14250 kHz. QSL to K3RLY.

CT6—This prefix was used by several CT1 stations during the *CQ* WPX Contest. For QSLing purposes route via the CT1 call with the same suffix. For example, CT6OF would be via CT1OF.

CZ3—A special Canadian prefix. Frank, CZ3-EVK, operated from Wilno, Ontario to commemorate that city's centennial.

DU3—Sounds like an ordinary prefix but there aren't many on the bands. DU3BS has been reported on 20 meter s.s.b.

FC6—FC6CXT has been worked on 14241 kHz.

FOØ—FOØVAP was heard on 14203 kHz.

IVØ—This was a special Italian prefix to commemorate Vatican Holy Year.

JI—Having completed the assignment of the JG series of callsigns, the Japanese are now assigning JI calls.

KP6—KH6EVM/KP6 has been active on 20 meter s.s.b. above 14300. QSL to Suite 209, 1427 Dillingham Blvd., Honolulu, Hawaii 96217.

KVØ—KVØISU operated May 1-5, 1975 from Iowa State University. QSL to WAØKHF.

KZ2—KZ2PTF was QRV from a trade fair in Sussex County, N.Y. QSL to W2 Bureau.

TK—This prefix was used by the French during the month of May to commemorate the 50th anniversary of IARU and the REF. TK2MO was F2MO, and in the French Overseas Territories TK7G was FG7, TK7M was FM7, TK7R was FR7 and TK7Y was FY7.

VC1—VC1HH was used by VE1HH to celebrate the centennial of New Glasgow.

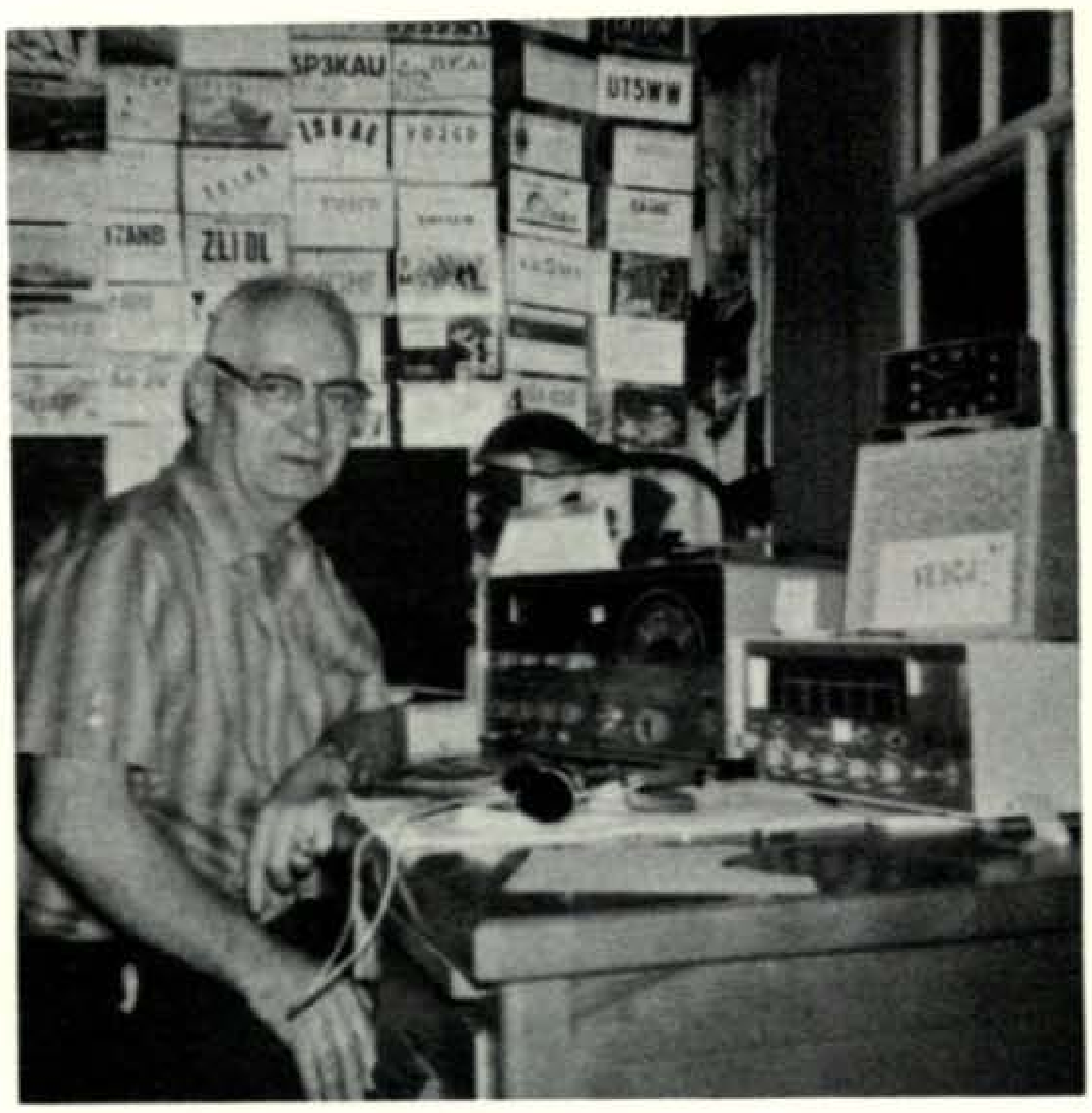
YKØ—OE5CA/YK has been very active. Frequencies reported include 14270, 14298 and 28560. QSL to OE5REB.

YZ—YU stations are using the YZ prefix from May 9 to November 29 to commemorate 30 years of the Yugoslav Federal People's Republic.

XK3—XK3EUP was Garth, VE3EUP, in commemoration of the 150th anniversary of Peterborough.

ZW4—ZW4AKL used this special prefix during the contest. QSL to PY4AKL.

4K1—4K1C and 4K1F are special Russian antarctic stations. QSL to Box 88, Moscow, USSR.



Recently qualifying for WAZ from the high plains of Canada is Cliff Jones, VE5CJ, of Saskatoon, Saskatchewan, age 65. Cliff uses Hallicrafter's gear, HT-37 and SX-146, with a 2-element quad up 50 feet.

5L—The 5L prefix was used in place of EL by the Liberians to celebrate the 10th anniversary of the Liberian Radio Amateur Association. Operation using this will continue until the end of the year. 5L2D = EL2D, etc.

8SK, 8SM and *8SL*—These prefixes were used by Swedish amateurs from April 18 to June 30 to commemorate the 50th anniversary of the Sveriges Sandare Amatoer (S.S.A.), The 8SK prefix will see continued use by the S.S.A. headquarters station until the end of the year.

QSL Information

A4XFP—QSL to P.O. Box 248, Muscat
A4XVB—Via G4DLG
A6XB—To K1DRN
A6XN—C/o DJ9ZB
C5AG—Via ZD3G
C5AR—To G3LQP
CEØAE—c/oWA3HUP
CN8DX—Via P.O. Box 120, Rabat, Morocco
CR6LF—To W3HNK
CR7BF—c/o Box 120, Nampula, Mozambique
CT3AR—Via P.O. Box 601, Funchal, Madeira Islands
DU3BS—To Box 94, APO San Francisco, CA 96298
EA7VN—c/o Apartado 479, Sevilla, Espana
EP2BQ—Via Box 1065, Teheran, Iran

[*Continued on page 72*]

Spanish operators are showing a lot of interest in CQ awards recently. EA3JK of Tarragona is one of their latest WAZ winners.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

July	5-6	Venezuelan Phone Contest
*July	5-6	DL QRP C.W. Contest
*July	5-6	Area Code Contest
*July	12-13	Ten Ten Net QSO Party
July	12-13	ARRL "Open" CD C.W.
July	19-20	ARRL "Open" CD Phone
*July	19-20	Colombian Contest
*July	19-20	Space Net VHF Contest
*July	26-27	World Wide VHF Activity
*July	26-28	County Hunters C.W. Party
July	26-27	Venezuelan C.W. Contest
Aug.	2-3	Romanian Contest
Aug.	2-3	Illinois QSO Party
Aug.	9-10	Argentina Phone Contest
Aug.	9-10	European DX C.W. Contest
Aug.	16-18	New Jersey QSO Party
Aug.	23-24	All Asian C.W. Contest
Aug.	23-24	Arizona QSO Party
Aug.	30-31	SSA 50th Anniv. Contest
Sept.	6-7	ARRL VHF QSO Party
Sept.	6-8	Maryland/D.C. QSO Party
Sept.	13-14	European DX Phone Contest
Sept.	13-15	Washington State QSO Party
Sept.	20-21	VE/W Contest
Sept.	20-21	Scandinavian C.W. Contest
Sept.	27-28	Scandinavian Phone Contest
Sept.	27-29	Delta QSO Party
Oct.	4-5	California QSO Party
Oct.	4-5	VK/ZL/Oceania Phone
Oct.	11-12	VK/ZL/Oceania C.W.
Oct.	18-19	Manitoba QSO Party
Oct.	**25-26**	**CQ WW DX Phone Contest**
Nov.	8-9	European RTTY DX Contest
Nov.	**29-30**	**CQ WW DX C.W. Contest**

Venezuelan Contest

Phone: July 5-6 C.W.: July 26-27
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This year for the first time a c.w. section has been added and some modifications have been made in the scoring and awards. Therefore use the following rules rather than the ones published prematurely last month.

It's still a world wide type contest on all bands 10 thru 80. There are three categories, single operator, single and all band, and multi-operator, single and multi transmitter, all band only.

Exchange: The usual RS(T) report plus a 3 figure contact number starting with 001.

Points: Contacts between stations in different countries 2 points. Between stations in same country 1 point if on 40 and 80, but zero (0) if on 10, 15 or 20, but permitted for multiplier credit.

Multiplier: One for each country and YV call area contacted on each band.

Final Score: Total QSO points multiplied by sum of different countries and YV call areas worked on each band.

Awards: Medals to the highest scoring stations in the U.S.A., Canada and each continent. Certificates to all stations working the following totals: North and South America, 20 YV's and 10 other countries. Europe and Africa, 10 YV's and 10 countries. Asia and Oceania, 5 YV's and 10 countries.

Times must be logged in GMT, indicate multiplier only first time it is worked on each band and use a separate sheet for each band. Include a summary sheet showing the scoring and other information, and the usual signed declaration. Usual disqualification rules are in effect.

A remittance of $2.00 or its equivalent in IRC's is requested with each certificate application. Mailing deadline is Sept. 15th for phone and Sept. 30th for c.w. to: Radio Club Venezolano, P.O. Box 2285, Caracas 101, Venezuela.

Romanian Contest

Starts: 1800 GMT Saturday, August 2
Ends: 1800 GMT Sunday, August 3

This one is sponsored each year by the Romanian Amateur Radio Federation, however no official announcement has been received.

You may work other European countries as well as YO stations, on each band and mode, 3.5 thru 28 MHz.

Categories: Both single and multi-operator, single and all band in both divisions.

Exchange: RS(T) plus a progressive QSO number starting with 001. YO stations will include 2 letters denoting their county.

Scoring: European contacts count 2 points, 10 points if it's a YO station. Multiply total by number of European countries and YO counties worked on each band and mode.

Awards: Certificates to the top scorer in each country in each category. And a Crystal Cup to the over-all champion.

Mailing deadline is September 1st to: Romanian Amateur Radio Federation, P.O. Box 1395, Bucuresti 5, Romania.

*14 Sherwood Road, Stamford, Conn. 06905

Illinois QSO Party

Two Periods (GMT)
1800 Sat. Aug. 2 to 0500 Sun. Aug. 3
1200 Sun. Aug. 3 to 2300 Sun. Aug. 3

This is the 13th annual party sponsored by the Radio Amateur Megacycle Society. The same station may be worked on each band and mode.

Exchange: RS(T) and QTH. County for Ill., state, province or country for others. (Ill. may work in-state stations.)

Scoring: One point per QSO. Ill. stations multiply total by sum of Ill. counties, states, VE provinces and DXCC countries worked. Others use Ill. counties for their multiplier. (max. of 102)

Ill. mobiles add 200 to score for each county operation from which 10 or more contacts were made. For non-Ill. stations there is a bonus multiplier of 1 for each group of 8 contacts with the same county. Look for K9CJU/9 (or possible special call) operating from *USS* Silversides, famed WW II submarine, each contact worth 5 points.

Frequencies: 60 kHz from low end of each c.w. band. 25 kHz from high end of phone bands. (also 21375 & 28675) And 25 MHz from low end of Novice bands on the half hour.

Awards: Certificates to top stations in each category in each state, VE province, DX country and 1st three places in Illinois. Single, multi-operator, mobile and Novice compete separately.

Mailing deadline is Sept. 15th to: RAMS, K9CJU, 3620 N. Oleander Ave., Chicago, Ill. 60634. Include large s.a.s.e. for results.

European DX Contest

C.W.—Aug. 9-10 Phone—Sept. 13-14
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is the 21st annual European contest sponsored by the DARC.

Use all bands, 3.5 thru 28 MHz. There are two classes, Single operator, All Band, and Multi-operator, Single Transmitter.

Only 36 hours out of the 48 hour contest period may be used by single operator stations. The 12 hour rest period may be taken in one but not more than 3 periods, anytime in the contest.

Exchange: A five or six figure number, RS (T) plus a QSO number starting with 001.

Scoring: One point per QSO and one point for each QTC reported.

Multiplier: For non-Europeans, number of EU stations worked on each band. Europeans will use the ARRL list and call areas as follows: JA, PY, VE/VO, VK, W/K, ZL, ZS, UA9/UAØ. In addition the multiplier on 3.5 may be multiplied by 4, on 7 mHz by 3 and on 14/21/28 by 2.

Bob Cox, K3EST operator of W3AU in the 1974 WPX Contest finally receives a Trophy after many years of contest operation. This one, the Joe Hiller W4OPM Memorial donated by the Virginia Century Club, of which Joe was the founder, was for the highest single band (14 MHz) score in the USA. *(Photo by W8IMZ)*

Final Score: Total QSO points, plus QTC points, times the sum total multiplier from all bands.

QTC—Traffic: Additional QSO point credit may be realized by reporting a QTC. This is a report of a QSO you have made earlier in the contest and later sent back to a EU station.

The general idea being that after a number of EU stations have been worked a list of these can be reported back during a QSO with another station. One point can be earned for each QSO reported. A QTC can only be sent from a non-European to a European station.

A QTC contains the time, call and QSO number of the station being reported. ie: 1300/DK2BI/134. This means that at 1300 GMT you worked DK2BI and received his number 134. It may be reported only once and not back to the originating station.

A maximum of 10 QTC's to the same station are permitted, and the same station worked several times to complete this quota. Only the original contact however has QSO point value.

Keep a uniform list of QTC's sent. QTC 3/7 indicates that this is the 3rd series and that 7 QSO's are now being sent.

Awards: Certificates to the highest scorers in each country and call area listed above. Continental leaders, and stations having at least half the score of the continental leader.

Disqualification: Violation of the rules of the contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed cause for disqualification. Decision of the Committee is final.

Jack Reichert, W3ZKH receiving the Don Miller W9WNV, Ted Thorpe Memorial Trophy, for their record breaking score from PJ9JR in the 1974 CQ WPX SSB Contest. That's Ray Terkoski, WA3IAQ the other half of the Multi-operator, Single Transmitter crew. *(Photo by W8IMZ)*

It is suggested that you use the official DARC log and summary forms. A s.a.s.e. with sufficient IRC's should be sent to address below. Figure 40 contacts to the page if you make your own. And use a separate sheet for each band. (W/K and VE stations can send their request to W1WY or WA3KWD).

Mailing deadline for logs is Sept. 15th for C.W. and Oct. 15th for Phone. To the WAEDC Contest Committee, D-895 Kaufbeuren, P.O. Box 262, West Germany.

European Country List

C31 — CT1 — CT2 — DL — DM — EA — EA6 — EI — F — FC — G — GC Guer — GC Jer — GD — GI — GM — GM Shetland — GW — HA — HB9 — HBØ — HV — I — IS — IT — JW Bear — JW — JX — LA — LX — LZ — M1 — OE — OH — OHØ — OJØ — OK — ON — OY — OZ — PA — SM — SP — SV — SV Crete — SV Rhodes — SV Athos — TA1 — TF — UA1346 — UA2 — UB5 — UC2 — UN1 — UO5 — UP2 — UQ2 —UR2 — UA Franz Josef Land — YO — YU — ZA — ZB2 — 3A — 4U1 — 9H1.

New Jersey QSO Party

2000-0700 GMT Sat./Sun. Aug 16/17
1300-0200 GMT Sun./Mon. Aug. 17/18

This is the 16th party sponsored by the Englewood ARA. Phone and c.w. are considered separate bands. The same station may be worked on each band and mode and N.J. may work other N.J. stations for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH. County for N.J., ARRL section or country for others.

Scoring: Out-of-state multiply N.J. QSO's by N.J. counties worked. (Max of 21)

N.J. stations score 1 point for W/K, VE/VO contacts, 3 points for DX. Multiply total by ARRL sections. (max. of 75) KP4, KH6, KL7, KZ5 are 3 points and section multiplier.

Frequencies: 1810, 3535, 3735, 3905, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28600, 50-50.5, 144-146. Phone on even hours, 15 on odd hours, 160 at 0500 GMT.

Awards: Certificates to the top scorers in each N.J. county, ARRL section and DX country, 2nd place awards if four or more logs received. Also to Novices and Technicians.

Use GMT, indicate multiplier first time it is worked and include a summary and QSO check sheet. A large s.a.s.e. if results desired.

Stations planning activity in N.J. are requested to advise EARA by Aug. 2nd so that coverage of all counties may be planned.

Logs must be received no later than Sept. 13th by the Englewood ARA, 303 Tenafly Road, Englewood, N.J. 07631.

All Asian DX Contest

Starts: 1000 GMT Saturday, August 23
Ends: 1600 GMT Sunday, August 24

This is the c.w. section, the phone section took place in June with complete rules and Asian country list in the May CALENDAR.

Briefly it's the world working the Asian countries. The exchange is RST plus age for OM's and RST plus 00 for YL's. One point per QSO. Asians use non-Asian countries for their multiplier. (DXCC list) Non-Asians use prefixes of Asian countries. (CQ WPX list)

Logs must be received no later than November 30th and go to: J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan. Include a IRC and s.a.e for copy of results

SSA 50th Anniversary Contest

Phone: Sat. Aug. 30 C.W.: Sun. Aug. 31
From 0600 to 2400 GMT

The SSA has organized this one to celebrate the 50th anniversary of Swedish Amateur Radio.

The object is to contact Swedish amateurs on all bands 3.5 thru 28 MHz. The same station may be worked on each band, phone and c.w. are separate contests.

There are three classes: Single and multi-operator and s.w.l., all band only.

Exchange: RS(T) plus a progressive contact number starting with 001.

Scoring: One point per contact multiplied by the number of Swedish prefixes worked on each band. SM1-7 + Ø, SK1-7 + Ø, SL1-7 + Ø and SJ9. (max. of 25 per band)

Awards: To the two top scores in each category both phone and c.w. All entries will receive a Special Participation Award.

Mailing deadline is October 1st to: SSA

Contest Manager, Jan Hallenberg, SMØDJZ, Sleipnergatan 64.7 TR, S-195 00 Maersta, Sweden.

Editor's Notes

After many years of procrastinating I finally got out to the Dayton Hamvention. Mostly due to the fact that this year for the first time they included a Contest Forum on the program, and our own Bernie Welch, W8IMZ was the moderator.

It was a successful affair with many well known contesters on the program and in attendance. To mention a few, OH2BH/ZD3X, W3ZKH/PJ9JR, W9SZR/LU5HFI, the ARRL CAC and many, many more.

It was my privilege to present WPX Contest awards to PJ9JR, W2PV, W3AU and W3SS.

With so many of the *CQ* Contest Committee in attendance it also offered an opportunity to hold one of our infrequent in person meetings.

I've heard so many stories about the Dayton Hamvention but you've got to attend one to believe it. Over 12,000 attended this year, with 1600 at the Banquet.

It seemed that everybody who is known in DX circles was at the North Jersey and National Capitol Hospitality rooms, JA1AEA and his group the most distant visitors. And you couldn't possibly cover the Exhibits and Flea Market in one day. Yes indeed, it was quite a shindig.

While in Dayton it was my pleasure to visit the R. L. Drake Co. at Miamisburg with Bernie, and get a VIP tour of the plant by Peter Drake. We now know the meaning of "quality control."

It was good to have an "eyeball" with all you fellows. Hope we can do it again.

73 for now, Frank W1WY

Spread The Word

An eye-catching bumper sticker encouraging the man in the street to "Talk to the World—Become A Ham Operator" is available from *CQ* for 25¢ plus a legal-size s.a.s.e. Quantity prices upon request. Write to: *CQ*, 14 Vanderventer Av., Port Washington, NY 11050.

Be a Part of It All

Join AMSAT—The Radio Amateur Satellite Corporation. Your $5.00 annual dues bring a handsome membership certificate and the quarterly publication "AMSAT Newsletter." Write AMSAT at P.O. Box 27, Washington, D.C. 20044.

Propagation

BY GEORGE JACOBS,* W3ASK

AMERICAN astronauts and Soviet cosmonauts will work together in space this month in an attempt to solve some of the remaining mysteries of the ionosphere. The ionosphere is that region in the earth's upper atmosphere where atoms of oxygen and nitrogen are ionized by ultraviolet radiation from the sun. This electrified region makes possible the refraction of high frequency radio signals over very great distances.[1]

At present the amount of oxygen and nitrogen in the earth's upper atmosphere is not accurately known. As part of the APOLLO-SOYUZ (ASTP) cooperative mission, astronauts and cosmonauts will measure the amount at the spacecrafts' orbital altitude of approximately 135 miles. This is within the lower level of the F-layer of the ionosphere.

Ultraviolet light beams will be sent from the APOLLO spacecraft to the SOYUZ vehicle where they will be reflected back to a special instrument aboard APOLLO called an optical absorption spectrometer. The amount of reflected light reaching the spectrometer will indicate the concentration of oxygen and nitrogen atoms between the spacecraft.

Measurements will begin when both vehicles are separated by a kilometer (0.6 mile), and they will continue as the spacecraft approach to within 150 meters (165 yards) of each other. By combining the known distances with the amount of light measured by the spectrometer, scientists hope to determine the amount of oxygen and nitrogen in the lower ionosphere.

Sunspot Cycle

The present cycle continues to decline slowly, but steadily. The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 12 for March, 1975. This results in a smoothed sunspot number of 32, centered on last September. A smoothed sunspot number of 17 is forecast for this July. The cycle is now in its "low period," and it will remain so through its minimum point and until the next cycle climbs to a smoothed sunspot of 20 again. According to latest estimates, this is likely to take another two years or so.

*Radio Propagation Editor, *CQ*, 11307 Clara St., Silver Spring, MD 20902

[1] "Short Wave Radio and the Ionosphere," Leinwoll, S. and Jacobs, G., *CQ*, Nov. 1969, p. 16.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For July, 1975

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date *July*				
Above Normal: 26	A	A	B	C
High Normal: 9-11, 20, 22-24	B	B	C	D
Low Normal: 6-8, 12-13, 15-16, 18-19, 21, 25, 27-28	B	C	D	E
Below Normal: 1, 3-5, 14, 17, 29-31	C	D	E	E
Disturbed: 2	D-E	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, an opening shown in the charts with a *propagation index* of (3) will be poor (D) on July 1, probably not open at all on July 2 (E), poor again on July 3-5 (D), fair on July 6-8 (C), 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, or check WWV at 14 minutes past each hour.

DX Conditions

With longer hours of daylight and the sun high in the northern sky, h.f. propagation conditions should be considerably more stable during July than they were during the spring months.

Twenty meters should be the optimum band for DX propagation during the month. The band should normally remain open to one area of the world or another from sunrise through midnight. Peak conditions are expected for a few hours after local sunrise, and again during the late afternoon and early evening, when the band may often open in almost all directions.

Considerably fewer DX openings are expected on *15* meters and even less on *10* meters, as a result of changing seasonal conditions and declining solar activity. *Fifteen* should normally open fairly frequently towards the south. Check for short-skip openings into the Caribbean area and Central America as early as 10 A.M., with a peak expected to all areas of Latin America between 3 and 6 P.M., local daylight time. The band may also occasionally open to Africa during the late afternoon from the eastern half of the country, and to Australasia and the South

Pacific area during the late afternoon and early evening from the western half of the country.

On *10* meters, the only possible DX looks like some very spotty short-skip openings during the day towards the Caribbean and possibly Central America and a very occasional longer-skip opening deeper into South America during the afternoon.

During the hours of darkness, *40* meters should open to many areas of the world, but seasonally high static levels may at times make DX reception difficult. Higher static levels are also expected to hinder DX on *80* meters, but the band should open to some areas of the world during the hours of darkness. Not many DX openings are expected on *160* meters during July because of seasonally high levels of static and absorption. Best bet is an hour or two *before* midnight for openings towards the north and east, and just before local sunrise for openings towards the west and south.

DX Propagation Charts for July appeared in last month's column. For an assessment of day-to-day conditions expected during the month, see the "Last Minute Forecast," which appears at the beginning of this column.

Peak Sporadic-E Propagation

Short-skip propagation conditions are expected to be optimum during July as a result of a seasonal peak in sporadic-E ionization. During the daylight hours, considerable short-skip openings are forecast for *10* and *15* meters over distances ranging between 500 and 1300 miles, with some openings extending out to beyond 2000 miles. Around-the-clock short-skip openings should be possible on *20* meters on a good number of days, with the skip often as short as 300 miles and as long as 2300 miles. Short-skip conditions on *20* should peak during the late afternoon and early evening.

Good daytime short-skip conditions are expected on *40* meters, with openings between 100 and 750 miles. During the hours of darkness the skip should lengthen, with openings possible between 250 and 2300 miles. Conditions on *80* meters are also expected to be good during the daylight hours, with openings up to approximately 300 miles. During the hours of darkness, good openings should be possible on this band up to the one-hop limit of 2300 miles. While no short-skip openings are likely on *160* meters during the daylight hours, some good openings should be possible during the hours of darkness up to about 1300 miles, and at times as long as 2300 miles. Seasonally high static levels may often mar reception on *40, 80* and *160* meters during July.

V.h.f. Ionospheric Openings

Intense sporadic-E ionization expected during July is very likely to result in numerous *6* meter openings and an occasional *2* meter opening. Fairly frequent *6* meter openings should be possible over distances ranging between approximately 600 and 1300 miles, with some openings extending out to beyond 2000 miles. When *2* meters opens, it may be possible to work stations between 1000 and 1300 miles way. While sporadic-E short-skip openings can take place at just about any time of the day or night, statistics indicate that conditions peak for a few hours before noon and again during the late afternoon and early evening.

The *Delta Aquarids* meteor shower is expected to peak at about 2 P.M. EDT on July 29, with an hourly meteor count of about 20. This should make possible meteor-scatter type openings on the v.h.f. bands from late on July 28

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 (10 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a *propagation index* of (2), or higher.

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 mid-point*. 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 MST zone; 5 hours in CDT zone; and 6 hours in 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 in other areas of the USA, *subtract* 7 hours in the PDT zone, 6 hours in MDT zone, 5 hours in CDT zone and 4 hours in 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.

through the early hours of July 30.

Check for auroral and other unusual type of ionospheric propagation on the v.h.f. bands during those days that are forecast to be *Below Normal* or *Disturbed* in the "Last Minute Forecast," which appears at the beginning of this column.

MAIL-A-PROP

If you're interested in more comprehensive propagation forecasts and updated information for taking the mystery out of band openings, try the bi-weekly MAIL-A-PROP newsletter. The MAIL-A-PROP forecasts are based primarily on a detailed analysis of solar, geomagnetic and ionospheric data, and they have achieved an accuracy of nearly 90% during the past year. The format 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 given at least monthly. The forecasts cover each h.f. amateur band from 160 through 10 meters, and apply also to the adjacent bands for the broadcasting and other services.

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

The generally four-page MAIL-A-PROP newsletter is published every two weeks, and contains forecasts of overall conditions on a day-by-day basis. The newsletter is sent via first class mail, or airmail if necessary, to reach subscribers *before* the forecast period begins.

MAIL-A-PROP is mainly intended for use in North America, but there are satisfied subscribers in Europe and as far away as Singapore and Pago Pago.

The forecasts and analyses are written in plain, easy to understand language, and are in a convenient and easy to use form. An annual subscription to MAIL-A-PROP is $25, with a six-month subscription available for $15, postpaid. A special two-month trial subscription is available for $5, postpaid. A free sample copy is available for an s.a.s.e. For further information, write to MAIL-A-PROP, 11307 Clara Street, Silver Spring, MD 20902.

This month's column contains *Short-Skip Propagation Charts* for July and August, as well as Charts centered on Hawaii and Alaska. The Short-Skip Chart contains band predictions for one-hop openings between distances of 50 and 2300 miles from your transmitting location.

73, George, W3ASK

CQ Short-Skip Propagation Chart
July & August, 1975
Local Daylight Savings Time At Path Mid-Point

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	08-10 (0-1) 10-14 (0-3) 14-18 (0-1) 18-22 (0-2) 22-08 (0-1)	08-10 (1) 10-14 (3) 14-18 (1-2) 18-22 (2-3) 22-08 (1)	08-10 (1-0) 10-14 (3-0) 14-18 (2-0) 18-22 (3-0) 22-08 (1-0)
15	*Nil*	08-10 (0-2) 10-14 (0-3) 14-18 (0-2) 18-20 (0-3) 20-22 (0-2) 22-08 (0-1)	08-10 (2) 10-14 (3) 14-18 (2) 18-20 (3) 20-22 (2) 22-00 (1-2) 00-08 (1)	08-10 (2-0) 10-14 (3-0) 14-16 (2-0) 16-18 (2-1) 18-20 (3-1) 20-21 (2-1) 21-00 (2-0) 00-08 (1-0)
20	10-00 (0-1)	07-10 (0-2) 10-16 (1-4) 16-21 (1-3) 21-00 (1-2) 00-07 (0-1)	07-10 (2) 10-16 (4) 16-19 (3) 19-21 (3-4) 21-00 (2-3) 00-07 (1-2)	07-10 (2) 10-16 (4-2) 16-19 (3) 19-21 (4) 21-23 (3-2) 23-00 (3-1) 00-05 (2-0) 05-07 (2-1)
40	08-12 (1-2) 12-16 (1-4) 16-20 (2-4) 20-00 (1-2) 00-08 (0-1)	08-10 (2-3) 10-12 (2) 12-16 (4-2) 16-18 (4-3) 18-20 (4) 20-00 (2-4) 00-08 (1-3)	08-10 (3-1) 10-16 (2-0) 16-18 (3-1) 18-21 (4-3) 21-00 (4) 00-06 (3-4) 06-08 (3)	08-10 (1-0) 10-16 (0) 16-18 (1-0) 18-21 (3-2) 21-06 (4) 06-08 (3-1)
80	07-12 (3-4) 12-17 (4-3) 17-22 (4) 22-05 (3-4) 05-07 (3)	08-10 (4-1) 10-12 (4-0) 12-17 (3-0) 17-19 (4-1) 19-21 (4-2) 21-23 (4-3) 23-05 (4) 05-07 (3) 07-08 (4-2)	08-10 (1-0) 10-17 (0) 17-19 (1-0) 19-21 (2-1) 21-23 (3-2) 23-05 (4) 05-07 (3) 07-08 (2-1)	08-19 (0) 19-21 (1-0) 21-23 (2-1) 23-04 (4-3) 04-05 (4-2) 05-06 (3-1) 06-07 (3-0) 07-08 (1-0)
160	18-19 (1-0) 19-20 (1) 20-22 (3-2) 22-00 (4-3) 00-06 (4) 06-08 (3-2) 08-09 (1) 09-10 (1-0)	19-20 (1-0) 20-21 (2-0) 21-22 (2-1) 22-00 (3-2) 00-04 (4-2) 04-06 (4-3) 06-08 (2-1) 08-09 (0-1)	21-22 (1) 22-01 (2-1) 01-04 (2) 04-06 (3-2) 06-07 (1) 07-08 (1-0)	21-23 (1-0) 23-01 (1) 01-06 (2-1) 06-07 (1-0)

See "How To Use Short-Skip Charts" in box at the beginning of this column.

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.

° Indicates best time to listen for 160 Meter opening.

ALASKA
Openings Given In GMT

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

[*Continued on page 66*]

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties

#125—John E. Knaak, KØEQY 3-28-75.
#126—Louis F. Wenisch, W9ZHD 4-19-75.

THE July, "Story of The Month," as told by Walt is:

Walter E. Morris, K4ELK

(All Counties #111, 10-16-73)

"I was born in Arcadia, Florida in 1915, grew up in central part of the state, where I graduated from Orlando High School in 1934. During my last year in school I obtained my first call, W4CRS, and was active on 40 meters with the classic rig of the day, a pair of 45s TNT running all of 15 watts input!

"After graduation, I worked at various jobs while studying radio at home. A commercial license was earned and for a few months I was a part time radio operator for the local police department. In 1938 I joined what was then a small airline but which over the years has grown into one of the nation's international/transcontinental trunk lines. I am still with the company and for the last twenty-two years have been head of the communications department.

"The first ham license was permitted to lapse in 1940 and I was inactive until 1958 when the currently held call, K4ELK, was put on the air. I again became inactive late in 1960 while I devoted all my spare time to the earning of a BBA degree at the University of Miami (Evening Division).

"Resuming hamming in 1966, I chased DX and in 1970 started working for 5BWAS. I soon found that it was very hard to get needed states on 20 meters. One day while idly tuning the band, I discovered the ICH Net. It was obvious that there was a ready source of states, so I started calling the mobiles that were in states that I needed. . . . and was hooked! 5BWAS was completed early in 1971, but by that time the habit of working on the ICH Net was ingrained and could not be denied. At the time, I did not seriously consider trying to work all counties, I just enjoyed the camaraderie of the Net, and with the forbearance of the Net members, acting as Net control from time to time.

*P.O. Box 73, Rochelle Park, NJ 07662.

"In the spring of 1973, it dawned on me that in the process of having fun, I had reached the point that with some effort and luck, I just might finish "all counties". Finally, through the help of many co-operative mobilers who went out of their way to give me a last state county, I was down to four, one in Tennessee and three in Mississippi. Wes, WB4TNY, offered to get me two of them that were close to his home QTH, and Clint, K5JBC stated that if I would let him know when these two were confirmed, he would make a special trip to get me the last two, Clarke and Greene, Mississippi. Wes did his part and then on October 5, 1973, Clint drove all the way across Mississippi from his home in Louisiana and gave me the last two.

"I am married to one of my high school classmates (Hazel) and we have one son, Glen, who is now 26."

Awards Issued

As the Special Honor Roll indicates, John Knaak, KØEQY (exW5OYG) obtained *All Counties* endorsed All 2×SSB.

Lou Wenisch W9ZHD (ex WB2AHB) qualified for *All Counties* on his Wedding Anniversary, NO he has not been married 3075 years.

Awards

Massachusetts Bicentennial Award: Rules and photograph of this award in my column of February 1975.

Pennsylvania Keystone Award (PKA): Here are the revised requirements for this Award as issued by the Harrisburg Radio Amateur's Club, Inc. Required: Confirmed contacts with 100 different Pennsylvania Amateur Radio Stations after January 1, 1957. Send alphabetical-by-call list of 100 different Pennsylvania station QSLs, showing station, date, time, band and mode, plus the following statement: "I certify that the above list is a true copy of the log information of Amateur Radio Station ———, and that the confirming QSLs are in my possession." Send this and $1.00 (DX send 8 IRCs)

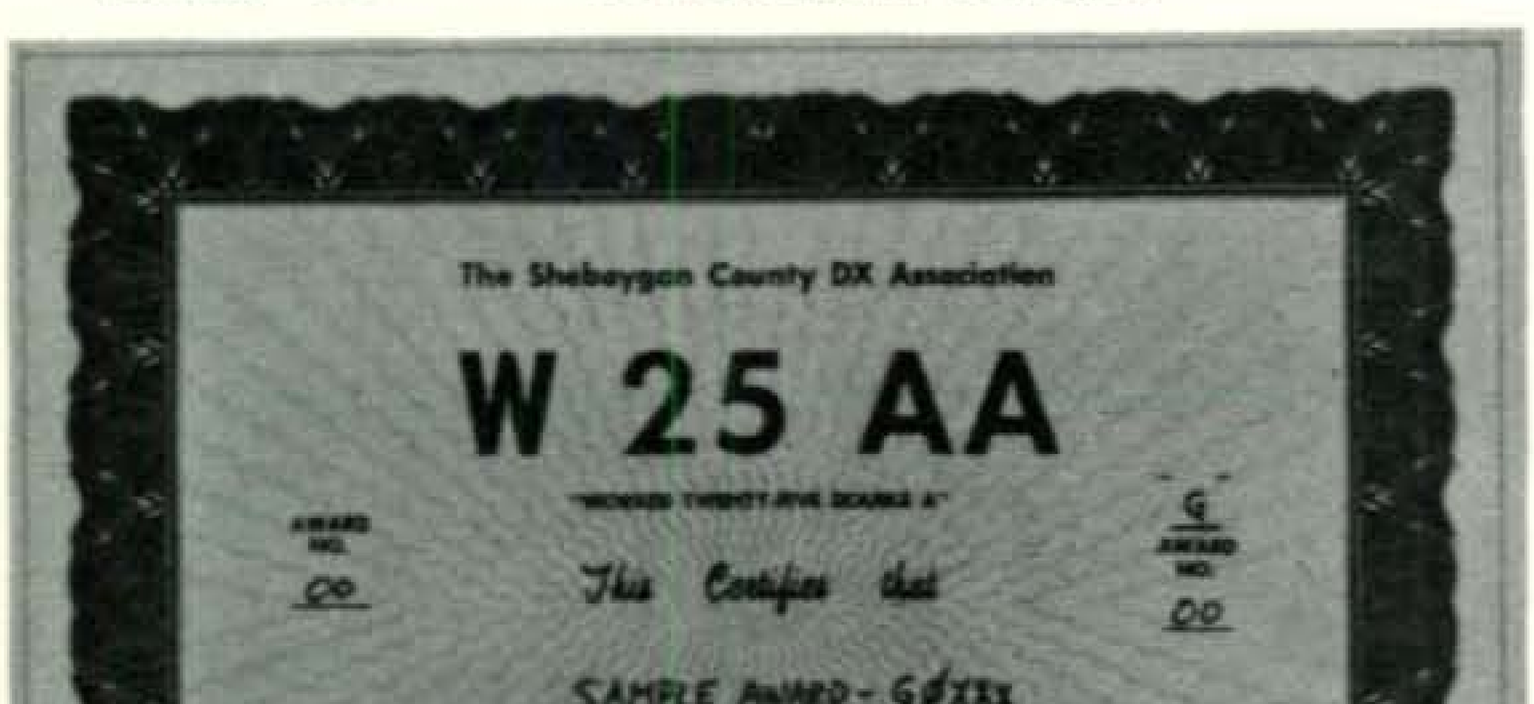
Walter, K4ELK. A far cry from the pair of 45s (15 watts) in 1934.

Commonwealth Achievement Certificate.

to: Awards Manager, Harold L. German, W3-IMN/WA3NGB, 129 North 30th Street, Camp Hill, PA. 17011. There are two different endorsements available, the only charge for which is a self-addressed, stamped envelope: 1—Novice: For working 25 Pennsylvania novice stations in a calendar year. 2—100 PA. Stations: For working 100 different Pennsylvania amateur stations in a calendar year. Endorsements are issued only for QSOs subsequent to the date of issuance of the basic certificate. Full information concerning these endorsements is supplied to award recipients at time of issue of the Keystone Award.

Commonwealth Achievement Certificate: Also issued by the Harrisburg Radio Amateur's Club, Inc. Issued for post WW II confirmed contacts with political subdivisions within the Commonwealth of Pennsylvania, of which there are 2636. The award is issued in the following classes, with the first column for K/Ws; 2nd column for DX including KH/KLs; 3rd column K/W county requirements; 4th column KH/KL/DX county requirements:

Class "AAA"—Gold Trophy—2636/—/67
Class "AA" —Silver Trophy 2636—/67/—
Class "A" —2500/2000/65/55.
Class "B" —2000/1500/60/50.
Class "C" —1500/1000/55/45
Class "D" —1000/750/50/40.
Class "E" — 750/500/40/30.
Class "F" — 500/250/30/20.
Class "G" — 250/150/20/15.
Class "H" — 100/75/10/8.



W 25 AA Award.

Applications shall be submitted in columnar form, alphabetically by County and Subdivision, and shall include the following: Name of County, Name of Subdivision, station worked, date, time, band, mode and QTH of claimed station. Band/mode endorsements, where qualified. General Certification rule applies, with certification by two General Class, or higher amateurs; by recognized radio club secretary, with club seal; or by notary public. Charge for award: $2.00 or 15 IRCs. Additional seals 25¢ or 2 IRCs, plus s.a.s.e.

General data: Pennsylvania has 67 counties, 52 cities, 965 boroughs, 1551 townships, and 1 town.

The Club Station of the Harrisburg Radio Amateur's Club, Inc., W3UU, may be substituted for any county, to a maximum of three contacts. Each such contact must be on a different band. Any member station of the Harrisburg RAC, may be substituted for any one subdivision, other than a county, to a maximum of eight contacts. Each such contact must be on a different band. Confirmation of the initial contact only is required of the club or member stations. Additional claimed contacts will be confirmed from applicants logs. Club members must have received applicant's QSL card.

In all instances, except those for which Station W3UU, or a member station has been substituted, the initial contact in a county will be counted for both county credit and subdivision credit. *The Pennsylvania Manual,* 1972-73 edition will be the guiding document for arbitration of disputed credits. The decision of the Awards Committee shall be binding.

A 3′ x 5′ multi-colored "Political Subdivision Map of Pennsylvania" is available at a charge of $5.30, postpaid, from the Pennsylvania Dept. of Transportation, Publication Sales, Room 117-T, Transportation & Safety Building, Harrisburg, PA. 17120.

An alphabetical listing by County and Political Subdivision is available from the Awards Manager at a charge of $2.25 postage paid by 3rd class mail, or $2.60 by 1st class mail. This will include a current listing of the Harrisburg RAC membership. Club membership listing only, available for s.a.s.e. Awards Manager: Harold L. German, W3IMN/WA3-NGB, 129 North 30th Street, Camp Hill, PA. 17011.

W 25 AA Award: Sponsored by the Sheboygan

[*Continued on page 70*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

I LOOKED through the flea market at Dayton last April for new surplus goodies to work up for this column, but Uncle Sam's cupboard seems to be growing bare. The Viet Nam surplus must have all been left to the Provisional Revolutionary Government.

I did find, though, a piece of commercial surplus that might be of some interest. Sandy Mendelson, of Mendelson's Surplus, in Dayton, has bought about 100 discontinued marine single-sideband transceivers, model RF-1100, built by RF Communications, of Rochester, New York.

Sandy has quite a few complete sets, plus a lot of components out of which more can be built. The RF-1100 was a $4,000, 250 Watt unit, designed for use aboard commercial vessels, or fancy yachts. (It is definitely out of the class of my little sailboat, which cost, in toto, less than the list price of this set.)

The set is a 12-channel unit, and would probably be impractical to convert to tuneable operation. It might lend itself to certain mobile channel operation in the h.f. bands between 2.0 MHz and 22.7 MHz, but it does not cover the entire 2-22.7 MHz band, rather takes in certain chunks in that area allocated to marine, business, and land communications. The channel switching is automatically arranged through computer techniques, to select the proper transmitting mode for the frequency used.

The specs show the RF-1100 is capable of 250 watts p.e.p. above 4 MHz, and 150 watts below. Its frequency bands are:

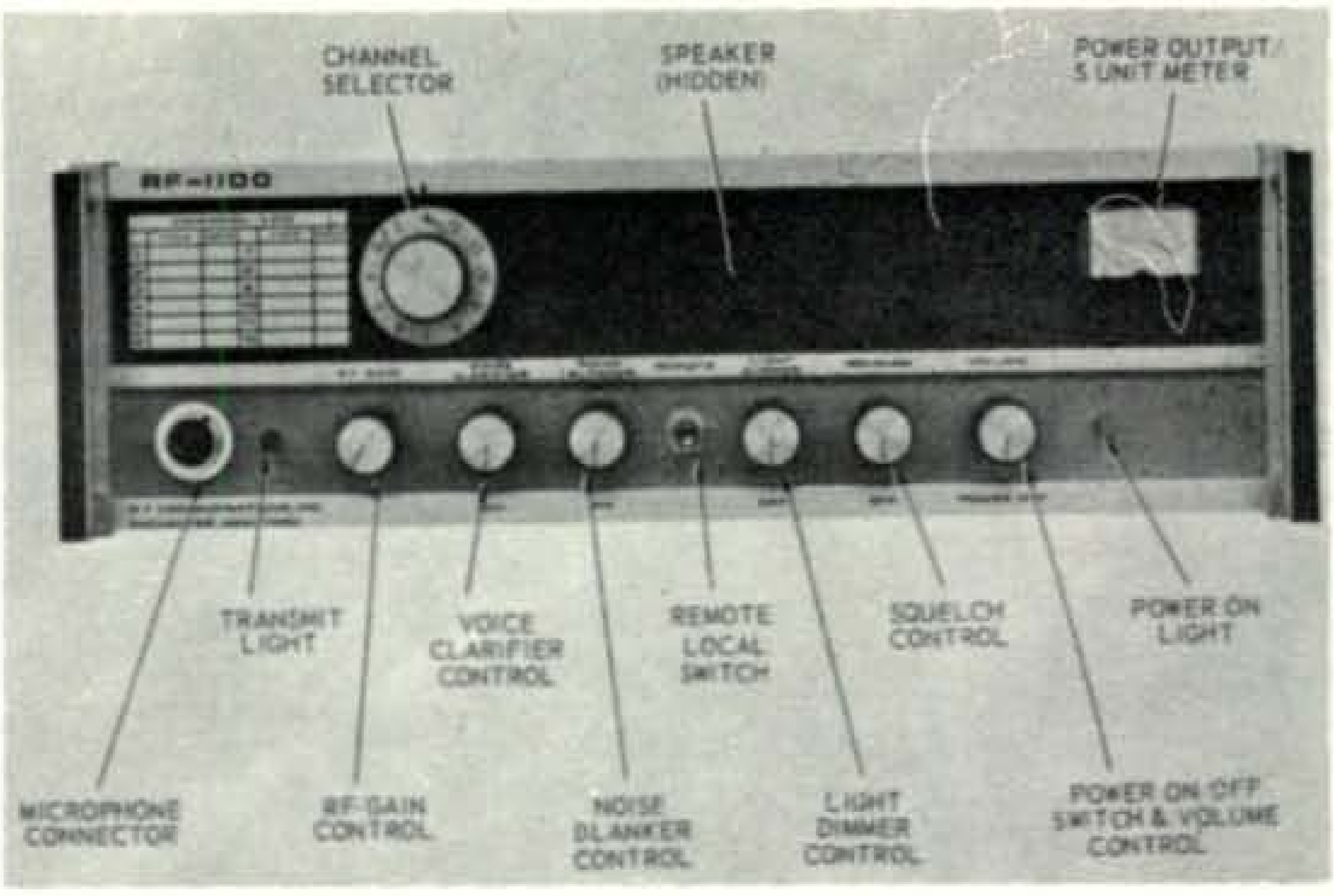
2 - 3.3 MHz
4 - 4.7
6 - 6.6
8.2 - 8.8
12.3 - 13.3
16.4 - 17.4
22 - 22.7

Modes include: upper sideband, suppressed carrier or reduced carrier, or compatible a.m.

Stability is rated at plus or minus 20 Hz at temperatures from −30 degrees C. to +50 degrees C. Vibration resistance is up to Mil Spec standard 167. Power input can be 115 or 230 volts a.c., 60 Hz, 680 watts.

R.f. output impedance is 50 ohms, unbalanced. The set requires a 600 ohm carbon mike.

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



A front panel view of the RF-1100 with controls called out.

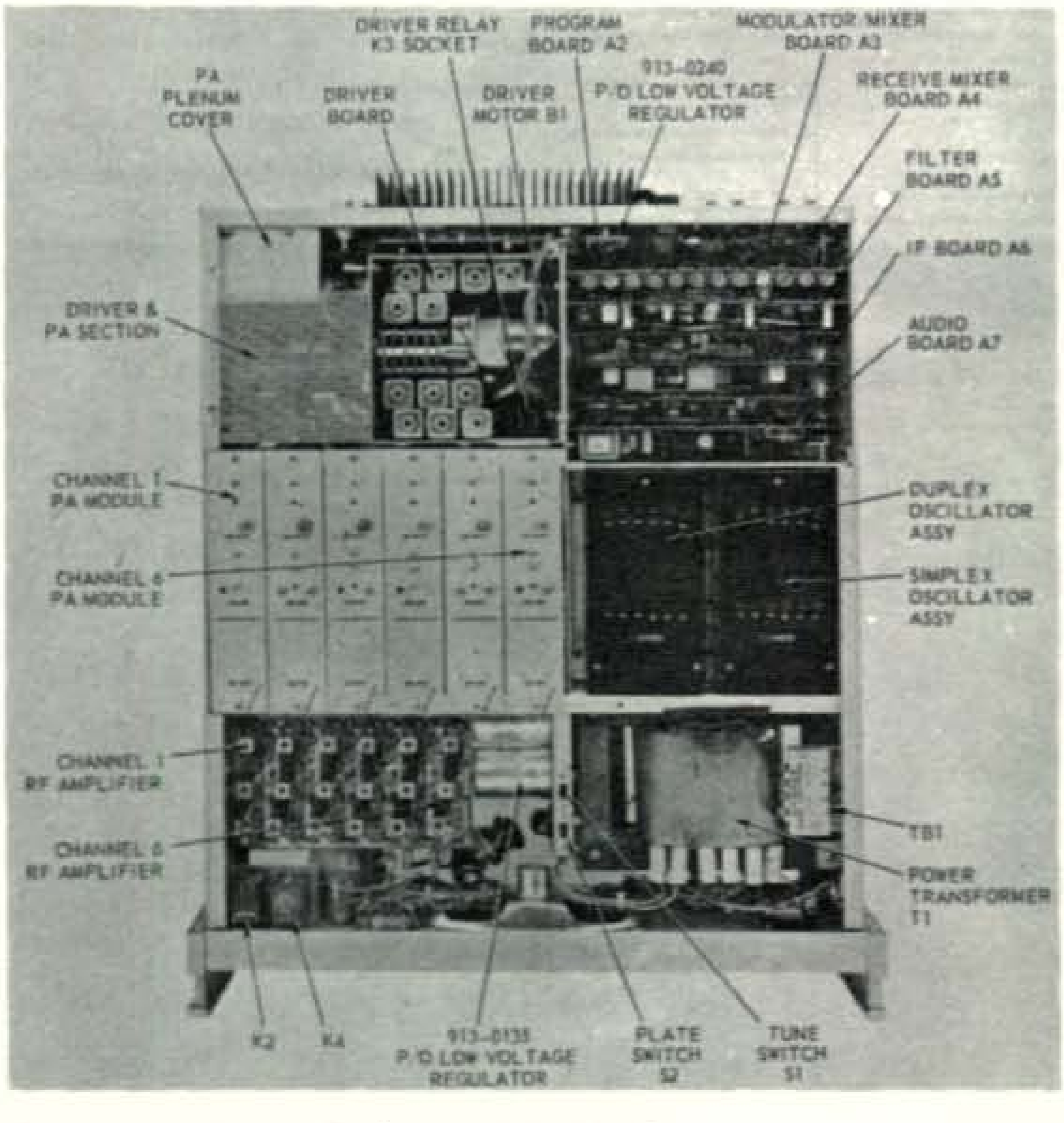
The receiver portion is a single-conversion superhet, with crystal filtering in the i.f. section. The intermediate frequency is 10.7 MHz. Sensitivity is rated at .05 microvolt in sideband mode, 10 db signal plus noise to noise ratio and 2.5 μv in a.m.

In addition to the usual controls, the RF-1100 has a noise blanker and a "clarifier" which allows plus or minus 100 Hz trimming of the injection oscillator.

The transmitter section uses an 8122 output tube, driven by a 12BY7. Otherwise the set is fully solid-state.

Crystals below 13.3 MHz are r.f. frequency less the 10.7 MHz i.f.; above 13.3 MHz crystal frequency is doubled.

Antennas normally used are either whips of from 24-26 foot length, or 75-150 foot longwires. A pi-network in the transmitter output



Interior view of the RF-1100 showing major component locations.

SUBSCRIBE TODAY SEE PAGE 80

CQ'S DIAL-A-PROP

For the latest up to the minute propagation forecasts and special contest predictions call 516-883-6223 any time day or night for a recorded message on conditions.

circuit is automatically tuned by channel selection switching.

The entire set weighs 55 pounds. It may be rack-mounted or used with a special mounting bracket in an "under-dash" arrangement. It measures 5¼ by 18 by 22 inches.

An interior view of the set is shown in the photo. As is obvious, this is a complex unit. If you buy one, be sure to get the manual with it. ■

Awards [*from page 64*]

County DX Association (Wisconsin) and is issued to those amateurs who have worked at least 25 different amateur stations which have their call sign suffix the two letters AA. Example: KV4AT, YV∅AA, YK1AA, etc. Endorsements are available for 100% Phone or CW or for a single band. An s.w.l. endorsement is also available. There is no starting date, so check back your QSL file. Applications must log data: date, station worked, band, mode, report and this must be certified by an officer of a recognized radio club or two other amateurs. Send certified list and $1.00 US or 12 IRCs to: Art Pahr, WA9UEK, P.O. Box One, Plymouth, Wisconsin 53073.

Notes

Thanks for all the nice mail, remember I issue the USA-CA only, and you do NOT have to work any Independent Cities, the data in my column October 74 was just to help you know what they can count for. There are now 3075 counties as Carson, Nevada and Nansemond, Virginia are no longer Counties. Write and tell me, How was your month? 73, Ed., W2GT.

Propagation [*from page 62*]

HAWAII

Openings Given In Hawaiian Standard Time #

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

Announcements [*from page 8*]

1975 at Macks Inn, Idaho. For more information write WIMU Hamfest Rt. 1, Box 215B, Thornton, Idaho 83453. ● **Calagary, Alberta Canada** – The Amateur Radio Association is pleased to announce that the Calgary Centennial Amateur Radio Convention will be held on August 1, 2, and 3, 1975. Special Guest speaker will be Dr. Owen Garriott, W5LFL, who was the Science Pilot on board NASA's Skylab 2 Mission. The Convention will be at Calgary Inn; for further information write to '75 Convention, Box 592, Calgary, Alberta T2P 2J2.

● **Canton, Ohio** – August 3rd, 1975 will be the Hall of Fame Hamfest and Auction in Canton OH. at the Stark County Fairgrounds. For more information write WA8SHP, 73 Nimishillan St., Sandyville, OH 44671.

● **Hilliard, Ohio** – On Sunday August 10, 1975, The Ohio Radio Club will sponsor their Fleamarket-Hamfest-Auction. It will take place at the Franklin County Fairgrounds Hilliard, OH (just West of Columbus). For more information, Write: CORC, Inc., P.O. Box 23, Delaware, OH 43015.

● **Flagstaff, Arizona** – The 25th Annual A.R.C.A. summer Hamfest is July 25-27th at Ft. Tuthill, Coconino City Fairgrounds Flagstaff, AZ., off I-40 & I-17. Contact W7IWL, K7VOR, or WA7NIY, for more information.

Cheap Selectivity [*from page 42*]

An A.M. Filter

Recently I find enjoyment in listening to the "DX Junke Box" program of Bonaire broadcast of Radio Nederland at 0500 UMT on Thursdays. And since they have improved the content, to the "DX Corner" of NHK. But the musical interludes didn't sound Hi-Fi using the c.w. or s.s.b. position of the filter switch. I hankered to fill position "A" of the Filter Switch with an a.m. filter of some 4 to 6 kHz bandwidth, but again the price was out of range of my pocket money.

One day, when in Tokyo, I passed through Akihabara and stopped at Toyomura Electronics. I bought one of the Toko Coil MPH-40K 455 kHz filters in a miniature can. It is supposed to be down 22 db at 6.0 kHz but I can't prove it. The little can comes packed in a plastic bubble on a card with details printed on the reverse side and cost about $1.30.[2] I mounted the card on a small rectangle of scrap perf-board 1″ × 1¼″ from the junkbox, soldered #24 insulated wires to pins 1, 2, 4, 6. And plugged it into the FL201 sockets of the HQ-215. The "A" position of the Filter Switch now functions, probably not as well as the Hammarlund filter would, but as well as a hams purse could hope for. If you try this coil and it doesn't function, reverse the in and out direction because the second Mixer (Q_{203}) is fed its collector current through the primary. And only one side of the filter conducts, the other side is blocked internally for d.c.

I elected to enlarge one hole in the perf-board to take the screw from the bakelite hold-down strip to hold this modification in place. It is light and fits very well because of the small size. Again the "base" pins on FL201 sockets are not used.

There you have it, fellows: Both c.w. and a.m. filter operation for the HQ-215 for less than $20. And no permanent modification to your prize receiver to mar its resale! ■

[2] Toko Coil MFH 40K. US distributor J.W. Miller Co., 19070 Reyes Av., P.O. Box 5825, Compton, CA 90224.

Microprocessors [*from page 20*]

All of the previous fancy ham applications could be programmed by some experienced programmer(s). Each application set is then loaded onto a cassette cartridge and sold (or swapped) to interested parties. These cassettes are then simply placed into the microprocessor, and the start button pushed. A $500 microprocessor becomes a c.w. station, an RTTY station, an SSTV station, a computer graphics terminal, a station logger, a Repeater Controller, a test equipment measurement controller or recipe retriever dependent on which cassette was used to load the microprocessor's instruction memories. ■

SWR Bridges [*from page 37*]

3. S.w.r. meters are reliable indicators of whether the s.w.r. is going up or going down.

4. Readings near unity, particularly with very low power, may be misleading or useless.

The authors wish to acknowledge the assistance of Gomer L. Davies for helpful discussion and assistance in writing the computer programs. ■

Function Generator [*from page 28*]

and provides ±6 volts for U_1, Q_1, and Q_2. The RC4194TK, (U_5) is in a multipin TO66 package head-sink mounted (with a mica washer) to the chassis; it provides ±15 volts for U_2 and U_3. Both U_4 and U_5 have 71.5K resistors associated with them. 71.5K is the Raytheon recommended value for the RC4194; but looking through one's 68K and 75K resistor bin will usually produce some resistors close enough for practical purposes. Each RC4194 also has a voltage-setting resistor associated with it (15K for the RC4194D and 37.5K for the RC4194TK). These values are also target values and must be adjusted to give ±6 and ±15 volts output, respectively. It is best to construct the power-supply first and make any resistor adjustments prior to connecting the waveforming circuitry. These resistors are marked in fig. 2 with asterisks.

To align the waveform generator, all the adjustment pots should be set at mid value, the function switch on SINE and the frequency range selector switch on MINIMUM FREQUENCY=10 Hz. With a 'scope on pin #2 of U_1, the SINE ADJUST and SINE SYMMETRY pots should be adjusted for best sine wave output. The 'scope probe should then be moved to the generator output b.n.c. and the OUTPUT LEVEL control set to give about 3 volts p/p output. The d.c. offset pot may be adjusted to cause the output sine wave to have a zero average value. The function switch should then be thrown to TRIANGLE and the TRIANGULAR WAVE AMPLITUDE pot adjusted to give 3 volts p/p output. Then similarly switch to SQUARE WAVE and adjust the SQUARE WAVE AMPLITUDE pot to give 3 volts p/p output. There will be some differences between function positions in the d.c. average levels, but these can be readily compensated for with D.C. OFFSET control.

The function generator described above is a great help in the author's experimentation on the bench. It is capable of outputs from 0.01 Hz to 100 kHz and will drive impedances as low as 50Ω. The output level can swing as high as ±10 volts, and the d.c. offset capability even makes the unit useful in clocking various logic I.C.'s. ■

DX [*from page 59*]

EP2DB—To W3KT
FCØBLZ—c/o I4BFY
FG7AN—Via WA3EDS
FL8DB—To Boite Postale 215, Djibouti, French Somaliland
FP8DH—c/o Boite Postale 189, St. Pierre &Miquelon Islands
FY7AK—Via K3BSY
FY7AO—To Boite Postale 455, Kourou, 97310, French Guyana
FYOBHI—c/o F5QQ
G3DEM—Via VE2YG
G3YKW—To VE2YG
GC3YKW—c/o VE2YG
HH2WF—Via W3HNK
HZ1AB—To Box 113, APO, New York, N.Y. 09616
HZ1TA—c/o OD5FV
IA5BFY—Via Roberto Borhy, I4BFY, 133 Via Toscana, 46141 San Ruffillo, Italy
IA5DJD—To I4BFY
IA5OAK—c/o I4BFY
II4FGM—Via I4BFY
IVØWXK—To P.O. Box 361, Rome, Italy
KG4BE—c/o Box 13, USN Station, FPO, New York, N.Y. 09593
KM6EA—Via Bob Holman, Box 19, FPO, San Francisco, CA 96614
KS6FF—To W6LKJ
KS6SFA—c/o Dept. of Education, Box 1618, Pago Pago, American Samoa
KX6BB—Via K3NEZ
LU2DZ/UN and LU2DZ/SU—To P.O. Box 593316, Miami International Airport, Miami, FL 33159
OD5JJ—c/o W3HNK
P29FV—Via K6ZDL
P29RJ—To JH3HPX
PAØIWH/S2—c/o W. Bolkensteijn, Paus Leostraat 14, Haarlem, The Netherlands
PVØAX—Via Box 783, Sao Paulo, Brazil
PY7ZAE—To PY1ZAE
ST2AY—c/o 4142, C.P.O., Khartoum, Sudan
SU1MA—Via Omar Ibn, El Khittab St., Heliopolis, Cario, Egypt
SVØWEE—To Floyd Spencer, 6219 Indian Valley, San Antonio, TX 78242
TI9FAG—c/o HB9AQM
TK7YAA—Via F2QQ
VE3SUD/SU—to VE1AL
VK4AK/9—c/o W7OK
VP1FF—Via WBØAOM
VP1IL—To P.O. Box 790, Belize City, Belize
VP1MT—c/o W3FVC
VP2A—Via W5NOP
VP2KK—To Ericson France, 21 Infirmary Rd., Basseterre, St. Kitts
VR1AC—c/o J. Dudek, Box 1158, APO, San Francisco, CA 96401
WA6HNQ/VQ9—Via MARS Station, FPO, San Francisco, CA 96635
YB9ABH/1—To Box 2761, Jakarta, Indonesia
YU1AJF—c/o W1CDC
ZD8RD—Via R. Drinkwater, c/o B.B.C., Ascension Island
ZF1AU—To WA4BTC
ZF1DU—c/o W2BVN
ZF1JH—Via WA6VNR
ZL3NR/C—To D.E. Horan, Waitangi, Chatham Island
4W1AM—c/o G3JUY
4W1GM—Via W3HNK
4S7UD—To JA1OJB
5B4CA—c/o G4AWJ
5T5ZR—Via P.O. Box 202, Nouakchott, Mauritania
5U7AW—To P.O. Box 1001, Niamey, Niger Republic
6W8EX—c/o Box 4002, Dakar Senegal
6Y5DE—Via VE2YG
6Y5YG—To VE2YG
7X5AB—c/o W2KF
8P6CZ—Via VE2YG
8P6DW—To WB6PYI
8R1J—c/o W4MXL
9K2DI—Via P.O. Box 5595, Kuwait
9L1JM—To W4BAA
9M2CX—c/o Box 111, Kuala Lumpur, Malaysia
9M2VLC—Via P.O. Box 308, Kuening, Sarawak, Malaysia
9N1MM—To W2KV (ex-W3KVQ/2) Edward M. Blaszczyk, 2308 Branch Pike, Cinnaminson, N.J. 08077
9V1SV—c/o W7PHO
9X5AN—Via Boite Postale 449, Kigali, Rwanda

73, John, K4IIF

Measuring Capacitance [*from page 33*]

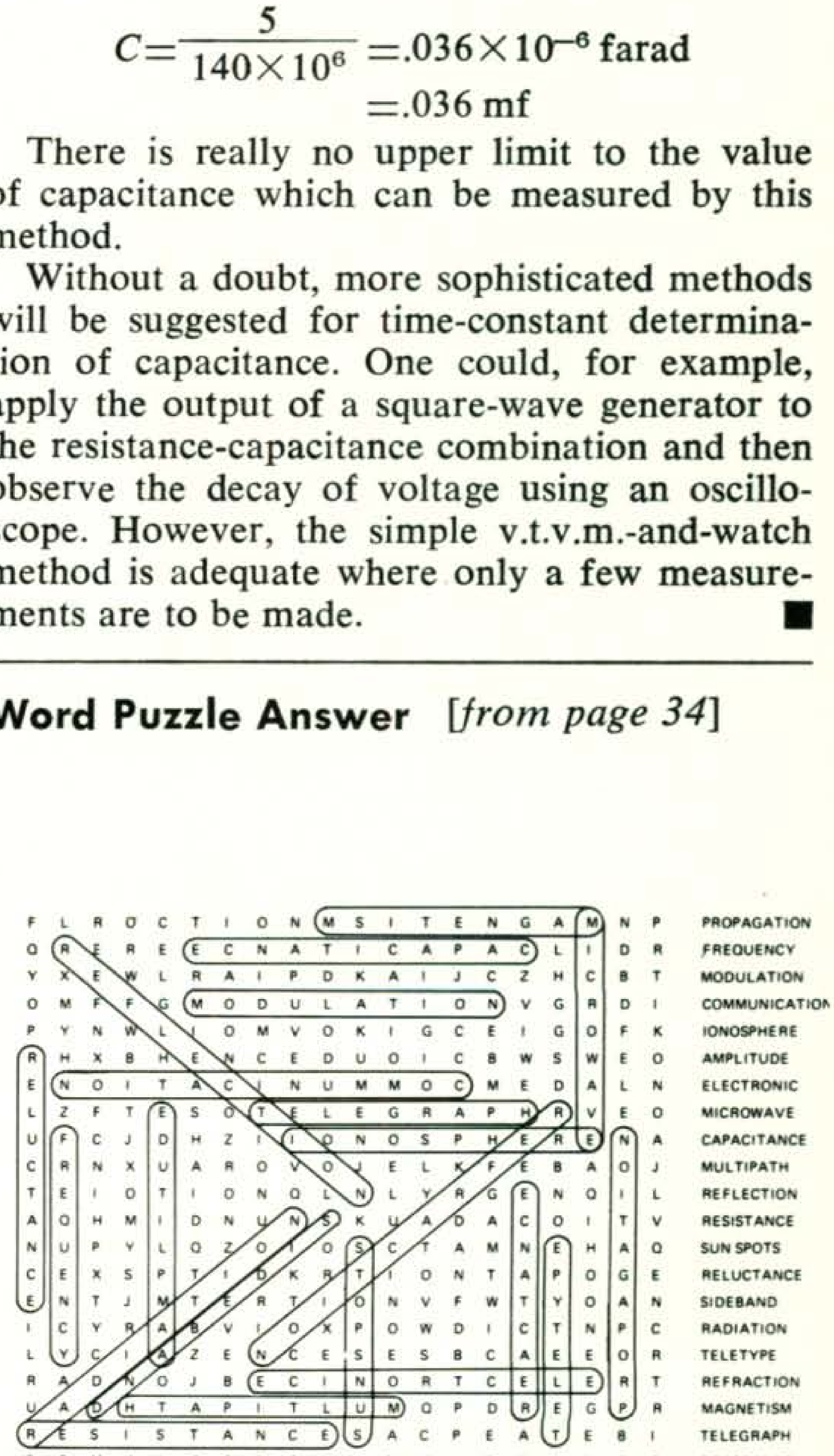
v.t.v.m. itself, the minimum time interval which can be measured precisely and, to a lesser extent, the time characteristics of the meter. Using a known capacitance I found the input resistance of my v.t.v.m. to be about 140 megohms and since I can measure a 5 second interval with some degree of confidence and precision, I believe that with my meter the time-constant method should be good for measuring capacitance as low as about

$$C=\frac{5}{140\times10^{6}}=.036\times10^{-6}\text{ farad}$$
$$=.036\text{ mf}$$

There is really no upper limit to the value of capacitance which can be measured by this method.

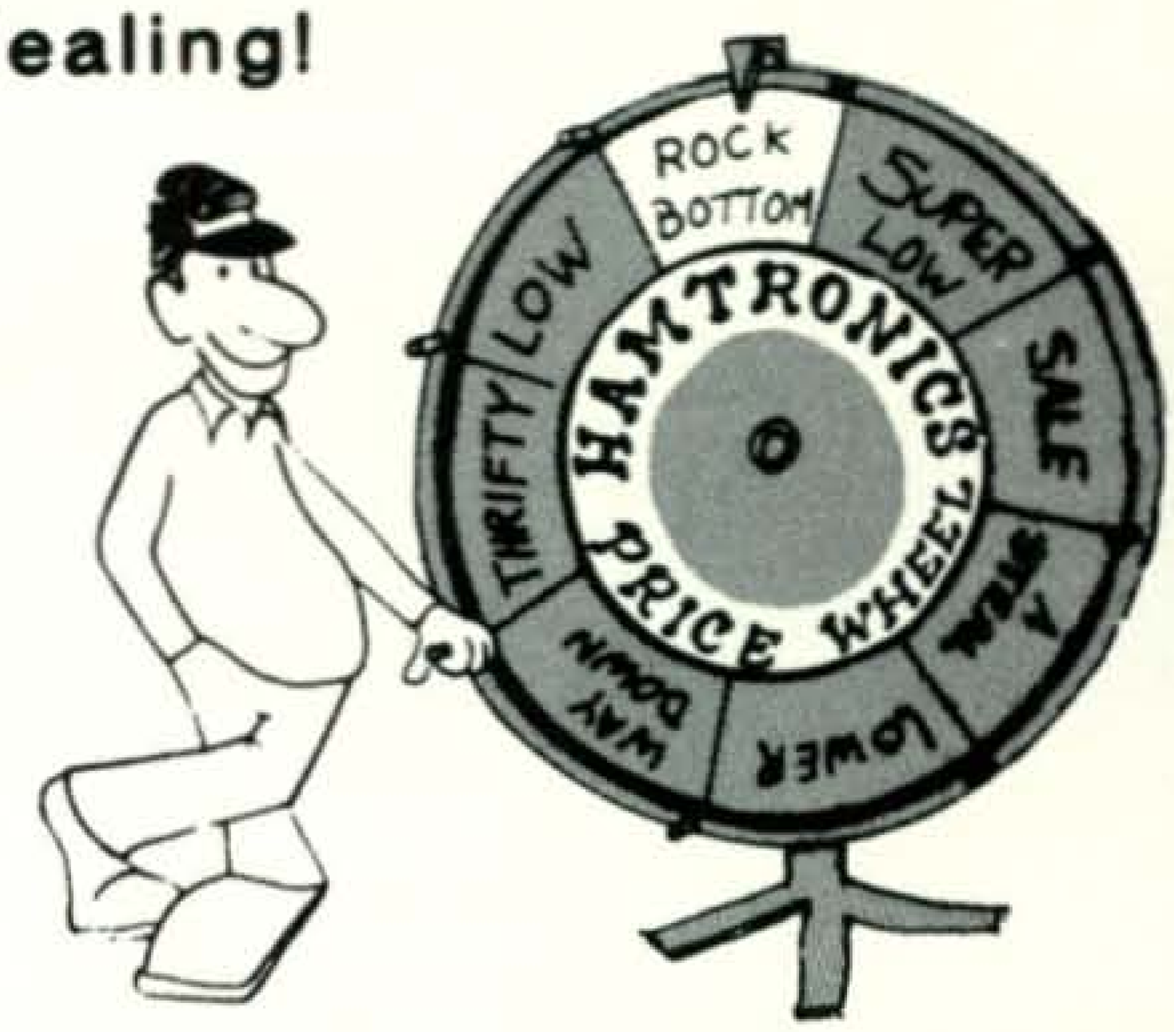
Without a doubt, more sophisticated methods will be suggested for time-constant determination of capacitance. One could, for example, apply the output of a square-wave generator to the resistance-capacitance combination and then observe the decay of voltage using an oscilloscope. However, the simple v.t.v.m.-and-watch method is adequate where only a few measurements are to be made. ■

Word Puzzle Answer [*from page 34*]



WHO SAYS THERE'S A RECESSION?

Not with "PRES" at the wheel doing the dealing!



You don't need a calculator to figure out the tremendous savings at Hamtronics, but we're going to give you one "FREE", yep that's right, with the purchase of the incomparable ICOM 230. You will receive an 8 digit calculator Model EC225 worth over $100.00. Absolutely "FREE".

FREE Inoue's WOW! NEW IC-230

- 162+ channels, simplex or offset (600 kHz) for repeaters
- All modular construction
- Super hot MOSFET/helical coil .4 μV receiver
- AVAILABLE NOW! ...only $489.00

SYNTHESIZED !

BASE/MOBILE 25 WATT VHF *Model* SRC 851T-00

WOW!!

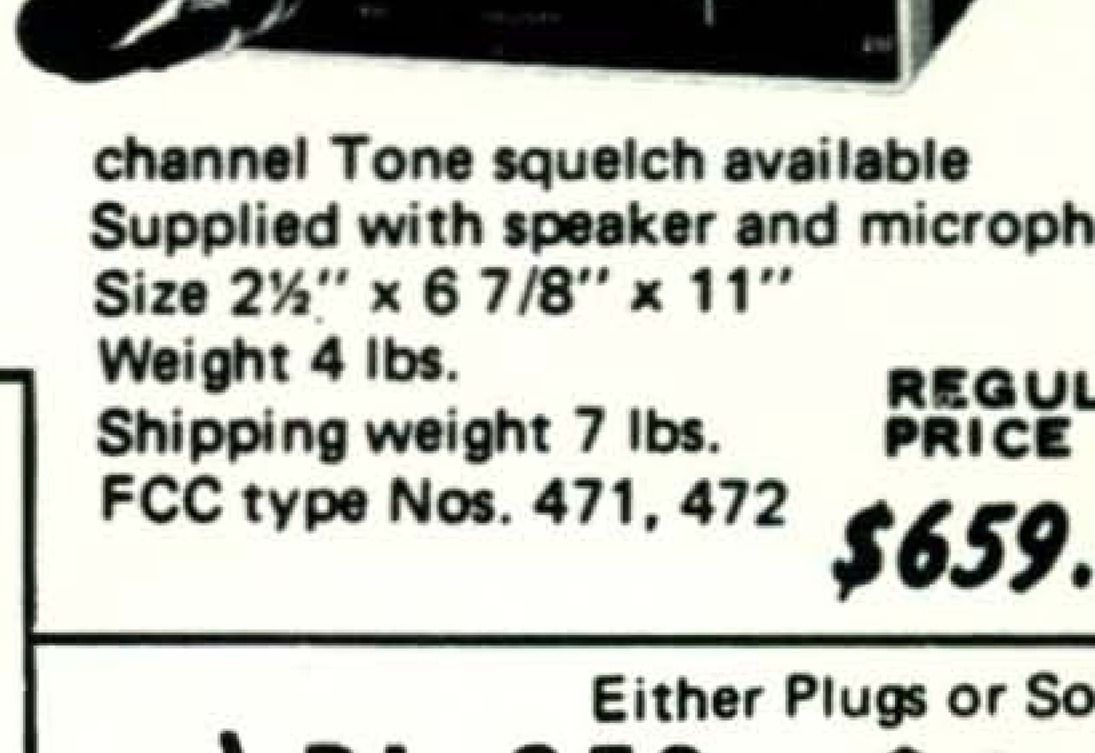
FREE STANDARD

HT–SRC 146A W/TALKIE
Brand New
Reg. $298.00

FREE! WOW!

We've made a fantastic purchase on these great selling standard radios, and we're passing the savings on to our customers. When you order the SRC-851T at the regular price of $659.00, you get the complete handheld package as an absolutely free bonus. This is a deal no two meter FM'er can want to pass up.

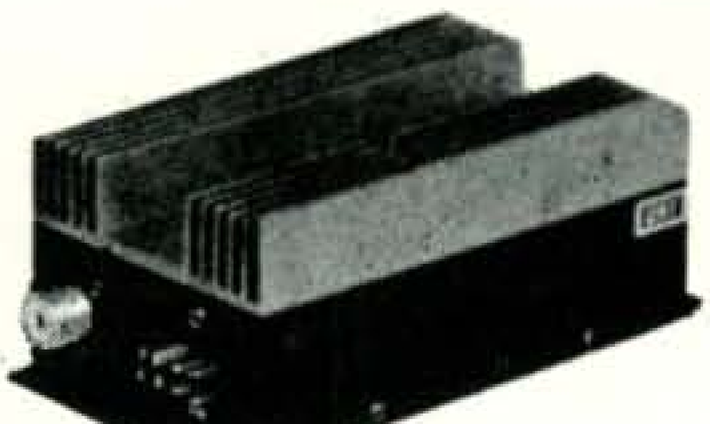
25 watt RF output nominal
All solid-state 12V DC
148 to 174 MHz
12 channel capability
Supplied with crystals for one



channel Tone squelch available
Supplied with speaker and microphone
Size 2½" x 6 7/8" x 11"
Weight 4 lbs.
Shipping weight 7 lbs.
FCC type Nos. 471, 472

REGULAR PRICE **$659.00**

talk power by TPL



TEMPO SOLID STATE POWER

MODEL	DRIVE POWER	OUTPUT POWER	PRICE
1202	5-25 watts	100-135 watts	$228
1202B	1-2.5 watts	120-130 watts	$239
802	5-12 watts	70-90 watts	$190
802B	1-2.5 watts	80-90 watts	$195
502	5-15 watts	35-55 watts	$110
502B	1-2.5 watts	45-50 watts	$130
302	1-2.5 watts	30-35 watts	$ 93
152	1 watt	15 watts	$ 59

Either Plugs or Sockets
Pssst! PL-259 SO-239 5 for $3.50 POST-PAID

HAMTRONICS

A DIVISION OF TREVOSE ELECTRONICS
4033 BROWNSVILLE ROAD, TREVOSE, PA. 19047

FOR INNOVATIONS IN LOW-COST TEST EQUIPMENT, THINK HP

Here's a professional 80 MHz counter for $275.*

The HP 5381A counter covers 10 Hz to 80 MHz and combines economy with lab quality and performance: Sharp seven-digit LED readout. High stability internal time base. 25 mV sensitivity. Three-position input attenuator. External oscillator input. Ratio measurement capability. Extremely rugged cast aluminum case.

Ideal for applications such as production line testing, service and calibration, frequency monitoring, education and training.

Go to 225 MHz for just $450.*

The HP 5382A has all the features of the 5381A, plus 8 digits and a 225 MHz frequency range.

Or go all the way to 520 MHz for $795.*

The new HP 5383A does it. You get 9 digits, fused input and direct counting as well.

All three come with full instrumentation warranty, full service support; all meet IEC safety specs. For more information call your nearby HP field engineer. Or, write.

02406B

*Domestic USA prices only.

HEWLETT PACKARD

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

UN33366...
$36.00

PLAQUES TABLETS TROPHIES

P132A
$22.80

- CLUBS
- FRATERNAL ORGANIZATIONS
- PROFESSIONAL ORGANIZATIONS
- ACHIEVEMENT AWARDS

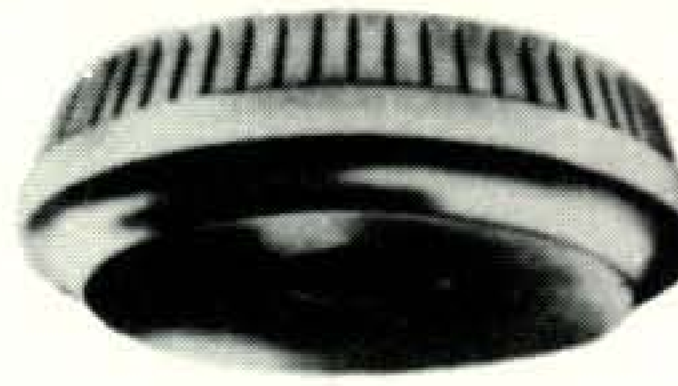
P180A
$30.30

Honor club officers, contest winners, local achievements. Denote memorial stations, donated equipment.

Let us handle all your award and trophy needs. International Bronze is one of the nation's foremost suppliers of custom cast bronze and aluminum plaques, engraved plaques and trophies. Write for our illustrated catalogue, and price list.

INTERNATIONAL BRONZE TABLET COMPANY, INC.
Dept. B 150 West 22nd Street New York, NY 10011
Phone 212-924-2323 *OUR THIRTY NINTH YEAR*

How to discover a fire before it becomes an inferno.



Patents Pending

EARLY WARNING IONIZATION FIRE ALARM INSTALLS IN MINUTES. PROTECT YOUR LOVED ONES, YOUR HOME, YOUR RADIO EQUIPMENT.

● Early warning ionization fire detector senses a fire before it produces visible smoke or flame, or noticeable heat. ● Loud, piercing intermittent warning alarm sounds at 85 db level at 10 feet. ● Powered by a single 12.6 v. long-life battery. ● Reliable solid-state circuitry. ● Installs with two screws to wall or ceiling (preferred). ● Alarm sounds when its time to replace the battery (once a minute for 7 days). ● Measures only 6" dia. by 1 9/16" deep. ● Shipped post paid anywhere in the USA for only $59.95.

You can't afford to be without this protection! Additional batteries $8.00 each.

Send check or money order to:

HOUSE OF POWER

P. O. Box 306, Merrick, N. Y. 11566

HAM SHOP

Advertising Rates: Non-Commercial ads are 10 cents per word including abbreviations and addresses. Commercial and organization ads are 35 cents per word. Minimum charge $1.00. No ad will be printed unless accompanied by full remittance.

Closing Date: The 15th day of the second month preceding publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of CQ cannot vouch for the merchandise listed therein. Direct all correspondence and ad copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, New York 11050.**

WANTED: Heath DX-100B, HM2103 & HM102, w/cables and manual for DX100B only. Must be in good to excellent condition. Make offer and you ship. S.L. Ballinger, 102 Garden St., Poughkeepsie, NY 12601.

WANTED: Several 1N1150/1N2634 and 1N1237/1N2633. W1FEH, 297 Nahant Rd., Nahant MA 01908.

FREE: Bargain Catalog, LEDS, Xtals, Microphones, Headsets, IC's, Relays, Ultrasonic Devices, Precision Trimmer Capacitors Unique Components.- Chaney's, Box 15431, Lakewood, Colo. 80215.

QSL CARDS: Send 50 cents for samples and prices THE PRINT SHOP, 2497 Bethel, Maple Rd., Bethel, OH 45106.

EARLY BATTERY RADIOS WANTED: Also tubes 01A, 199, WD11, WD12, Horn Speakers. Send model, quantity, Price to: Norman Webster, 19545 Ingomar Reseda, CA 91335.

SELL: DX-60 xmtr with HG-10 vfo, $95.00; Ameco TX62 6&2 xmtr, $50.00; Hammarlund HQ100A rcvr, $100.00. W9VTQ, P.O. Box 347, Zion, IL 60099.

TOWER FOR SALE: Rohn HDX-48 less base. Top section damaged. $200. Pick up deal. W2HTR 14 Phyllis Drive, Succasunna, NJ 07876.

LOOKING FOR old Lionel trains. Interested only in "O" gauge, excellent to like-new condition. Primary interest is locomotives prior to 1952, but will consider complete sets or more recent models. Am willing to buy outright for cash or swap radio gear to meet your needs. Write Dick Cowan, WA2LRO, c/o CQ Magazine, or call 516/883-6200.

Did you know that supplements to the book, "CQ YL," are available? They bring the book up to date with YLRL Officers through 1973 and the 6th YLRL Convention, held at Long Beach in May '72. If you have a copy of "CQ YL" and would like to add the new supplements (the pages are "slotted" so they fit directly into the "CQ YL" spiral backbone), drop a note with your request to author/publisher, W5RZJ, Louisa Sando, 4417 - 11th St., NW, Albuquerque, NM 87107. Please enclose two 10 cent stamps to cover cost of mailing. The one and only book about YLs in ham radio, "CQ YL," contains 21 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.00 postpaid.

TOROID WINDINGS, 3/4 inch, 10 for $2.50. Tubes Oldies and newer types. Send need lists, Capacitors, pots, toggle switches, Airtight Instrument Transport cases, Eq. Exhaust fans, Strong shop magnets $6, Weston Lab Standard Meters, Kulka Number 442L3 ten way term blocks $1, Plate Transformer 2KV at 700 ma$20. Fil. transformer, 6.3 v at 12A. .0002 ufd XMTR Cap at 6KV $3. New Aircraft Gyro $20, 3 and 4 ohm resistors at 100 watts $2. Boonton Number 97A DC voltmeter/amplifier .1 to 1000 v$75. USM-24C Scope $175, TS-352b/u Multimeter $25, Number 282b/gr XMTR $85. Non Linear Sys Number 125B AC/DC Converter $50, Stelman TA-1 Phone Patch Adapter $80. Kay 121CJ VHF/UHF Sweep Gen .5-1700MC, $275. Lambda C481M Reg. Power Supply, 375 VDC $65. Beckman FR67/u Counter $95, TS-382 Audio Osc. $75. RCA Low Freq. Receiver 90C 0-160 KC, TS-418. 419, 433, 622, etc. Stereo speaker cabinets. Bausch & Lomb 16, 25mm f/1.5 standard C mount lens, new $75. Bill Williams, P.O. Box 7057, Norfolk, VA 23509.

FOR SALE: ECS8 Vacuum Variable, 2 to 8 mmf. ideal for neutralizing capacitor, $17 postpaid. A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

SALE: Dycom Super "D"80 watt 2mtr linear, $50.00. Tecraft TR20/50 Six mtr transmitter w/AC supply, JT30 mike, change over relay and xtals $30.00 Heath HR10B receiver with calibrator, $60. Accurate Mod 156 Sig generator, $15. W8YLJ Del Carlin RRno.1 Bryan, OH 43506.

WANTED: Complete Ham Station 10-80, quote equipment and price. MSgt. R.L. DeSpain, 3804A Simpson St., Bergstrom AFB, TX 78743.

ADVERTISER'S INDEX

Wilson Electronics

FACTORY DIRECT

SPECIAL JULY SALE !!!

WILSON 1402SM HAND HELD 2.5 WATT FM TRANSCEIVER

* Rubber Flex Antenna
* Complete Set NiCad Batteries
* Leather Case
* Three Sets of Crystals, 52-52,

Plus Your Choice Of 2 Pair of Common Frequencies
Extra Crystals, $4.50 ea., Common Frequencies Only
10.7 MHz Monolithic i.f. filter installed $10.00.

$ 320 VALUE ALL FOR JUST $199^95

- 6 Channel Operation, Individual Trimmers On All TX and RX Xtals. All Xtals Plug In.
- S Meter Battery Indicator.
- 10.7 IF and 455 KC IF. 12 KHz Ceramic Filter.
- .3 Microvolt Sensitivity For 20dB QT.
- 2.5 Watts. Nominal Output 12 VDC.
- Microswitch Mike Button.
- Size 8-7/8 x 1-7/8 x 2-7/8 Inches.
- Weight 1 lb. 4 ounces. Less Battery.
- Current Drain RX 14MA TX 380 MA.

ACCESSORIES:
SMI Speaker Mike $24.00
BCI Battery Charger $29.95
1410A Amplifier Mobile Mount $99.00

To: Wilson Electronics
P.O. Box 794
Henderson, Nevada 89015
(702) 451-5791

☐ Ship me 1402 SM Special July Package
Plus ☐ SM1 ☐ 1410A ☐ BC1

Enclosed is $ ________ ☐ Check ☐ Money Order
☐ Master Charge ☐ Bank Americard
Expiration Date ________ M/C Interbank # ________
Card # ________
Xtals ________ ________ ________
Name ________
Address ________
City and State ________ Zip ________
Signature ________

All orders will be shipped Parcel Post within 48 hours after receipt of order (excluding weekends). Enclose additional $4.00 for prepaid shipping & handling. Nevada residents add sales tax.

Sale ends July 31, 1975

90 DAY WARRANTY
10 DAY MONEY BACK GUARANTEE

READER SERVICE

WANT MORE INFORMATION ON PRODUCTS IN ADS OR IN NEW PRODUCTS SECTION? The handy new Reader Service Coupons below, if used properly, will get this information to you in the shortest time possible. A coupon must be filled in for each new product or advertised product of interest. The name of manufacturer must be included, as well as your name, address, etc. We will forward these requests on the same day received. Send to CQ Reader Service, 14 Vanderventer Ave., Port Washington, NY 11050.

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

Please send me information on Page No.
Manufacturer

Name

Address

City State Zip

A CQ Magazine Reader Service JULY '75

YAESU FT-101E TRANSCEIVER

Now, more radio from the radio company.

Are Yaesu's FT-101's the finest all-around transceivers in the world? Yes – and now the best is even better. The new FT-101E includes a potent R. F. speech processor. Plus improved, easy-to-use lever switches. A more refined clarifier control for push-button, independent clarifier operation. There's also a 160 meter crystal included without extra charge.

And all the other features that have made the FT-101 series of transceivers among the world's most popular are still here: 260 watts SSB PEP. Globe-circling power on CW and AM. 160 to 10 meters range. 0.3uV receiving sensitivity. And one very important feature you never want to forget is the famous Yaesu warranty, strong dealer network and convenient serviceability.

If you're a serious amateur, you're always looking for more radio. And the FT-101E is just that. $749* buys you a million bucks worth of enjoyment. See your Yaesu dealer or write for our catalog. Yaesu Musen USA, Inc. 7625 E. Rosecrans, No. 29, Paramount, Calif. 90723.

YAESU
The radio.

*FT-101EE (less processor): $659.