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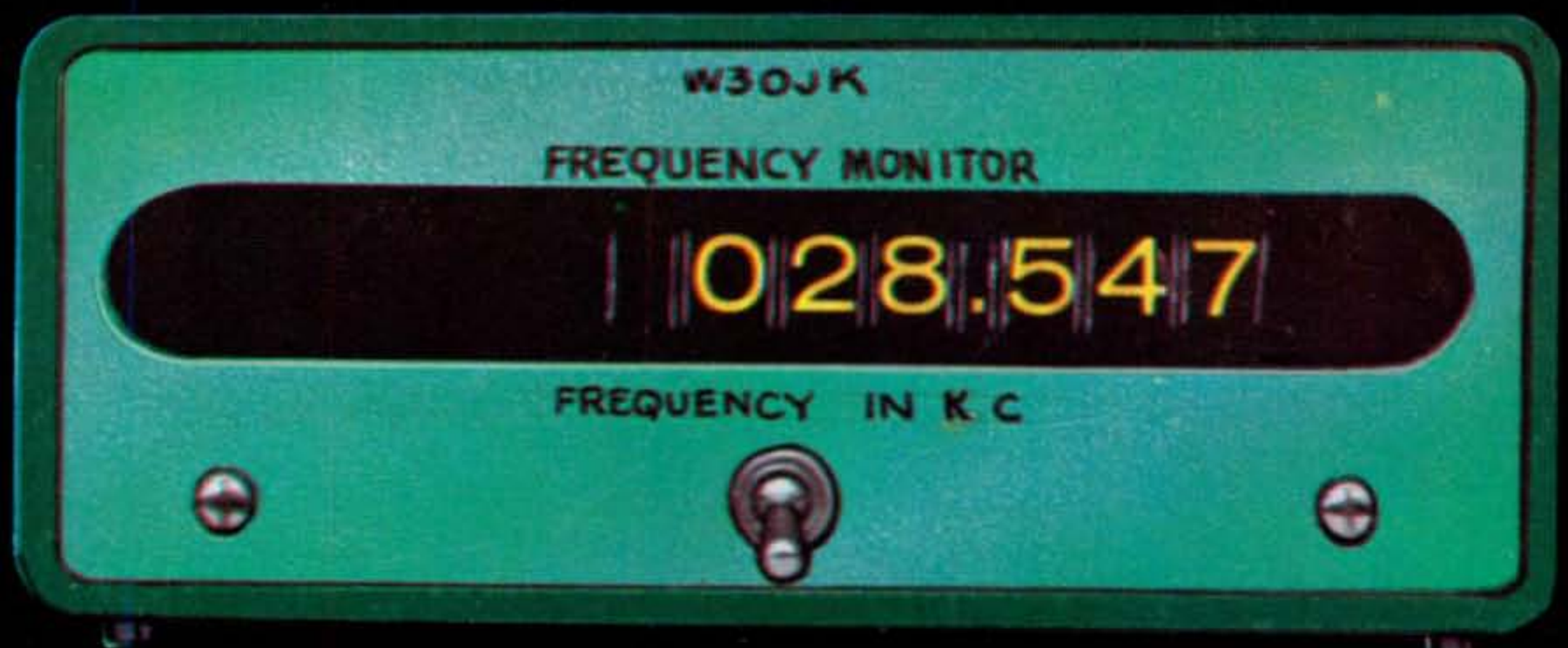

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January 1974
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Season's Best...

HEATHKIT HW-202 2-METER TRANSCEIVER . . . 179.95*

The ultimate Christmas kit for the 2-meter buff. All solid-state design can be completely aligned without instruments. Has 36-channel capability with pushbutton selection of 6 transmit and 6 receive crystals. Ten to 15 watts transmission into an infinite VSWR — indefinitely, without failure! Needs no automatic shut-down — continues to generate a signal regardless of antenna condition. Output at the built-in speaker is typically 2 watts at less than 3% total harmonic distortion. Receiver section utilizes MOSFET front end; IC IF; dual conversion, 10.7 MHz and 455 kHz via a 4-pole monolithic 10.7 MHz crystal filter. You get excellent overload and adjacent channel rejection, improved impulse noise rejection and built-in hash filter. Optional HWA-2202-2 tone-burst encoder, 24.95*, gives pushbutton selection of four pre-selected tones. 12-volt operation. Kit includes microphone, mobile mount, crystals for simplex on 146.94. Mailing weight 11 lbs. Encoder, 1 lb.

HW-202 SPECIFICATIONS — RECEIVER — Sensitivity: 2 dB SINAD* (or 15 dB of quieting) at .5μv or less. **Squelch threshold:** 3μv or less. **Audio output:** 2 W at less than 10% total harmonic distortion (THD). **Operating frequency stability:** Better than ±.0015%. **Image rejection:** greater than 55 dB. **Spurious rejection:** Greater than 60 dB. **IF rejection:** Greater than 75 dB. **First IF frequency:** 10.7 MHz ±2 kHz. **Second IF frequency:** 455 kHz (adjustable). **Receiver bandwidth:** 22 kHz nominal. **De-emphasis:** —6 dB per octave from 300 to 3000 Hz nominal. **Modulation acceptance:** 7.5 kHz minimum. **TRANSMITTER — Power output:** 10 watts minimum. **Spurious output:** Below —45 dB from carrier. **Stability:** Better than ±.0015%. **Oscillator frequency:** 6 MHz, approximately. **Multiplier factor:** X 24. **Modulation:** Phase, adjustable 0-7.5 kHz, with instantaneous limiting. **Duty cycle:** 100% with ∞ VSWR. **High VSWR shutdown:** None. **GENERAL — Speaker impedance:** 4 ohms. **Operating frequency range:** 143.9 to 148.3 MHz. **Current consumption: Receiver** (squelched): Less than 200 mA. Transmitter: Less than 2.2 amperes. **Operating temperature range:** —10° to 122° F (—30° to +50° C). **Operating voltage range:** 12.6 to 16.0 VDC (13.8 VDC nominal). **Dimensions:** 2¾" H x 8¼" W x 9⅞" D.

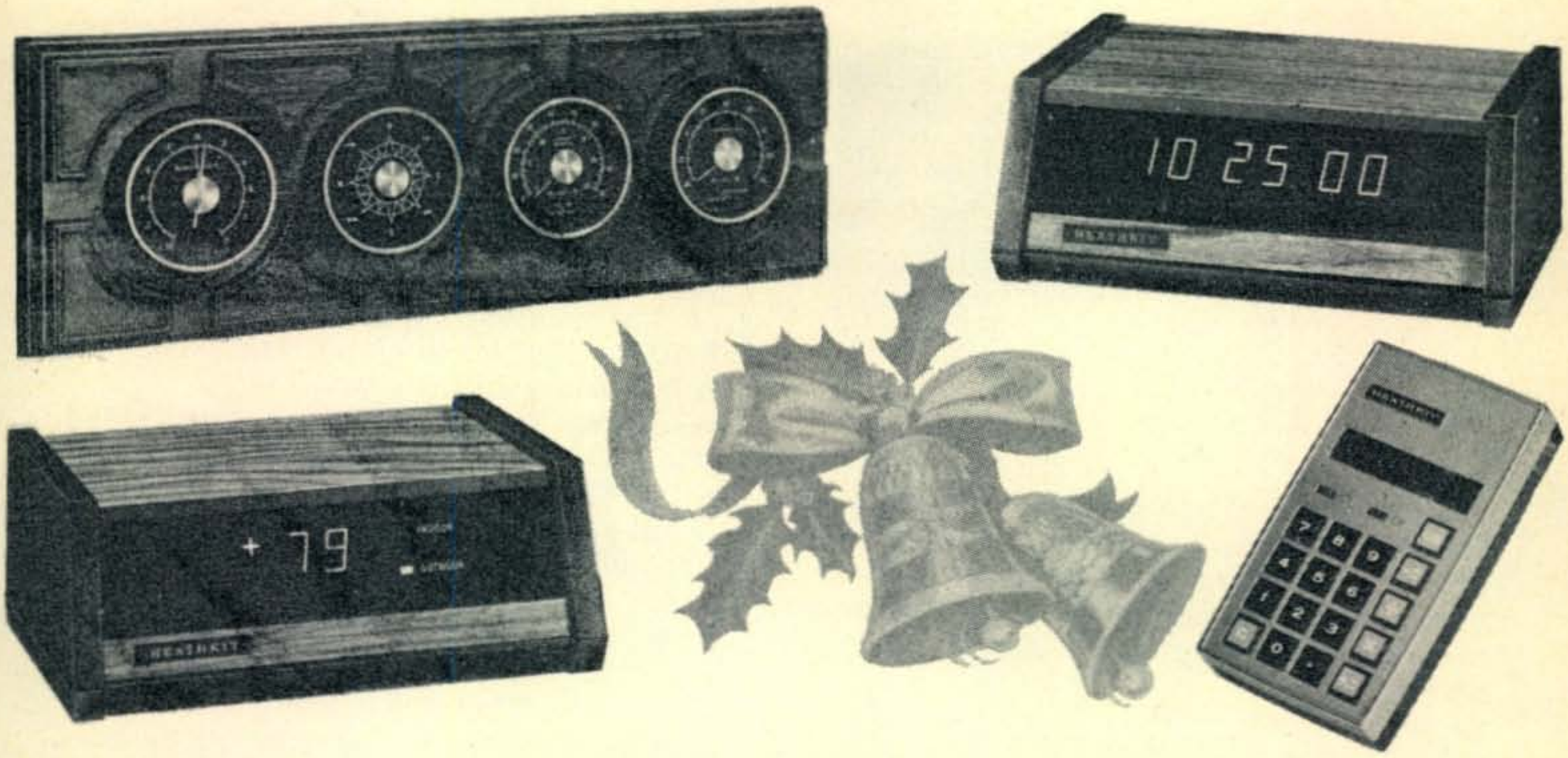
*SINAD = $\frac{\text{Signal + noise + distortion}}{\text{Noise + distortion}}$

HEATHKIT SB-102 80-10 METER TRANSCEIVER . . . 385.00*

The most popular kit-form transceiver ever produced. Has solid-state, factory-assembled and aligned master oscillator for quick stability, accurate tracking. Plus front-panel selection of built-in 2.1 kHz SSB or optional 400 Hz crystal filters; built-in CW side-tone; built-in VOX; full coverage of 10 meters; complete metering facilities. Mailing weight, 24 lbs. HP-23B AC power supply, 19 lbs., 51.95*. HP-13B DC supply, 8 lbs., 69.95*.

SB-102 SPECIFICATIONS — RECEIVER — Sensitivity: Better than 0.35 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **SSB selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down — 2.1 nominal shape factor — 6 to 60 dB. **CW Selectivity:** (With optional CW filter SBA-301-2 installed) 400 Hz minimum at 6 dB down, 2.0 kHz maximum at 60 dB down. **Input Impedance:** Low impedance for unbalanced coaxial input. **Output impedance:** Unbalanced 8 and 600 ohm speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Spurious response:** Image and IF rejection better than 50 dB. Internal spurious signals below equivalent antenna input of 1 microvolt. **TRANSMITTER SECTION: DC power input:** SSB 180 watts P.E.P. continuous voice. **CW:** 170 watts — 50% duty cycle. **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm non-reactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2:1 SWR. **Oscillator feedthrough or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit-receive operation: SSB:** Push-to-talk or VOX. **CW:** Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker in CW mode. Approx. 1000 Hz tone. **Microphone input impedance:** High impedance. **Carrier suppression:** 50 dB down from single-tone output. **Unwanted sideband suppression:** 55 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **Noise level:** At least 40 dB below single-tone carrier. **RF compression (TALC):** 10 dB or greater at .1 ma final grid current. **GENERAL: Frequency coverage:** 80-10 M amateur bands. **Frequency stability:** Less than 100 Hz per hour after 10 minutes warm-up from normal ambient conditions. Less than 100 Hz for +10% line voltage variations. **Modes of operation:** LSB, USB and CW. **Visual dial accuracy — "Resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 kHz. **Calibration:** 100 kHz crystal. **Audio frequency response:** 350 to 2450 Hz +3 dB. **Power requirements:** HP-23B or HP-13B supplies. **Dimensions:** 6⅝" H x 14⅞" W x 13⅜" D.

from Heath to you



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NEW HEATHKIT IC-2006 POCKET CALCULATOR . . . 69.95*

Battery-powered calculator kit is less than 1″ thick, yet performs all math functions with results up to 8 digits. Features constant key for repetitive multiplying and dividing; ⅛″ LED display with no distorting magnifier. Sophisticated IC and related circuitry mount on single circuit board for neat assembly. Case is attractive matte-chrome and black. Includes operations manual containing sample problems and valuable reference tables. Uses 9-volt battery or optional AC converter (Model GRA-43-1, 1 lb., 3.95*). Mailing weight, 2 lbs.

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Proven design in the tradition of the HT-37 and solid-state dependability are combined in this compact transceiver featuring state-of-the-art FET's, hot carrier diodes and bi-polar transistors for peak, reliable performance for only $625.

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- Weight: 25 pounds
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- Built-in speaker
- Power requirements: 117 V or 234 V 50/60 AC; 13.4 VDC negative ground
- Modes: Selectable Upper or Lower Sideband-CW or RTTY
- Type of service: continuous operation with 2-tone S SB-CW-RTTY (50% duty cycle)
- Power Output: 125 Watts P.E.P. (Nominal) into 50 ohms
- Receiver Sensitivity: Less than 1 uV for 15 db SN Ratio
- Selectivity: 2.0 kHz
- Receiver IM: 60 db below 2 equal 10MV signals
- Receiver Image and IF Rejection: Greater than 60 db.
- Internal Receiver Spurious: Less than equivalent 1 Microvolt Signal
- Transmitter IM: 30 db below P.E.P. (26db below one of two equal tones)
- Adjacent Channel Desensitizing: 3 db with greater than 10,000 MV
- Sideband Suppression: -50 db minimum @ 1 kHz
- AF Power Output: 2 watts
- Stability: 100 Hz after warmup. Max. 100 with 10% line voltage change
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- CW Sidetone
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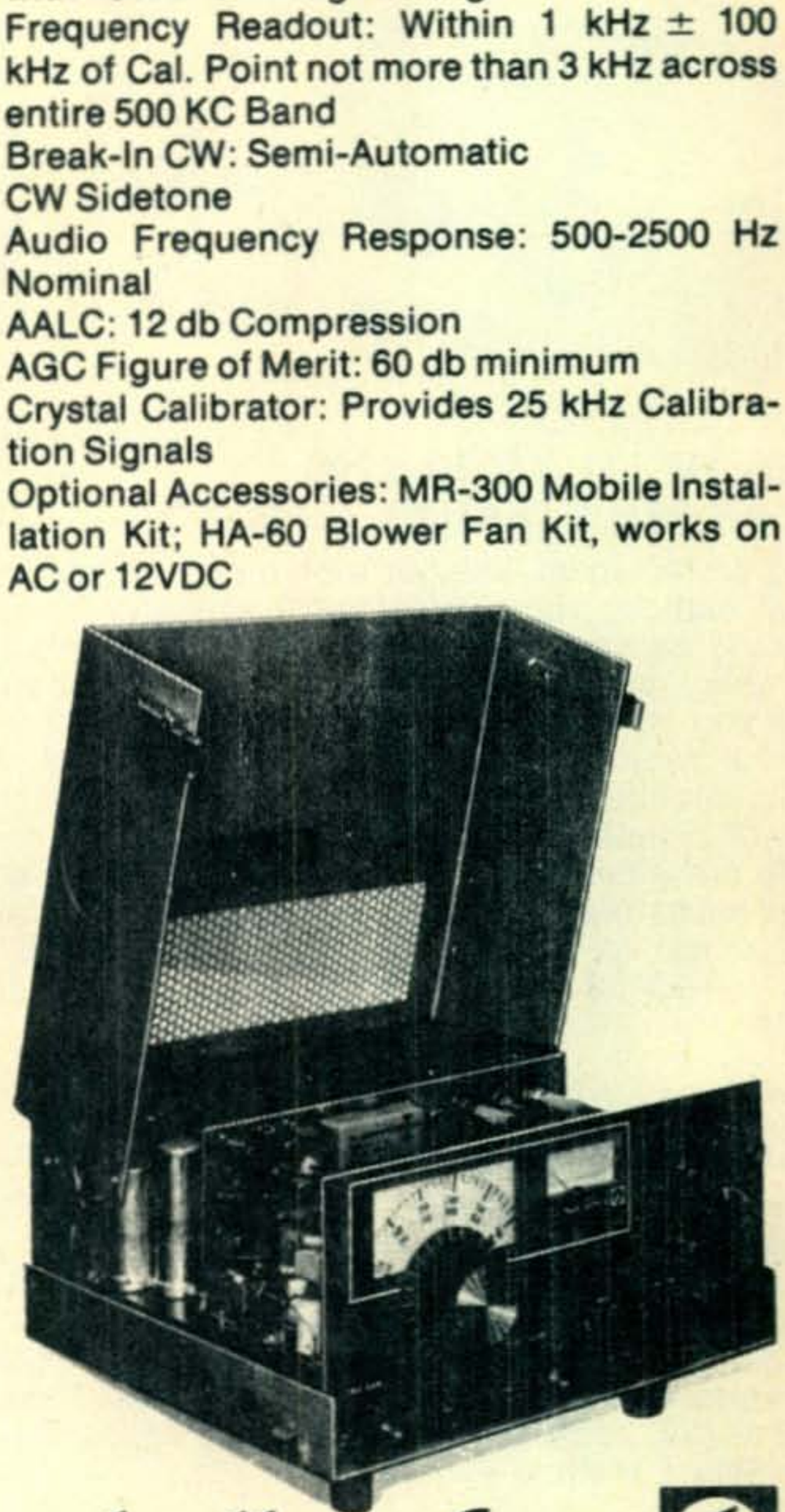
- AALC: 12 db Compression
- AGC Figure of Merit: 60 db minimum
- Crystal Calibrator: Provides 25 kHz Calibration Signals
- Optional Accessories: MR-300 Mobile Installation Kit; HA-60 Blower Fan Kit, works on AC or 12VDC



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JANUARY, 1974 VOL. 30, NO. 1

The Radio Amateur's Journal

FEATURES

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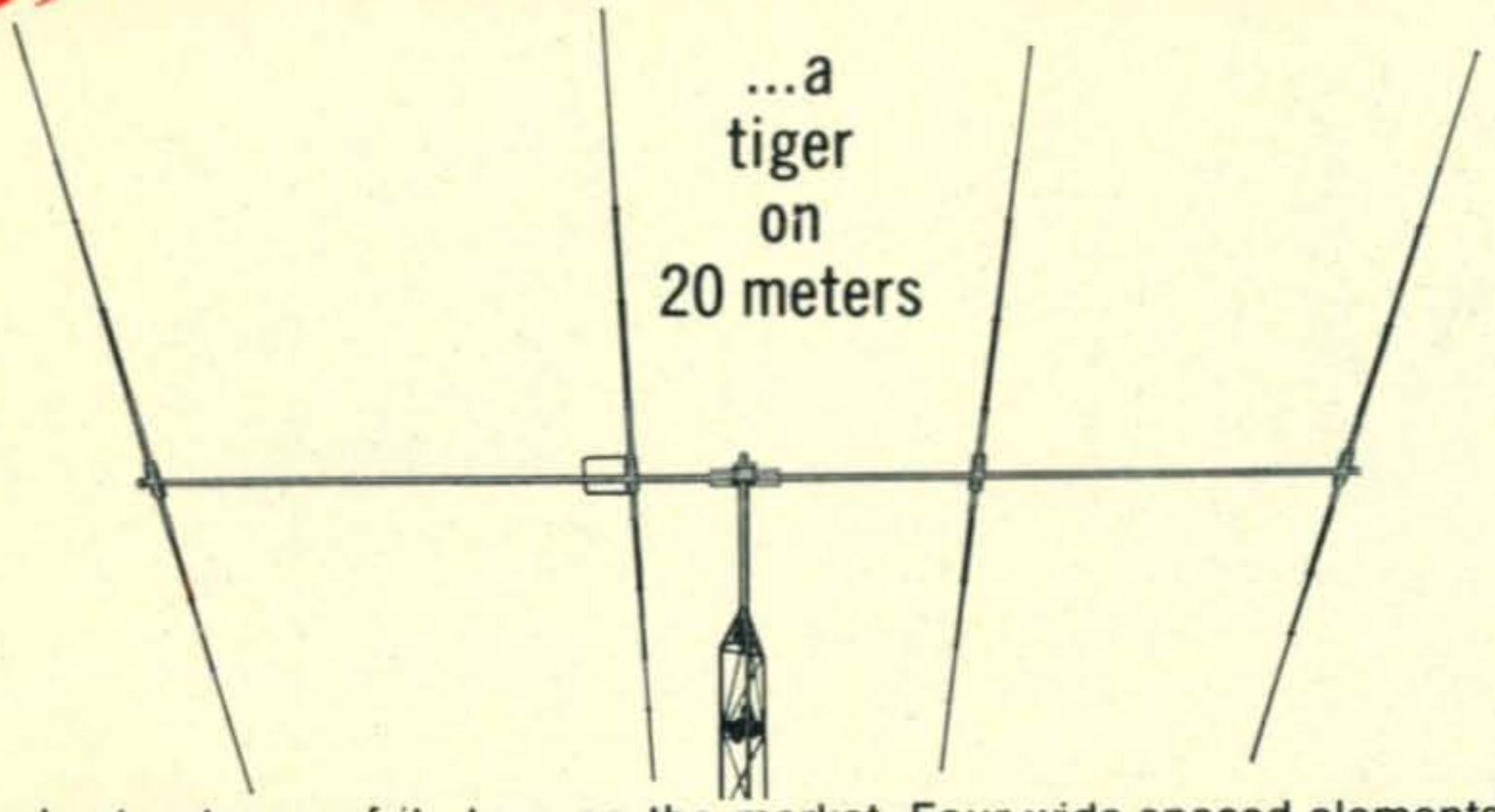
HY-GAIN 204BA MONOBANDER



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

- 10 db forward gain
- 28 db F/B ratio
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- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

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

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Our August 1973 Zero Bias decried the deliberate dissemination of "false and misleading information under the guise of leadership and editorial commentary." We feel that it is a firm obligation of the opinion-makers in our hobby to behave in a responsible manner and to take great pains to see that they do not mis-lead those they seek to lead. But quite obviously not all these leaders share our feelings.

A recent illustration of such a breach of truth to amateurs concerns, of all things, the Russian callbook.

A local amateur had the good fortune, in late 1973, to obtain a copy of the latest edition of the Russian callbook: 380 pages of Russian calls with the operators' names and cities or villages. What a prize catch for a DX'er! Not perfect, mind you, since it lacked street names and numbers, but in the highly organized Russian postal system, a name, call and village name is quite adequate to ensure prompt delivery of QSL's or other correspondence directly to our Russian counterparts.

What the Russian callbook needed was translation and distribution, and the most logical organization to handle such a task was the publisher of the "Radio Amateur Callbook Magazine" in Illinois. Our lucky amateur made a gift of the Russian book to the publishers of the *Callbook*. Being responsible publishers, they sought to determine the desirability of disclosing to the amateur world the QTH's of tens of thousands of Russian hams. In a slight error in judgment, they contacted an official of IARU Region I, covering Europe, European USSR, Africa and the Middle East, for his guidance. His opinion? He declared most emphatically that the QTH's of the Russian amateurs should not be published! His protestations were so strong that *Callbook* shied away their original intentions to publish the complete information and instead proceeded to translate and publish the first portion of the Russian listings – minus the absolutely essential QTH's. See it for yourself in the 1974 foreign *Callbook*.

Now, we fault *Callbook* to some extent for this fiasco. We think they should have checked with ARRL or at least with a few major DX clubs instead of reaching across the Atlantic to inquire of Region I on a matter involving a US publisher. But, still, in good faith, they sought fair guidance from a responsible leader in our hobby. What they got, however, was a snow job, intentional or otherwise.

Whether wilfully or naively, Roy Stevens, G2BVN, constructed a strong, though erroneous case against publication of the QTH's of Russian amateurs.

He claimed the inviolability of the Central Radio Club in Moscow in matters of correspondence with Russian amateurs, whether QSL's or other. He alluded to the criminal offense of possession of foreign currency by Russian citizens, and in a recent letter to the Long Island DX Association Bulletin editor, K2KGB, pleaded, "let us avoid provoking their authorities into any action which might harm individuals or amateur radio as a whole."

The facts of the situation are not quite as Roy sees them, however. For instance, Russian citizens are free to receive mail from the rest of the world, and that includes QSL's from US amateurs. Bureaucracies being the self-perpetuating monsters that they are, the Central Radio Club would most certainly prefer that all QSL's continue to funnel through Box 88, Moscow, but it's hardly a legal necessity despite the suggestions to the contrary by the CRC's officials.

Admittedly, possession of foreign currency by Russian citizens is a sticky point, and one which should be guarded against by refraining from sending currency of any type through the mail, which is a wise policy anywhere in the world.

Probably the most significant rebuttal to Roy's plea for no Russian QTH's is the recent discovery that given enough time, the Russian callbook can be purchased in its original form through major US booksellers specializing in foreign publications. New York City has at least one such dealer of which we are aware, and if it can be purchased commercially – even with difficulty – then why should *Callbook* be urged not to publish the same information for the benefit of the majority of amateurs?

To imply that Russian amateurs or amateur radio might be harmed by publishing a translation of a book already available in the US is, in our judgment, false and mis-leading. We hope that *Callbook* is now convinced of this, and that future editions will carry useful information about Russian amateurs similar to the Polish, Romanian, Czechoslovakian, East German, Hungarian, Bulgarian and Yugoslavian listings they already carry.

Have we made a mountain of a mole hill? Perhaps. But we feel that the "mole hill" is representative of a larger problem and that is the matter of faith in the leadership of amateur radio. Until our opinion-makers are convinced that we demand the truth above all else, then I'm afraid we'll have to discipline ourselves to critically weigh and evaluate everything they say to separate fact from fantasy.

73, Dick, K2MGA

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OUR READERS SAY

New Departments

Editor, *CQ:*

Really enjoyed your QRP column by Adrian Weiss, K8EEG. Would like to see more along these lines. Believe QRP construction articles would be quite popular. Considering the cost of homebrewing these days, this seems to be the area in which it can be done economically.

I have built the HW-7 and also have an Argonaut, so know this low power stuff really works.

Earl Stacy, W7JKG
Selah, WA

Editor, *CQ:*

Glad to see two articles in the November issue I feel have much merit: The QRP by K8EEG, and the Novice Shack by W9EGQ. I have a "fun rig" Argonaut and am having a ball! We need more young people in our ranks. Keep up the good work.

Bob Pierce, WBØCGI
Lakewood, CO

Editor, *CQ:*

Just wanted you to know that I am delighted at the addition of the two new departments, "QRP" and "Novice Shack." These will greatly enhance the value of *CQ* to this OM.

Concerning "QRP:" Have you any plans for construction of a solid state, VFO, All-band cw xmtr, 1-2 watts or so, in the works? I am looking for such an article.

John F. Leahy, WB6CKN
Gonzales, CA

Editor, *CQ:*

Glad to see the new Novice and QRP departments. Maybe I'll find my two needed novices, Vermont and N.H., to complete my novice W.A.S. I am not QRP, but do work quite a few QRP stations and enjoy each lower power contact. Now all you have to bring back is 2 QSL of the month department.

Richard W. Randall, K6ARE
Livermore, CA

WD-11

Editor, *CQ:*

Why is it that you people back in the East claim that KDKA was the first broadcasting station in the U. S.? --re the article "The WD-11" in the November issue of *CQ*.

Informed people in radio know that KQW in San Jose was first!! That was in 1909.

A mock-up of this station is on display at the Foothill College Electronics Museum in Los Altos Hills, California, some 30 miles south of San Fran.

Prior to the assignment of the call letters of KQW it was known as FN and was engineered by C.D. Herrold, its founder.

I would be of the opinion that if anyone is interested in the complete story, they might write to the San Jose Mercury and News in San Jose or to the San Francisco Chronicle for photostat copies of the articles appearing in the respective papers on 28th and 26th of January, 1973.

The next time you are in "Frisco" stop by Los Altos Hills and see a most interesting display of old time electronics.

Everett G. Taylor, W6DOR
Davis, CA

Victim of Politics?

Editor, *CQ:*

In response to Mr. Sternberg's, W2JUP/WB2-ZWR, letter in the Nov. '73 issue of *CQ*, it should be pointed out that the FCC is not the cause of many current Amateur problems. The FCC is strictly the enforcer of objectionable regulations emanating from the White House Office of Telecommunications headed by Mr. Clay T. Whitehead. The purpose of many of these regulations is to create objections by various groups of Amateurs in an effort to split and weaken the Amateur Fraternity. Then large business interests can gobble up portions of the Amateur spectrum. While many of us are fighting the new repeater rules, the new third party traffic rules, etc., the 220 mHz band is under major attack. The new repeater rules, which are far more demanding than commercial repeater rules, are a deliberate attempt to weaken 2 meter activity.

Mr. Sternberg mentioned the new Commercial Broadcast requirements which limit the requirements for First Class Radiotelephone Licenses. This is, of course, an effort to reduce the technical requirements for Commercial Broadcasters and improve their finances while not reducing the cost of advertisements.

It is a ridiculous situation for a Commercial License to cost less than an Amateur License, yet this is the situation.

I feel that heavy handed politics have permeated the management of our r.f. spectrum.

An effective proposal, which ARRL hesitates to review, would be to take Amateur Radio out of the FCC jurisdiction and place it under the Dept. of Health, Education and Welfare. A precedent was set for this type of action by the FAA which took over control and management of their frequencies from the FCC. Putting the Amateurs under HEW would place them in a department that has the strength and public support to protect our interests. Also we could probably contribute much to HEW. This move would require some action by Congress, but that would take less effort than trying to defend all the current positions we have under fire right now. Also HEW is more directly responsible to Congress and the public than is the FCC.

Howard M. Krawetz, WA6WUI
Sunnyvale, CA

Announcements

Oak Park, Michigan

The Oak Park Amateur Radio Club will hold its Fifth Annual Swap and Shop on Sunday, January 13, 1974. Past attendance has been 850-1,000. This year expected attendance will be from 1,500 to 2,000. Contact: L.M. Nathanson, W8DQL, Chairman, OPARC, 14300 Oak Park Blvd., Oak Park, MI 48237.

Massachusetts N.A.H.C.

The Massachusetts Chapter of the National Awards Hunters Club has a new Custodian: William C. Holliday, WA1EZA, 22 Trudy Terrace,

Canton, Mass. 02021. Reason is the death of a popular/active, well-liked County Hunter, W1DOM, on November 12, 1973, bringing sadness to all County Hunters.

Greenbelt, Maryland

The Green Mountain Repeater Association, Inc., will hold its FM Mini-Fest on Feb. 3, at 1 p.m. Meeting will be held at Goddard Space Flight Center in Greenbelt. Guest Speaker, Mr. Victor Clark, ARRL Roanoke Div. Director. Movie, Prizes. Join during meeting and get a two dollar discount. Free coffee and doughnuts.

Wheaton, Illinois

The Wheaton Community Radio Amateur Club will hold its twelfth annual mid-winter swap and shop on Sunday, Feb. 10, 1974 at the DuPage County Fairgrounds in Wheaton. Hours from 8:00 a.m. to 5:00 p.m. The fairgrounds are west of Wheaton on Manchester Rd., just east of County Farm Road. Plenty of free parking. Free coffee and donuts available from 9-9:30 a.m. Refreshments and food available all day. Prize drawing starts at 12:00 noon. Contact Paul Sexauer, 1931 Prairie Sq., Apt. 217, Schaumburg, IL 60172.

Arlington Heights, Illinois

The Forest View ARC Hamfest is Sunday, Feb. 3, at Forest View High School (2121 S. Goebert Rd., Arlington Hts.) from 8:00 a.m. to 5:00 p.m. Features include free parking, all indoor facilities, food and refreshment stand, manufacturers' displays, and brand new Drake TR-22 for door prize. Bring gear to swap, sell or auction. Talk-in on 146.94. Adv. Registration $1.50 or $2.00 at the door. For adv. reg. or info, write Tony Mazzeffi, WB9GFC, 490 Easy St., Des Plaines, IL 60016.

Kohoutek Intergalactic Net

The Kohoutek Intergalactic Net (KIN) is linking together comet watchers, celebrations, observatories, scientists, and comet cruises and flights in those countries permitting 3rd party communications. The Earth Society, sponsoring the "Kohoutek Comet Watch" cruises, sees KIN as an excellent way to tie together comet observers, and the organizers of the San Francisco "Kohoutek Celebration of Consciousness" on Jan. 26-27 (16,000 people) are hoping to work closely with KIN to link up with parallel celebrations around the world on the same days. If you can set up an exhibit at a comet event, or handle phone patch traffic (or for any other reason), you are invited to join KIN on 14,300 kHz. at 0000 GMT (7 p.m. EST) daily and on 3900 kHz. (and 146.94 mHz. locally) during hrs. of comet visibility (early evening). For more info, contact: Wes Thomas, W2IKQ, 606 5th Ave., E. Northport, NY 11731.

Whitewater, Wisconsin

The Tri-County ARC Mid-Winter Swapfest is March 17, 9:00 a.m. to 5 p.m. at the National Guard Armory, Whitewater. $1. advance, $1.50 at the door (additional $1. reserves one display table). Advance tickets eligible for special prize, talk-in on .94. Refreshments, free parking, everything indoors. For tickets, and details, Dan Servais, WA9AJW, Rt. 4, Box 309, Elkhorn, WI 53121. Tel: (404) 723-2227. S.A.S.E.

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CHOOSE FROM TWO VERSIONS

MODEL CGT-144 (illustrated) antenna complete with trunk lip mount for easy, no holes installation on side or edge of trunk lip. 180° swivel included for adjustment of antenna to absolute vertical. Supplied operational with 17' MIL spec RG-58-U and PL-259 transceiver connector factory attached. Antenna is removable from mount. Shpg. Wt. 3.34 lbs.... **$37.95**

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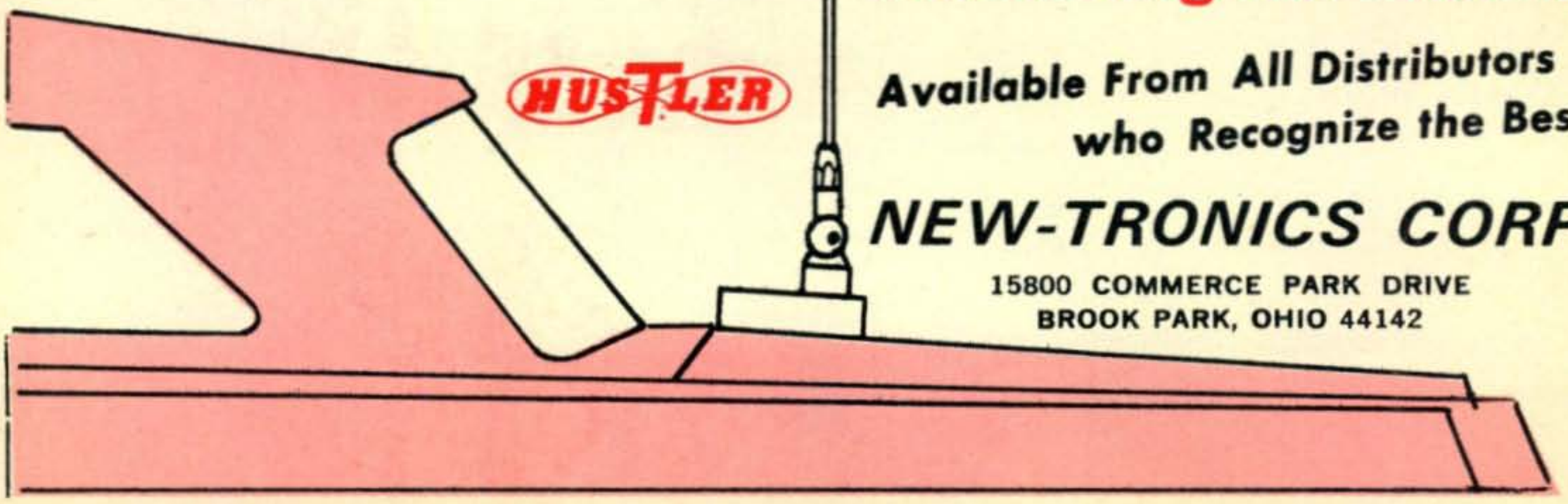
give your mobile signal the big push! this large aperature, two meter antenna will create a new dimension in amateur mobile communications. —where action counts, get the decisive advantage of colinear power gain performance; transmitting and receiving!



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Q AND A

BY CHARLES J. SCHAUERS,*
W6QLV

MOBILE radio problems do not often appear but when they do some of them can try the patience of a real expert! Usually, the amateur who has mobile radio problems has one of these: stubborn ignition noise; antenna loading difficulties; alternator or generator noise; battery problems not encountered in the average car; blown power supply transistors or diodes; or receiver—end overloading.

Most mobile amateurs now use transceivers—but there are still a few of the O.T.'s around using separate transmitters and receivers/converters—especially on 10 meters.

Space does not permit that we go into each one of the problems mentioned above and offer our solutions, and we suggest you write Q&A, carefully describing "symptoms" and we'll try to help you.

Hustler Loading

"I have been using a Hustler mobile antenna on my 72 car and now I am in the process of installing it on my 74 station wagon. Can I expect the same results I have been getting (excellent) if I install it in the same relative position as on the 72? Also, I'd like to know why on the old car that loading was difficult on 15 and 75 meters (not as quick as the other bands)?"

The Hustler is a good antenna. There is little reason to believe that you won't get good results when it is installed on your new wagon. Any vertical using "center loading" (on a car) may seem "critical" when it comes to tuning, especially on 75 meters—sometimes a half inch on this band will make a difference in operation. You can "calibrate" the Hustler resonator sections by using a grid-dip meter (for frequency) and mark each whip top with finger-nail polish (above the retaining nut). Use one stripe for the lowest frequency on the band, two for the next etc., then by noting these on a card you can hop out and get on a net frequency or? Good luck!

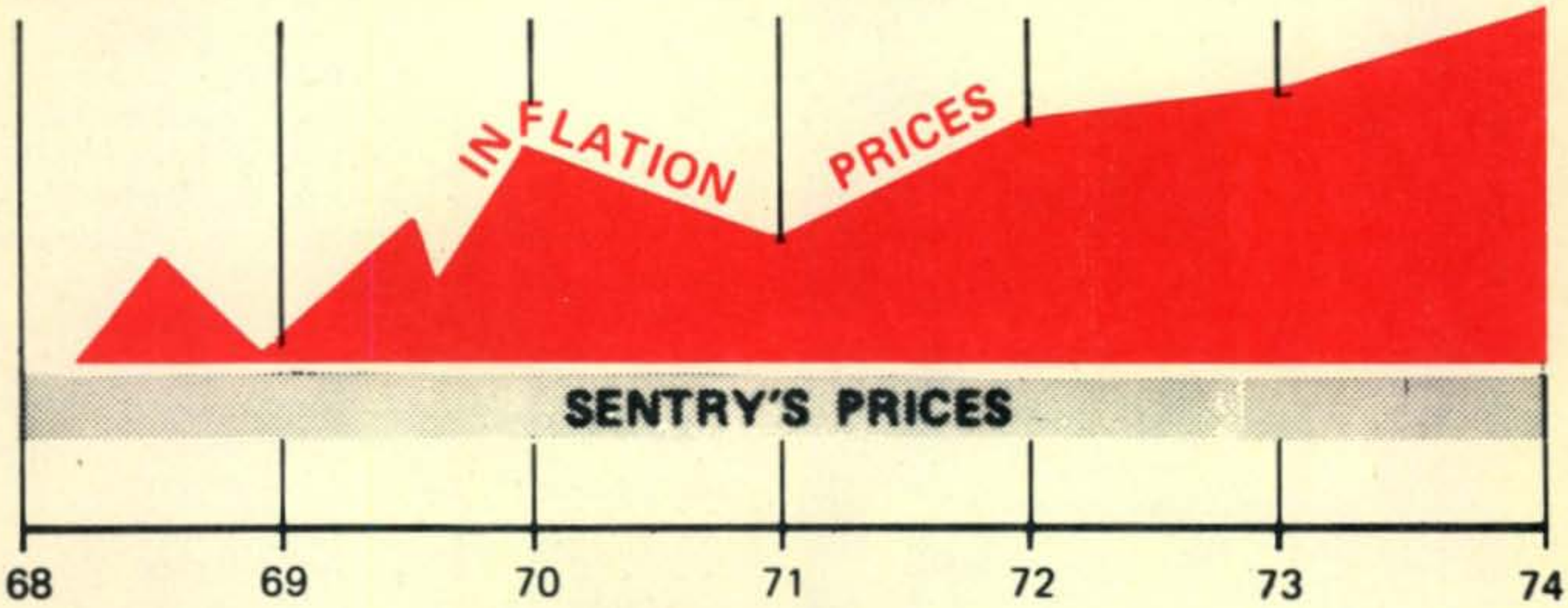
Antenna Meter

"I just bought an antenna meter made by the

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, N.Y. 11050

Tired of Inflated Prices?

Check Sentry's Offer to hold down your 2 Meter FM crystal expenses.



BUY ANY THREE crystals at the regular price and receive **ONE CRYSTAL AT 25% OFF!**

NO PRICE CHANGE IN THE LAST 5 YEARS – and in some cases, volume prices have been slashed.

UNCHANGING POLICY OF:

- *Warranty* – Sentry guarantees any Sentry crystal to be free of defects in workmanship for an unlimited time.
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- *Fast Delivery* – Any tolerance on any crystal, 5 working days for one to three crystals.

All of this "PLUS" Inflation Fighting Prices.

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E.F. Johnson Company. It is a second-hand job and I have no instruction book on it. Being a Novice I don't know how to use it, so I need help. It is marked Cat. No. 250-849, 50 ohms, 500 watts, FWD, REV, SET, XMTR and ANT., on the front panel."

The little box you have is an s.w.r. meter. The transmitter is connected to the left coax receptacle and the antenna to the right. First, tune your transmitter *without* the unit in the line, then when you think it is ready for operation, insert the antenna meter. Adjust the SET pot for *minimum*, put the switch in the FWD (forward) position, then with the transmitter in *tune* position set the SET control to somewhat less than *half* position. Now key or modulate the transmitter and again set the SET control, but this time to "set" on the meter scale. Then throw the switch to REV position and read the v.s.w.r. The higher the meter reading the greater the v.s.w.r. You can use the meter for tuning up the transmitter so that you have maximum output and "minimum" s.w.r. Remember one thing though, keep the SET control at minimum when tuning up, advance it for maximum power.

FT-101 Sensitivity

"I loaned my FT-101 to a friend of mine and when I got it back the receiver sensitivity when using the noise blanker seemed to be lower. What would be a good reason for this?"

Look at your instruction book. See page 22. If the threshold noise blanker (NB) control is set too *high* it can desensitize the receiver. It is VR-1 on PB-1182. If re-setting VR-1 has no effect then suspect other components in the NB circuit. The noise blanker in this transceiver works very well if adjusted properly.

F.M. & S.S.B.

"It seems to me that if we could combine f.m. and s.s.b. we'd really have a communications system. Why hasn't this been done?"

What you are thinking about is the noise free operation of f.m. and the gain of s.s.b. over a.m. (roughly 9db). Each system has its own advantages but combining the two is not technically feasible.

T-175 Linear Problems

"I just acquired a Knight T-175 linear amplifier and plan to use it on 10 meters when I get my General license. I have no instruction book but my set appears to be a clean second hand job and I should have no trouble getting it to operate except for one thing. I find that there is an extra final plate coil which I assume is for 6 or 10 meter operation. This extra coil was just laying in the set. How does one tell the difference between a 6 meter and 10 meter coil? Then, what size of fuse must be used with this set?"

I always tell Novices that when buying a piece of used gear they should insist on having an in-

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Quotes on request for amateur or commercial crystals for use in all other equipments.

Specify crystal type, frequency, make of equipment and whether transmit or receive when ordering.

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The famous sealed helium filled Balun . . . employed with the DGA Series Antenna Systems. Solderless center insulator and easily handles more than full legal power while reducing unwanted coax radiation. Equipped with a special SO-239 type coax connector and available either 1:1 or 4:1.

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struction book but not all heed my plea! The 6 meter coil has *less* turns than the one for 10 meters and either must be soldered into place. Knight didnot use a coil switch because they wished to reduce switching losses. The fuse in the set should be a 2 ampere fuse. I suggest you get a book before using the amplifier, and to be very cautious, for there is about 800 volts floating around in that chassis!

Final Tube Replacement

"The manual covering my transceiver has a section on final tube replacement. It says the tubes should be matched and then after these are installed the neutralization should be checked. I did this after the last set and found the neutralization off. Why is this?"

Variance of tube characteristics. You can have a difference in tube characteristics when switching from one brand to another or even within brands. Even with micro-meteric manufacturing there are slight differences especially in internal capacitance.

Attenuator Questions

Q & A receives many questions relative to attenuators, both receiving and transmitting. We would like to repeat some information on both. When you are using a grounded grid transmitter (final) the excitation supplied appears as *added* r.f. in the output and *no* attenuation is necessary. However, when there is no g.g. amplifier overdriving precautions are essential, and this results in the use of attenuators, where part of the drive is "swamped." What you actually do is to dissipate the extra r.f. power and this must be into a non-inductive load usually made up of carbon type resistors. This is a power waste pure and simple! I'm a g.g. man and that's it.

Receiver attenuators are "different"—they are used to prevent front-end overloading and some are good at doing this, but believe me they do not solve the problem entirely. An attenuator is a "loss device" and in the case of the receiver acts as an r.f. shunt.

Don't use attenuators unless you must. Q & A cannot design attenuators for a specific setup using a homemade final etc., the time is just not available.

Thyristor Connections

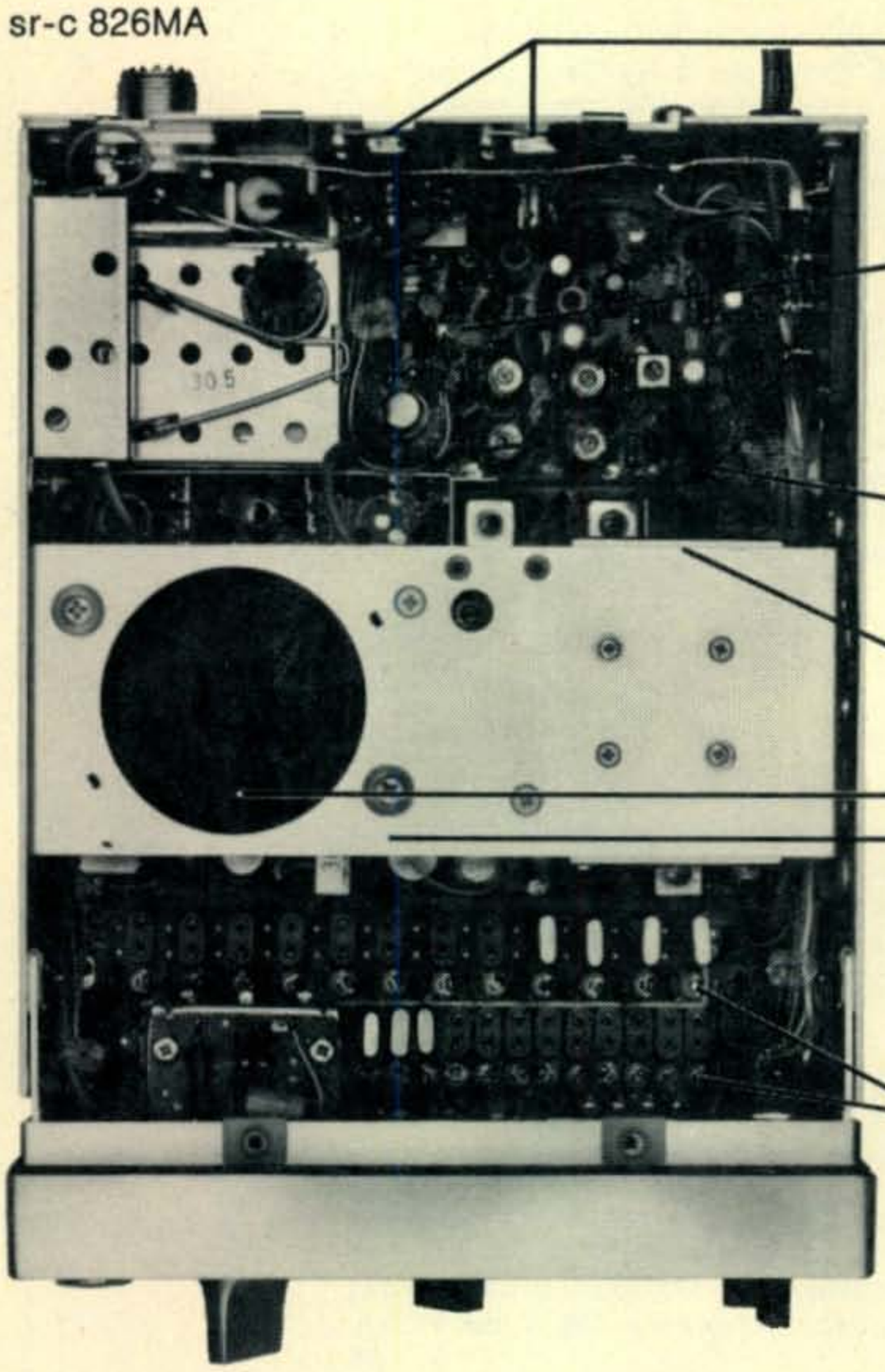
"I obtained a number of thyristors and have been experimenting with them, but in bending the leads on packages of some of them, the leads came loose. Why is this, and is there any special way to bend them?"

Some early thyristors did have fragile lead connections. To make a right angle or other bend on the early types and as a precautionary measure for the newer ones, use two pairs of longnose pliers. Clamp one about ¼" away from

[*Continued on page 80*]

ANATOMY OF A GREAT 2-METER RADIO

sr-c 826MA



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STANDARD's "ASTROPOINT" system gives the no compromise performance for the active amateur, unlike the claims made by the "cheapies." Don't be misled by gimmicks or gadgets—it's what's inside that counts. Reliable, solid state circuitry and Glass-Epoxy PC boards used throughout, backed by our 6 month warranty. INSIST ON TOTAL PERFORMANCE—INSIST ON STANDARD.

The 826MA comes complete with microphone, mounting brackets, 4 channels and line filter.

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SWAN's 700CX is a real inflation fighter. You can experience more powerful communications with this one rugged value-packed transceiver, for less cost, than any other ham rig in its class. Here is all the dynamic power you need to punch through QRM — without an expensive accessory amplifier.

Shop around and compare. There's just no competitive method that'll give you everything the CHAMPION has to offer for such a reasonable investment.

Here's some of the many standard features built into the 700CX: Automatic Level Control • Fast attack AGC, with controlled decay • Dual-ratio planetary tuning • CW sidetone • Selectable sideband • 2.7 kHz bandwidth • S-meter • 5.5 MHz crystal I.F. filter • Wide-range "Pi" antenna coupler.

See any authorized SWAN dealer for complete specifications and a demonstration. Then figure it out — all this **AND** 700 watts, too, for $569.95 — that **IS** less than 82¢ per watt — it's a real value.

Options include: SWAN 117XC, matching AC power supply and speaker — $109.95; SWAN 14-117, DC power supply — $139.95; SWAN FP-1, phone patch — $48.95.

NEED PORTABILITY? IF SO, MAKE IT WITH THE SWAN 300B

CYGNET *de novo!!* The New 1974 SWAN Cygnet transceiver with 300 watts P.E.P., an internal power-supply, and built-in speaker . . . weighing less than 25 pounds . . . is now available. Take it anywhere. Features: 5-Bands • SSB/CW • CW sidetone • AGC • ALC • S-meter • Semi-CW break-in with optional VX-2 VOX unit • Excellent sensitivity and selectivity.

Sets up right now! Simply connect an AC source, plug in your microphone and antenna — you're on the air!

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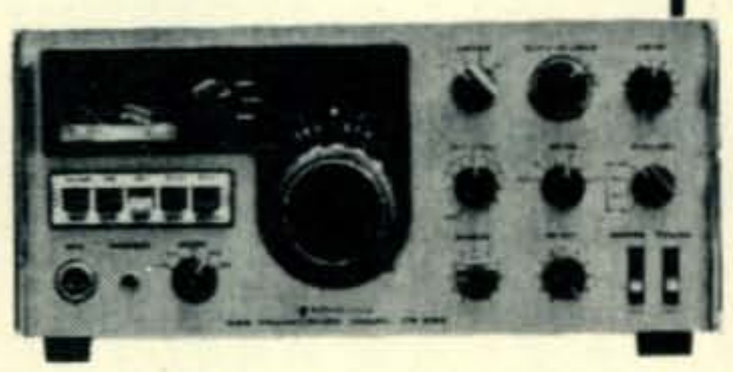
PLUS A HOST OF OTHER IMPORTANT FEATURES AND PROVEN Kenwood reliability. All at a price most amateurs can afford.
The price . . . $599.00



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. . . the ultimate tranceiver. The promise of the transistor has been fulfilled. Here is the transceiver you will want to own . . . whatever you have now, get ready to trade up. Its important features are far too numerous to list. Its specifications are superb. The TS-900 is unquestionably the best transceiver of its kind ever offered. The price . . . $795.00

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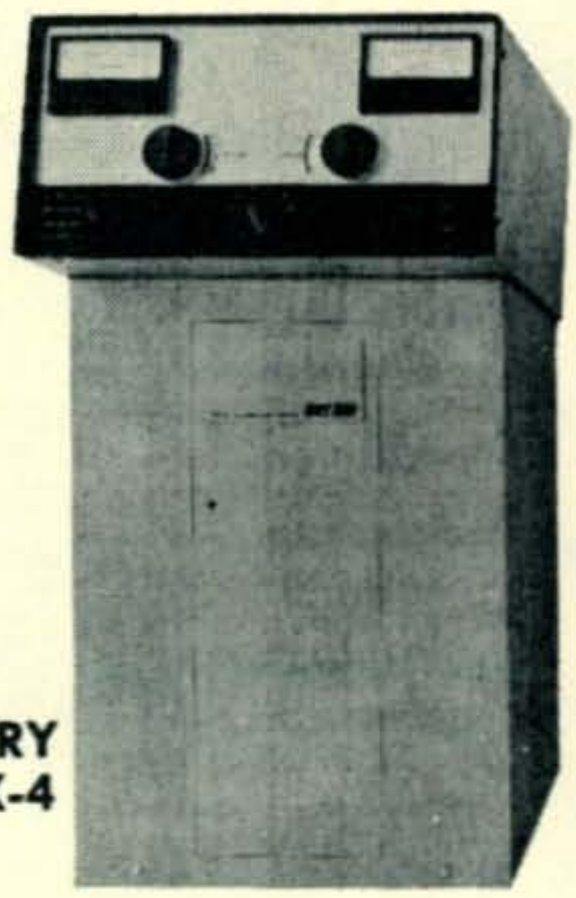
The R-599A is the most complete receiver ever offered. It is solid state, superbly reliable, small and light-weight, covers the full amateur band . . . 10 thru 160 meters, CW, LSB, USB, AM, AM.N and FM. Features selectable AGC (slow or fast), built-in calibrator, monitors T-599A frequency to calibrate transmitter, squelch circuit, 1 KHz frequency readout, versatile cross channel operation with the T-599A, stable and accurate VFO, and many, many more. In fact, the R-599A is loaded with features. . . many that are "optional at extra cost" in other receivers. The price . . . $439.00

. . . a winning pair!

HENRY 2K-ULTRA

There has never been an amateur linear amplifier like the new 2K-ULTRA. Small and lightweight, yet rugged and reliable . . . all that the name implies. The ULTRA loafs along at full legal power without even the sound of a blower. Its anode heat is silently and efficiently conducted to a heat sink through the use of a pair of Eimac 8873 tubes. In fact, all of its components are the very best obtainable. The price . . . $845.00.



HENRY 2K-4

The 2K-4 linear amplifier offers engineering, construction and features second to none, and at a price that makes it the best amplifier value ever offered to the amateur. Constructed with a ruggedness guaranteed to provide a long life of reliable service, its heavy duty components allow it to loaf along even at full legal power. If you want to put that strong clear signal on the air that you've probably heard from other 2K users, now is the time. Move up to the 2K-4. Floor console . . . $845.00.

KENWOOD T-599A

The T-599A is mostly solid state . . . only 3 tubes, has built-in power supply, full metering (ALC, Ip, RF output & high voltage), CW-LSB-USB-AM operation, 1 KHz frequency readout, smooth easy VFO action, built-in VOX (with delay, sensitivity and anti-VOX adjustments), built-in semi-automatic CW with sidetone, full amateur band coverage 10 thru 80, versatile cross channel operation with the R-599A. The price . . . $459.00

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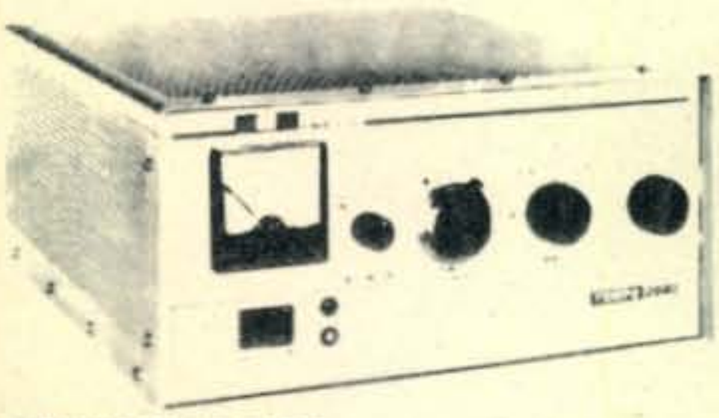

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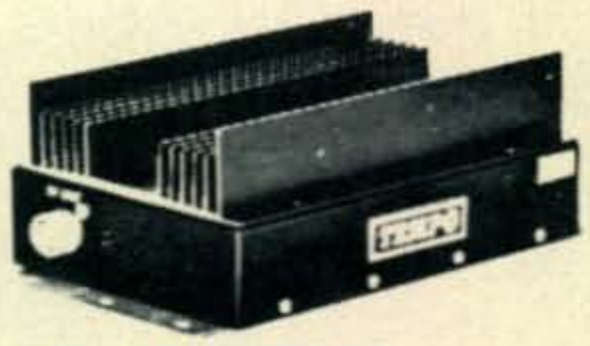

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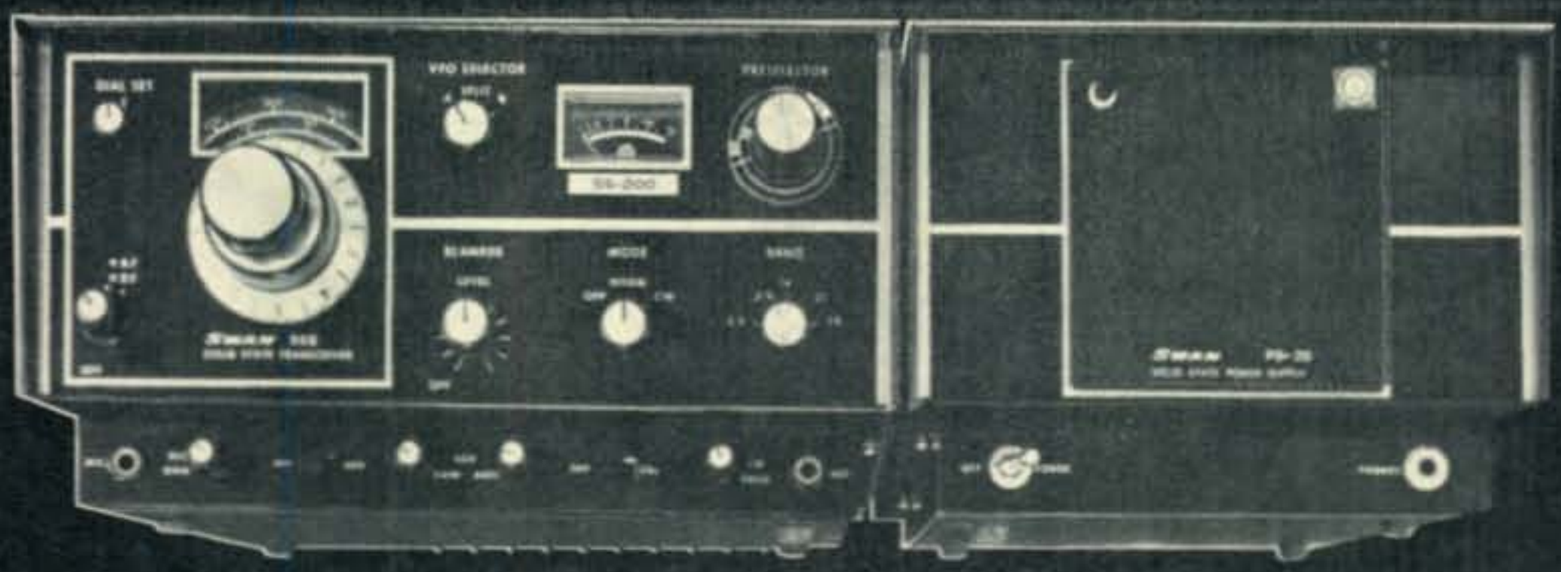

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THE BEST PRACTICAL DEVELOPMENTS IN AMATEUR RADIO

HB (S + I) + C^2 = Counters

Where: HB = Homebrew
S = Surplus (and junk box)
I = Initiative (opposite of inertia)
C = Old time ham cooperation

BY JOSEPH P. FINCUTTER,* K3STU

YES, the picture shows two counters, but the story leading to the counters is the real topic of this article. This is not a "How to Build It" article, but a "How It Might Be Done" article. And I think that a few questions might establish interest in the article:

1. When your favorite amateur magazine(s) arrive(s), are you appaled by how little of useful value there is (are) in it (them)? NONSENSE!

2. Do you read the articles on something that you might like to build only to feel that you can't get all the components that are specified? SUBSTITUTE!

3. Are you afraid to tackle a construction project because you don't understand integrated circuits, transistors, zeners, truth tables, etc . . . ? READ and STUDY A LITTLE!

4. Do you lack "shop facilities" for construction work? A CARD TABLE IS OK; EVEN THE KITCHEN TABLE IS OK, WITH XYL APPROVAL!

5. You want to build something and it is on a PC board and you can't make PC Boards? NOT AS HARD AS YOU MIGHT THINK!

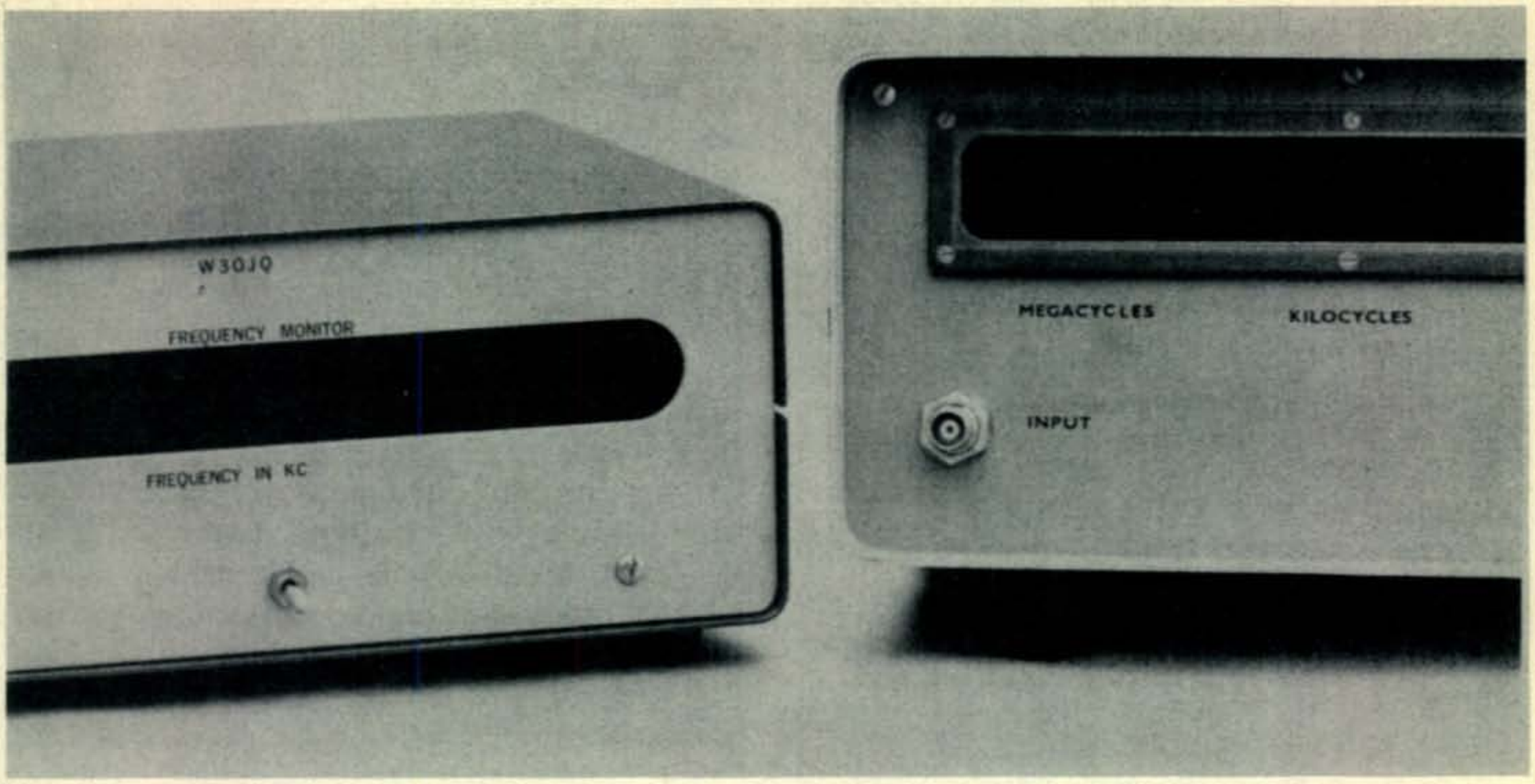
6. And . . . . . numerous other questions . . . . . just as easily answered. IF THERE IS A WILL THERE IS A WAY!

Well, these are good and legitimate questions, but all can be answered with a positive response. All it takes is a little initiative, a few good friends who are willing to help and the desire to "do and learn" more of what is so interesting in this hobby of amateur radio—HOMEBREW construction —a long-neglected art!

The reality of good friends with a cooperative spirit and a willingness to help initiated the construction of the counters as well as other similar projects. These good friends are all members of the Butterfly Net in the Metropolitan Washington, D.C. Area who meet nightly on 28.547 mHz, a supposedly dead band, at approximately 2400 GMT. There is only one formality: after each ID at the required less-than-10-minute intervals, the Net Tender says, "This is the Butterfly Net; are there any joiners?" It's amazing! Sometimes no response at all and then we've had answers from all over the US and a few from outside the US. This is a great group! We gather for a few social events each year and there are no

* 5620 Alta Vista Road, Bethesda, MD 20034

"Planning for the Future," a discourse presented by A. Prose Walker of the FCC over the past several months at different gatherings of amateurs, is a very thought provoking message. Whether you agree with him or not, he asks some very important questions that involve everyone of us to some degree and the future of amateur radio in general. In short, "How have you contributed to the future of amateur radio?" or "What have you done that can be used as justification to continue amateur radio as we presently know it?" This following article attempts to show what one group of amateurs has done to not only assist one another in gaining more technical expertise, but also to "inhabit" a supposedly DEAD BAND to show that it is usable for local contacts and for some very interesting "old time friendly relationships."



Partial views of counters by W3OJQ (left) and K3STU (right). W3OJQ's cabinet was homemade to fit his PC board layout whereas K3STU's is an LBM Model C-4 commercial cabinet.

dues! There are Kneedlers, engineers, technicians, photographers, managers, retirees, workers, kneedlers, high and low ranking military, etc., a real cross-section of the workaday world. There are always a number of projects among the members which gives us topics of conversation each night. However, should the conversation start to drag, eventually someone makes a statement and we proceed to put him "in the barrel" and don't let him out too easily. Or if we really want to start an argument, someone asks "What frequency are we on?" Hence, the counters!

During one of our regular evening sessions several months ago a good net member said he could get some "new surplus" (manufacturer's over-run) that sure had some nice ICs, transistors, etc., (42 ICs, 33 transistors, 4 NIXIE tubes, 33 capacitors, 123 resistors, 17 diodes and numerous other items of hardware) for $7.50 per board. And he also said that there were some small PC boards with 3 NIXIE tubes and the BCD to Decimal/Decoder Driver ICs for $4 per board. Who could turn down such a bonanza as this? Very shortly our good friend had orders for more merchandise than he could pack in the boot of his Karmann Ghia and he also needed money since his "mad money" could not finance such a procurement as this. So by the following morning he had the money, the purchase was made, the goods were delivered and several projects were under consideration by the purchasers.

Now lets explore the myth in the first question at the beginning of this article! There is one helluva lot of good reference material in all of the amateur magazines! If you don't believe me, take the last 12 issues of any one of the magazines, sit down and scan through all of them and be amazed at what you don't remember seeing when you first got the magazines. The bibliography at the end of this article is only a short list of good articles that formed the basic reference material around which this counter was "designed." I'm sure that there are other (many more) articles that could have been included and their absence is due only to space limitations and the time it would have taken to survey everything that had been printed on the subject of basic IC theory and on counter circuits in particular over the past 5 years. Besides circuits that appear in magazines, there are many catalogs and manufacturers' specification sheets that can be obtained upon request. Some manufacturers also have Application Notes for a reasonable price, if not free. In any case, since all ICs on the surplus boards were made by Signetics I was able to obtain a wealth of good information from Signetics.

For at least a month or so after the purchases were made, much of the net discussions and the "10:01 Sessions" (Beer

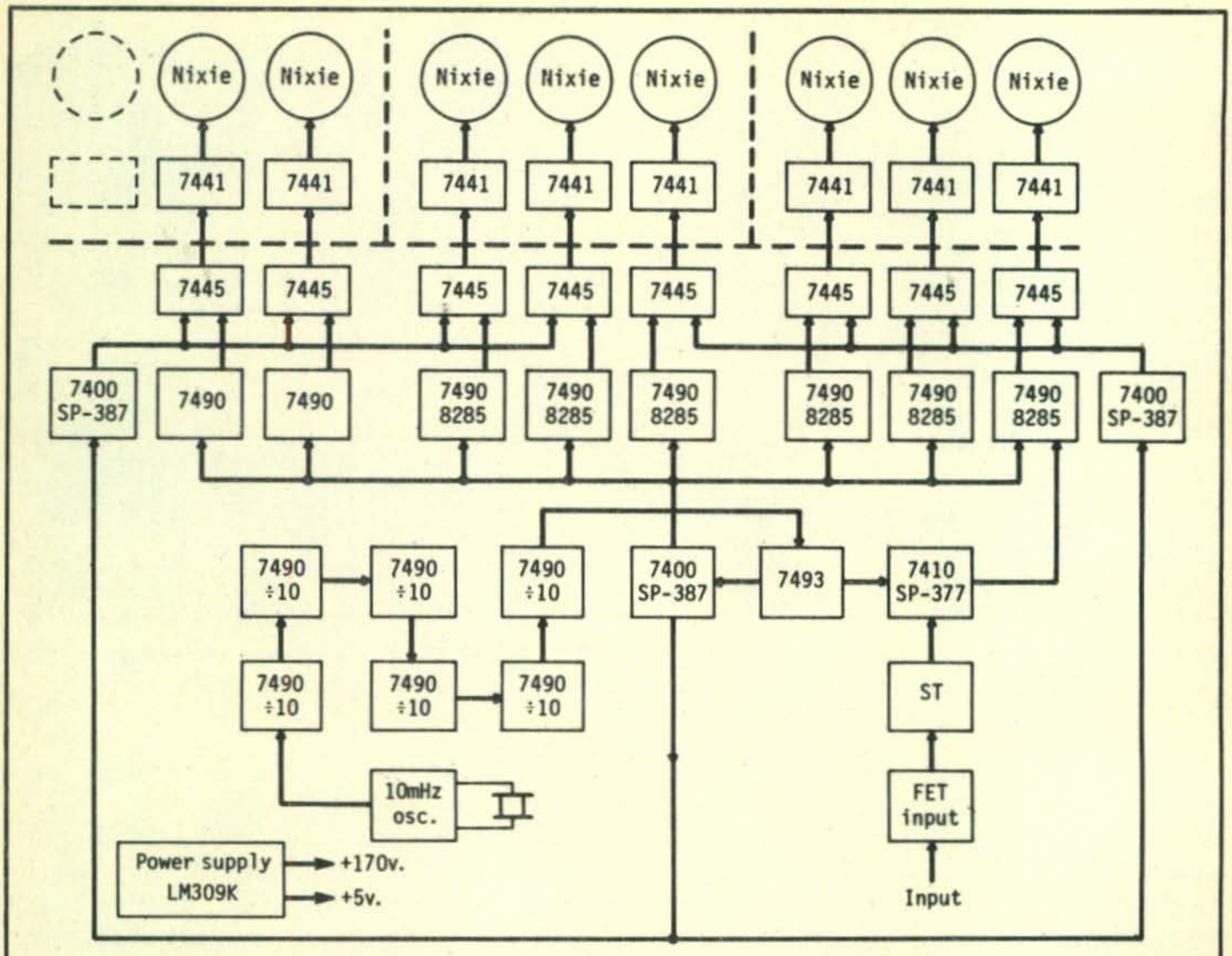


Fig. 1—Block diagram of a typical frequency counter built by several members of the Wash., D.C. Butterfly Net from surplus components. Circuit is based on the McLeish circuit published in *QST* for *October, 1970.*

and Burgers at 10:01 P.M. Friday evenings at a local Pub) centered around a basic counter circuit. We all agreed that the McLeish article[1] was a good basic circuit and could be "redesigned" to use the cuips we had on hand. So the next step was to prepare a block diagram, fig. 1, that would be a starting point for what we wanted. From this block diagram, using McLeish's article, substitutions of ICs could be made, pin numbers could be assigned and a good interconnection wiring diagram could be drawn. This approaches taken by the individuals were numerous and interesting. Some started with a board layout and would worry about a cabinet later; another found a suitable cabinet and then made a layout; still another wanted to reduce his counter to a very small enclosure which could be fit into an available space in his shack equipment. Some wanted to read frequency off the received signal; some wanted measurements to ±100 Hertz; others to ±1 Hertz; others wanted time interval measurements as well, continuous count over long periods of time, etc, . . . ad infinitum!

Being economy-minded we all tried to use what was available in our shacks, barter and exchange, going to additional purchases only when necessary. For example, I was going to use a good 100 kiloHertz crystal for my clock circuit until I very accidentally knocked it off the work bench onto the concrete floor. Defective! So I had to come up with a new clock crystal. I found an ad for a 10 megaHertz crystal in an oven (small size) for $2.50, but the minimum order was $5; so I ordered two, knowing full well that I could "dispose" of the extra crystal with no difficulty. When additional purchases were necessary we helped one another by announcing on the net that we would be making up an order and would include what might be wanted by others. In spite of the U.S. Postal Service record for poor delivery service, most items were re-

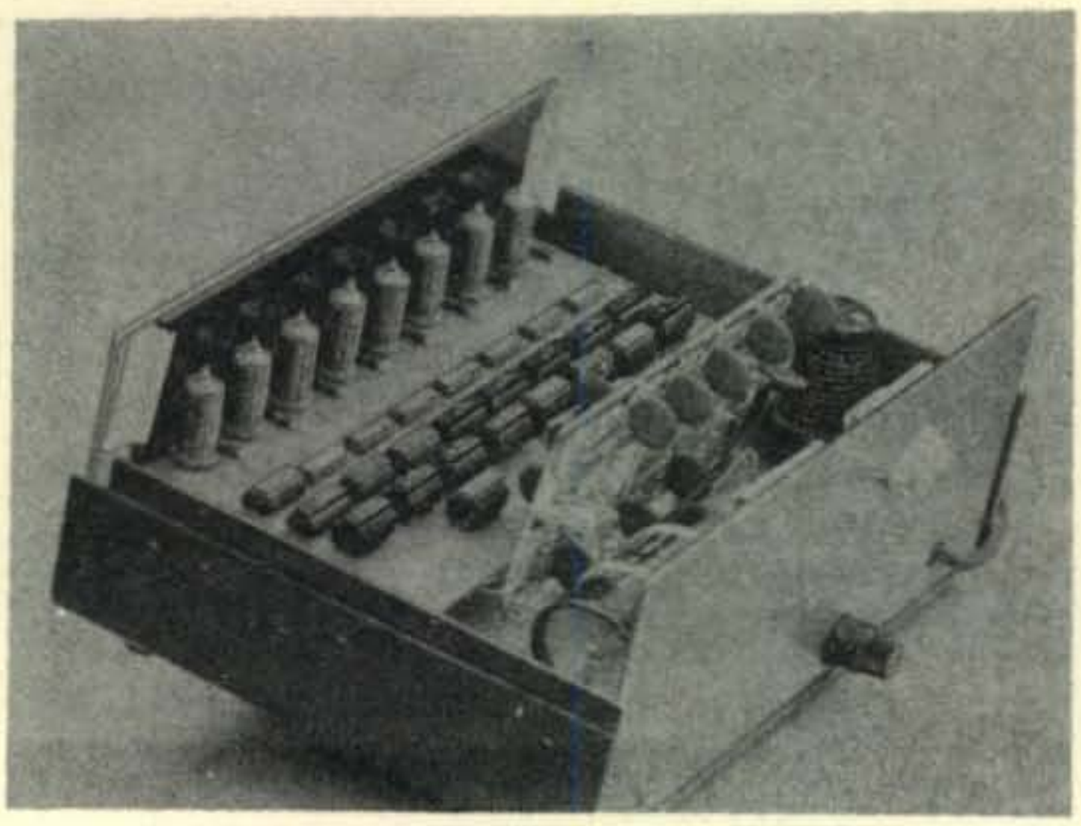
[1]McLeish, W1EO/7, "A Frequency Counter for the Amateur Station," *QST*, Oct. '70, p. 15.

ceived within a week or two of the date of the orders. I might also mention that there was a lot of that good old "barter and exchange" particularly in the early stages of design and construction. During construction there was a portable drill press that "moved around" quite a bit also, since there was need for some 600 holes in each counter board.

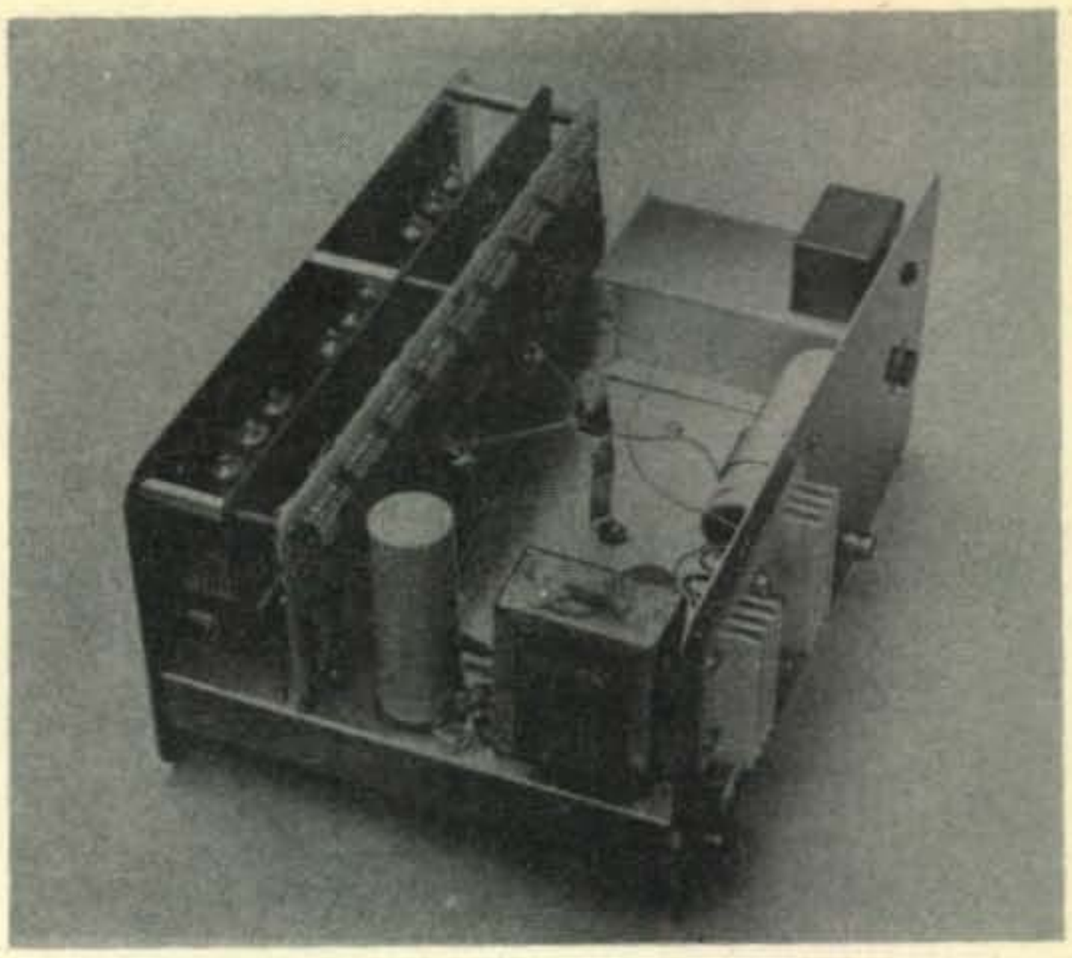
I decided to "hardwire" my circuits; another decided to make a PC board with the help of a professional photographer on the net. Together they learned a lot about "art work," positives versus negatives, developing, etching and etchants, etc. But the resultant boards are very good and look like professional jobs. Others tried making PC Boards with fingernail polish or masking tape and a $1.69 bottle of etching solution from Radio Shack. After some frustration on the part of all involved, success was evident. But then came the drilling of approximately 600 holes with a #70 drill in the fiberglass boards. Tedious, time-consuming, frustrating; and be sure that you have an ample supply of #70 drills before you start—fiberglass is hard on drills and the drills break easily.

Once all the holes were drilled, I installed Molex pins in the holes as sockets for the ICs, costing about 15¢ vs 50¢ per IC socket.

Removal of the ICs from the surplus boards presented somewhat of a problem, but the use if an Ungar #6982 Extractor and an Ungar #6942 Desoldering tip made the removal easy and I would say that only



Interior view of the W3OJQ counter. The power supply is mounted along the inside of the back panel; the clock circuit and the control circuits are on the vertical PC Board; the counting and Indicator circuits are on the horizontal PC Board.



Interior view of the K3STU counter. 10 mHz crystal and clock circuit is in metal enclosure in the upper right; power supplies in the lower right; counting, control and indicating circuits are on the left; the input is in a shielded enclosure under the chassis in the mildle rear at the BNC connector. The spider-like device in the center is an eperimental "light-pipe" for decimal points. Planned additional experimentation will replace the light pipe source and utilize the center open space for a "frequency meter."

one or two chips were damaged in the removal process. This damage was due primarly to the fact that the manufacturer had bent two pins on several of the ICs to hold them in place during his soldering operation. This fact was not obvious until after a lot of heat had been used and the ICs didn't want to come out with the tension of the spring in the 6982 Extractor.

I found that it was extremely helpful to draw an interconnection type wiring type schematic so that I could follow each connection as I wired the circuits. It was also very easy to recheck all the wiring before the ICs were inserted. Additionally, I put a red dot next to Pin 1 on the TOP and the BOTTOM of the board to insure proper insertion of the ICs. Once the wiring was all checked and rechecked the ICs were inserted. When inserting ICs into Molex pins, don't remove the tie strip on the groups of 7 or 8 pins until after you have inserted the ICs. This makes easier the insertion of the ICs. With all voltages connected and all the ICs in place it should work!

If it doesn't, then the trouble shooting starts. Some sort of IC tester would be desirable, but a lot of good can be done

[*Continued on page 82*]

A Contest Rig For 160

BY THOMAS W. WEBB,* W4YOK

THIS article describes a 200 watt c.w. transmitter which was built expressly for the 160 meter contests held each winter. The circuitry is straightforward, the one novel feature being the use of a color TV sweep tube as a high-efficiency class C power amplifier.

The transmitter is v.f.o. controlled. Grid-block keying of the v.f.o. is used to permit full break-in operation. (A TR switch is used by the author.) The transmitter constructed by the author will deliver 165 watts output with an input of 200 watts.

Circuit Description

A 6AH6 Hartley v.f.o. (fig. 1) tunes from 1800 to 1850 kHz. The grid circuit is tuned to half-frequency (900-925 kHz) with the low-Q plate circuit resonant in the 160 meter band. A greater tuning range could be achieved by using a variable capacitor possessing a greater percentage of the total grid circuit capacitance. Keying is accomplished by holding the v.f.o. cut off by the bias voltage until the key is closed, shunting the bias voltage to ground through a high-impedance voltage divider.

The v.f.o. output is fed into a cathode follower which provides isolation. The 6T9 pentode driver supplies excitation for the 6LW6 final. Both of the 6T9 stages are allowed to conduct continuously, simplifying the keying of the transmitter.

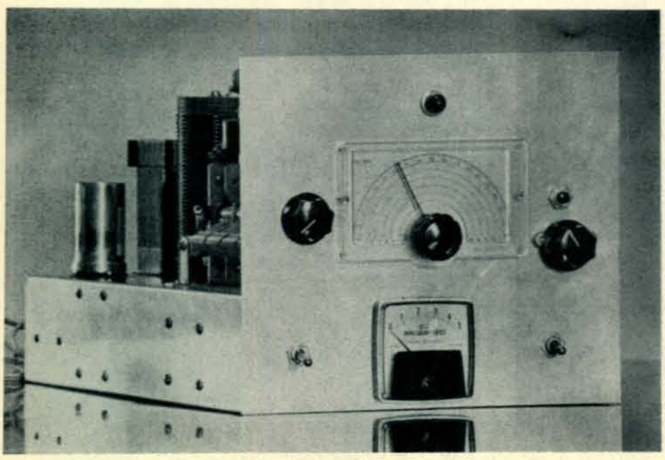
The 6LW6 final is biased off until the r.f. signal from the driver stage appears at the grid. The tube then conducts during only a part of the positive half of the drive cycle, resulting in excellent final efficiency. Final plate current is metered in the negative leg of the high-voltage bridge rectifier (fig. 2).

Construction Details

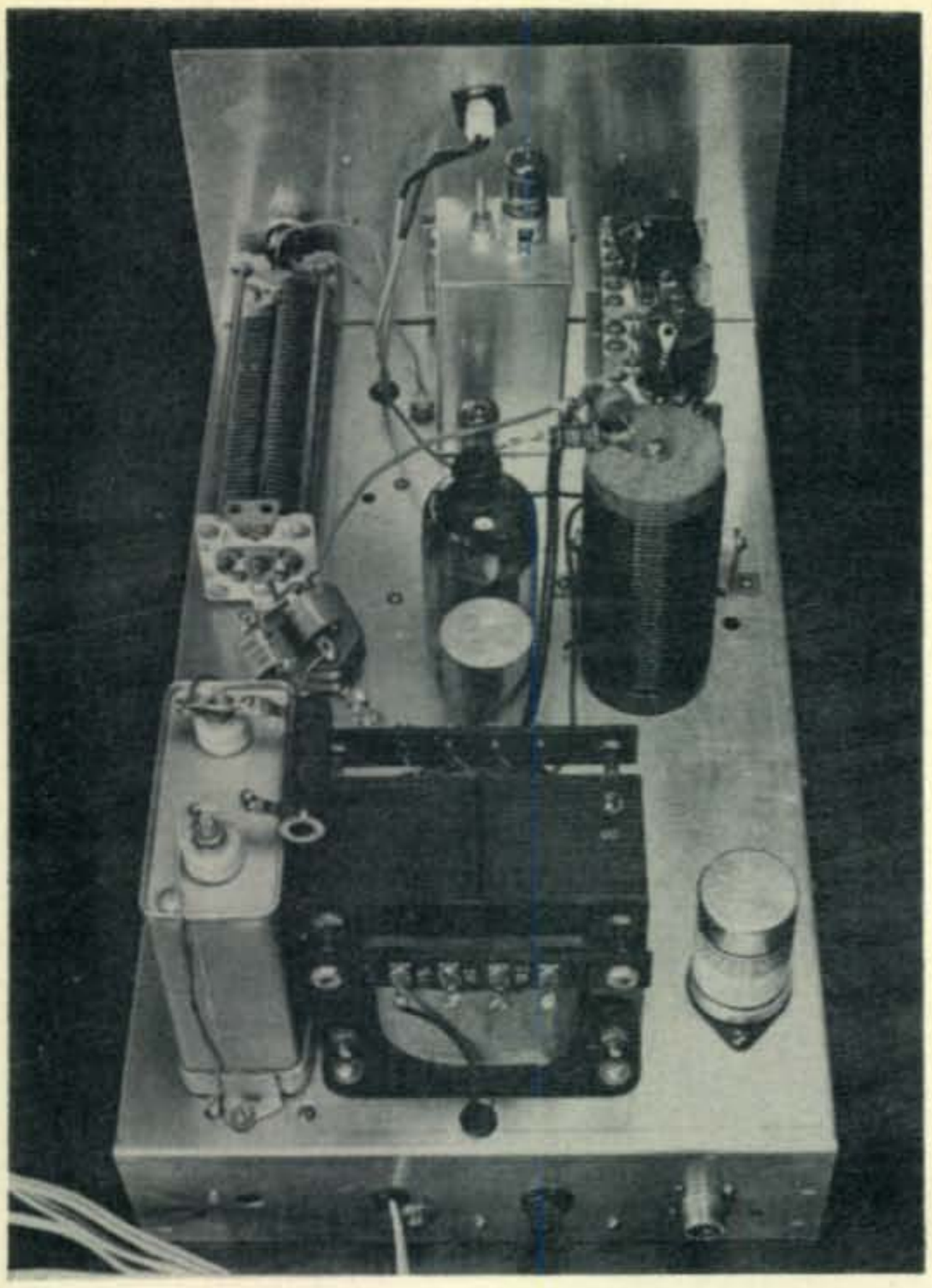
The v.f.o. grid coil (L_1) used by the author is an unknown number of turns wound on an unknown slug-tuned form, tapped one-third from the bottom. Inductance was measured on a Q-meter as 210 μh. It should be possible to use a J.W. Miller 4410 here if one can peel off about one-third of the turns, make the tap and then rewind the coil. The author's coil was cannibalized from an old forgotten project.

A chassis measuring 17" × 10" × 3" was used for the transmitter and its power supply. The front panel is a 9" × 10½" piece of aluminum. The v.f.o. dial was purchased at Radio Shack.

* 231 Bittersweet Lane, Henderson, KY 42420



The 160 Meter Contest Rig runs 200 watts input on c.w. only and is v.f.o. controlled over the 1800-1850 kHz range. Controls to the left and right of the v.f.o. dial are PA Loading and Tuning. The toggle switches are A.C. On and Standby. The push-button switch above the plate tuning parallels the key contacts for tuneup or for v.f.o. spotting when S_2 is in Standby.



Viewed from above it's evident that the 160 meter rig can be assembled "casually" with many componnts salvaged from the junk box. The v.f.o. circuitry is contained in the small Mini-box behind the panel, with its associated V-R tube just to the rear. The 6T9 driver is hidden from view by the large plate transformer T_3. The chassis measures 10×17×3 inches. Other transformers and chokes are located below. A cabinet is highly recommended since lethal voltages are present at numerous points above chassis.

The v.f.o. circuit was built into a 4" × 2½" × ½" Mini-box which is mounted on the main chassis directly behind the dial. The v.f.o. tube's screen resistor should be outside the box to minimize heating.

The power supply was built from available junk box components, although the reader may wish to use smaller components in order to make the finished unit more compact.

Fig. 1—Schematic of the 160 Meter Contest Rig. L_1 is 210 μh, tapped ⅓ up from the ground end, and may be a J. W. Miller 4410 tapped as needed. L_2 is 230 μh and may also be a Miller 4410. L_3 is 15 μh (Miller 4407). L_4 is 36t. #14e. wound 9 turns per inch on 2" dia. bakelite form. Tap at 26 turns. C_1 is an 8-80 pf variable (Hammarlund MC-755). RFC_1 is 1 mh, 500 ma. Resistors are ½ watt unless otherwise specified; capacitors are in pf unless otherwise specified.

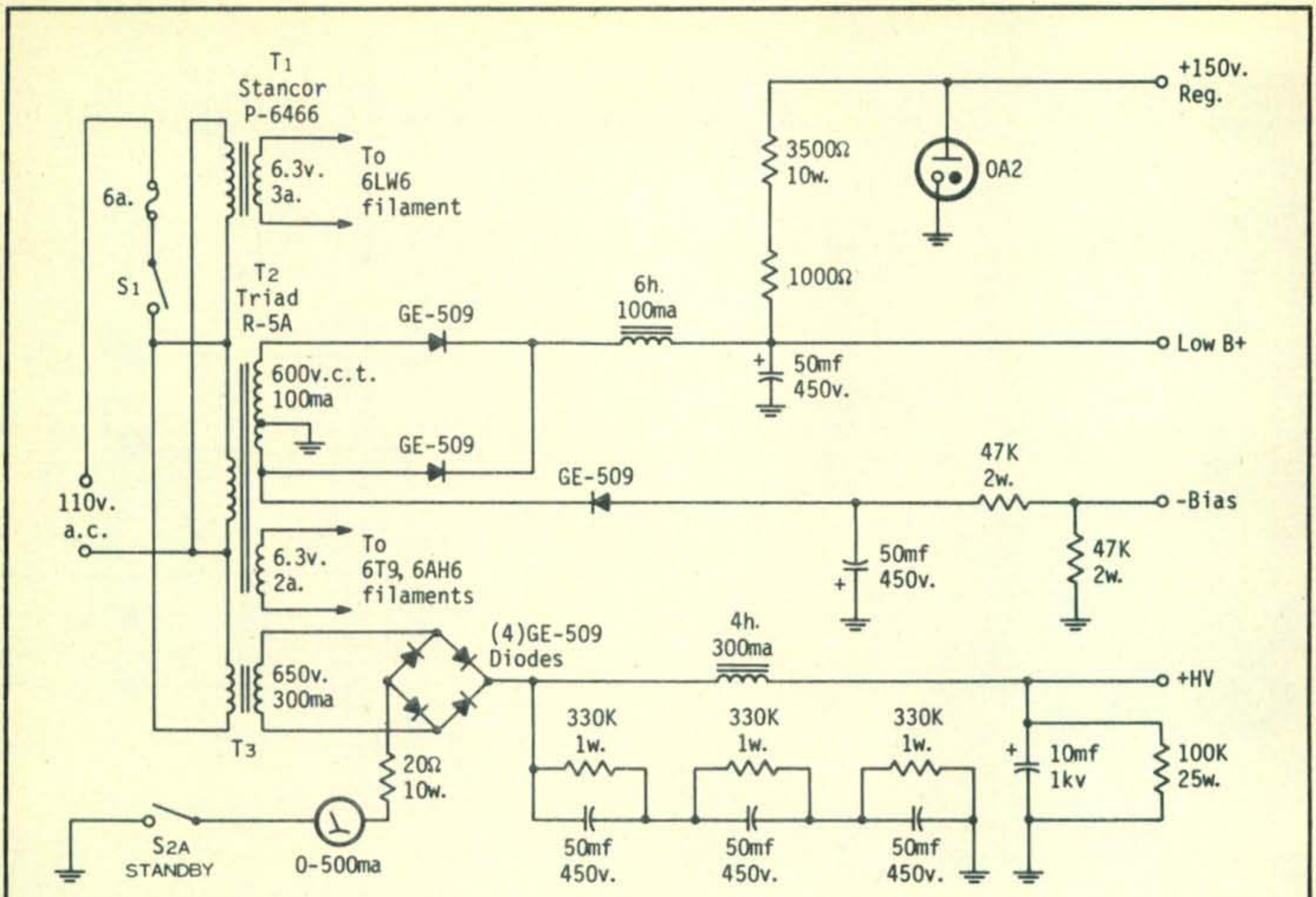


Fig. 2—Schematic of power supply for the 160 meter transmitter Transformer T_3 is a surplus unit delivering 650 v. at 300 ma.

The 6LW6 Pentode

The 6LW6 was made available early in 1972. It is rated at 40 watts plate dissipation in color TV horizontal sweep service.

Several people have asked me how one extrapolates this rating to amateur-type service. I don't know the answer to this question, but I offer the following observations: My transmitter will load up to a little over 300 watts input. Power output is about 220 watts. I have made several QSO's (during the daytime, of course!) while running 300 watts. The tube shows no color and appears to be quite happy. I conclude that the rating can be at least doubled for A1 operation. During the initial adjustment of my tank circuit, I ran 300 watts input with *no output* for a few seconds at a time without the catastrophic failure one might expect.

Conclusion

Results with this simple rig have been gratifying. With a loaded 80 meter dipole, several hundred stations in 47 states were worked this past winter.

Keying characteristics are good. No chirps or clicks are evident. Only T9 reports have been received. V.f.o. stability is excellent after a five minute warmup. ■

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CQ Reviews:

The HeathKit IB-1100 and IB-1102 Frequency Counters

BY WILFRED M. SCHERER,* W2AEF

UPWARDS of two years ago the Heath Company brought out their first digital electronic frequency-counter kit, the Model IB-101,[1] which, at that time, took quite a slice off the price of such an instrument. A newer counter has since been introduced at an even lower-cost: only $169.95. In addition, the newer model IB-1100 has a higher top-frequency limit of over 30 mHz (the range starts at 1 Hz), compared to 15 mHz for the older IB-101.

Except for the increased frequency range, the IB-1100 is similar in operation to the IB-101, providing up to a 5-digit direct readout in kHz with a resolution to 1 Hz or in mHz with a resolution to 1 kHz. By making use of both ranges (that is, switching between them and correlating the two) the instrument yields an 8-digit capability with megaHertz also determined to within 1 Hz. The accuracy is rated as to ±1 count, ±time-base stability. Input sensitivity is rated as 100 mv. This model also incorporates some structural advantages described later.

*Technical Consultant, *CQ*.

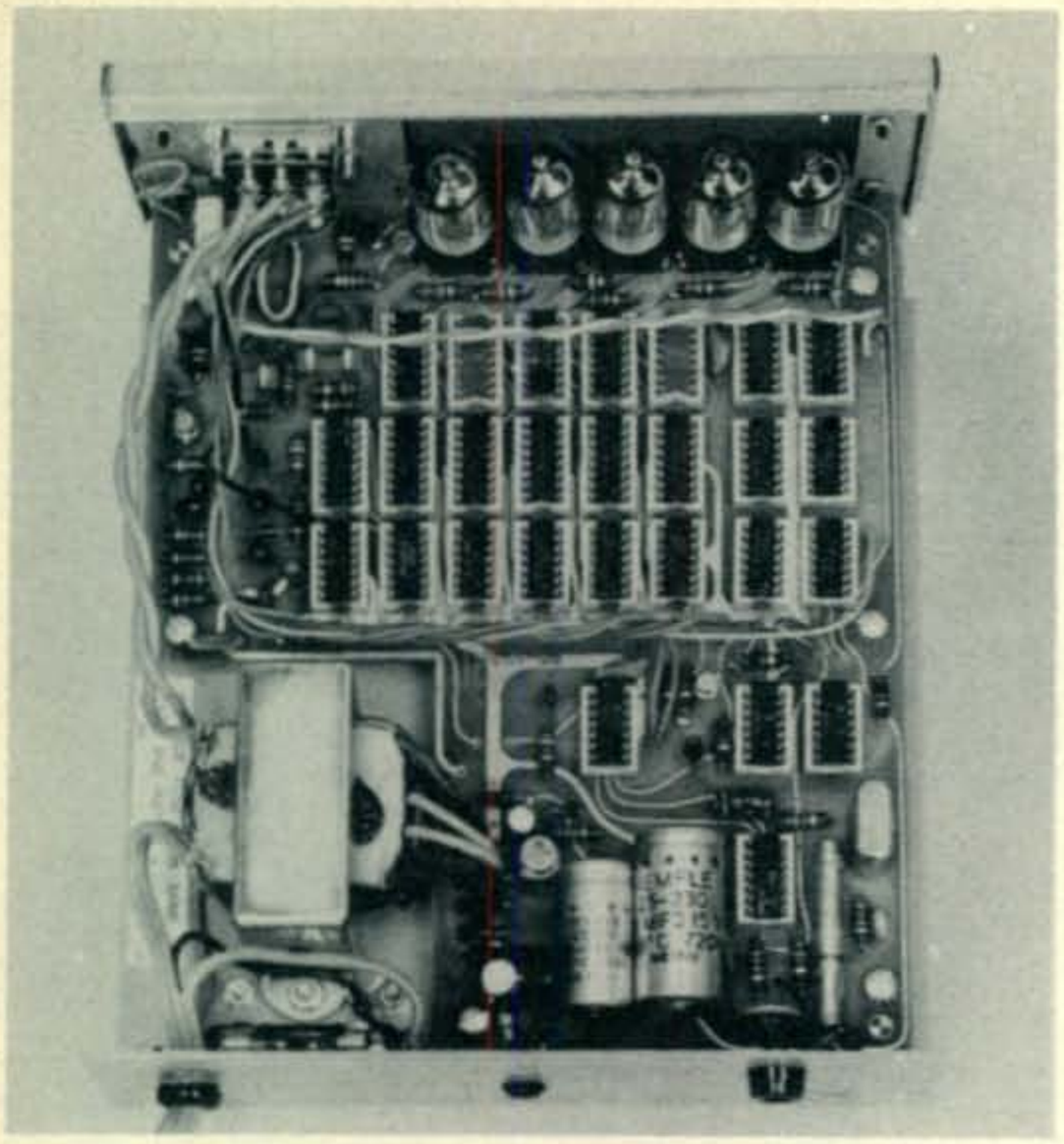
[1]"*CQ* Reviews: The Heath Model IB-101 Frequency Counter," *CQ*, July '71 p. 47.

The Heath IB-1100 Frequency Counter shown in a tilt-up position supported by fold-back wire feet. The mHz range is in use showing a readout of 30.923 mHz. If the complete frequency were 30.923456 mHz (30,923.456 kHz), the display on the kHz range would show only the last five digits or 23.456 kHz. By correlating the two readings frequency can thus be indicated with 1 Hz resolution.

Circuitry

The main difference in the lineup of the IB-1100 over that of the IB-101 involves the input setup. The input terminal is a.c. coupled rather than d.c. coupled, thus avoiding the possibility of damage to the input transistor when a relatively high d.c. potential is present on the circuit under measurement. Also, the input transistor is diode-protected against overload. In place of a single FET, the amplifying section employs a JFET direct-coupled to a bipolar transistor with 100-percent negative feedback from the latter. This results in near-unity gain; however, it is a wideband affair providing a high input impedance for the instrument with a transformation to a low impedance for matching to a transistor amplifier. A fourth transistor, functioning as an emitter-follower, acts as a buffer between the amplifier and a Schmitt trigger that employs two transistors instead of an IC. Loading of the Schmitt trigger by the TTL IC for the first decade counter is prevented by an emitter-follower transistor between the two circuits.

The remainder of the setup is like that of the IB-101 with a 1 mHz crystal-controlled clock, dividers, decade-counting units, memory latches, decoder-drivers, gaseous-discharge cold-cathode display tubes, reset and transfer circuits and overrange indicator. The increased top-frequency limit also is enhanced by some different type



Interior view of the IB-1100. It is assembled on a single circuit board with the IC's plugged into nylon sockets.

switching IC's. A built-in power supply is a.c. operated with an attached 3-wire line cord.

Construction

The IB-1100, as with the earlier counter, is assembled on a double-sided fiberglass circuit board, but a change here is that actual sockets are used for the 27 IC's in the unit instead of Molex socket pins. This simplifies the assembly work, which took us 7-7½ hours including adjustment.

Another welcome difference is that the installation of the display tubes is made much easier and accurate by the use of Amperex ZM-1000 types in place of the Burroughs B-5859S or National Electronics NL9055. The new tubes have rigid base pins (such as on a standard miniature tube) instead of soft-wire pins found on the other type tubes that require a guide to aid in proper pin alignment and a support when the tube is being inserted into its socket.

On the panel is a BNC type input connector, a neon overrange lamp and two slide switches, one for power On-Off, the other for a display range in kHz or mHz.

A screw-driver-adjust control at the rear of the unit is provided to set the time-base crystal against a standard source such as WWV. A test point at the rear furnishes a signal for adjusting the input sensitivity by means of controls operated through the bottom of the case.

The IB-1100 has a chrome-finished bezel and tinted viewing window, and slides into a wrap-around case. Instead of a combination bail handle tilt-up stand on the case, there are two wire collapsible legs at the front feet that may be snapped into place for a tilt-up or a flat position of the instrument. This is a sturdier arrangement and when the unit is lying flat, such as when stacked with other gear, there is no handle resting at the front to interfere with the controls or input connector.

Operation and Performance

Like other Heath counters, the IB-1100 provides a stable display—the readout does not flutter through the count. With any shift in frequency the readout changes only at the end of the counting cycle in accordance to the time base which is 1 second for the kHz range and 1 millisecond for the mHz range.

When the kHz position is in use, and the measured frequency is above 99.999 kHz, the overrange lamp will light to apprise the user of this situation, in which case the range should be switched to the mHz position.

Although the input sensitivity is rated at 100 mv (250 mv maximum), our unit functioned well below the minimum limit (down to 50 mv at most frequencies) and counted correctly up to 49 mHz. The maximum allowable input potential is rated as 200 v.d.c. and 150 v. r.m.s. up to 100 kHz with a linear de-rating of 48 v. per decade above 100 kHz. The input impedance is 1 megohm shunted by less than 20 pf.

The time-base stability rating (after 30-minute warmup) is less than ±3 p.p.m. between 22° and 37° C. and less than ±20 p.p.m. between 10° and 40° C. The aging rate is given as less than 1 p.p.m./month after 30-days operation. The ambient-temperature operating range is 10°-40° C.

Power requirements are 110/130 or 220/260 v., 50/60 Hz at 15 watts. The size of the unit is 3⅛" × 7¼" × 9¼" (H.W.D.) and it weighs 4 lbs.

Model IB-1102

Another Heath counter is the IB-1102, a more sophisticated and higher-priced job selling for $299.95. It has an increased frequency range of 1 Hz to "over" 120 mHz with up to an 8-digit direct readout

on a kHz range with a resolution to 1 Hz or up to a 6-digit readout on a mHz range with a resolution to 1 kHz. The decimal point is fixed on each range. For measurements at 100 mHz and above (up to the top limit) the IB-1102 has a 9-digit capability when both ranges are used and are properly correlated, providing a resolution to 1 Hz.

The sensitvity is rated at 50 mv and the accuracy is ±1 count ±time-base stability. The time-base clock is a temperature-compensated crystal oscillator with a high stability of ±1 p.p.m. between 15° and 50° C. and an aging rate of 1 p.p.m./year. There also are provisions for operation with an external 1 mHz time base.

The usual overrange indicating lamp is included along with two others that show which range is in use, while a fourth one flashes in step with the gating during use of the kHz range.

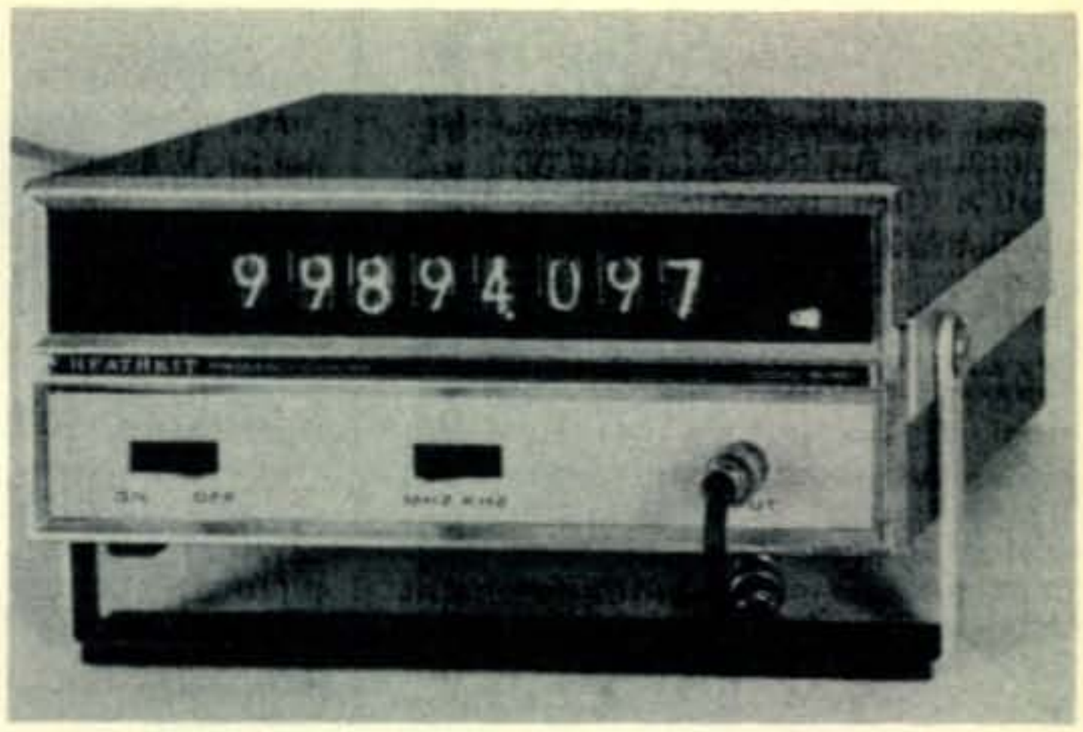
Lineup

Here again the significant difference over other Heath counters is the input circuitry, otherwise the lineup is essentially similar.

The input is d.c. coupled to a diode-protected FET which in conjunction with a bipolar transistor comprises a high-to-low impedance converter. The signal is then amplified by a two-transistor differential amplifier . . . another transistor serving as a constant-current source for the amplifier. The two resulting signals, which are of equal amplitude and 180° out of phase, go to a differential cascode amplifier made up of four transistors. An emitter-follower at each output isolates the amplifier from the IC Schmitt trigger which drives the first decade counter via the gater controlled by the time base. The decade counter is made up of two IC's whose outputs pass through transistor differential-level translators, which in turn drive the logic in the counting section.

An OP-AMP senses the average voltages at the input to the Schmitt trigger and adjusts the bias of one transistor of the input differential amplifier so that signals applied to the Schmitt trigger are of equal amplitude. Triggering level is automatic.

The time-base also is somewhat more elaborate, consisting of a 4 mHz temperature-compensated crystal oscillator (TCXO), a ÷ 4 divider, six ÷ 10 dividers, a Schmitt trigger, a multiplexer (programmable switch), a monostable multivibrator, a de-



The Heath IB-1102 Frequency counter shown with a readout of 99,894.097 kHz (99.894097 mHz) for a resolution to 1 Hz with the kHz range in use as indicated by the lamp at the lower right of the viewing window.

coder with reset driver, a gate and speed-up flip flop with gate switch. Space does not allow a description of just how these function; however, their operation is fully explained in the manual as is that of other functions.

When a 1 mHz external time base is to be used, the ÷4 divider is eliminated.

Assembly and Packaging

The IB-1102 is styled the same as the original IB-101 with a two-part case made of U-shaped top and bottom halves to which is attached a bail handle/tilt-up stand. A BNC input connector is at the front, while another one for the external time-base input is at the rear where there also is a slide switch to change between internal or external time bases. The line cord is a 3-wire detachable type.

Backlighted letters in the tinted viewing window denote the various counter functions such as: OVER (Overrange), GATE, MHZ, or KHZ.

Internally there are four individual circuit boards, one each for the counting sections with display tubes, the input section, the time-base generator and the power supply. All, except the counting/display board, are plug-in types installed in separate shielded compartments as shown in the photo. An extender board is supplied for easy servicing of the input and time-base boards under operating conditions. IC's plug into rows of Molex socket pins as in most Heath counters. Burroughs or National Electronics display tubes are used in this model.

[*Continued on page 84*]

The Inquiring Spectator

A Personal View of Amateur Radio Today

BY WILLIAM I. ORR,* W6SAI

CQ is pleased to present the first of a series of opinion colums which deal with pertinent aspects of amateur radio. The column is edited by William I. Orr, W6SAI. Published at irregular intervals, "The Inquiring Spectator" will examine and comment upon items of interest to tiday's radio amateur. From time to time, guest columnists will speak their piece, at the invitation of the editor. It is hoped that the opinions expressed in this column will stir the brain cells of the reader and perhaps encourage him to take a more active role in the day-to-day affairs of amateur radio.

On October 19, 1973, the ARRL (through the office of its General Counsel, Robert M. Booth, Jr., W3PS) filed its Comments on FCC Docket 19759, the proposed creation of a Class E Citizens Radio Service in the 224-225 mHz band. The ARRL filing ran to 57 pages, plus appendix, and was a masterly and all-inclusive presentation of the radio amateur cause. The ARRL, the Headquarters staff and others—particularly Bob Booth—are to be congratulated on a job well done.

Along with the ARRL filing, many radio amateurs (and a surprising number of CB operators) filed in opposition to the proposal. The complete filing of comments (pro and con) ran to 17 heavy volumes. It is now the duty of the FCC staff to sift through these filings, study the comments and the reply comments and then write a Report and Order, summarizing the comments and the proposed answers to them.[1]

When the Report and Order is completed by the Staff, it will be placed on the agenda of some future meeting of the FCC Commissioners for discussion and vote.

Wisely, the ARRL has requested oral argument before the FCC at the forthcoming meeting. The ARRL request says, in part, "Experience with other recent rulemaking proceedings before the Commission, including Dockets 18803, 19162 and 19245, informal observations of a number of Commissioners, and the closed "briefing session" between the Commissioners and EIA representatives in the spring if 1971 on RM-1747, have emphasized the desirability and necessity of oral argument on matters of such extreme importance to the Amateur Radio Service and the general public. Oral arguments are being held regularly on other matters of general public interest. Oral argument will enable each Commissioner to obtain a much more complete understanding of all aspects of these proposals than the filtered and condensed presentation prepared by the staff."

The FCC Record Speaks for Itself!

The ARRL comments review the melancholy history of the present Class D Citizens Radio Service in the words of the FCC, as given in their Annual Reports:

1959 "... it now appears that many persons have the mistaken notion that this Service provides for the use of radio as a hobby, for experimentation, or for random communication with distant or unknown stations. In order to correct this situation, rule changes have been proposed to more clearly indicate the

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[1]"Everything You've Wanted to Know About the FCC But Were Afraid to Ask," *CQ*, June '73, p. 23.

conditions governing the operation of homemade and factory assembled equipment."

1960 ". . . many of the individuals flocking to it (the Class D Service) do not understand, or ignore, the Commission rules governing operation in this service . . . Together this misconception or wilful disregard of the rules has caused much policing trouble and made it necessary for the Commission to tighten its Citizens regulations, take action against flagrant violators, and warn users in general about the necessity for abiding by the rules."

1961 ". . . over 1500 class D Citizens violation notices were issued during the year."

1963: "misuse of Citizens Radio stations operating privileges is so prevalent in some areas as to threaten the continued usefulness of the Service."

1964: ". . . the great volume of rule violations threaten this Service . . . by far the biggest source of unlicensed operation was in the Citizens Radio Service."

1965: Once again, the Annual Report noted the failure of CB licensees to restrict their communications to those permitted by the rules, then noted for the first time that the "irresponsibility of some producers of equipment" in manufacturing high powered equipment and the fact that "through advertising media, licensees are encouraged to commit unintentional or deliberate violations of the rules." The Report also stated, "Present legitimate users are discouraged by the disproportionate influence of the inconsiderate minority who flagrantly violate the rules and disregard the Service."

1966: The FCC Annual Report, for the first time, noted that "Many non-identifying stations are not only cluttering up Class D channels, but also are conducting clandestine operations on the frequencies alloted to the Industrial Radio Service."

1967: "Monitoring and inspections have of many of the Commission's rules. Typical abuses include use of pseudonyms to avoid detection, use of unauthorized frequencies, long-distance communication, excessive "on-the-air" time, use of obscene, indecent, or profane language, use of overheight antennas, and overpower stations."

1968: "Enforcement is complicated by lack of resources plus a basically irresponsible attitude towards radio transmission by a large percentage of licensees who have no serious business or practical need for radio communication. Noncompliance is geographically spread throughout the nation."

1970: The Annual Report stated, that, because of the ever-increasing number of unlicensed stations, the class D Service was at times "useless for legitimate use" and that enforcement was "a greater problem than in all other services combined."

1971: The Annual Report stated "no measurable improvement in compliance with the rules," and an "inability to identify offenders due to the failure to use proper staion identification."

1972: "Citizens Radio continues to be a major source of violations seriously inhibiting the use of the Service. The Commission has been engaged in an extensive program of field enforcement to detect more violations and enforce greater compliance with Citizens Radio Service Rules."

CB Radio—A National Scandal

The whole melancholy story of the degradation of the Citizens Radio Service is spelled out in the FCC Annual Reports. It is interesting to speculate if members of the Commission have actually ever read these Reports! For if they have, *the answer to Docket 19759 is self-evident in the words of the annual FCC reports.*

Unfortunately, this picture of the "Ugly American" reaches overseas, as the main abuses of the Citizens Radio Service can be heard internationally. There is no doubt that the lawlessness exhibited by this stepchild of the FCC will have an adverse impact on the spectrum proposals the U.S. may place before the next International Telecommunications Union World Administrative Radio Conference to reallocate the 3-30 mHz portion of the radio spectrum.

What Ever Happened to Class A?

Unknown to most CBers and radio amateurs alike, a class A Citizens Radio Service has been in existence for a number of years in the bands 462.5375 to 462.7375 mHz and 467.5375 to 467.7375 mHz for fixed and mobile operation using f.m. with a maximum power input of 60 watts. A total of 16 channels are provided in the two segments for fixed, base and mobile opera-

[*Continued on page 84*]

Happiness Is Visiting A Ham

Part II—Conclusion

BY GEORGE PATAKI,* WB2AQC

LAST month our ham travelogue carried us to Guadeloupe, Antigua, St. Thomas, Puerto Rico, Dominican Republic and left us in Haiti where we enjoyed a chance pool-side visit with Sen. Barry Goldwater, K7UGA. This concluding installment describes our visits to hams in Jamaica, Curacao, Venezuela, Grenada, St Lucia and Martinique.

Jamaica

From New York I wrote a letter to the Jamaica Amateur Radio Association, telling about our trip. When our ship, the MS *Istra,* docked in Kingston, a welcoming group was waiting for us. There was Lloyd, 6Y5LA, Eric, 6Y5ED, and his 12 year old son Earle, who is second operator. Earle, believe it or not, copies code at 30 words/minute.

After the customary sightseeing, we visited the headquarters station 6Y5RA in the Red Cross building and later four other amateur stations. The first was 6Y5ED. Eric has a very good beam but no rotator. Every time he wants to change direction, his second operator Earle runs up to the roof, climbs the tower and turns the antenna.

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George, 6Y5GB, in Kingston, Jomaica, with a small part of his gear, is quite active on SSTV.

The second station was 6Y5LA; Lloyd is the president of JARA and he does a lot for the Association. We also visited Ruel, 6Y5RS, whose very neat station we operated for about an hour. Ruel is one of the pioneers in radio-communications and most of his early work belongs to history. The last amateur we visited was George, 6Y5GB, whom I worked on SSTV. George lives in a story book palace and has more gear than he can ever use.

It is not difficult to get a license in Jamaica; it may take a few weeks but JARA can help to cut the red tape. Contact Lloyd, 6Y5LA, for details.

The Jamaica Tourist Board puts out a booklet, "Interesting People," listing many Jamaicans by their hobbies and interests like Astronomers, Botanists, Historians, etc. The "Amateur Radio Operators" column lists 9 hams with their addresses, all desiring to meet visiting hams.

Jamaica has very nice places, easy to reach, and as my friend Tony, G3SKR/W2, would say "there they don't drive on the wrong side of the road."

I strongly recommend a vacation-DXpedition in the 6Y5-land. You and your family will have so many things to do and see, that any visit will seem too short.

Curacao

About 2 years ago, I had a QSO with Dick, PJ2CQ, and after learning that he's also in broadcasting, I invited him to New York. He came and stayed with Eva and I for a couple of days. We have a "Welcoming Center for Foreign Amateurs Visiting New York City" and we took him sightseeing, to the radio stores and he even had a chance to study the set-up of CBS-TV, the company I work for. I was sure that if I ever went to Curacao, I would have a good host.

In Curacao, Max, PJ2CE, shows Steve the world's second largest oil refinery.

Unfortunately, when our chance came, Dick was not available. Instead we met Max, PJ2CE. I worked Max when he was on a little DXpedition to Aruba. With Max as a guide we saw what is perhaps the world's largest oil refinery, various housing projects, a large phosphate deposit, even a jail complex. At Max's house we operated PJ2CE and chatted by telephone with Jose, PJ2MI, a good friend whom we first met as PJ7JC in St. Maarten.

The center of Willemsted, Curacao, especially the Otra Banda, closely resembles Amsterdam: the same colorful houses, the same decorated gables, the same small stores. The Dutch influence is visible everywhere.

Interesting point in Willemsted: the public phones are free.

Outside Willemsted we saw groups of huge cacti. Steve, my father-in-law, wanted to be photographed with those grandiose but spiny plants. I told him to get into the cactus bushes and smile. The deeper he went, the less he smiled. I kept ordering him deeper and deeper and I was just sorry that my mother-in-law was not with him.

I recommend visiting Curacao and if you bring along your mother-in-law, this is the place to photograph her. If you intend to stay a little bit longer and operate, you have to apply well in advance for a PJ9 call. Don't trust the "duty free" prices; before you buy anything double check with known home prices.

Venezuela

Even though we were born in Romania, we are Hungarians. In Caracas we had the pleasure to meet Hungarian born amateurs: Cornel, YV5CFV, and Helen, YV5CKR, with her family.

We'd had a few QSO's with them, but never met them before. When our ship docked at La Guaira, the port of Caracas there were many people waiting. Which ones were the hams? I went to the upper deck, so everyone could see me, and started to yell: "Calling CQ, calling CQ." Hundreds of people looked at me with interest, but two of them threw their arms in the air, starting to jump like in an Indian rain dance, and calling me back. There they were: Cornel and Helen.

They had come a long way from Caracas to meet us and they took us back to their capital city.

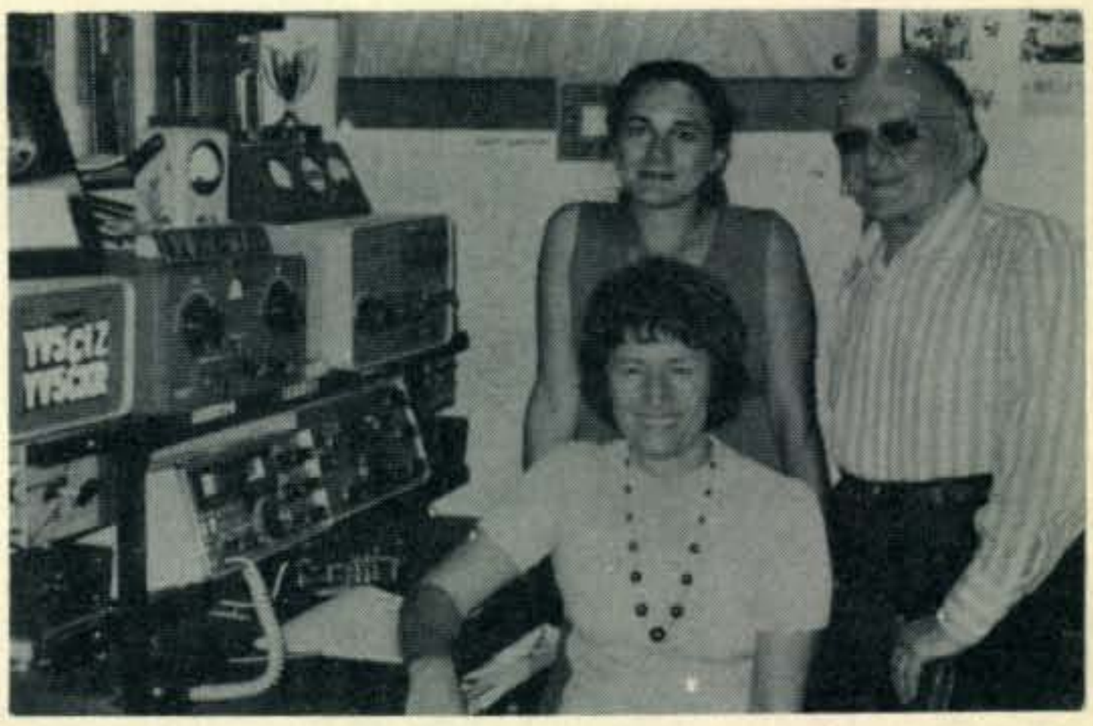
In Caracas we visited the "Radio Club Venezuelano" and their club station, YV5AJ, where we met Cesar, YV2TV, one of the club's most active operators.

After a short sightseeing tour, we visited Cornel's house and his station, YV5CFV. We made a few QSOs and a W6 congratulated me for my excellent English. I know that for an YV5, my English is OK, but for a WB2, my English has a thick DX accent.

Later we went to see Helen's station, where we met her husband Laci, YV5CIZ, and her son Laci Jr., YV1ACI, nicknamed Cika, all active hams. Helen is also an excellent amateur painter.

What is a common language between a Romanian (my father-in-law Steve), some Americans (Eva and I) and a bunch of Venezuelans? Hungarian of course. We exchanged notes to find out that there are perhaps hundreds of Hungarian speaking hams around the world.

Caracas is a beautiful, modern city located in a deep valley. So how come those YV signals are always so strong? I think because one Venezuela kilowatt equals 3



Helen, YV5CKR, in Caracas, Venezuela, welcomes Eva, WA2BAV, and her father, Steve.

Stan, VP2LC, the Police Commissioner of St. Lucia, receives George, WB2AQC.

California kilowatts. And one California kilowatt equals 3 East Coast KWs. And—as everybody knows that—we, on the East Coast, are the only legal ones.

I recommend the local "creole" food specialities. The cooking is made locally but the recipes are made in Heaven. Don't try to visit Caracas in one day, as we did, it is well worth a longer stay. . . even if you don't speak Hungarian.

Grenada

As I did the last time we visited St. George's, I called up the local broadcasting company. One of the hams working there told me to meet Evelyn, VP2GI. Evelyn, a busy businessman, lives in the center of the city, but took time out to drive us around.

We later visited Mike, VP2GAE, who was about to move to Canada, and Leroy, VP2GAI, who hopefully will not give up his rare VP2G call for a common VE call.

In the evening, a local steel band boarded the ship to serenade us. It was OK but about 60 db above the level at which I usually enjoy music.

Grenada, the Spice Island, is worth one day stopover. If you go to the beaches, don't take your cash with you. Most of these islands don't have sophisticated banking or finance, but some individuals are real experts in transferring funds.

St. Lucia

I don't believe in miracles but when just before our trip, on a "dead" 10 meter band, comes Bob, VP2LI, and sets up a personal meeting, I have to revise my belief. This was special luck because Tim, VP2LT, did not answer my letter.

The minute we arrived at Castries, I called Bob, VP2LI, chief engineer of a microwave communications station. He arranged for us to meet Stan, VP2LC, Police Commissioner of St. Lucia, John, VP2LAW, a radio technician from England, and Greg, VP2LG, whom we met on our first visit.

Stan, VP2LC, gave us a police car and an officer as a guide to take us sightseeing. My father-in-law was very impressed riding in a police car; he'd done this before, but now for the first time, he was riding in the *front* seat.

We went to meet Bob, VP2LI, up at his station. The "rig" is not unusal but the 20 and 30 foot parabolic dishes are quite impressive. From his mountain top QTH there

Around Castries we saw some beautiful villas, but for every good, solid house, we saw hundreds of shacks where the whole family cooked, ate and slept in one room.

St Lucia has nice spots, friendly hams, but I wouldn't spend a longer vacation there.

Eric, 6Y5ED, and his 2nd operator, Earle, age 12, who copies code at 30 words/minute.

Martinique

As we docked in Fort-de-France I spotted Fan, FM7WN, and Brother Vincent, FM7WG, who came to welcome us. I met Brother Vincent on a previous trip and recognized Fan from his photo-QSL card.

With Fan and Vincent, we toured the city, then the countryside. We drove to Mount Pelee, a volcano which in 1902 erupted and destroyed the whole capital city of St. Pierre, killing everybody except a prisoner in the jail's dungeon. Now the volcano, with its top in the clouds, was quiet and harmless, so we did not see any good reason to get arrested.

We had lunch together and I have to recommend the local cuisine.

After a day of sightseeing we visited Fan's house and operated his station, using his callsign FM7WN.

First Eva called CQ and was answered by Car, WB2LRK, a good friend of ours from our home town, New York City. It's really a pleasure to take a long trip to faraway places, then to sit down at a radio station and talk with your friends back home. We gave Car a new country for DXCC.

I made a few QSOs and even sent a message to my boss at CBS-TV, that we are OK and I'll be back on time. During each of our trips I've sent him that same message because he's always worried that I'll overstay my vacation. Due to circumstances beyond my control, this time I really was back in time.

We also visited the grammar school where Brother Vincent teaches. If you think 20 meters is noisy during the phone portion of the *CQ* World-Wide DX Contest, visit a grammar school in recess.

Bring more than enough film with you, because if you have to buy it locally, you may have to pay double the price at home.

Don't be over-confident that your English is good all over, unless you only want to get information about Martinique, from other American tourists who know less than you do.

Epilog

Graham Green wrote a very funny novel: *Travels With My Aunt.*" If my travelogue is not so good, it is only because my father-in-law is not as funny as Graham's aunt. So every complaint should go directly to my father-in-law, and to his wife who took all the fun out if him. ■

Results of the 14th Annual CQ 160 Meter DX Contest

BY CHARLES M. O'BRIEN,* W2EQS/9

CONDITIONS for the 1973 *CQ* 160 M. DX Test were great. Do you or do you not agree? European signals on the east coast (some were heard far to the west) were only fair the first night, but great the second. Caribbean, South American and Central American signals were terrific both nights. The second night European signals were QRMing each other to an extent hardly believable but many Ws were knocking them off like ten pins on the first call while others kept calling and calling before finally getting an answer from but a few. Frustration! Egad!

Once again, someone was looking out for us, for as comments from logs indicate, all over the country and throughout the world they never heard so much DX or so many different countries.

But the word "frustration" is still an enigma to many. As for me, these were my last few days in New Jersey before moving to Indiana. And such an ignominious way to bow out as W2EQS/NJ. At 0730 GMT Sunday I blew a fuse in the transmitter. And where were all my replacements? In Indiana, naturally! C'est la vie.

The 1972 contest broke all previous records by a good margin, and those 1972 records were smashed again in '73 . . . and by a good margin—proof that on the whole conditions were excellent. Would you believe 47 countries from all continents? The 1971 record was 38. 1972 brought 43. What will the '74 'Test bring? You might be interested in what countries were on but from which no logs were received: CO, DX, GD, GI, HR, OHØ, PAØ, UA, UB, VP2L, VP5, VS6 and 4W1. UA and UB are suspect, but in the past the USSR has permitted amateur operations on this band.

For two consecutive years we had operations from all 50 states, but this year one was missing. Where were you, Rhode Island? There were even three KL7s on!

Other statistics: Up to 1972 the highest multiplier ever made in this contest was 69. This year four exceeded that mark . . . K1PBW/1 (77), KV4FZ (73), W3IN (73), and W5SZ (71). In 1972 5 stations exceeded 300 QSO's. This contest it was seven led by W3IN with an amazing 373. In 1972 the greatest number of countries worked was 22. 1973 saw six fellows surpass that mark with K1PBW/1 and KV4FZ leading the pack with 28!

The case of the missing VE's has been a mystery for years, but we did receive three more Canadian logs than last year. Missing Provinces were Prince Edward Island, Alberta and Northwest Territories. VE8OK, where were you?

Many complaints are received about W/VE working and/or calling in the "DX Window." This is unsportsmanlike conduct. In the future, W/VE's ignoring warnings that they are violating "The Window" will be disqualified. Most of you know of the "DX Window" (1825-1830 kHz) but preferably W/VEs should remain below 1823 or above 1833.

Once again may we request the phone boys to operate 1835 kHz for this one weekend only? Thanks, fellows. Remember that this contest is a yearly event scheduled to run over the last

W1GBP and his kite supported 160 M. vertical antenna stunt. Mission aborted because of no wind over contest weekend. Gets pretty cold with lots of the white stuff on the ground in New Hampshire in January.

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full weekend of January from 2200 GMT Friday to 1600 GMT Sunday.

A most attractive certificate will be sent the winners in each State, Province and DX country and, in cases where scores are close, one will also be sent to 2d and 3d place stations.

Comments

1st District — *W1WY:* Condx very good N/S. New ones VP8KF, LU5HFI, ZP9AY, CP1EU. *K1PBW/1:* I was very, very lucky. It must have been saving up all that time I was off the air (Ernie's entire house had burned practically to the ground just a few months prior—*ed.)* because I have never been so fortunate to be able to work 5 new countries in one night—especially with all the easy ones gone by now. And, if that wasn't enough, I managed to dig out another new one the following night. Just got over the London flu, marginally, the day before and still felt queasy Friday at 5 but body and soul managed to hold out. *W1B1H:* By accident I ran across your 1933 QSL today and thought you'd like to see it. How about that? 40 years ago we worked on 160 and I've been off the band from that time to just recently. *W1VF:* My 1st time in this Contest. Met many old friends and enjoyed myself. The band was really jumping. *W1MX:* This was my 1st try. Would have done better had I read the rules more carefully. Not until early Sunday did I know how much each DX contact was worth! *W1GBG:* Competition was stiffer this year. Last year I worked most DX on 1st or 2d call but this year it took many, many calls even to work the "easy" DX stations *W1BB/1:* Great time working DX! Amusing/thrill trying to raise G6BQ for over an hour. He very QRL. Then raised VP8KF first call!!! Made 53 DX QSOs to 23 countries (25 including W/VE).

2d District — *W2EQS:* Had been tuning for ZD9BM for years but never heard a peep. Then comes his log and wasn't I one of the few Ws he heard. *W2AZQ:* Invisible shield effect on 1st day but enjoyed 2d day very much. *W2HUG:* Same equipment I've used in every *CQ* 160 Contest since it started. *WA2SRQ/2:* Here's a picture of the antenna we used. This is the Loran A transmitting tower at the U. S. C. G. Electronics Center in Cape May, N. J. We obtained their permission to use it. The antenna is a 140' tower with insulated base, non-conducting fiberglass guy ropes and a ground system of 120 quarter wave radials. That little box at the base of the tower houses the matching network which, fortunately, was flexible enough so that we were able to tune out the reactance at 1810 Hz. The water in the upper part of the photo is the Atlantic, a few hundred feet from the antenna. The thing worked even better than we had hoped it would. Hope to participate next year from the same location.

3d District — *W3IN:* Couldn't beat last year's OSO total but DX contacts far more numerous. Practically no EU 1st night but many the 2d. *W3BUR:* Two KH6's in 2 minutes. Need KL7 for WAS! *W3AJS:* Biggest thrill working so many 6's and 5's. Big gripe: US c.w. and phone QRM in 1827 slot. Unable to work any foreigners there for past year. A very fine, lively contest.

4th District — *K4MG:* Band condx Friday night fabulous. Sounded like 40 meters during early '30s. Too many stations for 25 Hz but a 500 cycle filter sure beats old 3.1. *W7UXP/4:* Just moved to Florida from Hawaii and didn't get a good antenna up. Plan a better one next year so will be more competitive. Am ex-KH6HCM. *K4BHG:* Condx were best of the 3 years I've been in the Contest. *W4OZF:* 1st *CQ* 160 Contest. Enjoyed it very much. Hope to put up a real antenna for next year's affair. *WB4VUP:* QRM was murder. Sounded like c.w. SS on 20 m. Condx excellent here but antenna gave out at 2 A.M. Sunday. *W4YWX:* This was a great contest! Have just put up new Heights tower at 88' and 160 meter inverted Vee is at top. Worked VP8KF, LU5HFI and ZP9AY in 14 minutes for new countries.

Betcha you didn't know there was a gal behind the key at YV5CKR, eh? Helena is chief operator of an all ham family: YV5CIZ, the OM, YV5ACI/5, son.

Here's Bill, K2GNC, known to so many of us. The antenna is two 90' top loaded phased verticals for 160, spaced 130' with switchable direction.

5th District — *W5SUS:* Condx were pretty good and made the most DX contacts of any 160 contest in which I've taken part. Hope to be with you for many years to come. *WA5QBO:* New 340' end fed antenna works well. Still think if stations would spread out a little it would make test less QRMey and more fun. Biggest thrill working KH6CHC. *K5MAT:* Missed R. I. again this year, darn it. Sure wish the CQs wouldn't get so long when things start to drag. Several guys missed me because I got disgusted. 3 X 3 is plenty at any stage of a contest. Heard quite a bit of DX. *WB5BHN:* I had a "better" antenna this year but spent too much time goofing around at the NMSU station, W5GB. *W5SZ:* Worked 2 VE1's and both were in Nova Scotia. What's the odds on that? Also, where were Vermont, R. I. and KL7? *W5SBX:* Biggest thrill was having both ZP9AY and VK6HD answer my CQs. Condx excellent Friday; high power line noise Saturday held QSO total down.

6th District — *W6AMO:* Made my best score so far but don't know if due to low sunspots or to my new 73' vertical. Condx were good but very few sigs heard from W1-2-3 thru QRN level here. Sigs from JA were strongest heard here since 1968. *K6UA:* Have phased 130' verticals and a Rhombic so did well on JA's. Called and called G3YUV but no luck. *W6GWQ:* Another fine Contest. Condx were very good for this area on the 27th. See you next year. *WA6VNR:* This was my 2d 160 Contest. Enjoyed every minute. Condx better than last year or could be my improved antenna. *K6BCE:* This was my 1st attempt at operating on 160 and am very excited at what can be done on this frequency. I have a 150' tower on top of a hill and I cut a half wave dipole for 160 stringing it to the tower in a sloped configuration. With the addition of nearly a mile of ground radials this proved to be a highly efficient radiator.

7th District — *W7HZL:* Had to work in lumber mill this weekend. Sorry! *W7JRG:* Biggest surprise having LU5HFI come back and give me 589 when I was hearing him only 449. *W7MKB:* Heard 2 other Montana stations on this year (3 of us)!!! *K7ICW:* Had a great time. At last I have an antenna that works and can do a respectable job. Was fortunate to work W3GL in Delaware for State #48. Need only confirm R. I. and work Vermont for WAS. The band is really getting to be good. *W7AVV:* Condx much better than last year. Didn't work anything new but had the usual good time. *WA7RTA:* Great fun! 1st contest of any kind. *WA7OAU:* Condx good! *W7ZC:* Biggest thrill was QSO with QRPPer K8EEG/0 with 4 watts at his end. Do not approve lumping multi-ops with single op stations. *K7IDX:* ZL1BKZ super loud both mornings. Good N/S condx especially 1st night.

One of Europe's best known 160 meter DX operators, OK1ATP, Jarda. He's given many a ham his first OK QSO.

8th District — *W8KAZ:* Nice Contest! *K8CCV:* Murphy's law still in effect. Still need KL7 for WAS. *W8PCS:* Didn't hear so much DX this year but enjoyed it anyway. *WB8APH:* Had great WX for my balloon during test...no wind. Was too tired to bring it down. Went to bed Sunday morning. Wind was about 40 m.p.h. when I woke. The balloon and part of antenna were long gone—hi! Tnx to all for great Contest. *K8OQL:* Worked 5 new States toward 160 WAS. Lots of fun trying to sandwich Contest in with college homework and a dose of the flu. New dipole makes working West Coast easy. *K8HKB:* The balloon supported half wave vertical sure worked great. Hated to take it down.
9th District—*K9CUY:* Lots of DX heard even though receiver was in trouble. *WB9BUV:* Heard GM, HR, PY, KH6, KP4. Condx not good. Heavy work schedule here so low score. *W9PNE:* I still enjoy contests after 41 years of ham radio. The *CQ* WW 160 Contest is my favorite. DX condx were unstable but I did work 15 countries. Two of these were new ones for #66 and #67. *W9YYG:* Biggest thrill was working VP8 on 1st call. *W9ABA:* Starting Saturday afternoon my noise level rose to S-8/9. Hence, no operation possible except with only the loudest stations.
10th District — *WØNFL:* Good Contest this year. As good as condx were, we didn't hear any EU. They may have been there under all the lids calling CQ Test in "Window." Wish, we could get FCC to ban 1825/30 to U.S. Would make DXing more enjoyable. *WØPSF:* Worst score for long time. Had a bad spurious signal develop. 2nd night had 60 m.p.h. blizzard (all roads 200 miles closed) and tin shed really shook. *WØA1H:* Absolutely the best condx I've ever heard, especially Australia. Heard ZL1BKX but condx made him fade out. *W2TA/0:* Wait 'til next year!!! *WBØBQA:* Unfortunately I was rag chewing on 20 meters the 1st night forgetting about the test. The 2nd night I did about as well as the 1st—hi! *WØRHI:* Good Contest but power should be lower. *WØOFX:* Condx good 'til snowstorm Saturday P.M. Power was of intermittently Saturday from 1800Z until 0700 Sunday when it went off entirely. So had to QRT. Heard lots of EU sigs as well as South America, VK6 and the Pacific but no luck. Tnx for nice Contest.
Canada — *VO1KE:* Funniest story was discovering that .001 bypasses weren't big enough for 160/getting a blast from W1BB/discovering VO1FB was getting nowhere also. *VE1ASJ:* Lots of fine DX on this year but I just didn't have the time to spare. Had company. But, EU sure was rolling in. Incidentally, any time I went back to DX the W's would go in the DX Window calling me. So this is one reason I didn't stay at it longer. By the way, the JA/5Z4 QSO was the first ever between those two countries and I'm sure the LU/ZD9 was a first also. (Andy was kind enough to forward the logs for both ZD9BM and 5Z4KL—*ed.*). *VE2SD:* Had bad line noise; also heavy radio aurora—no visual. *VE3DU:* Condx weren't the best and the 1st part of both evenings signals from the east were very poor... in fact, on Saturday evening not much got thru here 'til about 0430Z. Didn't hear a single EU here but skip seemed good with plenty of DX signals to the south and west. *VE5XU:* The South American path was the best ever heard. All other directions below norm. Worked both nights 'til 0630Z so operating time restricted. *VE7HQ:* There must be a lot more stations on 160 now—more contacts and more QRM! Heard many Easterners but had trouble working any. Even changed direction of my inverted Vee legs between the 1st and 2nd evening but no improvement. Best DX were the KH6 stations. Heard ZL1BKX who had a really good signal, VK3QI and JA1YAC but no QSO with them. Will have to have some kind of vertical antenna for next year I guess.

DX DX DX DX DX DX DX DX DX DX
KL7HGA: During Contest I operated from the KTKN radio transmitter building using the station's 300' tower. KTKN signs off the air at midnight and on at 6 A.M. so my operating time was cut down considerably. But, with the tower, I was able to work almost everything I heard. According to my scratch pad, the only ones I heard but wasn't able to work were W5SZ and W0OAW. I called them quite a few times but apparently I was too weak for them to copy. As usual, the Contest was very interesting but I'd love to get into a 160 contest some year when the aurora is quiet and the band wide open. *LU5HFI* (ex-HS5ABD): LU's 1HDC, 3HAK, 7HBH and I worked well into darkness getting the bottom half of a half-wave sloper" out into the underbrush of a neighboring field. The minute the antenna was hooked up it was noted that the band was lively and for the first night there was never a dull moment. The 2d night was a bust as static crashes covered all but four stations, all of them having been worked the night before. Next year a pair of 813's will be added to help get thru to the KH6's et. al. The champ for signal strength was WA2SRQ/2 who blasted thru at all hours overriding QRN and everything else. *VK3APN:* Hard work for us "down under" but fun. Called JA7AO many times without success. Listened to VK3CZ work a string of G's but didn't hear a thing from EU except DHJ—most frustrating! Thank you for an enjoyable contest. *VP7NY:* Didn't make as many QSOs as I had hoped to make. *8P6DR:* Something must be done about U.S. stations transmitting in DX Window. I may be in contest next year from G3RWL. *VP9BO:* As usual, a fine Contest. Condx good. Got a new country—PJ. *OK2BFN:* Heard PY1DVG, YV5CKR and 5Z4KL. *OL1AOH:* 1st night condx were very bad; 2d night quite good. But worked many less European stations this year as compared to last. *OK1DWA:* 1st night very bad condx. Very, very many strong stations from Prague. Quite a few stations from other European countries except OK. *EI9J:* Condx weren't the best but if my signal was a couple of S points better those are the condx that one could cash in on. During the time I was on I heard very little of interest. No signals whatsoever from South America though I heard you boys working LU and VP8. Some of the EU boys worked VK's but by the time I came on the band they had gone out though condx would need to be very good before I could have any hope of working them anyway. Heard, but only for a short while, 4W1AE and 5Z4KL. Still have to work 5Z4KL although I've called him a number of times. *G3KMI:* Oh, you can't beat a good contest. There's a strange sense of urgency about mending the rig at half three in the morning especially with KP4, 4W1 and W5 floating around! *OH3XZ:* Activity on 160 was quite high in EU. Some DX was heard and Central European stations called them but these signals were too weak in OH. Next year I will try with better equipment. *DL9KR:* (Where were you, Jan? Somewhere, but not on the air—*ed.*). *KH6RS:* At least 13 JA's know where to look for KH6—but ZL1BKX never did. Fun—for one night. *KH6CHC:* Loran gives me a headache. Have megawatt Loran line-of-sight from QTH.

Multi-op Station Operators

W1KVI/1: K1MTJ, K1RQE, WA1QZW, K1OYB. **K1VBL** & WA1KVY. **WA2SRQ/2** & WA2WLN. **K2STO** & WA2FGF. **WA2SPL** & WB2OEU. **K5LZJ** & K5RLW. K5SOR. **W5YG:** WA5FTP, WA5RRL, WA5RXT, WA5TIY. **K6BCE** & WA6NNJ, W6EEG. **W6JTB/6:** K6PJY, WA6GJW. **W7SFA:** K7JCA, VE7ZZ/W7. **K8HKB** & K8RNE, K8SJU, K8KRN, WA8MQQ. **K8KAS** & WB8BLL, W8JSX. **WAØCVS** & WBØDJY. **KØKU:** WBØFGV, WAØTKJ. **OK1ZDK:** OK1DHJ, OK1DAX. **OK1KRY:** OK1AOG, OK1ATC, OK1AQO. **OK1KPU** OK1AUN, OK1MUF, OK1RO. **G6UW:** G3YCY, G3YMH, G3ZAY, G3ZNU, G3YJW, G3XZP, G4AVK, G4ANB. **G3KMI:** G3WIE, G3ZBU, G3ZER, G3ZXR, G4APA. **G3PDL** & G3VIP. **GM3IGW/A:** G3IGW, G4MH. **GM3OLK/A:** GM3OLK, GM3FXM, **GM3**-PFQ, GM3YBQ, GM3YOR, GM4ALK, GM4AQO, GM4-BFQ. **GW3UCB/P:** G3WHK, G3WXS, G3XZK, G4BEG, GW4BGD, G4BRK. **GW3VUM** G3XDY, G3ZPY, G4ALS, G4ATK.
Check logs are graciously acknowledged from: OK1DPD, OK1FAR, OK1MAA and OK1-18735 and VK SWL, Eric Trebilcock.

The first column indicates the number of contacts, second is the multiplier, third is the number of different countries worked and the last column is final score.

Connecticut

K1PBW/1	303	77	28	85,470
W1WY	169	57	18	28,500
W1BIH	51	24	5	3,024

Maine

W1VF	81	39	8	9,438

Massachusetts

W1MX	277	68	21	53,448
W1GBG	201	60	18	34,200
W1HGT	102	44	21	25,872
W1PL	165	52	14	25,376
W1BB/1	65	31	25	17,174

New Hampshire

W1GBP	147	43	5	13,674
W2MNK/1	49	21	1	2,058

New Jersey

WA2UOO	241	57	12	32,946
W2EQS	180	53	15	25,864
W2AZQ	91	36	8	9,144
W2BP	42	30	17	7,560
W2GBY	90	37	5	7,548
W2HUG	90	39	7	7,208
W2CVW	37	16	2	1,568
W2MPP	8	7	1	112

New York

W2DXL/2	215	66	23	42,636
K2GNC	177	20	22	34,680
W2UWD	108	41	11	12,136
W2QIP	114	37	6	9,696
K2VGR	96	36	5	7,776
K2BQO	56	29	4	3,944
W2GP	40	15	2	600

Maryland

W3IN	373	73	23	80,154
W3GN	200	50	12	24,800
W3AXW	95	42	7	9,660
W3MAR	47	23	8	4,002

Pennsylvania

W3BUR	180	55	11	30,208
WA3HMM	116	41	8	11,480
W3UHP	141	35	5	10,710
W3AJS	141	34	2	9,996
W3QOR	91	25	4	4,950
WA3PFQ	12	10	1	240

Alabama

K4MG	102	36	5	8,352

Florida

W4BRB	175	60	18	33,480
W7UXP/4	207	57	15	30,438
K4BHG	158	54	16	23,976
W4OZF	120	45	12	15,120
WB4VUP	129	42	5	11,844

Georgia

W4YWX	302	69	21	54,342
WB4RUA	76	38	5	6,764
K4BAI	66	28	2	3,640

Kentucky

K4GSU	223	65	21	43,550
W4GHS	207	56	11	27,888

North Carolina

W4TMR	237	54	8	27,000
WB4CIN	120	36	5	9,404

South Carolina

WA4YZC	151	58	13	24,708

Tennessee

W4HYY	106	46	11	13,032
W4UD	82	29	3	4,988

Virginia

W4QCW	114	53	24	25,064
WA4RGH	94	31	6	6,820
W4KFC	50	23	3	2,484
W4WSF	40	20	3	1,920
W4GF	46	20	2	1,840

Arkansas

W5SUS	251	62	17	38,068
W5MYZ	56	31	1	1,736

Louisiana

WA5QBO	194	56	13	27,104

New Mexico

K5MAT	126	47	5	13,348
WB5BHN	70	35	4	5,460

Oklahoma

K5JVF	77	46	3	7,452

Texas

W5SZ	351	71	21	62,338
W5SBX	266	64	18	43,264
W5RTQ	258	64	18	42,752
W5FIX	88	41	4	7,772

California

W6ITY	195	64	18	37,248
W6YRA	165	53	14	24,698
W6AMO	150	43	7	15,996
K6UA	53	26	20	14,040
W6UA	95	39	7	9,594
WA6PGB	106	34	5	8,296
W6DQX	102	32	5	8,064
W6GWQ	79	31	7	7,006
WA6VNR	98	27	2	5,292
W6MAR	56	29	4	3,712
K6YB	29	19	4	1,558
W6KG	31	15	4	1,170

Idaho

W7HZL	21	5	2	210

Montana

W7JRG	81	36	4	6,408
W7MKB	16	10	2	320

Nevada

K7ICW	90	41	3	7,708
WA7CWM	88	31	3	5,642
W7ABX	61	17	2	2,074

Oregon

W7AVV	104	36	6	9,072
WA7RTA	93	31	4	6,510

Utah

WA7OAU	118	45	5	12,420
W7ZC	125	42	3	10,836

Washington

K7IDX	113	40	8	14,960
WA7ILC	114	31	8	11,396
WA7OFH	102	35	5	9,100
W7FIM	28	8	2	448

Michigan

K8VQP	217	52	8	25,480
W8KAZ	170	39	4	13,884

Ohio

K8CCV	277	63	19	47,376
W8PCS	75	30	3	4,740

West Virginia

WB8APH	195	47	7	19,834
K8OQL	117	37	4	9,250
K8QYG	22	13	1	576

Indiana

WA9AUM	132	42	6	13,104
K9CUY	65	30	4	4,380
WB9BUV	50	28	5	3,248
W9LVH/9	53	24	4	2,832

Illinois

W9DL	337	67	14	53,198
W9PNE	164	59	15	26,432
W9YYG	144	54	14	17,658
WB9BMY	136	42	5	12,432
W9ABA	109	35	3	7,840
K9KEP	54	28	2	3,024

Wisconsin

WB9AVN	40	18	1	1,440

Iowa

WØNFL	213	62	16	34,968

Kansas

WØIUB	136	44	3	12,320
WØPSF	125	43	5	11,911

Minnesota

WØAIH	268	82	20	45,074
W2TA/Ø	213	48	9	26,950
WBØBQA	51	29	4	5,346
WØRHI	66	35	2	4,660

Missouri

WØOFX	180	51	7	20,400
WØBV	59	30	2	3,540

North Dakota

WØZTL	96	42	2	8,064
WØSDN	79	43	2	7,138

South Dakota

K8EEG/Ø	74	38	2	5,624

Canada

Newfoundland

VO1FB	44	17	6	3,500
VO1KE	14	9	3	324

New Brunswick

VE1ASJ	85	32	6	6,464
VE1AXT	21	11	2	462

Nova Scotia

VE1CD	81	33	8	7,722

Quebec

VE2SD	41	16	2	1,312

Ontario

VE3DU	100	42	5	8,736
VE3BFK	103	31	2	6,386

Saskatchewan

VE5XU	63	34	6	5,372

British Columbia

VE7UZ	102	43	7	12,212
VE7HQ	81	20	2	3,240

Alaska

KL7HGA	21	5	5	1,025

Argentina

LU5HFI	62	27	7	15,768
LU5EVM	8	8	8	336

Australia

VK6HD	19	10	4	1,480
VK3APN	19	4	3	272
VK3ANU	15	2	2	72

Austria

OE1KU	65	7	7	2,254

Bahama Islands

VP7NY	33	16	2	5,200

Barbados

8P6DR	119	40	12	45,000

Bermuda

VP9BO	112	37	7	40,219

Bolivia

CP1EU	9	9	6	585

Brazil

PY1DVG	96	39	11	35,100

Canal Zone

KZ5LS	43	23	5	9,430

Czechoslovakia

OK1ATP	203	19	17	15,695
OK2BFN	141	18	15	9,468
OK1MCW	165	12	12	7,260
OL1AOH	147	13	11	7,137
OL5ACY	152	10	10	5,350
OK1JCW	146	10	10	4,930
OK1FCW	137	10	10	4,820
OK3ZAV	114	13	13	4,654
OK1DWA	122	11	11	4,620
OL1API	145	8	8	4,072
OK1DCW	104	11	11	3,718
OK1AMS	137	8	8	3,672
OK1IDK	98	11	11	3,652
OL4APS	113	9	9	3,168
OK1KOK	100	9	9	2,907
OK2SIS	107	9	9	2,864
OK2PDN	99	9	9	2,547
OK2HI	82	9	9	2,214
OK2PDJ	101	7	7	2,030
OK2PEE	76	8	8	1,888
OK5AQC	88	7	7	1,764
OK1DOW	79	7	7	1,673
OL5AQK	103	5	5	1,575
OK1JKL	70	7	7	1,463
OK1MG	55	8	8	1,432
OK1KIX	69	7	7	1,365
OK2PAW	70	7	7	1,295
OL6AQJ	74	6	6	1,176
OK1XC	60	6	6	1,080
OK1AIJ	67	6	6	1,056
OL8CAG	62	6	6	1,042
OK3ZAR	50	7	7	1,015
OL4AOK/P	54	6	6	990
OL8CAC	60	6	6	990
OK1JEN/P	56	6	6	852
OK2QX	46	6	6	768
OK1AXA	47	6	6	738
OK2BOH	60	5	5	735
OK3TFA	53	5	5	710
OK1FRF	34	7	7	686
OK1KZ	50	5	5	620
OK2SBJ/P	60	3	3	423
OK1AGW	45	4	4	420
OK1ARO	33	5	5	390
OL9CAW	30	4	4	264
OL9CAZ	12	5	5	240
OK2BBQ	16	5	5	235
OK2BCI	12	5	3	215
OK3TAO	20	4	4	208
OK1AEH	14	1	1	28
OL6AQN	13	1	1	26
OK3RJB	11	1	1	22

Eire

EI9J	107	22	14	14,740

England

G3VRW	194	15	10	11,115
G3VDW	102	8	8	2,400

Finland

OH3XZ	49	9	9	2,151
OH3NB	43	7	7	301

Germany

DJ5PN	164	25	16	22,375
DJØWJ	83	9	9	3,465
DK5CU	72	8	8	2,712
DL8CM	33	7	7	1,008
DJ2YE	14	5	5	305

Hawaii

KH6HS	120	37	7	40,774
KH6CHC	101	39	8	38,493

Iran

EP2BQ	50	11	11	2,750

Falkland Islands

VP8KF	58	29	10	15,225

Japan

JA3AA	67	8	7	1,760
JA7AO	73	9	7	1,737
JA1MCU	26	6	6	498
JA9YAP	52	3	3	345
JA6WGE	51	2	2	210
JA3AHQ	19	3	3	171
JA4ONZ	30	2	2	136
JA6AUX	47	1	1	94
JA4DDM	5	1	1	10

Kenya

5Z4KL	5	3	3	75

Marcus Island

JD1AGZ	4	1	1	20

Netherlands Antilles

PJ2VD	122	36	9	42,660

New Zealand

ZL1BKX	19	7	4	987
ZL1MQ	11	5	4	335

Paraguay

ZP9AY	36	25	10	7,875

Peru

OA8V	70	33	10	21,615

Puerto Rico

KP4AST	190	49	16	89,033

Scotland

GM3WDF	293	28	15	43,092

Switzerland

HB9UD	19	6	6	570
HB9QA	18	6	6	540

Tristan da Cunha

ZD9BM	3	3	3	45

Venezuela

YV5CKR	57	32	9	16,384

Virgin Islands

KV4FZ	295	73	28	193,231

Multi-Op Stations

Maine

W1KVJ/1	188	56	16	29,120
K1VBL	132	37	6	10,952

New Jersey

WA2SRQ/2	315	72	25	65,520
K2STO	100	31	5	6,200

New York

WA2SPL	230	62	17	39,432

Texas

K5LZJ	200	56	13	27,776
W5YG	173	53	11	23,002

California

K6BCE	215	61	16	35,658
W6JTB	103	31	5	7,130

Washington

W7SFA	197	54	11	28,728

Ohio

K8HKB	295	65	20	53,950
K8KAS	244	53	11	30,528

Colorado

WAØCVS	160	46	8	16,928

Kansas

KØKU	273	62	15	40,424

Czechoslovakia

OK1KZD	126	10	10	4,170
OK1KRY	108	9	9	3,141
OK1KPU	114	8	8	2,984
OK1KYS	64	10	10	2,170
OK1KCF	35	4	4	340

England

G6UW	242	24	14	23,448
G3KMI	213	21	14	17,304
G3PDL	175	22	16	15,400

Scotland

GM3IGW/A	272	25	17	35,725
GM3OLK/A	194	11	11	10,175

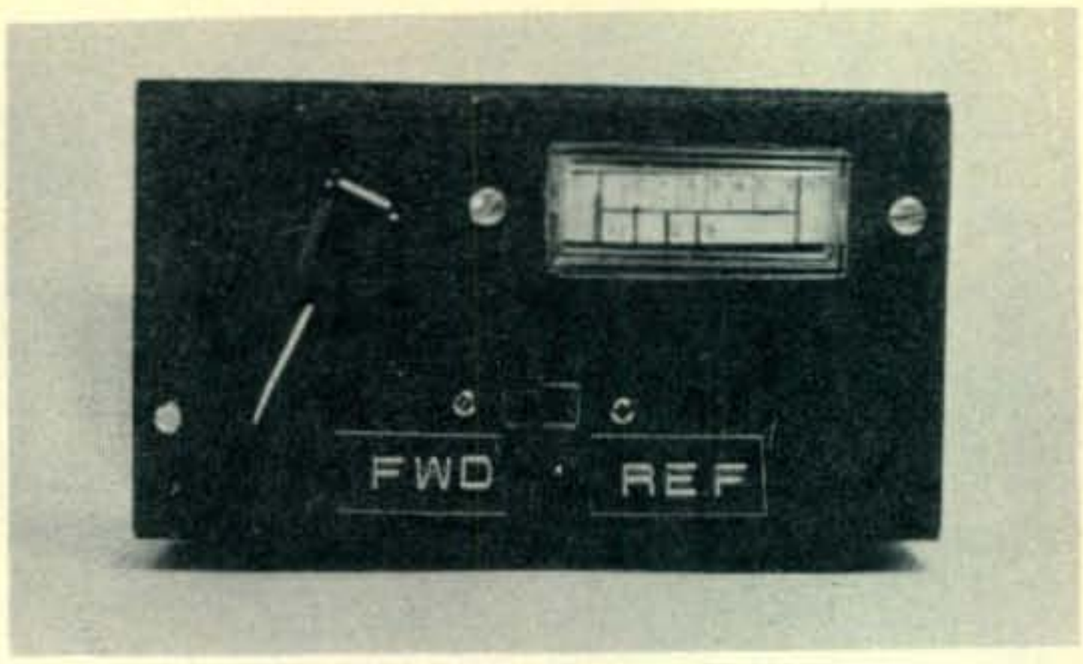
Wales

GW3UCB/P	173	14	12	12,180
GW3VUM	201	11	11	10,560

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG



Front view of the in-line wattmeter/s.w.r. bridge.

IN our last column, we stressed the importance of the QRPp operator having the capability of measuring output power from his transmitter. I hate to admit it, but I'm guilty of not practicing what I preach—not always at any rate. It's not that I don't have an in-line wattmeter—I have a couple of them. It is just a matter of failing to follow one of the cardinal rules of the QRPp art—constantly check every part of the station to insure that everything is operating properly and as expected. While my oversight didn't prove costly this time, it could have blown a chance to add countries #77-82 to the growing QRPp DXCC list at K8EEG for 1973. Here is how it all happened.

As everyone knows, 10 meters is as dead as the proverbial doornail—except that a good QRPp operator never takes anything for granted. He has to be there when that unexpected opening to some rare DX occurs—or he misses out on a clear shot at a new one. Well, it is a general rule of thumb in QRPp operation to operate on the highest frequency band that is open at the time. This is due to the fact that atmospheric loss decreases by the square as you move from one band to the next higher band. And so, on Sunday, October 28, I checked 15 meters before listening around on 20, which is almost always open. 15 was really crowded. So on up to 10 meters I went in search of an opening. And WOW what an opening it was! Now, during the peak of the sunspot cycle, this level of opening would have been routine. But for the bottom of the cycle, it was fantastic!

Since it was an s.s.b. contest that brought the signals on the band, I hauled out the old HX-20 which had been modified for QRPp years ago, hoping silently that the thing still worked on s.s.b. The calibrated in-line wattmeter was hooked up to the regular solid state QRPp rig, so I just tossed an old cheapie s.w.r. bridge into the line and fired up. With the quad pointed to the Caribbean, I worked VP1SYL on the first call. Excitement! Then PJ9GIW came back immediately. After sev-

*213 Forest Ave., Vermillion, SD 57069

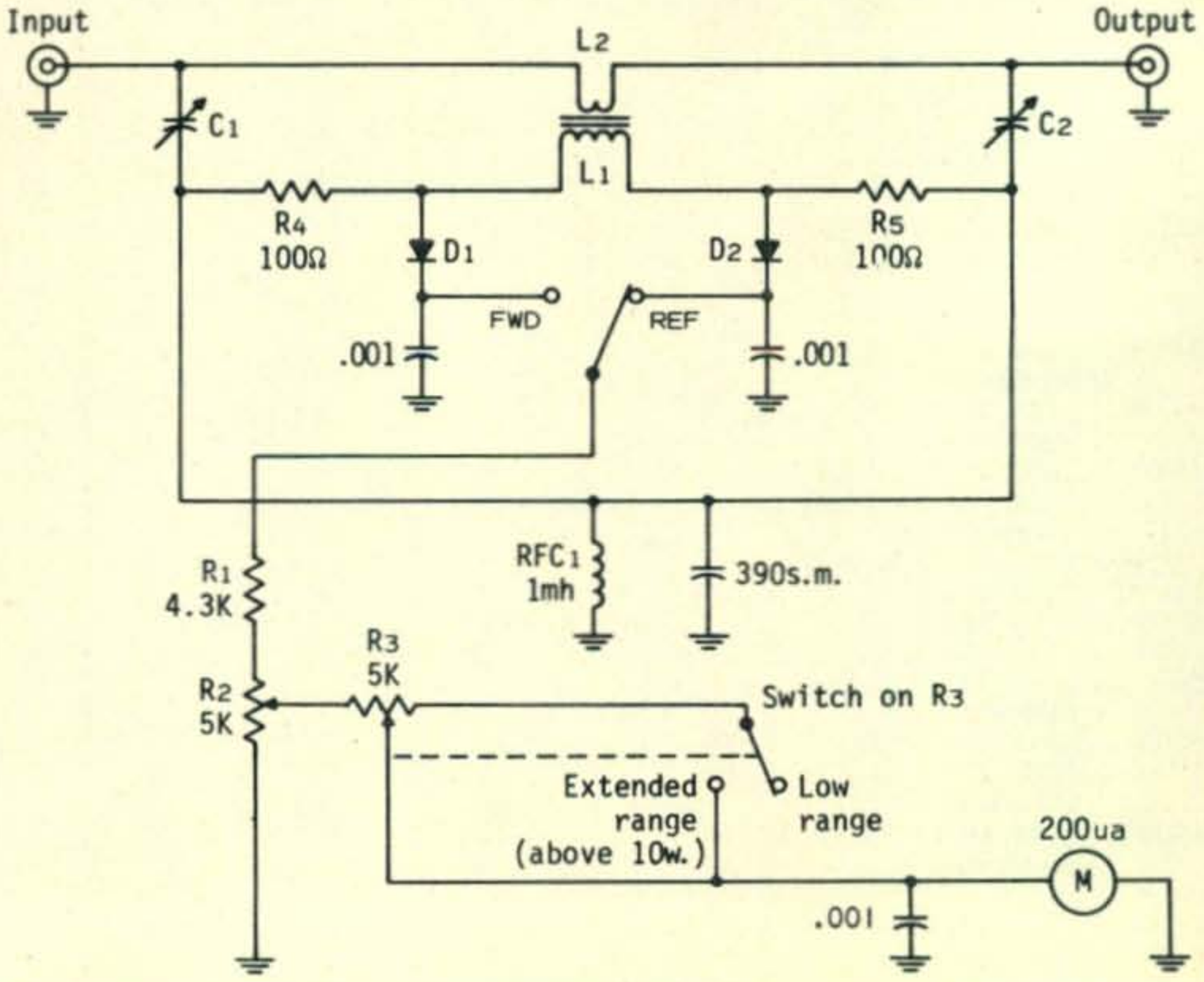


Fig. 1—A simple wattmeter /s.w.r. bridge using the popular Breune circuit. The 5k pot R_3 is wired so that in the off position there is minimum resistance between R_2 input and R_3 wiper output.
$C_{1,2}$—"gimmick" trimmer, 3-20 pf (see text).
D_1—1N34A, 1N60, or equiv. r.f. diode.
L_1—46t. #28 on Amidon T-502 toroid core. Wound in same direction of twist.
L_2—2t. #22 plastic link, inserted between ends of L_1. Wound in same direction of twist.

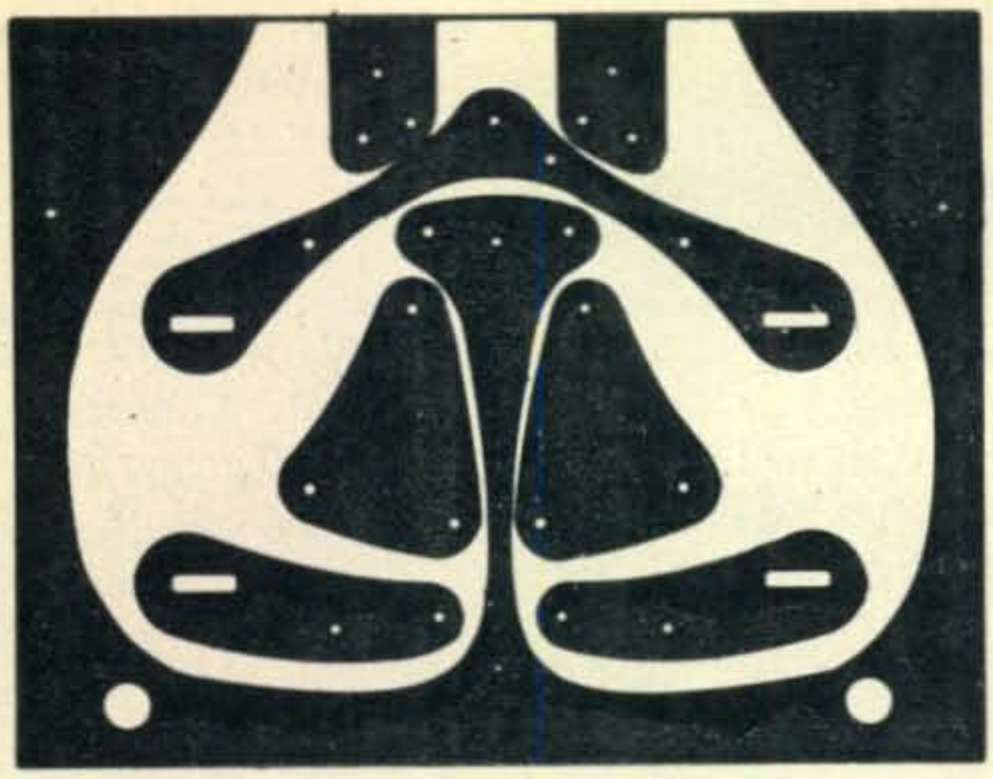
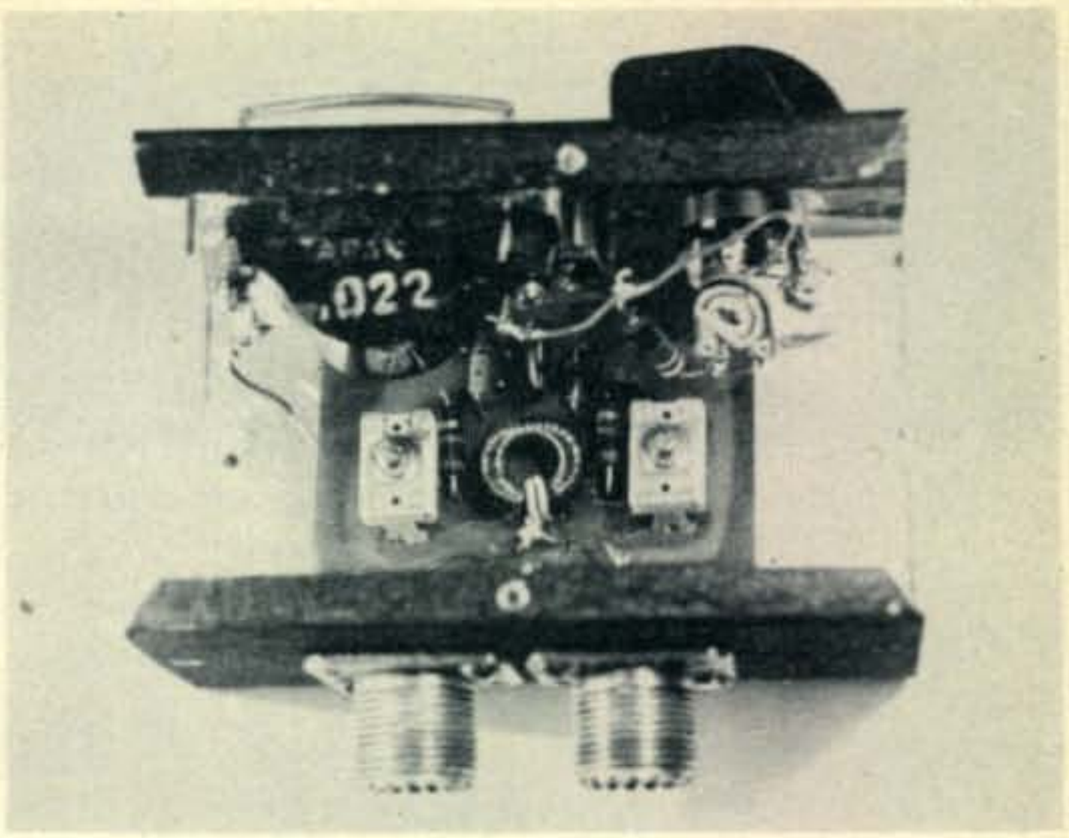


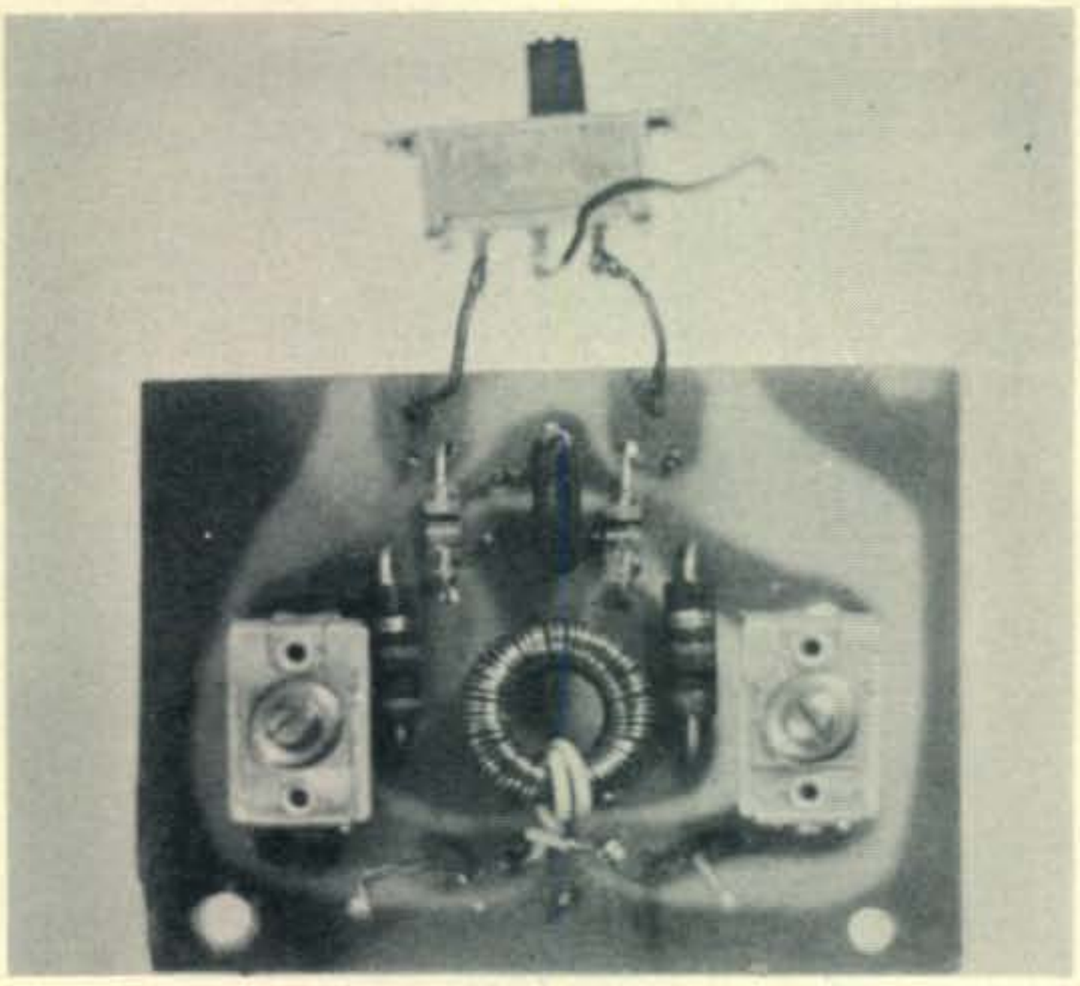
Fig. 2—Full size printed circuit template for the bridge. The foil side is shown.



Interior view of the QRP bridge.

eral calls, I managed to raise a really rare one —FGØAFA/FS7 on French St. Martins. Then came a half-hour stint of calling A2CCY in Botswana with no luck—and, finally, payday! I was so excited I blurted out that I was QRPp and back came his response: "(chuckle) yeah, QRPp you say. I worked you before. HA HA." So I repeated my "four watts QRPp" and got another "Go on, don't feed me that line!" What can you say when they don't believe you? That was the first hour of operation. Three new countries already. The second hour scored with KZ5NG, 9Z4LO, TI2WX, and PY1BAR. All 55-57 reports, with some difficulty getting through. Five new countries for the effort and that euphoria that goes with it. Now what does this all have to do with power measurement capability?

Quite simple. After going off the air, I decided to check the output from the rejuvenated HX-20. Four watts? Well, I broke out in a cold sweat and my stomach tightened into a knot when I realized that I could have missed five new ones because of slipshod carelessness —the HX-20 was putting out a rockbusting 420 *milliwatts!!!* I triple checked that to make sure. 420 milliwatts it was! The point is—if I had inserted the in-line wattmeter, I would have coaxed the maximum 2.8 watts from the rig to raise my odds. Maybe would have worked a few more new ones. Who knows? I was lucky this time. It won't happen again. Read on if you want to avert a similar near-tragedy.



Close up view of the assembled board. See parts placement, Fig. 4, next page.

In-Line Wattmeter/S.W.R. Bridge

Fig. 1 is a simple and accurate wattmeter/s.w.r. bridge using the popular Breune circuit. The major advantage of this circuit is that it

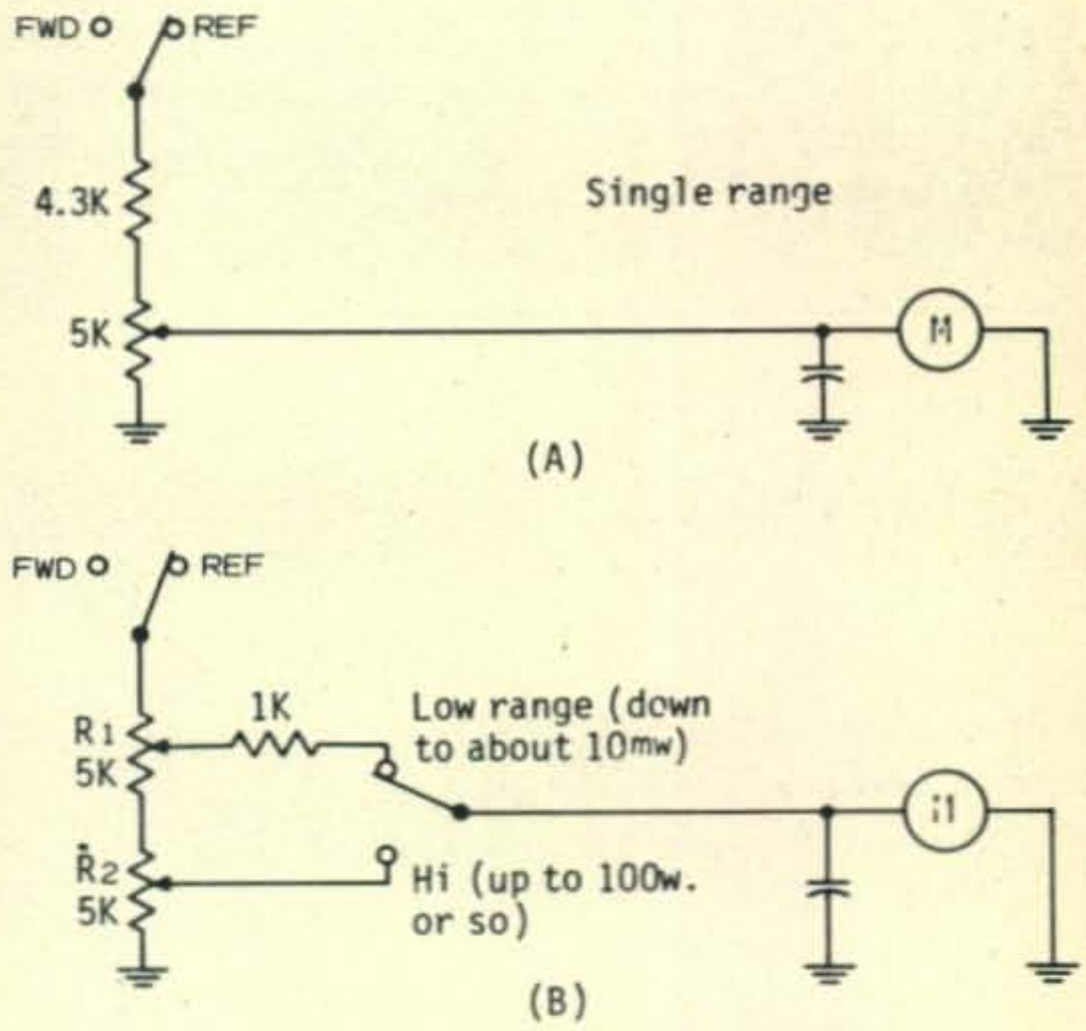
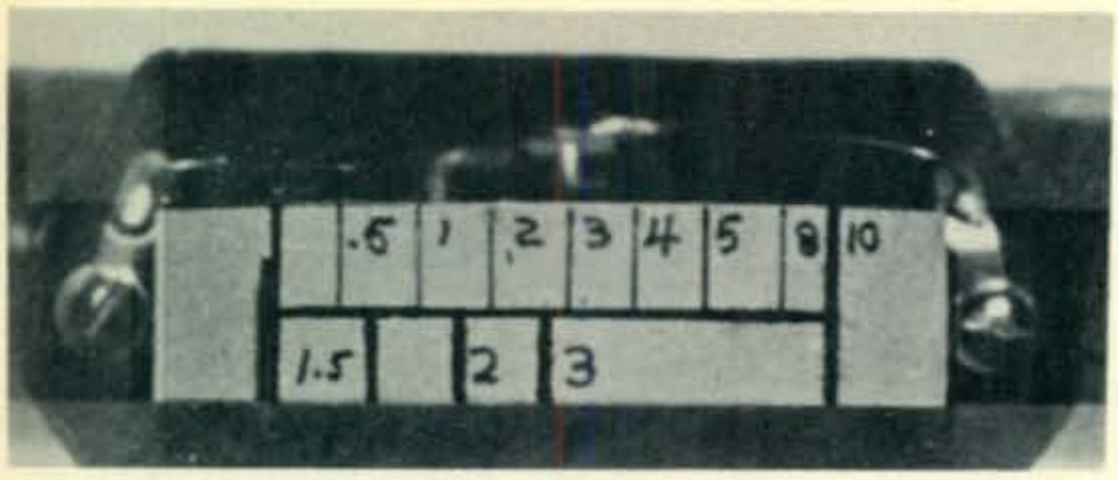


Fig. 3—(A) the modified circuit with R_3 eliminated. Additional pots can be included for extra calibration ranges as shown in (B). By using a separate pot for each range, as many ranges as desired can be added. In another meter, not shown, the above voltage divider is used to provide one watt and ten watt ranges.



Close up view of the meter scale.

is not frequency sensitive, as are strip-line bridges. The calibration is accurate on all bands within the h.f. spectrum. The circuit is quite simple. A two turn link is inserted in the feedline and coupled to a primary winding. Current from the primary is then rectified by one of two diodes for either forward or reflected readings, and d.c. metering circuit reads out the power moving through the feedline. A nulling circuit consisting of $C_{1\text{-}2}$, C_3, and RFC_1 eliminates any bridge effect on the feedline.

Sensitivity is determined by the meter movement, number of turns in the primary coil, and the resistive voltage divider circuit. In the meter shown, sensitivity is 200 ua, and with a primary consisting of 47 turns of #28, the instrument will register full scale needle deflection down to somewhere in the neighborhood of 10 milliwatts. The instrument of Fig. 1 is designed to allow full scale adjustment at from one to about fourteen watts. The potentiometer arrangement adds flexibility should the need arise to measure outputs higher than the present calibration.

A full size printed circuit board template is shown in Fig. 2. The p.c. board approach is especially valuable in an instrument such as this, where circuit balance is an important factor. Standard size components are used throughout. RFC_1 is mounted on the underside of the p.c. board, as are the two .001 mf bypass capacitors. Photos show the construction approach. The cabinet is homebrew and fashioned from aluminum stock. The two coax receptacles are mounted on the rear wall, and two pieces of #18 copper wire support the p.c. board once soldered to the receptacles. A short wire is connected directly from the coax receptacles to the nearest ground foil point on the p.c. board. The potentiometer R_3 is a miniature type, with s.p.s.t. switch included. R_2 is a p.c. board type subminiature potentiometer which is soldered directly to a terminal on R_3.

The project can be simplified by eliminating the extended range R_3. Or extra R_2's can be added and switched in and out to provide several calibration ranges as shown in Fig. 3.

While a pair of Elmenco subminiature trimmer capacitors are shown at C_1 and C_2, these can be replaced with a simple "gimmick" capacitor. The gimmick is made by twisting two six inch pieces of #22 insulated wire tightly together to form the two "plates" of a capacitor. During adjustment, the free end of the gimmick is clipped away an eighth of an inch at a time until the right capacitance is reached.

Adjustment and Calibration

When construction is completed, a non-reactive dummy load is connected to one coax receptacle, and an r.f. power source to the other receptacle. Before applying power, be sure that R_2 is at maximum resistance to avoid damage to the meter from the surge of power. Apply r.f. power, and place the FOR-REF switch in the position providing the highest meter reading. That becomes the FOR position. Switch to REF, and while observing the meter reading, adjust C_1 until a null is reached.

The same procedure is followed for the

[*Continued on page 80*]

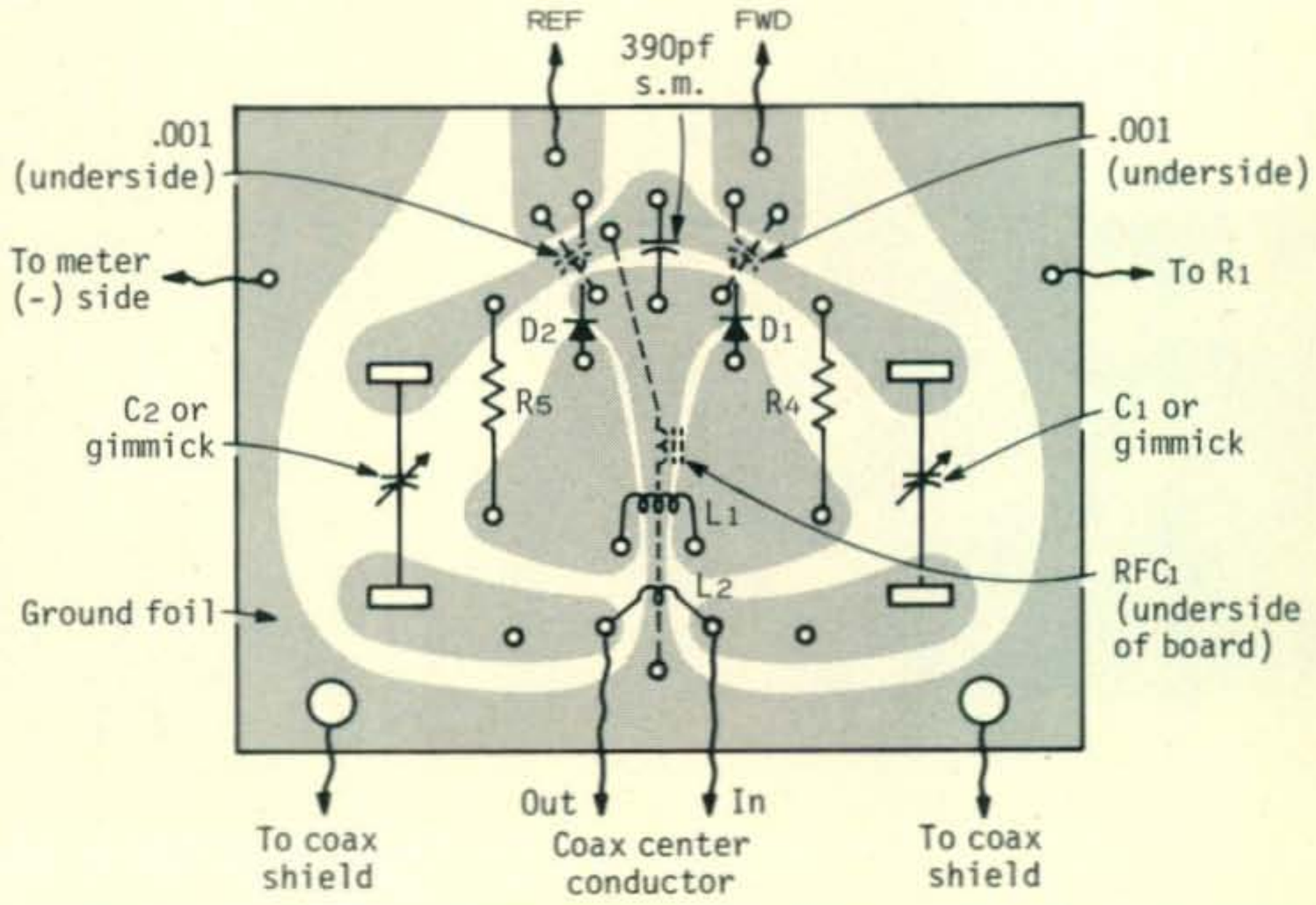


Fig. 4—Phantom view of the wattmeter/s.w.r. bridge PC board showing parts placement. For additional information, see photo.

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Slow Scan TV

BY COPTHORNE MACDONALD,* WØORX

The Myth Of Expertise

THE New Directions Roundtable has been under way for 8 weeks at this writing, and we've had some exciting Sunday afternoons. (It meets on 14253 kHz at 2000 GMT and 7163 kHz at 2230 GMT.) We have had free flowing dialogue between people that covered the full spectrum of outlook from Radical Left to Conservative, and from Humanist to Facist. And we've been learning a lot. One thing I've learned is that there is still an unfortunate tendency to leave things to the experts. Many "experts" have been proving themselves somewhat less than expert lately (re: the energy crisis, wheat deals, inflation, and assorted other goings on in Washington and elsewhere). A frequent comment on the Roundtable is, "I don't feel qualified to comment on that". I understand the feeling. The tendency is to think that because a person has been working in a field for 20 or 30 years that it would take us the same length of time to understand what he understands at this point. If that were true, it would be quite defeating indeed. But it's not true. Most experts could compress all their expertise into a single book and make that expertise available to others. Some do it. Some go part way and hold back enough to keep themselves more expert than their readers. Others hoard all they know and don't share any of it.

Recent events should be enough to convince us that leaving things to experts leaves us out of control of our own lives. What can we do? Two things. We can become more expert in more things ourselves. Reading almost any book on a subject can carry us over the threshold of complete ignorance. Six hours spent reading a well written book by an expert who has really tried to share his expertise can give us a sizeable percentage of that expertise. Second, we can demand plain English explanations from experts. Many experts adopt a condescending, "You really aren't capable of understanding this", attitude. The reasons for this vary. The doctor, for example, may not want to take the time to explain the mechanism of hypertension. He may not *know* why you are vomiting. Or, he may just want to maintain the myth that 12 years of training are required to take care of a person's health.

What in the world does all this have to do with SSTV? Plenty. Building gear is fun. Designing what you build is more fun. It is also becoming necessary. The electronic parts situation has been getting progressively worse. To gather all the parts to exactly duplicate a particular SSTV monitor design could take six or eight months (assuming you could find distributors willing to put up with your small orders). Home-brewers must do more improvising than in the past. The day is coming when available parts will dictate a project's design details. Amateurs who want to build their own gear will be forced to do more designing themselves. Much of this design work will have to be done *after* the key parts have been obtained.

One of the myths of expertise is that in order to design electronic equipment from scratch you must go to college for four years and get an EE degree. EEs perpetuate this myth, and it's obvious that most company personnel directors

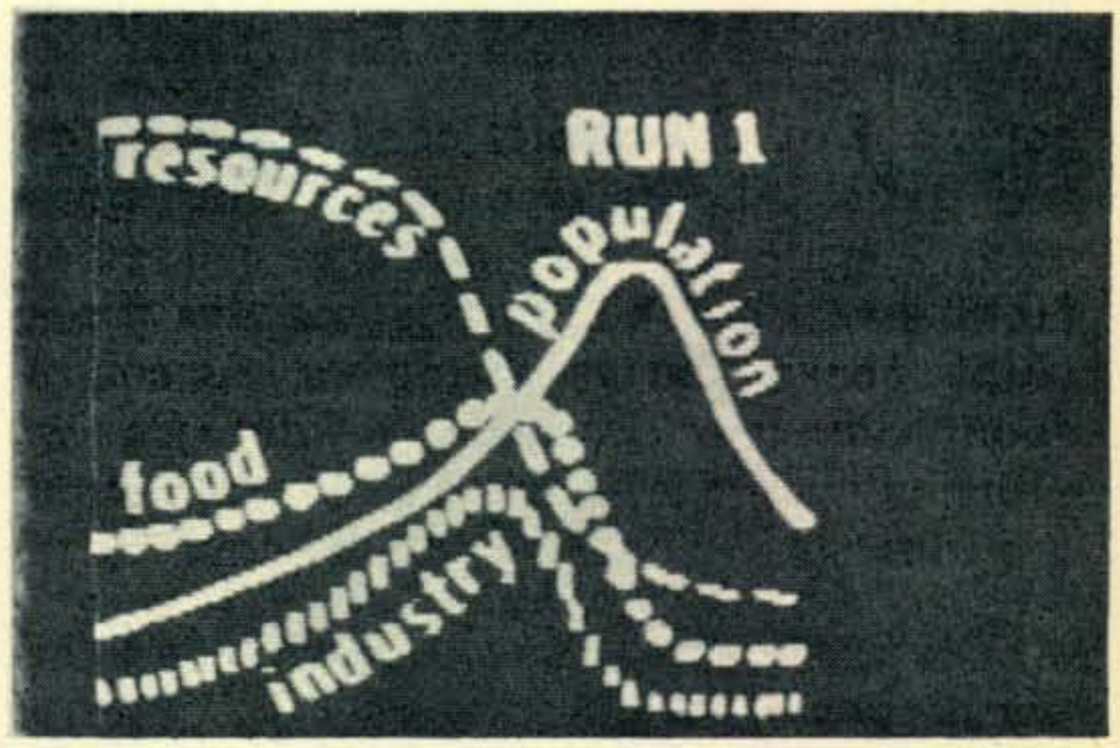

Fig. 1—SSTV pictures of computer output curves. Sent during the New Directions Roundtable review of the M.I.T. study of the world system, *The Limits to Growth.*

*P.O. Box 483, Rochester, Minn. 55901

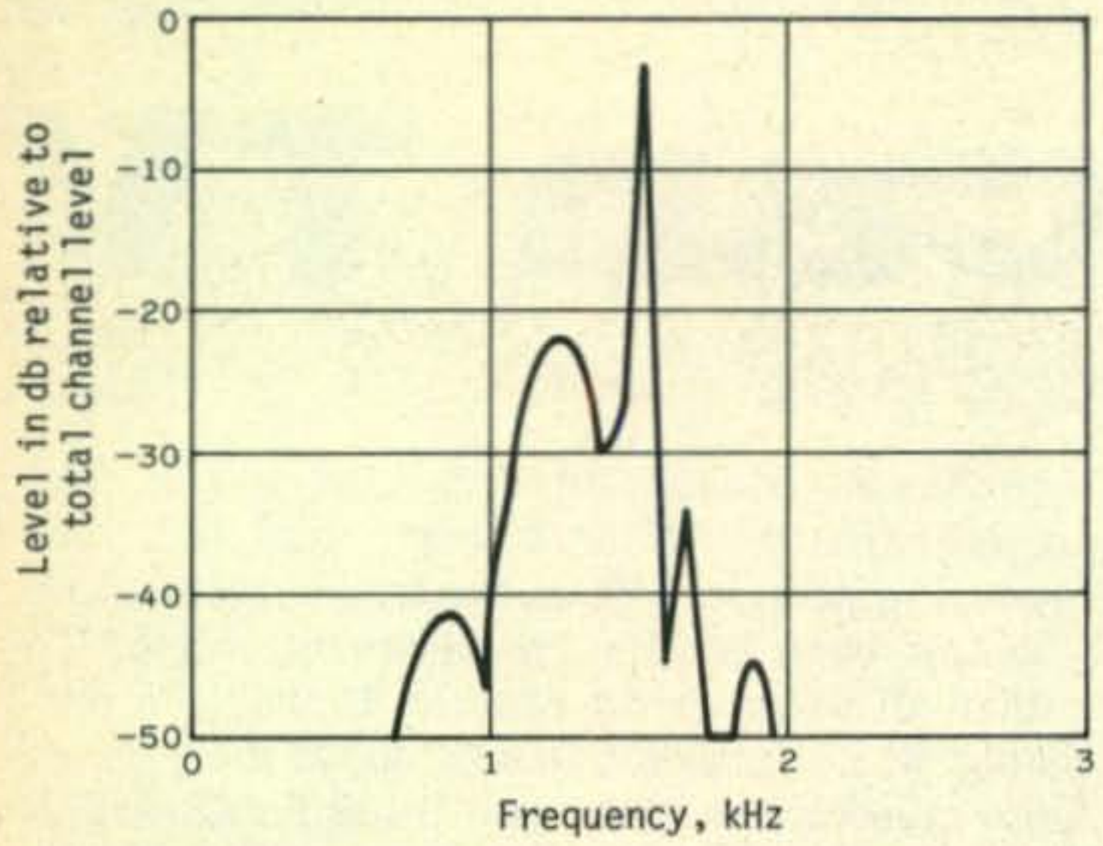

Fig. 2—SSTV frequency spectrum: All-black picture.

believe it. Many of you know that it's a myth, and during this new year I hope to convince more of you that it is. I want to continue to shed my cloak of "expertise" and to share with you the basic SSTV design techniques I've picked up during the past 16 years. We've already done quite a bit—this is the 18th column in this series! Now I want to fill in the blanks between the topics we've covered, and get down into all those simple design approaches that will allow you to add SSTV equipment design to your bag of tricks.

The SSTV Signal

SSTV signals are audio. It is amazing that 15 years after the first articles on the subject appeared, and five years after the FCC approved SSTV for use, some amateurs still don't realize this. I guess we slow-scanners haven't been doing as good a job of communicating with the rest of the amateurs as we might. Of course, if we want to intelligently design filters, and discriminators, and limiters, and subcarrier modulators for SSTV, we must delve fairly deeply into the characteristics of that SSTV/audio signal.

The SSTV signal is a frequency shifted audio tone. During the active scanning time, the frequency of the tone depends on the particular "shade of grey" being transmitted at any instant. If something white is being scanned, the tone frequency is 2300 Hz. If the grey shade is black, the frequency is 1500 Hz. For intermediate grey tones the frequency will be between these limits. During the horizontal retrace interval, the tone switches to a frequency of 1200 Hz for 5 milliseconds. During the vertical retrace interval the tone switches to 1200 Hz for 30 milliseconds (or 67 milliseconds in Robot equipment).

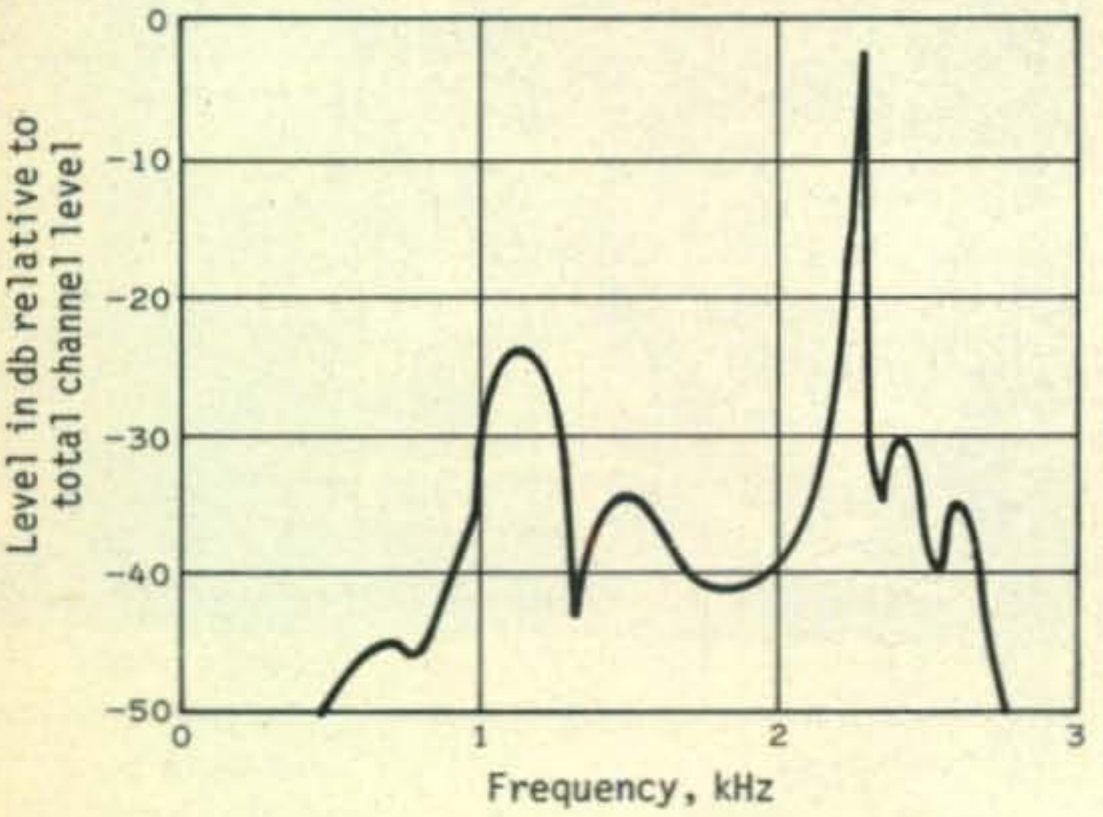

Fig. 3—SSTV frequency spectrum: All-white picture.

We know from basic modulation theory that sidebands are generated whenever a carrier is modulated. This occurs when our audio subcarrier is frequency modulated by the slow-scan video and sync pulses. A video signal that is used to modulate a carrier or subcarrier is called a baseband video signal. In SSTV, the baseband video can contain important frequencies from near zero up to about 1 kHz. A 120 line vertical bar pattern, containing 60 black and 60 white bars would produce a 1 kHz baseband video signal if scanned at SSTV rates. Coarses patterns would tend to generate lower frequencies. Fine detail and sharp edges in a picture produce the high frequencies; smoothly changing grey areas produce only low frequencies. The highest baseband frequency that must be passed by the modulation system depends upon the finest detail you want to transmit. This is usually specified in terms of the finest black and white bar pattern that can be transmitted. In order to have the horizontal resolution equal to the number of scan lines (equal to the vertical resolution) we need to be able to transmit a 120 line pattern—hence the 1 kHz. Another way of looking at the picture resolution of SSTV is to say that we want the received baseband video to take no longer than 1/120 of an active scan line to shift from one grey level to another.

With f.m., you may recall, the sidebands occur spaced at multiples of the modulating frequency on either side of the carrier frequency. But what is our carrier frequency? It depends, of course on the shade of grey being transmitted. When transmitting a black and white bar pattern we can assume that the carrier frequency is half way between the black and white carrier limits—1900 Hz. With a 120 line bar pattern the modulation index is $\frac{2300\text{-}1500}{1000} = 0.8$. With a modulation index this low, we know that it is only necessary to transmit the set of sidebands closest to the carrier. These sidebands fall at 900 and at 2900 Hz. "But my rig won't pass 2900 Hz; what then?" You have single sideband f.m.! Strange as it seems, that is what we have, part of the time. It works, and is common practice not only in SSTV, but also in wideband video tape recording. Much of the time, the combination of carrier frequency (grey shade) and modulation frequency (picture detail) will give us more

than one sideband that passes through the rig, but we can usually live with only one.

The SSTV Frequency Spectrum

As you might expect, the spectrum of an SSTV signal shifts around a lot in response to changes in picture content. This is obvious even when listening by ear to an SSTV signal. Figures 2 thru 5 show the measured frequency spectrum of an SSTV signal while scanning four different pictures. The data was taken with an HP 302A wave analyzer while a single line of picture information was repetitively scanned. The spectrum actually consisted of a series of discrete frequencies—spaced at 15 Hz intervals. For clarity, the curves follow the level of these frequencies but do not show the drop in level between adjacent frequencies. The output of the subcarrier f.m. modulator was passed through a O—2500 Hz low pass filter, and the spectrum was measured at the filter output. The filter had almost no attenuation below 2500 Hz, but at least 40DB attenuation above 3500 Hz. The O DB level is the level of the subcarrier with no modulation, and is also the combined level of all the discrete frequency components. Note that the spectrum in the vicinity of 1200 Hz, the sync frequency, remains about the same regardless of picture content.

Experience has indicated satisfactory transmission of SSTV pictures if the frequency components between 900 or 1000 Hz on the low end, and 2500 Hz on the high end are passed. If the video sidebands below 900 Hz are also transmitted, horizontal resolution somewhat greater than 120 lines can be observed.

The subcarrier spectrum will be disturbed by selective fading and other multipath phenomena. Selective fading occurs when the same r.f. signal arrives via two different transmission paths and cancels out. Typically it acts as though a notch filter is being swept across the band.

Q & A

Q. What problems am I apt to encounter in trying to use a wide angle deflection yoke such as found on a 21 or 24 inch short neck tube, on a 7BP7 or 5FP7 which was designed for 53 degree deflection?

A. There is a good chance that the yoke won't fit. The 5FP7, 7BP7, and most other older magnetic tubes have a 1.5 inch neck diameter. Most of the modern CRTs have a smaller neck diameter. Aside from this there is nothing wrong with using a wide angle yoke on a small angle tube. I'd suggest that you check your local TV parts distributor for a 90 degree, 1.5 inch neck, replacement type yoke having 38 to 50 millihenries inductance in both H and V axes. Yokes with lower inductance are OK to use, but the required drive current goes up inversely as the square root of the inductance. In other words, a 10 mHy winding will require twice as much current for the same scan amplitude as a 40 mHy winding.

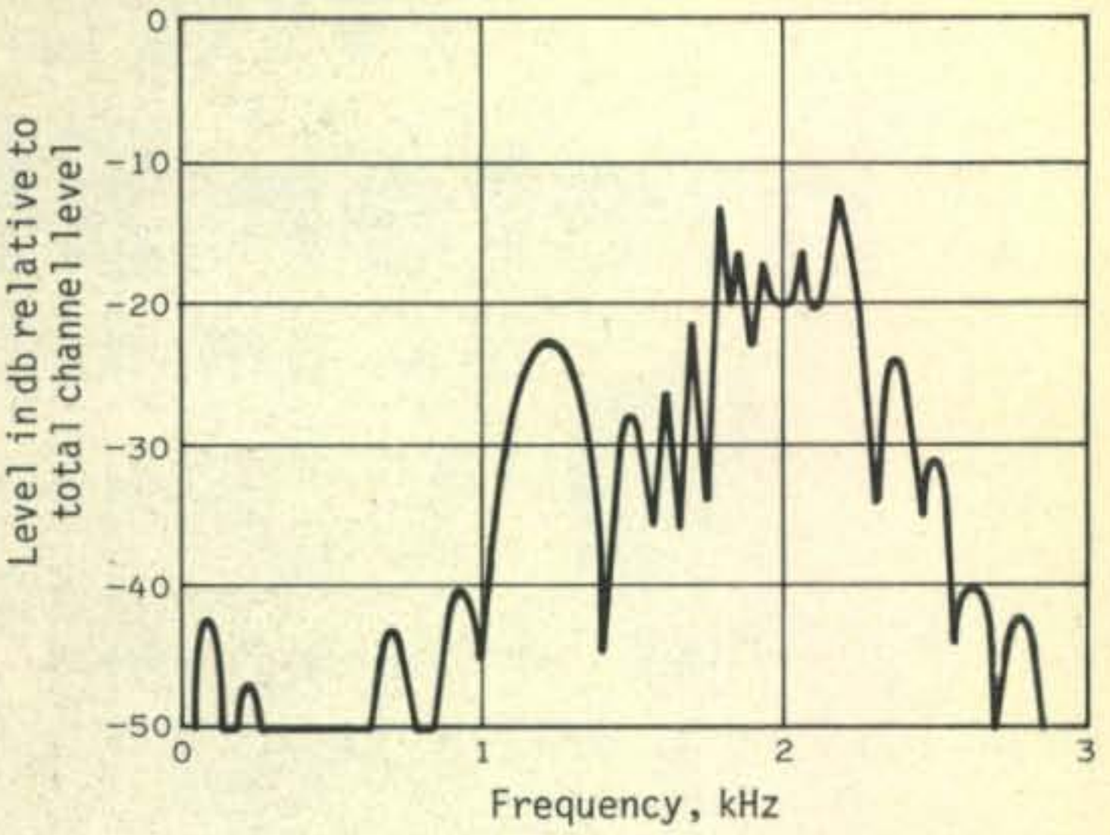

Fig. 4—SSTV frequency spectrum: Typical picture containing large areas of various grey levels.

Q. Where can I get information on slow-scan TV?

A. This column has been published since July, 1972, and most back issues are available from *CQ*. The January, 1973 issue contains a rather complete bibliography of articles on SSTV. Don Miller, W9NTP, and Ralph Taggart, WB8DQT, have written an excellent book, the *Slow-Scan Television Handbook*, available from *73*, Inc., Peterborough, N.H. for $5.00 postpaid.

Vy 73, Cop, WØORX

CQ Country Chart

A two color, wall-sized country chart is available on poster stock and in large type for only $1.25 per copy postpaid. Address request to: CQ DX Country Chart, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

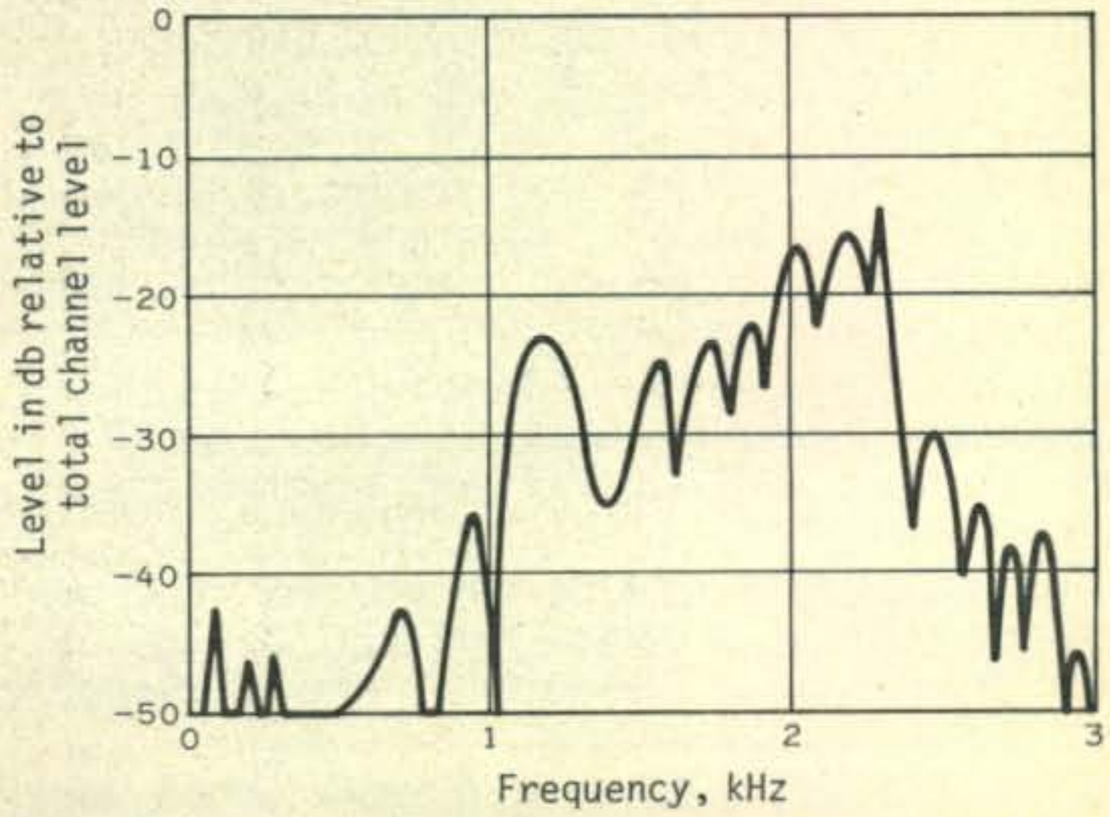

Fig. 5—SSTV frequency spectrum: Typical black line drawing on a white background.

Meet the 2 meter SSTV Gang.

From left Bill Arrasmith, W6TEZ, Judge William Ritzi, W6ONC, Judge Pearce Young, WB6HWY
Byron Paul, WA6RNG (Executive Producer of the New Dick Van Dyke Show)

that's right... 2 meter SSTV

Shown above are four hams who have had so much fun working SSTV on 2 meters and 220 that we asked them if they'd make a few comments about it for one of our ads.

We went up to Los Angeles (where they all operate) and chatted with them a bit. They all agreed that one of the biggest enjoyments of working 2 meter SSTV is the new dimension it adds to 2 meters, far more interesting and creative than operating radio alone.

They noticed a steadily increasing SSTV activity on 2 meters, observing that there must be 50 or more operators working SSTV on 2 meters or 220 in LA alone.

One observed that working DX doesn't offer the challenge it used to, since you can buy all the power you want, . . . "So where's the challenge. SSTV is the new challenge!"

They work a schedule once a week or so, and have little problem in raising SSTV contacts. "In fact, everytime we get on the air," Judge Ritzi noted, "we have break-ins from a lot of hams wanting to know more about SSTV."

And a bit of information that hadn't occurred to us; their families really get interested in SSTV. They all enjoy it, and often work together preparing the art work and pictures for the production of their 'TV' shows.

We were very grateful for their comments, and, for the time they gave to us. Thank you gentlemen.

We can't guarantee that you'll appear in one of our ads when you begin working SSTV on 2 meters, but we're pretty sure we can guarantee you as much enjoyment as our "2 meter SSTV Gang" from Los Angeles.

For details, and complete literature on Robot's SSTV equipment just write to us.

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MODEL 80A CAMERA $295
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NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

The Code Before and after the Novice Test

For the information of the uninitiated, the first item in Federal Communications Commission amateur examinations is the code test. The applicant first listens to five minutes of code sent at the prescribed speed and writes down the corresponding letter, number or punctuation mark. Passing requires 60 consecutive seconds of errorless copy. The applicant then demonstrates his sending ability.

Although only the alphabet is involved in the 5 w.p.m. Novice test, a Novice must also know numbers to send and receive call letters and signal reports on the air. In addition, most smart Novices punctuate their transmissions. And both numbers and simple punctuation marks appear in the 13 w.p.m., General class code test. Fortunately, all standard code courses include both. (This is old stuff to already licensed Novices. But be patient, we will ring your chime in a minute.)

Probably the best way to memorize the code is for an instructor to send the appropriate *dits* and *dahs* repeatedly on a code-practice set while the student writes down the letter or other symbol they represent *every time*. Recorded code courses are also good. The worst method, but the one probably most frequently used, is to memorize the code visually from a printed chart. The radiotelegraph code is a *sound* language, and much listening practice is needed to translate visual impressions into sound patterns.

After the code is memorized by any method, the only effective method of bringing one's copying proficiency up to a useful level is by regular practice copying speeds slightly faster than can be transcribed without error. Daily practice sessions of around a half hour are much more effective than longer, irregular practice sessions. Such a regular program quickly eats up recorded practice material, because the student memorizes it well enough to anticipate what is coming next after hearing the material a few times. Copying such material does little except to give the student a false opinion of his progress. Fortunately, the problem is easily solved. A receiver capable of tuning the amateur bands

*385 Johnson St., Gary, Indiana 46402

W1AW Code-Practice Schedule

Frequencies: 1.805, 3.58, 7.08, 14.08, 21.08, 28.08, 50.08, 145.88 mHz

Speeds Words per minute	*Days and Times*[1]
10, 13, 15	*Daily* 7:30 P.M., Eastern; 6:30 P.M., Central; 5:30 P.M., Mountain; 4:30 P.M., Pacific.
5, 7½, 10, 13, 20, 25	Sun., Tues., Thurs., Sat.[2] 9:30 P.M., Eastern; 8:30 P.M., Central; 7:30 P.M., Mountain; 6:30 P.M., Pacific.
5, 7½, 10	Mon., Wed., Fri.
13, 20, 25	9:00 A.M., Eastern; 8:00 A.M., Central; 7:00 A.M., Mountain; 6:00 A.M., Pacific.
35, 30, 25	Mon., Wed., Fri.[2]
20, 15	9:30 P.M., Eastern; 8:30 P.M., Central; 7:30 P.M., Mountain; 6:30 P.M., Pacific.
35, 30, 25	Tues., Thurs.
20, 15	9:00 A.M., Eastern; 8:00 A.M., Central; 7:00 A.M., Mountain; 6:00 A.M.,Pacific.

[1] Transmissions omitted on major national holidays.

[2] Omitted four times a year for Frequency measuring transmissions for ARRL Official Observers and others.

Table I—W1AW code-practice schedule.

gives one an inexhaustable supply of practice material—Novices working each other, traffic nets on 80 meters, exotic, foreign call-letter-number combinations, and the daily code-practice transmissions from W1AW, the ARRL headquarters station, at Newington, Connecticut.

W1AW Code-Practice Transmissions

Seven days a week the year around, except for a few national holidays, W1AW transmits machine-sent code practice at speeds of five through 35 words per minute simultaneously on eight amateur bands as per the schedule of Table I. Each transmission is made over a high-power transmitter and efficient antenna, and they are heard well on one or more of the frequencies almost everywhere in the United States and over much of the rest of the world. Once a month, the mid-evening and the morning code-practice sessions are replaced with special code-proficiency transmissions. Mail a copy of one of these qualifying transmissions with a signed statement that you made it without mechanical

Tom O'Hara, WB9JVB. 3316 Edison, East Gary, Ind. 46405, just knocked the "N" out of his call. In his 18-month Novice career, he parlayed a Heathkit HW-16 transceiver, 20 crystals, and a HyGain 14AVQ vertical antenna into 49 states, all confirmed, and 10 countries is five continents. But he likes best to ragchew on 40 meters. Tom, 15, is saving his money for a Drake TR-4C transceiver and dreaming of a 60' tower and a Quad is small replacement-type silicon rectifier.

help to: The Communications Department, ARRL, Newington, Conn. 06111, and you will soon receive a handsome code-proficiency certificate attesting to the highest speed at which you made errorless copy for a period of a minute or more. Underline the section of your copy which you think qualifies you. Five word-per-minute endorsement stickers for speeds up to 35 w.p.m. are available as your copying speed increases.

Novice Code Problems

Many Novices assume that by making many contacts on the air, their code speed will automatically increase to the 13 w.p.m., General class level. Nevertheless, too many Novices who have made hundreds of contacts and are fully confident of their ability to copy at least 15 w.p.m. have heard the saddest words an FCC examiner can utter after a code test: "See you again, next month." Examination jitters, which can knock a few words per minute off of one's normal code speed, and illegible handwriting may account for a few of these failures. More often, however, the applicant has simply overestimated his copying ability.

Most code students experience plateaus of learning. Up to a critical code speed, typically eight to 10 w.p.m., they make perfect copy. But there they stall, making a small, almost-constant percentage of errors at speeds up to 15 w.p.m. or greater. Oddly enough, an operator can be trapped on such a plateau and not be aware of it. Most routine Novice contacts are almost carbon copies of each other—call letters, signal report, location, name, weather, QRU, 73. Furthermore, the signal report, location and name, at least, are usually repeated several times. Thus, the receiving operator does not really face much of a challenge. Even so, how often after giving a station a 599 report, does he respond to a transmission with, "RRR. Solid copy. Please repeat your name . . ."

For such reasons, any Novice would be well advised to confirm his true code speed by copying a W1AW code-practice transmission before donating $9.00 to the Federal Communications Commission for the pleasure of failing the General-class code test. If your W1AW copy proves that your code speed is a solid 15 w.p.m. or greater, you are probably ready for the receiving test and can say, "What does Herb know?" But if your speed does not meet the challenge, a few weeks of regular copying of the W1AW 13, 15, and 20 w.p.m. code-practice transmissions will do wonders to your copying ability. No one would claim that such a program is fun, but it can be rewarding. Even if you are not planning to try for your General class license immediately, you will be pleasantly surprised to discover how much more fun "ragchewing" in code becomes as your code proficiency increases.

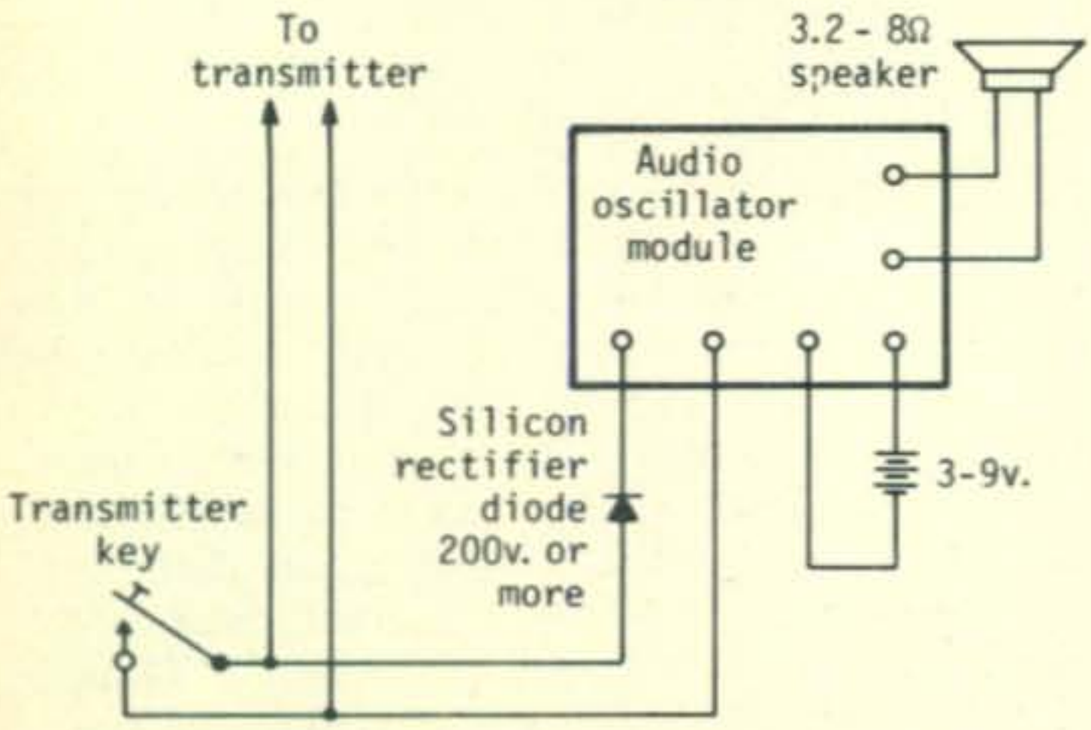


Fig. 1—Using code-practice oscillator as transmitter code monitor. Inexpensive code module available from electronic parts distributors. Diode antenna.

Simple Code Oscillator and Monitor

Being able to hear one's own sending is an undoubted help in sending readable code. Many amateurs using transmitters or transceivers lacking a built-in code monitor, listen to their sending on their own receivers. As a result, they are busier than a one-man band with the itch readjusting the receiver controls at the beginning and end of their every transmission. A single, inexpensive silicon rectifier diode will convert your old, transistorized code-practice set into an efficient sending monitor that will eliminate this frenzied dial twisting, when connected to the

keying circuit of most transmitters and transceivers lacking a built-in sending monitor.

Referring to fig. 1, first test the code oscillator in the normal manner to insure that it is working properly and its battery is in good condition. Next, test the oscillator with the silicon diode in series with one of the oscillator key leads; if the oscillator no longer oscillates, reverse the diode. Then transfer the conductors from the code oscillator key to the transmitter key, without disturbing the conductors already connected to the latter. You may have to reverse the wires between the code oscillator and the transmitter key for proper operation of both the transmitter and the code monitor.

The monitor can be assembled using one of the code oscillator modules available with instructions from most electronic supply houses for under $1.25. A small speaker, 1½ to 6-volt battery, diode, and a suitable enclosure are also needed. Good sending!

News Briefs

The recently-completed Novice License course of the Michiana Amateur Radio Club, South Bend, Indiana, started with 48 students. Twenty-nine of them took the code test. Twenty-seven took the written exam. Twenty-two received their Novice calls. . . . Complete rules for the annual ARRL "Novice Roundup," scheduled for the first week of February, are not available as these lines are being written. The general idea, however, is for Novices to work Novices and other amateurs in the United States and other parts of the world. Others work only Novices. Scoring consists of one point for each contest exchange, plus the highest speed on the contestant's code-proficiency certificate. This total is then multiplied by the number of ARRL sections and foreign countries worked. Certificates will be awarded to high scorers who submit their scores in the approved format. Send a request and a "business-size," stamped and addressed reply envelope to: Communications Department, ARRL, Newington, Conn. 06111, for complete rules. Scores go to the same address. The Novice Roundup offers a golden opportunity for operators trying for Novice WAS and to add new counties to their achievement.

Remember. This is your column. Support it by sending news of your activities, pictures of yourself and your station (preferably black and white) and suggestions to: Novice Shack, *CQ* Magazine, c/o Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Indiana 46402

73, Herb, W9EGQ

CQ Country Chart

A two color, wall-sized country chart is available on poster stock and in large type for only $1.25 per copy postpaid. Address request to: CQ DX Country Chart, CQ Magazine, 14 Vanderventer Ave., Port Washington, N. Y. 11050.

ANTENNAS

BY WILLIAM I. ORR, W6SAI

"CUBICAL Quad-Topic Number One!" read the headline in the December, 1948 issue of *CQ* magazine. And the headline is true today, for the Quad beam antenna is still a topic of conversation whenever DX operators gather, in person or on the air.

It is interesting to review the story of the Quad and to examine some of the more exotic versions of this popular antenna that have evolved over the years. A search of the literature reveals no information published on the Quad before World War II. Research conducted by W6SAI some years ago indicated that the Quad antenna concept was the brain-child of W9LZX, who at that time was the chief engineer of shortwave broadcast station HCJB in Quito, Ecuador[1].

*48 Campbell Lane, Menlo Park, CA 94025.

[1]Orr, "All About Cubical Quad Antennas", Radio Publications, Inc. Wilton, Connecticut.

The Quad was thought up to solve some antenna problems that were unique to HCJB and other tropical shortwave broadcast stations. As HCJB operated on several shortwave bands, numerous beam antennas were needed and these had to be as compact as possible due to the unavailability of land for an "antenna farm."

The first solution was to try a parasitic Yagi antenna, which was a failure as the combination of high transmitter power and the high-Q antenna produced destructive corona discharges about the tips of the antenna elements in the humid, tropical atmosphere.

The solution derived by W9LZX was to design a beam antenna that—quite literally—had no end tips to the elements. The loop, or Quad element, was the answer. The concept was derived from a folded dipole, fig. 1 (A). W9LZX "pulled open" the dipole to form a diamond and added a parasitic reflector element to it, fig. 1 (B).

Amateurs Use The Quad on Ten Meters

The antenna proved to be a success and word of the new design was quickly spread by the amateur operators at HCJB. The first amateur-built Quad antennas appeared during the period 1947-48 on the 10 meter band and, in the winter of 1948, both *CQ* and *QST* magazines printed the first build-it-yourself Quad information that dispelled some of the fanciful rumors about the antenna. The November, 1948 *QST* article discussed the theory of operation of this unique

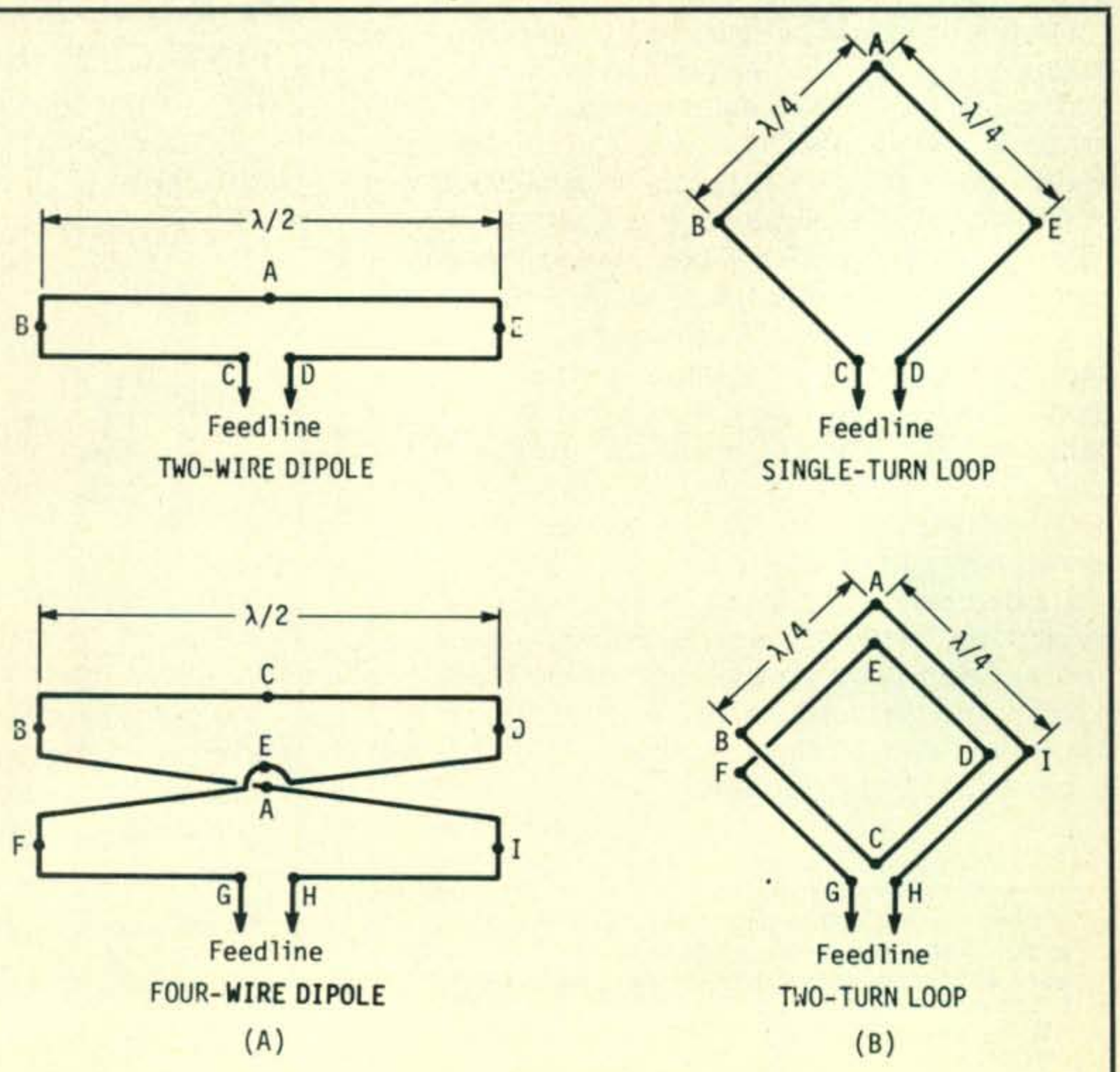


Fig. 1 — Cubical Quad antenna of W9LZX was derived from "pulled-open" folded dipole. (A) Two-wire dipole and four-wire dipoles are opened into single-turn and two-turn Quad loops (B). Equivalent points on the antennas are labelled for clarity.

antenna, fig. 2.

The HCJB design was adapted from a four-wire folded dipole and both reflector and driven element of the original Quad were double loops, to boost the radiation resistance of the antenna high enough to match a two-wire, 600 ohm transmission line, popular in those dear, dead days of shortwave radio. The *QST* article reported that a model Quad built for 144 mHz tests provided about 7.5 decibels power gain over a reference dipole. The article also voiced the suggestion that there appeared to be no reason to use a two-wire configuration for the reflector, as it was only an expedient to make the input impedance of the driven element assume a desired value.

The December, 1948 *CQ* article dealt more with the nuts-and-bolts construction of a practical 10 meter Quad beam, rather than with the theory of operation, fig. 3. The article discussed the 10 meter Quad design of W8RLT. The theoretical gain of the Quad was estimated to be 5.5 decibels, but *CQ* noted that the claimed gain approached 11 decibels! Viewed in the light of today's experience with the Quad, it appears that the actual gain of a properly adjusted 2 element Quad is in the vicinity of 7 decibels.

The Quad antenna continued to be a popular amateur array until the "tri-band," trap-tuned 3 element Yagi beam arrived upon the scene. It quickly eclipsed the single band Quad, until it was later found that three Quad antennas could be interlaced on one structure for operation on 20, 15 and 10 meters.

Today, the Quad antenna is as popular as ever, and this column investigates some of the more interesting applications of this unusual antenna.

The "Pulled Open" Folded Dipole

The idea of the "pulled open" folded dipole conceived by W9LZX was a valid principle.

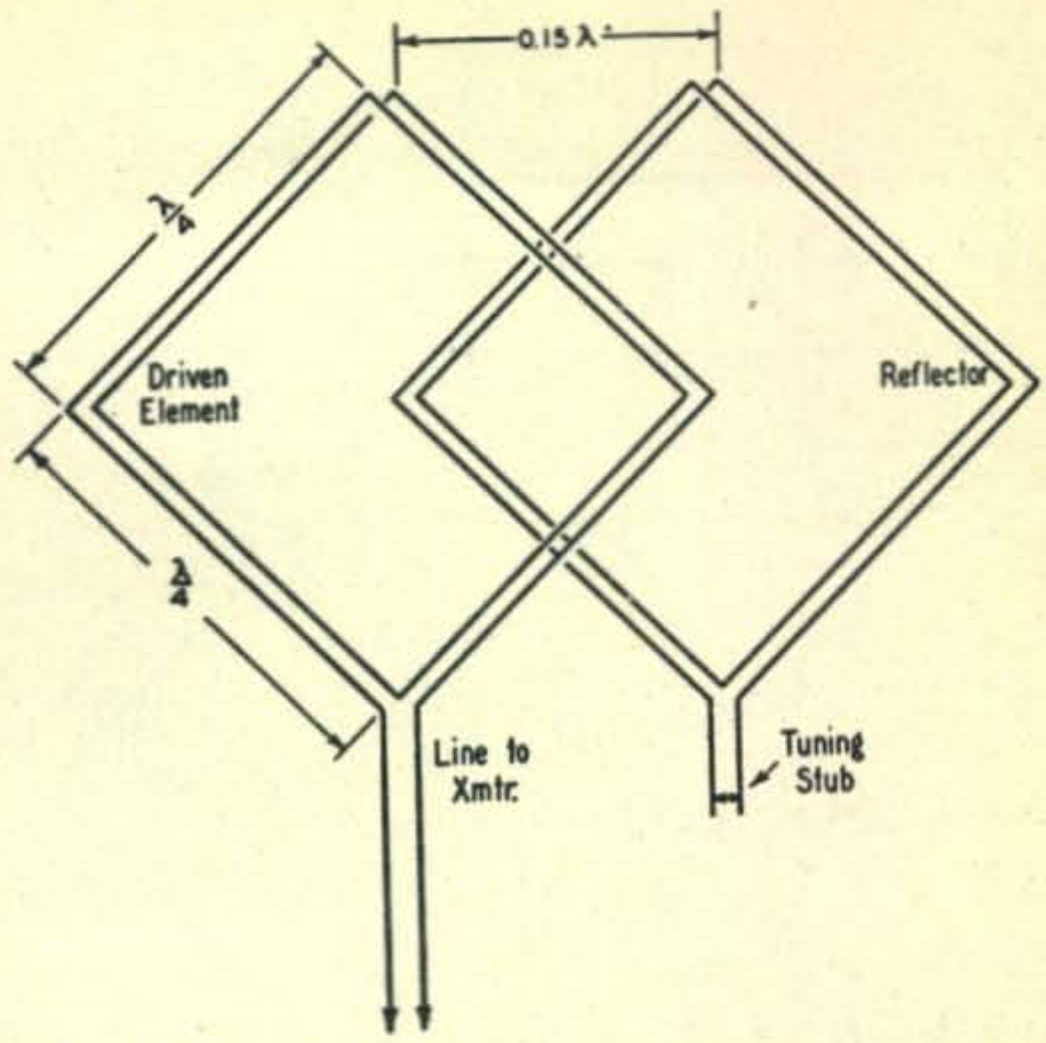


Fig. 2—Quad drawing shown in November, 1948 *QST* magazine. Two-wire loops were used for both reflector and director, with adjustment stub provided in reflector loop. Model Quad was tested on 2 meters and judged to have a power gain of 7 decibels over dipole.

Two- and four-wire dipoles opened in this fashion are shown in fig. 1 (B). The radiation resistance of either loop is lower than that of the parent dipole. The radiation resistance of the two wire dipole is about 288 ohms and that of the resultant single turn loop is about 140 ohms. The figures for the four wire configuration are about 1200 ohms and 600 ohms. Each diamond-shaped loop provides a power gain of about 1.4 decibels over a dipole, or 3.2 decibels gain over an isotropic radiator.

The folded dipole may be distorted into a square or a circle, or any other open shape and the characteristics will remain reasonably close to those exhibited by the diamond-shaped loop.

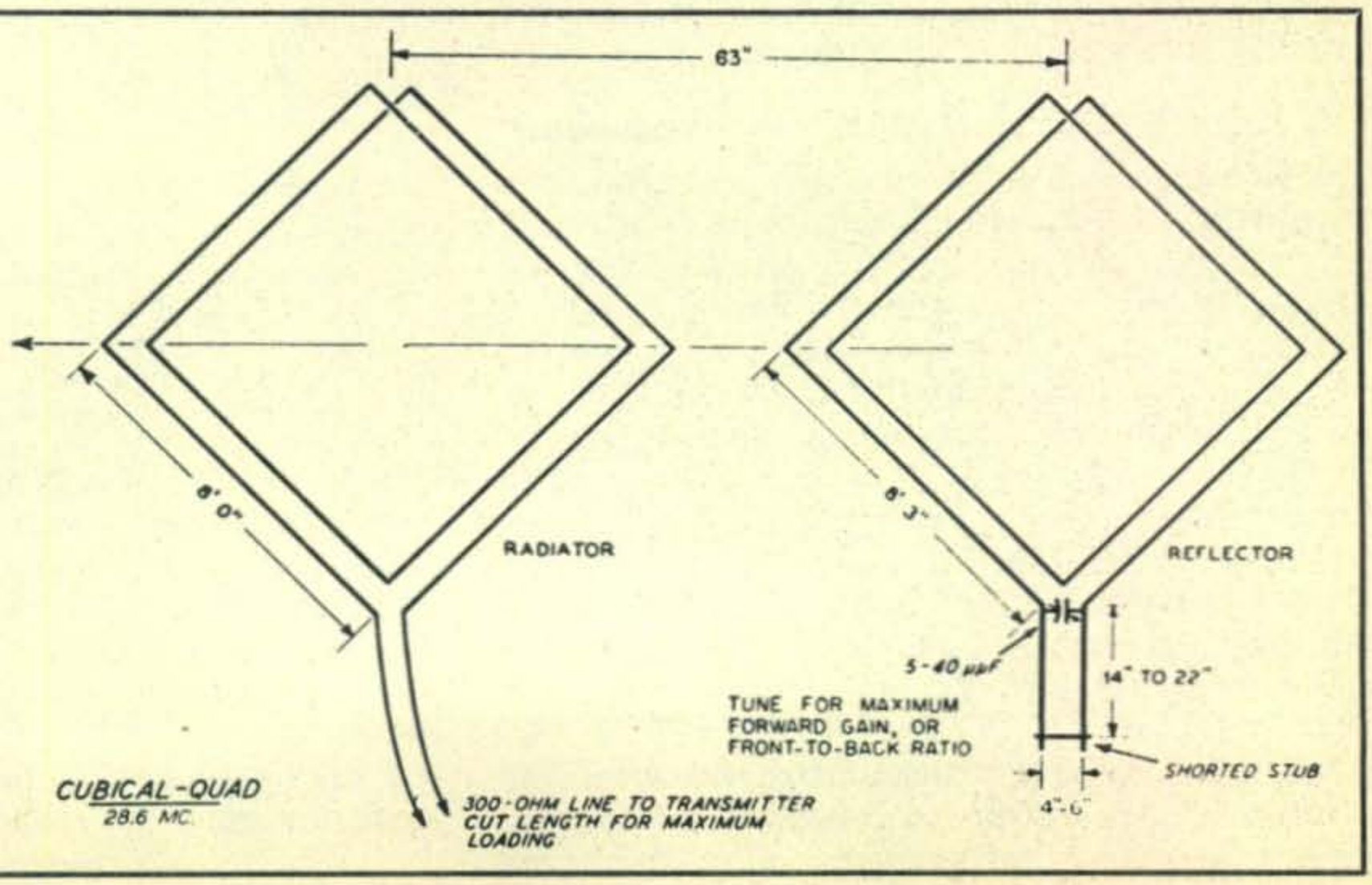


Fig. 3—CQ magazine provided construction data on Quad built by W8RLT in December, 1948. Dimensions shown are for 10 meter band. Reflector was tuned by combination of adjustable stub and tuning capacitor.

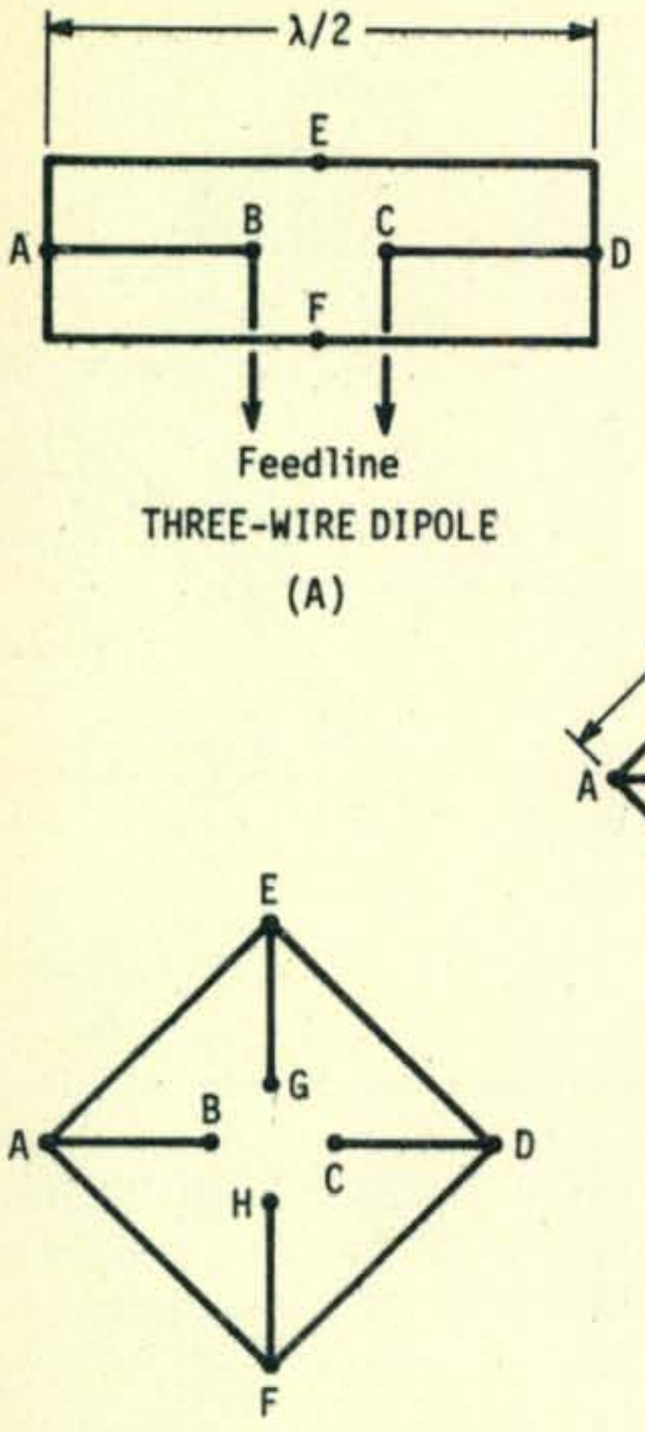


Fig. 4—Three-wire folded dipole may be opened into loop, leaving center wire for feed system. (A) Dipole with equivalent points indicated. (B) Center-fed Quad loop made from three-wire dipole. (C). Additional set of feed wires added at points E and F. Loop may be fed at points B and C for horizontal polarization or points G and H for vertical polarization.

The radiation pattern of any of these configurations is a slimmer version of the dipole radiation pattern, but includes a small vertically polarized lobe at right angles to the main lobe, caused by a minor amount of radiation from the vertical wires of the configuration.

A Polarization Trick With the Quad Loop

An interesting variation of the Quad loop can instantly provide either vertical or horizontal polarization at the wish of the operator (fig. 4). Drawing (A) is a conventional three wire folded dipole, driven in the center wire. This device has a radiation resistance of about 650 ohms. Drawing (B) shows the dipole pulled open, to provide a Quad loop, driven at the center of the middle wire. The loop is horizontally polarized and has a radiation resistance of about 300 ohms.

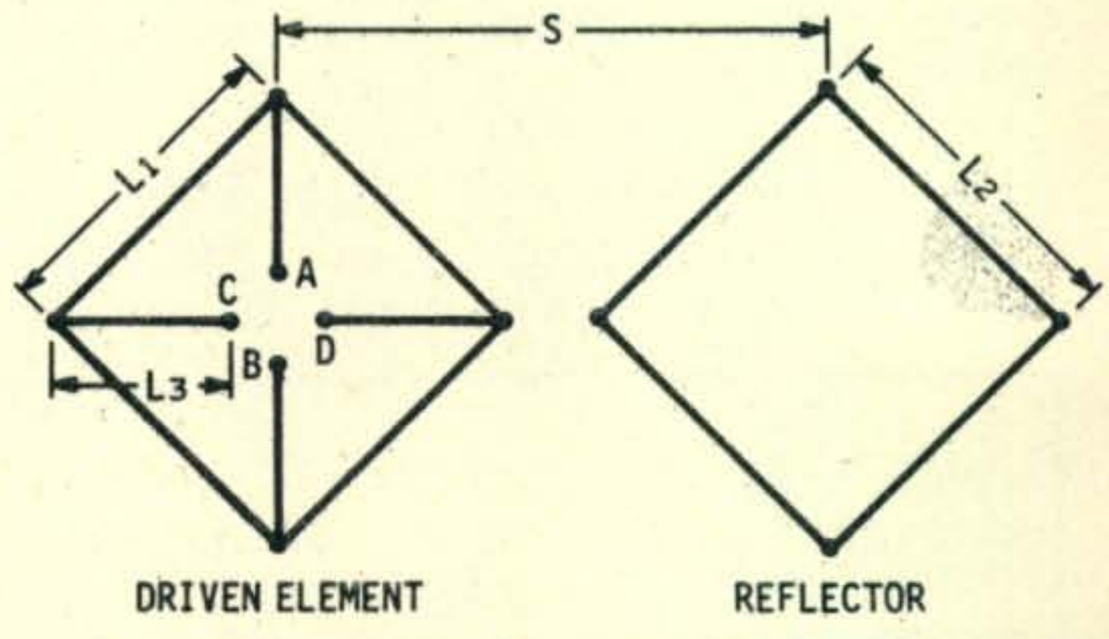
A second set of feed wires are added, shown in drawing (C) which are attached at the top and bottom points of the loop and terminate near the center. If the loop is fed by these vertical wires, instead of the horizontal wires, the characteristics of the loop remain unchanged, *except that the polarization has shifted from the horizontal to the vertical plane.*

Experiments have shown that radio waves reflected from the ionosphere arrive at a receiver with random polarization and the ability to change polarization of the receiving antenna at the flick of a switch can often improve the readability of a weak signal by a large factor. In like manner, the ability to switch antenna polarization during a transmission period can be helpful over a difficult communication circuit, as it is possible that fading can be substantially reduced.

The loop of fig. 4 may be easily cross-polarized by the addition of a double pole, double throw relay at the center to connect the transmission line to either the vertical or the horizontal feed wires. If the loop is used by itself, with no parasitic elements, the 300 ohm balanced feedpoint may be converted down to a 70 ohm unbalanced transmission line by means of a simple 4 to 1 ferrite core balun.

The "Flip-Flop" Quad Beam

Parasitic directors and a reflector can be added to the cross-polarized loop shown in fig. 4. If the parasitic elements are cut to the correct size, they require no adjustment stubs. The parasitic elements are thus symmetrical and "don't know" the polarization of the driven element. Hence, they need not be switched or otherwise adjusted when the polarization of the driven element is switched from horizontal to vertical or vice-versa. A set of representative



Band	L_1	L_2	L_3	S
20	17'8"	18'2"	12'6"	8'5"
15	11'8"	12'3"	8'4"	5'7"
10	8'8"	9'1"	6'3"	4'2"

Fig. 5—The "Flip-Flop" Quad beam. Either horizontal or vertical polarization may be chosen by placing a double pole, double throw switch at center of driven element so feed system is attached to either points C,D or A,B. Reflector element requires no switching. Since center elements (L_3) of driven element are shorter than outside elements (L_1), feed-point will display reactance. Addition of small inductors to elements L_3 will cancel out reactance.

dimensions for a two element "Flip-Flop" Quad beam for the various high frequency amateur bands is given in fig. 5. The feed point impedance is approximately 200 ohms, and a 4 to 1 balun may be used with a 50 ohm feedline.

The horizontal and vertical feed "wires" can easily take the form of the supporting arms of the cross-polarized loop and the whole driven element may be made up of horizontal and vertical aluminum arms supporting a wire loop strung from tip to tip of the cross-arms. (A six element version of this flip-flop design has been for sale to hyper-active CB operators for some time and an amateur experimenter could easily cut one of these "store-boughten" CB arrays down to size for 10 meter operation.)

The Delta Quad

In recent months the so-called delta Quad has received quite a bit of publicity, its excellence being extolled in various amateur magazines. In brief, the delta Quad is an array composed of triangular shaped elements, usually positioned with the apex of the triangle oriented down (fig. 6). The triangular shape seems to exhibit the same degree of gain over a dipole as does the square or diamond shape, and the radiation resistance is nearly the same as the other versions. Accordingly, the virtues of this configuration seem a bit obscure to the writer and, unless there is some mechanical advantage to using a delta Quad, it would seem easier for the experimenter to build the more common square or diamond shaped array.

The Swiss Quad

Another version of the Quad beam is the Swiss Quad, no doubt first used by a Swiss amateur! This interesting device is shown in fig. 7. The Swiss Quad is an all-driven array, with horizontal, tubular elements crossed at the center and vertical elements made of wire. Properly built, it is a rugged affair and is very popular in Europe. Both loops are fed at the bottom by means of a T-match (double gamma match) and the antenna bears a striking resemblance to two stacked W8JK beams, connected together at their element tips.

On-the-air tests indicate that the Swiss Quad has a gain figure comparable to the more common 2 element Quad design, with a deep null off the back.

One advantage of this design is that the cross-over point of each element is grounded to the supporting structure, a comforting feature to amateurs in areas having heavy lightning storms, as the antenna is inherently lightning-resistant.

The balanced-T matching system is fed with a 300 ohm line, or with a balun and coaxial transmission line. While the original Swiss Quad design included no resonating capacitors in the T-match bars, it is suggested that they be included. Length and spacing of the T-match and capacitor settings are adjusted for lowest s.w.r. on the transmission line.

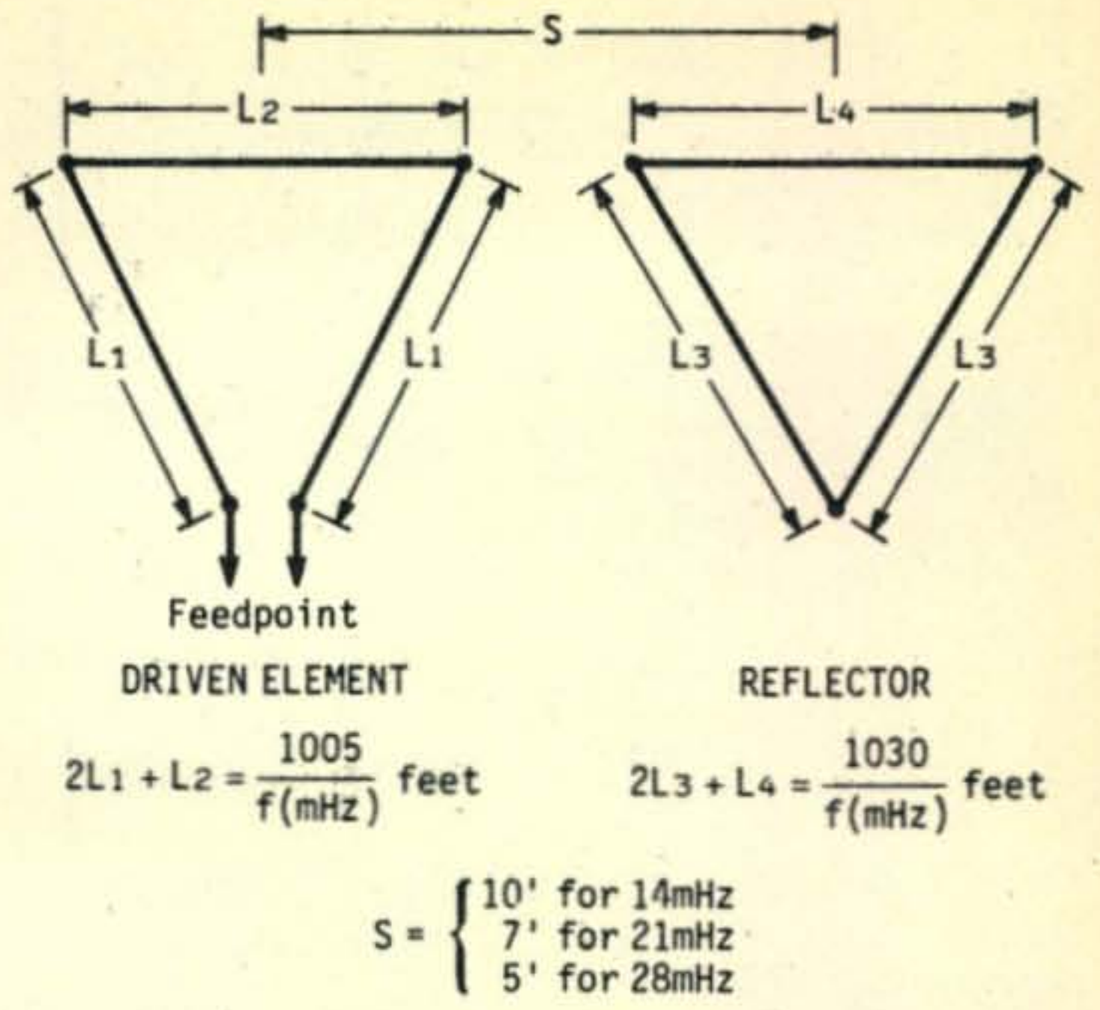


Fig. 6—Dimensions for Delta Quad array for 20, 15 and 10 meters. Length of sides is relatively unimportant as long as total side length works out according to formula. Usua design is to make sides L_1 and L_3 out of tubing and string side L_2 (wire) between tips of elements.

A 24 Element Quad Array!

W9LZX does it again! Clarence Moore has designed, and has in operation a new, giant Quad beam antenna, shown in figures 8 and 9.

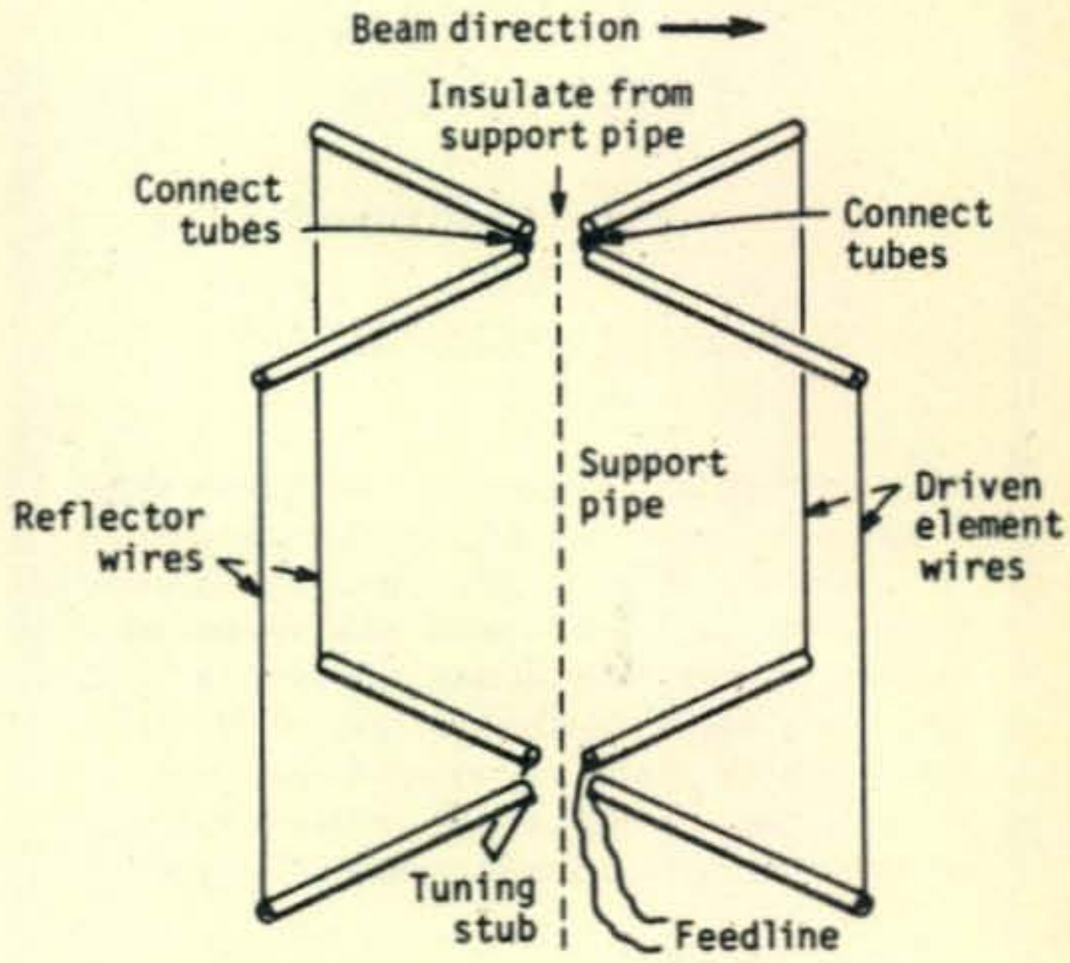


Fig. 7—Dimensions for Swiss Quad Antenna. Horizontal arms are made of aluminum tubing, with vertical sides made of wire strung between tips of tubes. All center points are insulated from the support pipe.

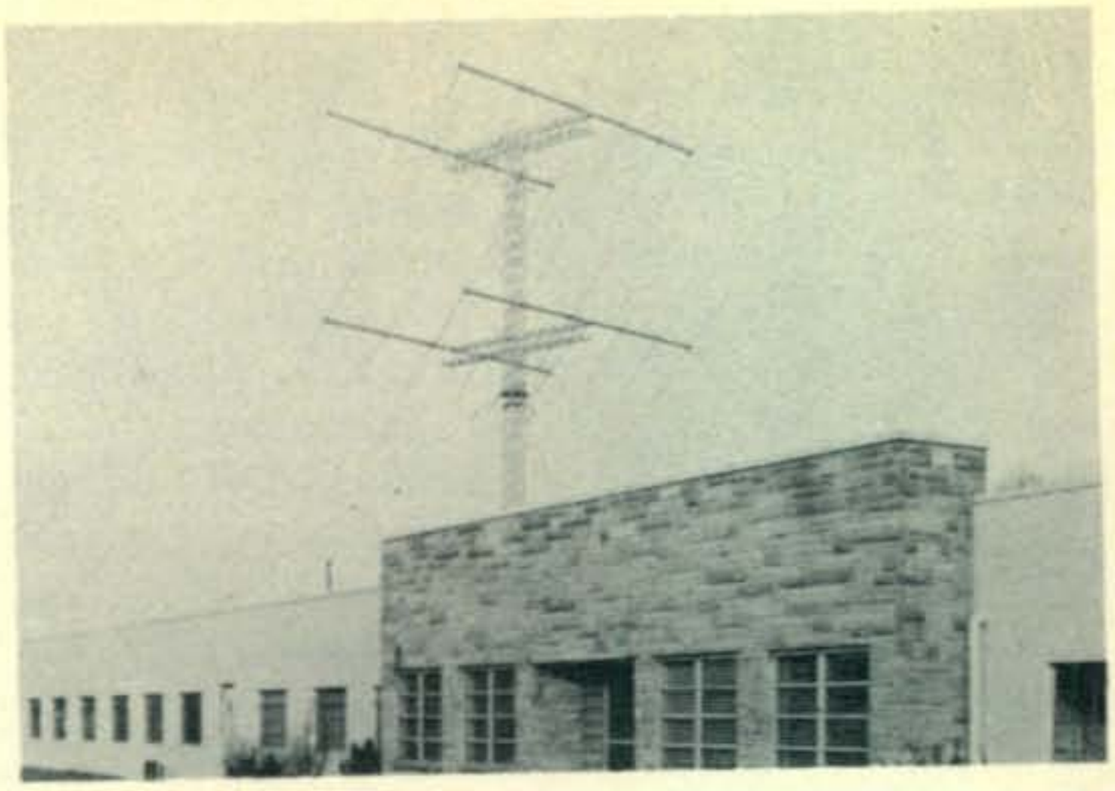


Fig. 8—Latest "monster" Quad array of W9LZX! Super-antenna is composed of four, six element Quads, each on a 40 foot boom. Quads are spaced a half-wavelength apart, held in position on two 45 foot horizontal booms made of triangular mast structure. Claimed gain of antenna is 23 decibels!

The array is composed of four, six element Quads, each on a 40 foot boom! The Quads are spaced a half-wavelength apart, and are held in position on two 45 foot horizontal booms made of triangular mast structure. The claimed gain of the array is 23 decibels as compared to a reference dipole!

The complete assembly shown in fig. 9 is a 15 meter antenna used by W9LZX at his laboratory (Crown International, Mishawaka, Indiana). A single six element Quad, one of four used in a similar giant array is shown in figure 9.

A Call for 80 Meter Quads!

Several amateurs have expressed interest in the erection of a Quad antenna for 80 meters. The author has heard of the existence of such monsters; indeed the 80 meter Quad of K3JH is shown in the *Quad Handbook*[1]. If the owners of some of the monster Quads will kindly step forward and identify themselves, I will be pleased to receive details of operation and construction for inclusion in this column at a later date.

73, Bill, W6SAI

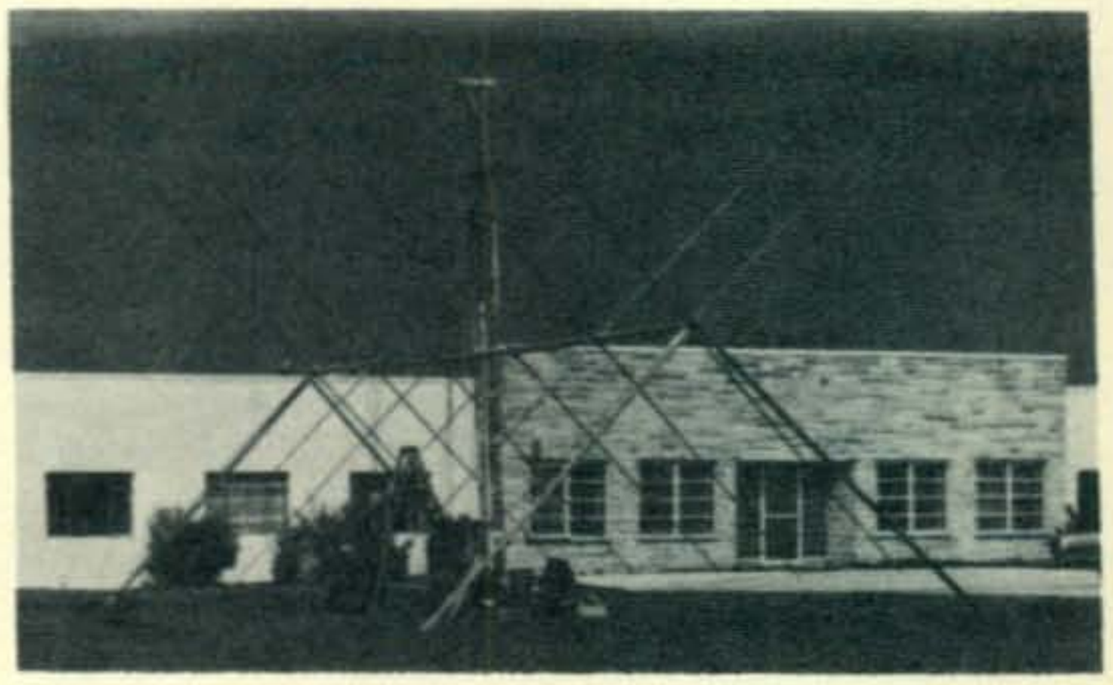
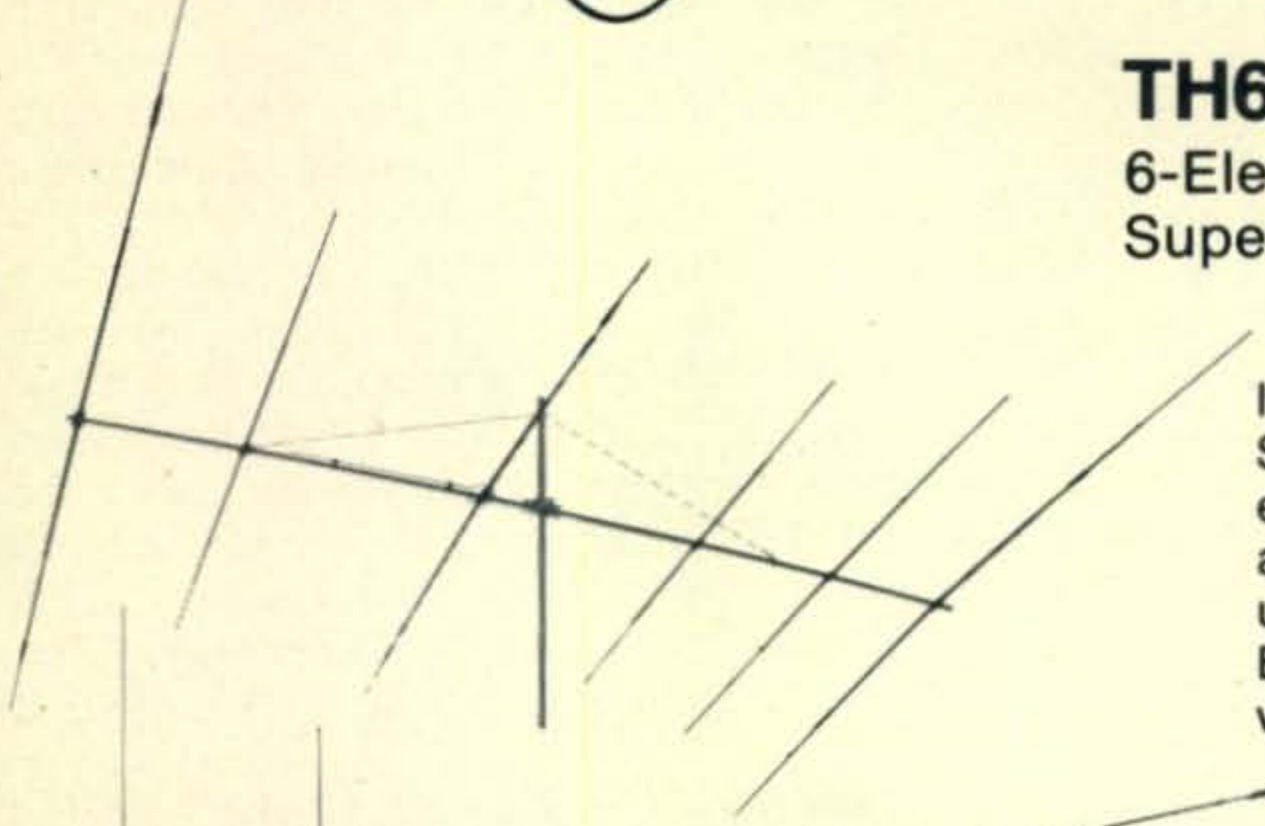


Fig. 9—Single, six element Quad rests in supporting structure while W9LZX puts finishing touches on assembly.

Don't settle for second. Get the best...

hy-gain *Antennas!*



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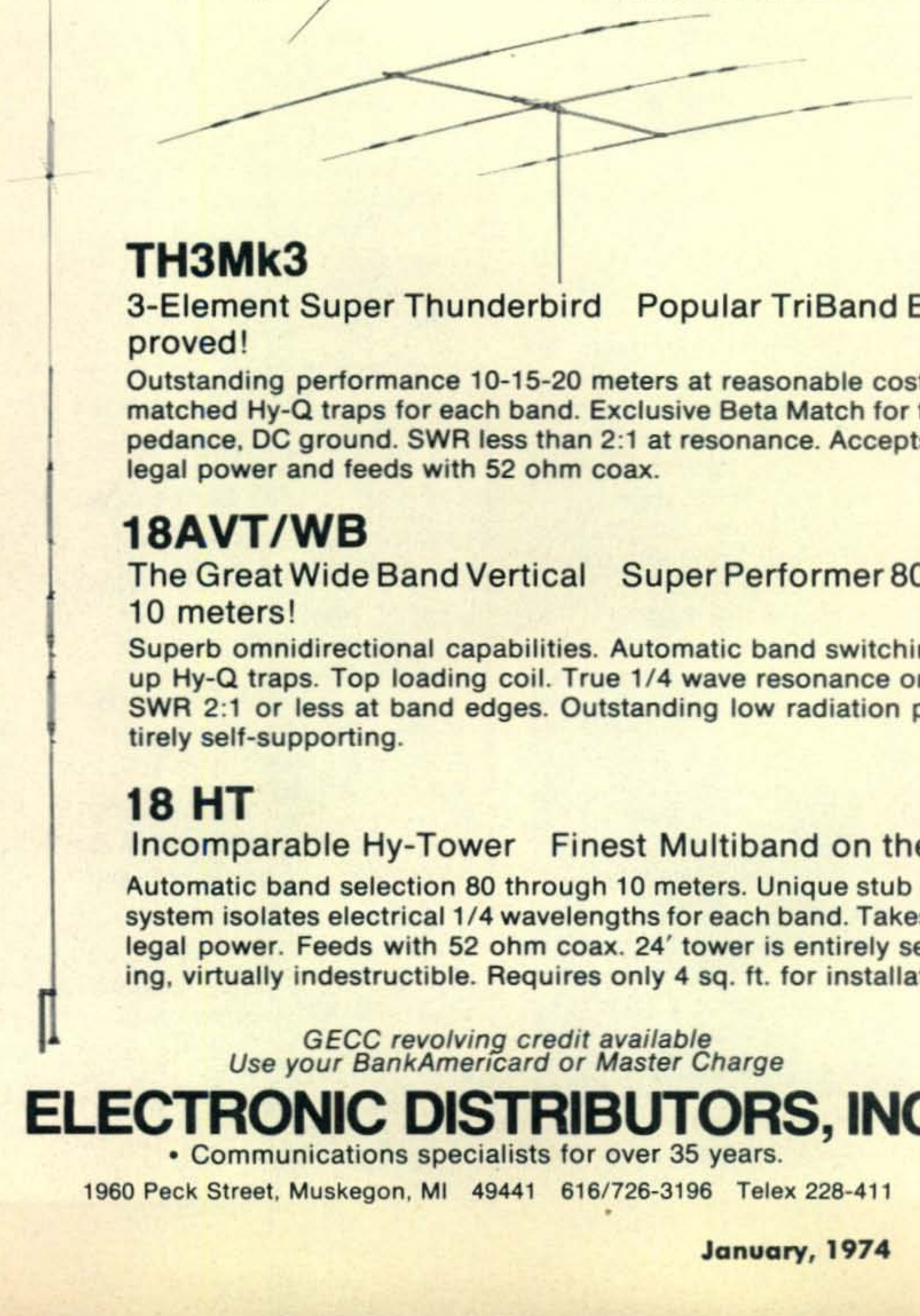
Superior Performance TriBander!

Impressive coverage 10-15-20 meters. Separate, improved Hy-Q traps for each band...SWR less than 1.5:1 on all bands. Takes maximum legal power, up to 1 kw AM, 2 kw PEP. Exclusive Beta Match. Factory pre-tuned. Feeds with 52 ohm coax.

$189.95



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Outstanding performance 10-15-20 meters at reasonable cost. Separate, matched Hy-Q traps for each band. Exclusive Beta Match for tapered impedance, DC ground. SWR less than 2:1 at resonance. Accepts maximum legal power and feeds with 52 ohm coax.

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Superb omnidirectional capabilities. Automatic band switching. Beefed-up Hy-Q traps. Top loading coil. True 1/4 wave resonance on all bands. SWR 2:1 or less at band edges. Outstanding low radiation pattern. Entirely self-supporting.

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Incomparable Hy-Tower Finest Multiband on the Market!

Automatic band selection 80 through 10 meters. Unique stub decoupling system isolates electrical 1/4 wavelengths for each band. Takes maximum legal power. Feeds with 52 ohm coax. 24′ tower is entirely self-supporting, virtually indestructible. Requires only 4 sq. ft. for installation.

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DX

BY JOHN A. ATTAWAY,* K4IIF

THE DX Department is pleased to begin the new year by announcing the first winner in *CQ's* new Single Band WAZ award series. He is H. E. Stricker, M.D., W8WZ, of Marysville, Ohio, who beat the world to WAZ on 20 meter c.w. adding fuel to the perennial agrument that the quickest route to a top DX score is via c.w. "Doc" is no newcomer to DX, being a top performer in both *CQ* and A.R.R.L. DX and contest programs for many years. His other laurels include 11 *CQ* contest certificates earned between 1948 and 1956, regular WAZ earned in 1956 (he had to wait 7 years for cards from Zones 19 and 23), DXCC on both phone and c.w., WBE, WAS and WAC. He served as SCM for Ohio and as Vice Director of his Division in 1952, and is a member of the Quarter Century Wireless Club and the Rag Chewer's Club. Having been first licensed in 1917 as 8WZ he holds a 50 year certificate in the Quarter Century Wireless Club.

The rig at "Doc's" QTH includes a homebrew tribander at 70 feet with 3-elements on 20 and 4-elements on 10 and 15, a Collins 32S3 exciter and 75S3 receiver with an old fashioned linear with a 250TH in the final. The linear uses plug-in coils and the antenna uses 3DZZ traps.

"Doc" says that winning the first Single Band WAZ was one of his greatest thrills in amateur radio, and that it was shared by Mrs. Stricker who monitored the mailbox daily and phoned the office when a new one came in direct. He made his first contact at 0002 GMT, Jan. 1, 1973 with JA2AHR. He worked all zones several times except for Zone 34 where SU1IM was the only station heard. UKØZAA was very active from Zone 19 and JAØAE from Zone 23. All zones were worked by Feb. 14 except for Zone 34 which was worked on April 25. Zones 19 and 23 were the last to be confirmed, with 19 coming in late in August and the Zone 23 card arriving on Sept. 14. All 40 confirmations were in the hands of the DX Editor on Sept. 16.

So the 20 meter c.w. plaque is history, but *CQ* is still holding 9 other plaques. These are for 20 meter s.s.b. plus plaques for both s.s.b. and c.w. on 10, 15, 40 and 80 meters. Who knows, in this sunspot low someone may even make it on 160 meters, and if they do *CQ* will certainly come up with an extra special award.

But the big news is still W8WZ. Congratulations to "Doc" and the Mrs., NUMBER ONE!!!

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

The first winner of a CQ Single Band WAZ Award is Dr. H. E. Stricker, W8WZ, see lead story. Doc worked em all on 14 mHz c.w.

News From The DX Clubs

The *North Jersey DX Association* recently had a fine get-to-gether for Father Moran, 9N1MM, who has been a missionary in Nepal for 22 years during which time he has provided a rare country confirmation for many, many DXers. Prior to his service in Nepal, Father Moran was a missionary to India for over 20 years.

The *Potomac Valley Radio Club's* new slate

The WAZ Program

Single Band WAZ

20 Meter C.W.

W8WZ.....1

S.S.B. WAZ

1145.....I8HH
1146.....W4GIW
1147.....W6OK
1148.....I2AHG

C.W.—Phone WAZ

3613.....DJ1UR
3614.....DL7HT
3615.....W2FBF
3616.....I6BQI
3617.....YO2BV
3618.....WA2HZR

Phone WAZ

487.....VK9BS

Complete rules for the Single Band WAZ program are shown on pg. 57-58 of the December, 1972 issue. Complete rules for regular WAZ may be found on pages 64-66 of the June, 1970 issue. Application blanks and reprints of both sets of rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, FL 33880.

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 Country List, LESS DELETED COUNTRIES, is used as the country standard. The ARRL has announced the addition of two countries to the DXCC List. They are the Federal Republic of Germany and the Democratic Republic of Germany. The present listing of Germany becomes a deleted country. These changes will be reflected in the next CQ DX Award Honor Roll listing.

CW

K6EC 315	W4YWX 305	DL3RK 301	W6NJU 296	WA6MWG 286
W6ID 315	K6LEB 305	W6ISQ 301	K1SHN 292	DJ7CX 279
W8LY 309	VK3AHQ 304	ON4QX 299	WA6EPQ 291	
W4IC 306	WØAUB 302	W4BQY 297	WA8DXA 288	

2XSSB

TI2HP 319	W6KTE 313	G3DO 305	YV1KZ 298	OE1FF 283
W2TP 319	W6NJU 313	K3GKU 305	SM6CKS 297	WØSFU 283
IØAMU 318	K6WR 313	WA6AHF 305	K1SHN 297	OE3WWB 282
W2RGV 318	ZS6LW 313	K4RTA 304	YS1O 297	DJ7CX 282
DL9OH 317	VE3MR 312	VE3ACD 304	ZL3NS 297	HP1JC 282
WA2RAU 317	W3DJZ 312	K6EC 303	WØYDB 294	WA2VEG 282
W3NKM 317	W4IC 312	KH6BB 303	18YRK 292	DL6KG 280
W9ILW 317	W6YMV 312	VE3GMT 303	WB2RLK 291	OK1MP 279
G3FKM 316	W9JT 312	IØZV 302	XE2YP 291	OE2EGL 278
K2FL 316	WA2EOQ 311	WA2HSX 302	YV1LA 291	K6GUY 277
W6REH 315	W9DWQ 311	WA6MWG 302	WB6DXU 290	W6TCQ 277
W6RKP 315	I1AA 310	WA3IKK 301	K8GQG 288	I1WT 276
W3AZD 314	F9MS 309	W6KZS 301	WAØKDI 288	WAØCPX 276
W6EUF 314	XE1AE 309	W6FW 300	W9OHH 286	W5QBM 275
I8KDB 313	F2MO 308	K4HJE 299	W3CRE 285	
IT9JT 313	OZ3SK 308	W9KRU 299	W8ZOK 285	
SM5SB 313	W9QLD 308	ZL1AGO 299	K1KNQ 284	
W6EL 313	VE2WY 307	G3RWQ 298	G3KYF 283	

of officers includes Leland "Bud" Smith, Jr., W4YZC, President; Frank Donovan, Jr. K1LPL /3, Act. Manager; Mike Sullivan, WB4BGY, Secretary; and John C. Kanode, W4WSF, Treasurer and *CQ* DX Awards Advisory Committeeman. New officers for the *Southern California DX Club* are Pete Hoover, W6APW, President; Larry Weaver, W6JPH, Vice President; George Torricelli, W6OK, Secretary; and Wayne Gingerich, W6EUF, Treasurer. Directors are W6GC, K6SVL, WB6UDC and W6EJJ.

The *Canadian DX Association* welcomes new members Adam, VE4SN; Phil, VE5PM; Eric, VE3XE; Gordon, VE7BEM and Glen, VE1HX.

The CQ DX Award Program

S.S.B. DX

300—WA8UUY 302—OK2BLI
301—W3CRE

Endorsements

S.S.B.: W6YMV—310, W3CRE—275, K3KNH—200 and WØUCK—200. W4YWX—1.8 mHz.

Complete rules for the *CQ* DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and copies of the rules may be obtained by sending a business size, self-addressed stamped envelope to the Assistant DX Editor, P.O. Box 1271, Covina, CA 91722, or to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

The rapidly growing *Western Washington DX Club* now boasts over 150 members and issues its own DX award, the "Washington Totem Award," for working 100 stations in the state of Washington including 20 members of the club. DX stations need only work 25 Washington stations including 10 club members. Address of the Award Manager is Western Washington DX Club, Inc., P.O. Box 224, Mercer Island, WA 98040.

(DX Club news is always welcome and should be routed to DX Editor, P.O. Box 205, Winter Haven, FL 33880.)

Rare Prefix News

BV—BV2A is the only legitimate station operating from Taiwan.

Jacque, XU1AA (F5QI), is on from Phnom Penh almost daily around 1700 GMT. Twenty meters is his preferrel band. Jacque works for French TV. *(Photo via VE2AFC)*

An evening in Bangkok during W5KZN's recent tour of the Far East. L-R: Pete, HS1AGQ; Jerry, W5KZN; Hans, HS1BG; Art, HS1AHW (host); Ed, HS1AIX.

GC4—GC4CHY has been active. QSL to GC3-NDX.

KX1—KX1MUM operated from the Bristol Mum Festival. QSL to Box MUM, Bristol, CT 06010.

The WPX Program

C.W. WPX

1281—I6BQI
1282—W7WMY

S.S.B. WPX

767—DU2EL
768—DK5AI
769—WBØCGJ
770—K3SWZ

Mixed WPX

406—WB2FJX
407—I8QO

WPNX

63—WN4ASV

WPX Endorsements

S.S.B.: I4ZSQ—750, W7KOI—400, K8CSG—400, W2SZ—400, and W8HGH—350.

C.W.: WA6JUD—650, UB5LS—600, W2GA—600, DL7MQ—600, UA4LM—550, W4WSF—550, K9OYZ—500, VE3BHZ—450, KH6HC—350, and G3DPX/W6—350.

Mixed: W4BQY—950, W4WSF—900, and WØYVA/4—450.

40 Meters: UA3GO and K4RDU

20 Meters: UA1CE

15 Meters: UA4LM

Europe: UA1CE and K4RDU

North America: W4KFB and K4RDU

Oceania: OK1MP and W6KYA

Complete rules for WPX, WPNX and VPX may be found on pg. 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size, self-addressed stamped envelope to the Assistant DX Editor, P.O. Box 1271, Covina, CA 91722, or to the DX Editor, P.O. Box 25, Winter Haven, FL 33880.

OR4—OR4VN is a Belgian Red Cross expedition in Nigeria. QSL to ON4VL.

PQØ & PTØ—Those needing QSLs from PQØMI and PTØMI should write directly to D. R. de Barros, PT4AM, P.O. Box O7/0044, 70.000 Brasilia, D.F., Brazil. O

VA2—VA2MO was a special club call. QSL to VE2AJD.

WD5—WD5FWA commemorated the opening of the Dallas-Ft. Worth airport. QSL to W5EJ.

WP2—WP2MAP was a special events station at the Miss America Pageant in Atlantic City. Station sponsor was the Southern Counties Amateur Radio Association. QSL to K2JOX, 205 Hamburg Ave., Egg Harbor, N.J. 08215.

WTØ—WTØNEB was a special events station at the Nebraska State Fair. QSL to Box 5006, Lincoln, NB 68505.

WW4—WW4RDC was QRV from the Roanoke Division Convention, Reston, VA. QSL to W4UPJ.

YA—All amateur activity in Afghanistan was discontinued last summer. QSLs for YA amateurs should be held until further notice.

3E1—An award is being issued to amateurs working three, 3E1 stations. Apply to P.O. Box 1395, Panama City, Panama.

DX In The Novice Bands

Novice DX Editor, Jim Alley, WN7UMU, aided by contributors Dan, WN9LMT, John, WN9JTM/5, and others, reports the following goodies in the 21 mHz Novice band. Jim is anxious to receive reports from more Novices, especially those working DX in the 40 and 10 meter bands, although 10 meter openings are becoming increasingly rare as we approach the sunspot minimum. Address reports to Jim at 2120 Wagonwheel, Las Vegas, Nevada 89119.

Station Worked	Frequency (kHz)	Time GMT
C31HF	21121	1655
CR6KW	21104	1930
CR6PV	21153	1930
CT1SX	21101	2250
CX1NE	21113	2330
DT (many)		
DJ, DK, DL, DM,	21100-21150	1400-2100
EA1KC	21102	1930
EA8CS	21106	1800
EA9EJ	21137	1800
EL2DK	21127	1830
EL2NS	21109	1430
EL7D	21152	1800
F (many)	21100-21150	1400-2100
FO8BW	21115	2000
G (many)	21100-21150	1400-2100
GM3ANO	21125	1830
GW2DPD	21125	1700
HI3AMG	21120	1800
HI7RFM	21125	1800

HV3SJ	21125	1800-1900
ISØDRD	21117	2140
KH6IBT	21107	2250
KZ5QRN	21105	1700
LA510	21109	1500
LZ1GU	21125	1515
OA6CV	21133	1715
OE3FFA	21105	2130
OH, OK, ON, OZ (many)	21100-21150	1400-2100
PAØSNG	21120	1700
PJ8NLO	21130	1700
PZ1DR	21125	1700
SP8FIX	21110	1600
SVØWTT	21122	1700
UK5IAI	21120	1430
VK (many)	21100-21150	0000-0400
VP9HI	21125	0015
VQ9R	21115	1645 & 2000
VQ9W	21185	1630
WS3SKY (NASA)	21115	1830
YU (many)	21100-21150	1400-2100
ZL (many)	21100-21150	2300-0300
ZP5HZ	21115	0000
ZS6ABQ	21149	1830
4Z4NNE	21132	1430
6W8DY	21100	1730
WA2FBI/6Y5	21125	0000
7XRFS	21117	1630
8P6BG	21165	1800
9J2JC	21107	1700
9Y4MH	21115	2230

All you Novices working toward WPNX go over the list carefully. There's plenty of good prefixes on the bands.

CQ DX Committeeman Vern Dameron, Jr., K1DRN, at the operating position of FPØXX during his July, 1973 DXpedition to St. Pierre. Vern made 729 contacts on 20 meter s.s.b. and all have been QSLed.

Vasco Felix, CT1ZG/CT7ZG, ex-CR6MN, is a CQ subscriber and has been active in the CQ Award and Contest programs for 4 years. Vasco started as an SWL-CTØ102 and was first licensed as CR6MN in Angola. He is 37, married and works as a radio announcer—producer for Emissora Nacional, the Portuguese National Broadcasting station.

QSL Information

The following offer to serve as QSL Manager for any interested DX station or DXpedition: Cecil Putnam, W5QWH, 2700 N. 7th St., McAllen, TX 78501.

A35FX—Via ZL2AFZ
A51PN—To W1JFL
CN8HD—c/o W2GHK
CR7GJ—Via W3HNK

[*Continued on page 79*]

Adriano Gominho, CR8AG, uses an FT-200 from his Portuguese Timor QTH. *(Photo via Jake, CT2AZ/W0JHY)*

Propagation

BY GEORGE JACOBS,* W3ASK

THE Swiss Federal Observatory at Zurich reports a mean sunspot number of 33 for October, 1973. This results in a smoothed sunspot number of 42 centered on April, 1973.

A smoothed sunspot number of 29 is forecast for January. During 1974 solar activity is expected to continue to decline slowly, but steadily, reaching a value of approximately 14 by the end of the year.

The end of the present sunspot cycle is now expected to occur during the late summer or early fall of 1975, with a level of approximately 7.

The following is an overall picture of H.F. band conditions forecast for January, 1974. For specific times of DX openings refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* for January and February, as well as Charts centered on Hawaii and Alaska. The Short-Skip Charts contain propagation forecasts for circuits varying in length between distances of 50 and 2300 miles.

10 Meters: Some fairly good DX openings shoull still be possible to southern and tropical regions during the daylight hours, with signals peaking during the afternoon. An occasional opening towards Europe and the east may be possible between 8 and 11 A.M., and towards the Far East during the late afternoon. Some short-skip openings, between approximately 1300 and 2300 miles, are also forecast for the afternoon hours.

15 Meters: Generally good 15 meter DX openings are forecast to many areas of the world during the hours of daylight. Fairly consistent shortskip openings, as a result of regular F-layer reflection, is also expected during the daylight hours, for distances ranging between approximately 1000 and 2300 miles.

20 Meters: Good DX conditions to most areas of the world are forecast for 20 meters sometime between sunrise and the late afternoon hours. Signals are expected to peak for about an hour or two after sunrise and again during the afternoon. Good short-skip openings, over distances ranging between 750 and 2300 miles, should also be possible. The band should occasionally remain open towards southern and tropical areas well into the evening.

40 Meters: DX openings should begin during the late afternoon hours, with conditions peaking during the hours of darkness and at sunrise. Atmospheric noise, or static, should remain at low seasonal levels during the month, and signals may often be exceptionally strong. Good short-skip openings are also forecast during the hours of daylight over distances ranging between approximately 150 and 750 miles. As darkness falls, the short-skip range should increase to between 1000 and 2300 miles.

80 Meters: With low static levels continuing through the month, fairly good DX openings are expected to many areas of the world during the hours of darkness. During the daylight hours short-skip should be possible up to about 300 miles. During the hours of darkness, the skip should increase, with openings possible between distances of approximately 400 and 2300 miles.

160 Meters: Some DX should be possible on this band from a few hours after sunset to shortly before sunrise. DX conditions peak when it is sunrise on the *eastern* terminal of a path. Short-skip openings up to the geometric limit of 2300 miles should be possible during the hours of darkness. Because of extremely high solar absorption in this frequency range, ionospheric propagation generally is not possible during the daylight hours, although it may sometimes occur over relatively short distances. Trans-Atlantic propagation tests are scheduled for 160 meters

*11307 Clara Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-To-Day Conditions Expected For January, 1974

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date *January*				
Above Normal: 8, 15-16, 22	A	A	B	C
Normal: 4-7, 9-12, 14, 17, 21, 23, 25-26, 29, 31	B	C	D	E
Below Normal: 1-3, 13, 18, 20, 24, 27-28, 30	C	D	E	E
Disturbed: 19	D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

B—Good opening, moderately strong signals with little fading and noise.

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

D—Poor opening, signals weak with considerable fading and noise.

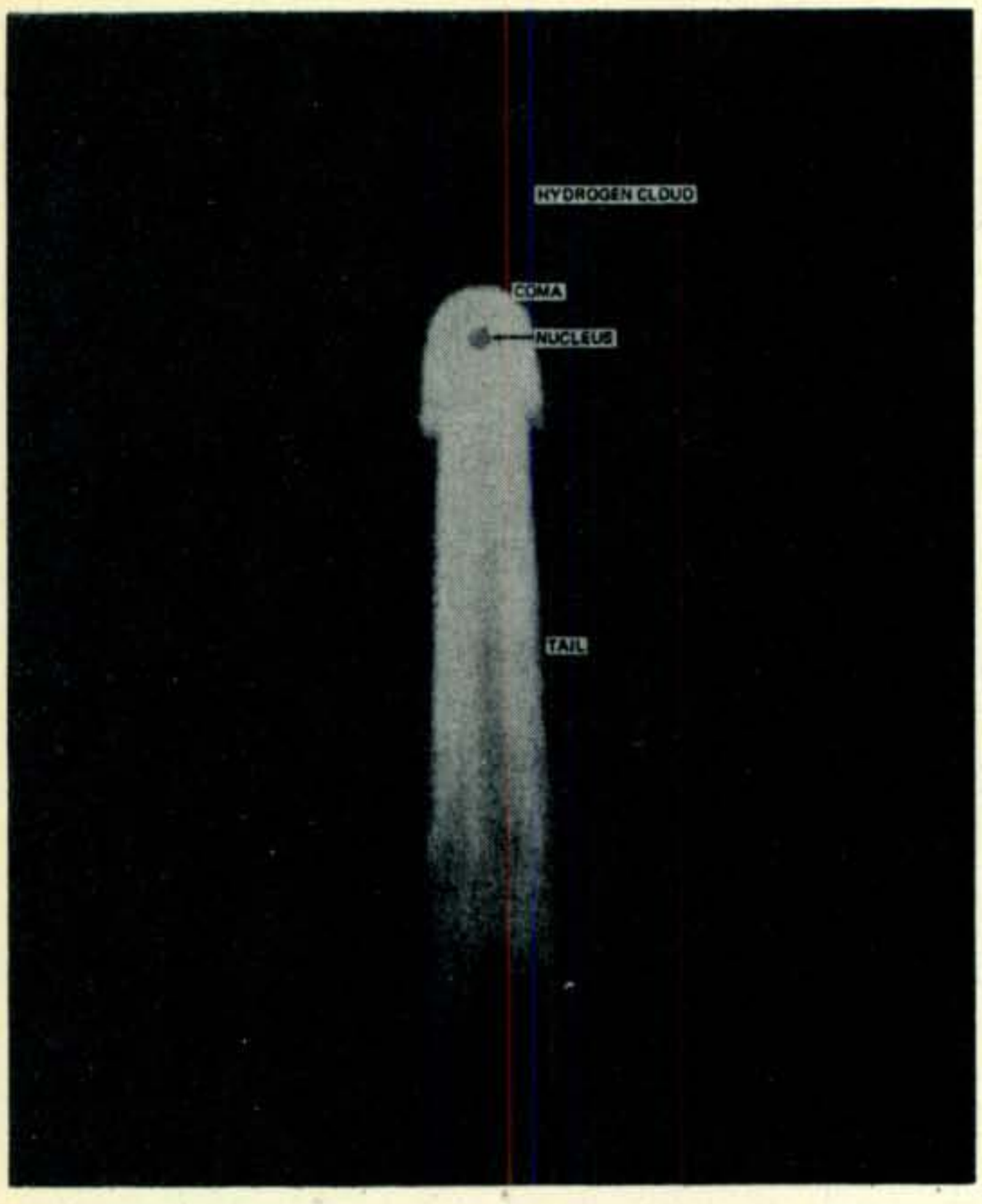
E—No opening expected.

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 particular opening for any day of the month. For example, all openings shown in the Charts with a *Rating & Forecast Quality* of (C) will be fair on Jan. 1-3; good (B) Jan. 4-7, excellent (A) Jan. 8, etc.

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



The Kohoutek comet which is now visible in the western sky for several hours after sunset. Its tail extends for approximately 100 million miles. *(NASA photo).*

between 0500 and 0700 GMT on January 13; trans-Pacific tests between 1330-1600 GMT on January 12. See last month's column for more details.

V.H.F. Ionospheric Openings

January is generally a poor month for v.h.f. ionospheric propagation. Conditions are poorest for sporadic-E and trans-Equatorial openings, and auroral activity is generally at a low seasonal level.

There is a possibility for meteor-scatter type openings during the first week of the month resulting from the *Quadrantids* meteor shower. This is a major shower which should peak on the 3rd and 4th with about 30 to 40 meteors entering the earth's atmosphere each hour.

Best bet for sporadic-E and auroral-type openings are on those days when h.f. conditions are expected to be disturbed or below normal. These appear in the "Last Minute Forecast" at the beginning of this column.

Comet Kohoutek

During January, the orbit of the recently discovered Kohoutek comet should carry it closest to earth. It should be easily visible with the naked eye in the western sky (look a little south of west), for several hours after sunset. The comet's tail should stretch across nearly one-sixth of the night sky, and its brightness should almost equal that of a full moon.

Travelling at a speed of 250 million miles per hour, the tail of this spectacular comet will extend for more than 100 million miles.

This is the first comet of this type since the famous Halley's comet, which last made its appearance in 1910. It will be under intensive observation and study by scientists throughout the world, in an attempt to unravel some of its mysteries.

For example, in the United States, an army of NASA scientists plan to examine the comet from all angles, and in visible, ultraviolet and infrared light. They will scrutinize it with giant telescopes both from the ground and from high flying airplanes. Cameras and telescopes aboard SKYLAB-4 will be used to get an even closer view, and instruments aboard the *Copernicus* and OSO-7 unmanned scientific satellites will send back telemetry data clear of the distortion caused by the earth's atmosphere. Instruments aboard the *Mariner-10* planetary probe will focus on the top-side of the Kohoutek comet as the probe roars towards Venus and Mercury.

These intensive observations are expected to yield new clues and some answers to old questions about comets and the structure of the universe itself.

It's not yet known what affect, if any, the Kohoutek comet might have on radio propagation. While the speed and the comet's immense tail suggest an ionization mechanism, its orbit is so high that it may not influence the earth's atmosphere at all. At its closest approach to the earth, on January 5, it will still be 75 million miles away. By comparison, the moon is less than 240,000 miles away, and meteor trails occur as near as 100 miles above the surface of the earth. So bouncing a signal off of the comet's tail is going to be magnitudes more difficult than off the moon or from meteor trails.

Easy or not, NASA does plan to bounce radar signals off the Kohoutek comet, in an attempt to learn something about the makeup of its nucleus, or head.

The comet is named for Dr. Lubos Kohoutek, a Czech-born astronomer at West Germany's Hamburg Observatory. He discovered the comet last March when it was only a speck in the sky.

73, George, W3ASK

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.

Claimed Scores For The 1973 CQ WW DX Phone Contest
On Page 75

CQ Short-Skip Propagation Chart

January & February, 1974

Local Standard Time At Path Mid-Point

(24-Hour Time System)

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	10-15 (0-1)	08-10 (0-1) 10-15 (1-2) 15-17 (0-1)
15	*Nil*	10-16 (0-1)	08-09 (0-1) 09-10 (0-2) 10-15 (1-3) 15-16 (1-2) 16-18 (0-1)	07-08 (0-1) 08-09 (1-3) 09-10 (2-3) 10-15 (3-4) 15-16 (2-3) 16-18 (1) 18-19 (0-1)
20	*Nil*	08-10 (0-1) 10-14 (0-3) 14-16 (0-2) 16-18 (0-1)	06-07 (0-1) 07-08 (0-2) 08-10 (1-4) 10-14 (3-4) 14-16 (2-4) 16-18 (1-2) 18-19 (0-2) 19-21 (0-1)	06-07 (1) 07-08 (2) 08-10 (4) 10-14 (4-3) 14-16 (4) 16-17 (2-4) 17-18 (2-3) 18-19 (2) 19-21 (1)
40	07-08 (0-1) 08-09 (1-2) 09-10 (2-4) 10-16 (3-4) 16-17 (3) 17-19 (1-2) 18-21 (0-1)	07-08 (1-2) 08-09 (2-3) 09-11 (4) 11-15 (4-3) 15-17 (3-4) 17-19 (2-3) 19-21 (1-2) 21-02 (0-2) 02-07 (0-1)	07-08 (2) 08-09 (3-1) 09-11 (4-1) 11-15 (3-1) 15-17 (4-2) 17-19 (3-4) 19-22 (2-4) 22-02 (2-3) 02-07 (1-2)	07-08 (2-1) 08-15 (1-0) 15-17 (2) 17-19 (4-3) 19-22 (4) 22-02 (3-4) 02-04 (2-3) 04-07 (2)
80	07-08 (1-2) 08-09 (3-4) 09-19 (4) 19-21 (3-4) 21-23 (2-1) 23-03 (1-2) 03-07 (1)	07-08 (2) 08-10 (4-2) 10-16 (4-1) 16-18 (4-2) 18-21 (4) 21-23 (3-4) 23-03 (2-3) 03-07 (1-3)	07-08 (2-1) 08-10 (2-0) 10-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-23 (4) 23-05 (3) 05-07 (3-2)	07-08 (0-1) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-23 (4) 23-03 (3) 03-05 (3-2) 05-07 (2-1)
160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3) 07-09 (2-1)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-1) 07-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-1) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (1)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2) 06-07 (1-0)

ALASKA

Openings Given in GMT†

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

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

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

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.

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 *standard* time is used at the *path mid-point*. For example, on a circuit between Maine and Florida, the time shown would be EST; on a circuit between NY and Texas, the time would be CST since the path mid-point, and use the appropriate standard time. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones, *add* 2 hours in the PST zone, 3 hours in MST zone; 4 hours in CST zone; and 5 hours in the EST zone. *Add* 10 hours to convert from SHT to GMT. For example, when it is 12 noon in Honolulu. it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart are given in GMT. To convert to *standard* time in Alaska and other areas of the USA, subtract 10 hours in the Alaskan Standard zone; 9 hours in the Yukon zone; 8 hours in PST zone, 7 hours in MST zone. *Add* 10 hours to convert from HST to GMT. For example, at 20 GMT it is 12 Noon in Juneau and 15 or 3 P.M. in NYC.

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.

HAWAII

Openings Given in Hawaiian Standard Time†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	08-13 (1)	06-08 (1) 08-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	06-08 (2) 08-12 (1) 12-15 (2) 15-16 (3) 16-17 (2) 17-19 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-03 (2) 03-04 (1) 19-21 (1)* 21-01 (2)* 01-03 (1)*

[*Continued on page 82*]

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

In our previous discussions of operational amplifiers[1] we have seen some of the more common circuits that can be implemented with these devices. To fully appreciate just how easy and interesting they really are however, requires some practical experimentation. With this in mind we will describe a simple power supply and indicate suitable op-amps that the experimenter can use to "prove out" the circuits of the last two months as well as "invent" others.

Most common operational amplifiers require a positive and negative supply for proper operation and the circuit given in fig. 1 will do the job nicely.

The Motorola MC1468G is a completely self-contained dual ± regulator and, together with the few simple components that just about everyone should have, will be ideal for powering any of the op-amps to be suggested later as well as the majority of units available. In addition, the supply is short circuit proof and will therefore protect itself against being inadvertently overloaded.

After building the circuit, a one minute check with a v.o.m. will assure that it either works or doesn't, and if it doesn't, you should be ashamed of yourself!

Fig. 2 is a wiring diagram of three op-amps that are available commercially and are ideal for initial experimentations. These units have been chosen because they most closely resemble the schematic representation and require no external components other than those indicated in the circuits of the past two months and are among the least expensive module type units available.

Table I indicates the important specification of each of the three op-amps discussed.

Additional literature and data can be, and should be, obtained from the various manufacturers at the following addresses:
Philbrick/Nexus, Allied Drive at Route 128, Dedham, Mass. 02026.
Melcor Electronics, 1750 New Highway, Farmingdale, N.Y. 11735.
Analog Devices, 221 5th St., Cambridge, Mass. 02142.

When using any of the above units, first set up the circuit configuration you wish and then, with power applied but with no input, adjust the offset trimming potentiometer to obtain zero output.

All of the above manufacturers also offer matching sockets for their op-amps which you may find worthwhile if you plan to breadboard many different circuits.

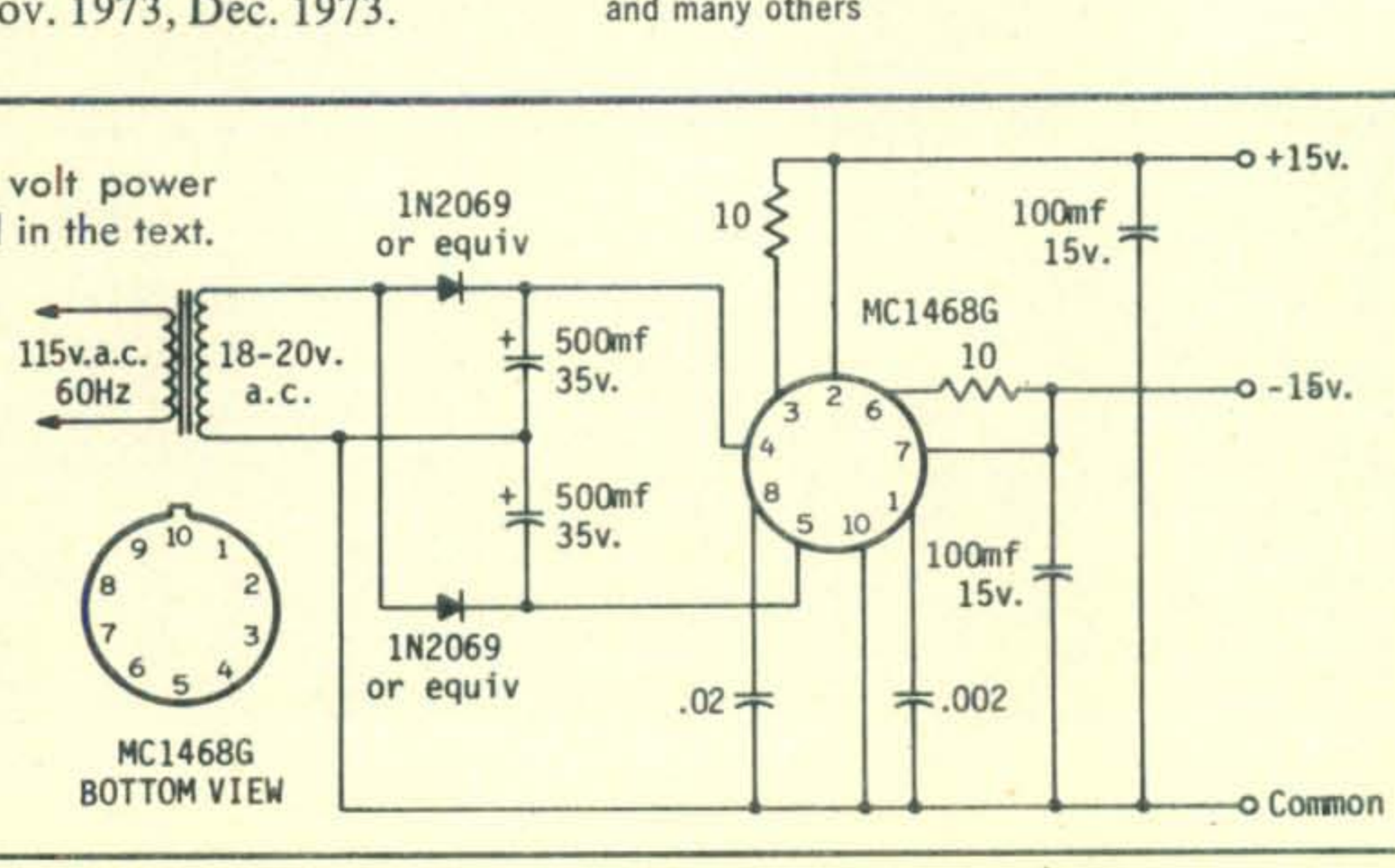
It is important to be aware that op-amps are also available in standard integrated circuit packages. These units however, may require additional external components for best results and it is wise to consult data sheets relating to specific devices. Three of the less expensive IC style op-amps are listed now with their specifications.

Manufacturer	Device No.	Typical Pwr. Sy. Req.	Open Loop Gain	Rated Output	Pkg.	Typical Price
Fairchild National Signetics and many others	uA709C LM709C N5709T	±9 to ±19 volts	15,000 min.	±12V min.	DIP	1.38
Fairchild Texas Inst. and many others	uA741C SW72741L	±5 to ±18 volts	20,000 min.	±12V min.	DIP	2.38
Fairchild National Signetics and many others	uA748 LM748 N5748	±5 to ±18 volts	500,000	±12V	DIP	2.00

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

[1] Math's Notes, CQ Nov. 1973, Dec. 1973.

Fig. 1—A dual 15 volt power supply as discussed in the text.



Type	*Power Supply Requirements*	*Max. Inputs*	*Open Loop Gain*	*Rated Output*
Philbrick/ Nexus 1028	±15V @ ±4ma	±15V	250,000	±10V @ 5ma
	Slew Rate	*Input Bias Current*	*Input Offset Volts*	*Price 1-9 pcs.*
	6V/usec	35 nanoamps	Adj. to zero	$11
	Power Supply Requirements	*Max. Inputs*	*Open Loop Gain*	*Rated Output*
Melcor 1861	±15V @ ±5ma	±15V	20,000	±10V @ 5ma
	Slew Rate	*Input Bias Current*	*Input Offset Volts*	*Price 1-9 pcs.*
	1.5V/usec	.25 nanoamps	Adj. to zero	$10
	Power Supply Requirements	*Max. Inputs*	*Open Loop Gain*	*Rated Output*
Analog Devices AD118A	±15V @ ±5ma	±15V	250,000	±10V @ 5ma
	Slew Rate	*Input Bias Current*	*Input Offset Volts*	*Price 1-9 pcs.*
	6V/usec	35 nanoamps	Adj. to zero	$11

Table I—General specifications of op-amps discussed in text.

A look at distributors' catalog or the various ads in *CQ* will no doubt indicate many other suitable op-amps.

For those who wish to progress even further, there are many excellent references describing op-amps and related circuitry and I would recommend a good technical library (usually associated with a university or college with an applied science or engineering curriculum) for additional information. There are also a few publications you can write for that will be useful and these, together with the proper address follow.

1. *AN-20, Applications guide for operational amplifiers,* National Semiconductor Corp. 2975 San Ysidro Way, Santa Clara, Calif. 95051.
2. *OP-AMP Application Chart,* Teledyne Philbrick/Nexus, 67 Allied Drive, Dedham, Mass. 02026.
3. *Handbook of Operational Amplifier Applications,* Burr-Brown Research Corp., Tucson, Arizona, 85706.
4. *Linear Integrated Circuits Handbook,* Fairchild Semiconductor Corp. Mountain View, California.

There are, of course, many additional books and pamphlets available too numerous to mention at this time.

We will be glad to publish interesting op-amp circuitry in this column that utilize either new or surplus grade devices as we receive them.

[*Continued on page 78*]

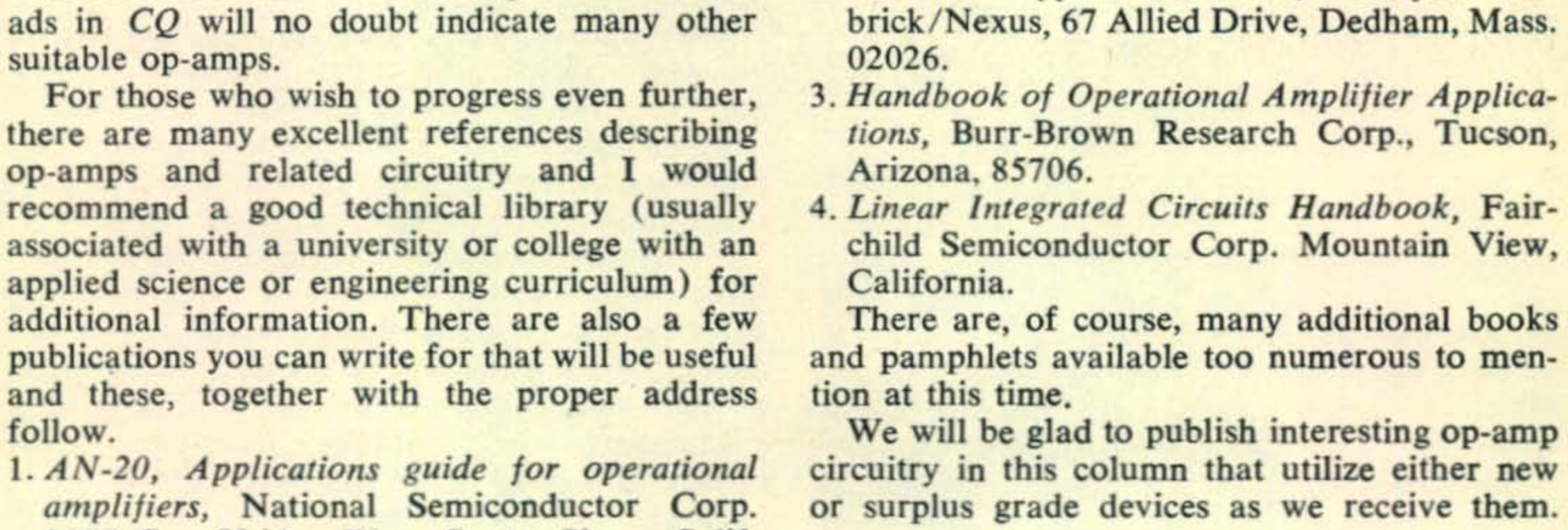


Fig. 2—Operational amplifier biasing and hookup information as per text.

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties
#108—Helen L. Fryer, WA3GLJ, 9-27-73.

THE "Story of The Month" for January is:

Don Brickey, W7OK

(All Counties #82, 8-2-72)

Don was born on a farm in Central Illinois in 1914. His first experience was with a Ford spark coil which could send code to a neighbor boy using the family's old Atwater Kent battery operated receiver. By the time he got into High School, someone said a license was required for even a small spark coil transmitter. Soon the call, W9AMP, was received and the spark coils were rectified to provide about 5 watts of power for a 201A TNT transmitter with a UV199 single tube regenerative receiver, all battery operated.

Don and his XYL, Milly, W9JHO moved to Nevada in 1965 where they are now W7OK and W7CDH. Don is retired after 25 years of working on 2-way f.m. communications for police departments, power companies and many other mobile communications users. Presently he is operating a small vending company. Their three harmonics are grown and living in other parts of the country, the youngest son is an amateur in Virginia. The amateur equipment now consists of the complete Drake line with a TR4 mobile unit. A 100 foot tower by the shack is used to support a tri-band Quad and 2 meter antennas, along with dipoles for 40, 80 and 160 meters.

Don built and operated the first 2-meter f.m. repeater in the State of Nevada and he is active in the Nevada State RACES on 2 meters and on 3996.5 kHz.

He always listens to the County Hunters Net on 14.337 whenever he can, and Don and Milly were looking forward to the trip to the County Hunters Convention last July in Ft. Wayne to renew old friendships and meet the many new friends on the Net.

Our records show that Don waited until August 2, 1972 and then applied for USA-CA-500, 1000, 1500, 2000 and 2500, endorsed All 14, All S.S.B., All Mobiles. USA-CA-3000 endorsed All S.S.B., All Mobiles and All Counties endorsed Mixed. For which Don wishes to ex-

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

Don Brickey, W7OK

USA-CA HONOR ROLL

3000		2000		500	
KØARS	129	WA3GLJ	194	W4ZRJ	964
K4ELK	131			SK6AW	965
WA3GLJ	132	1500		G3JXE	966
		WB4WBP	233	G3LZQ	967
2500		W8KOI	234	W8KOI	968
K8NQP	162	WA3GLJ	235	WB6FVO	969
K4ELK	163			JH1VOE	970
WA3GLJ	164	1000		WA3GLJ	971
		WB4WBP	312	9X5VA	972
		W8KOI	313	G3FKM	973
		WA3GLJ	314		

tend sincere thanks to the many mobile operators and net control stations for all the fine help, which made it all possible.

Don wishes to express the following: "County hunting has been one of the most enjoyable ham operating activities that I have ever engaged in. The best part of county hunting is not the accomplishment of working all the counties, but the making of so many friends. Counting hunting is the only award effort that I have ever engaged in where there is not petty jealousies and deliberate QRM from other participants. In fact, I do not know of any other ham operating activity where there is greater cooperation between participants which results in pride in other fellow's accomplishments. Friendships developed between County Hunters will last for years, all to the betterment of ham radio.

"I highly commend *CQ* Magazine and its editorial staff for their recognition of these facts and for their sponsorship of the Awards Program for this most worth-while ham operating activity".

Awards Issued

Helen Fryer, WA3GLJ waited until she had them *all* and then applied for USA-CA-500, 1000, and 1500 endorsed All S.S.B. All 80 and All 20. USA-CA-2000 All S.S.B. All 80. USA-CA-2500, 3000 and *All Counties* endorsed All S.S.B.

Jim Willingham, KØARS made USA-CA-3000.

Walt Morris, K4ELK was issued USA-CA-2500 and 3000.

Joe Vaughan, K8NQP qualified for USA-CA-2500 endorsed All 2×-C.W. *(Although by error I also tried to give him USA-CA-3000, but Jim being the honest man that he is, returned the 3000 Gold Seal even before I discovered my mistake).*

Jim Criner, Jr., WB4WBP (Son of WB4SXM) won USA-CA-1000 and 1500.

Stan Head, W8KOI (ex-K8MMZ/W9LZC) sent for USA-CA-500 and 1000 endorsed All 14, All S.S.B., All Mobiles and USA-CA-1500 Mixed.

Joe Haluska, W4ZRJ came up with a new one, USA-CA-500 endorsed All A-1, All QRPP (#1 using 5 watts or less).

Mixed USA-CA-500 Awards were sent to:
Hisingens Radioklubb, Sweden, SK6AW.
John Dunnington, G3LZQ.
Dean C. McLeland, WB6FVO, 13 years old!
John Allaway, G3FKM, Radio Society of Great Britain DX Editor who writes the DX Column, "The Month on the Air" for their magazine, *Radio Communications.*

USA-CA-500 Awards, endorsed All A-1 went to:
Kojiro Nakamura, JH1VOE (ex J1EC, J2HG) #8 to Asia. (He also puts a *big* signal into the U.S.).

Yodar Kritch Award
(10 meters)

Ron Wilkinson, G3JXE.

Alfons Vandenberghe, 9X5VA qualified for USA-CA-500-All S.S.B., (#1 Award to 9X5).

Awards

The Mobile QSL Bureau 3 × 3 Award: Issued for contacting members (members of the QSL Bureau—just under 500 at this writing), either mobile or fixed. S.W.L. on heard basis. Membership list for s.a.s.e. and 10¢ (Xerox fee). No date restrictions and any band/mode ok. Contact mobiles in three different counties or on any one county line. Contact fixed stations on three different days or occasions, or act as relay station for him on three different occasions. Basic Certificate Class E, for 25 members; Class D, Red Seal for 50; Class C, Yellow Seal for 100; Class B, Green Seal for 250 and Class A, Gold Seal for 400.

No set fee, but donations to Mobile QSL Bureau gratefully accepted for postage fund, etc.

No certified lists, no Notary Publics, No QSL's to be sent in. *Word of Honor Prevails!* Award sent in your envelope; s.a.s.e. for seals. Apply to: Mobile QSL Bureau, P.O. Box 146, Lakeside, California 92040.

Yodar Kritch Award: To help boost 10 meter activity, this award was dreamed up by four Baltimore stations—obviously members of the 10-X Club. (Don't know where they got the name). To get the certificate, you must work 3

The 3 X 3 Award

of the 4 following stations—WA3CDD, Dave #1830; WA3NCQ, Jim #2520; W3HJY, Mike #1844; and WA3OKX, Chuck #5495. These stations operate on 28.8 mHz, and contacts for the award must be made after September 15, 1973. After working the required stations, please send 18 cents in stamps and list of the stations worked to Jim Hart, WA3NCQ, 1718 Langley Road, Essex, Maryland 21221.

The Maryland-D.C. ten-ten net meets on Tuesday and Friday nights at 2000 hours EST in the winter and 2100 hours EDST in the summer on 29.0 mHz.

Klondike '73 Award. Rules page 71, Sept. 1973 CQ or write VA8CD, Andy Duncan, 31 Casino St., Takhini, Whitehorse, Yukon Terr., Canada.

Notes

Gee, 1974 starts my 53rd year in amateur radio and my 10th year writing this column with your kind help and cooperation—*THANKS!*

As this is being written, two more County Hunters have made *All Counties*, but their applications have not yet arrived.

Regarding the data on the Independent Cities of Virginia on pages 76 and 77 of September 1973 *CQ* — make two corrections/additions. Carter Glass III, W4JUK furnished me legal proof to convince me that Lynchburg also touches Amherst, so Lynchburg may be used for Campbell *or* Bedford *or* Amherst (only one and only once). Also that Petersburg touches Chesterfield, so Petersburg may be used for Dinwiddie *or* Prince George *or* Chesterfield.

Carter also advised me that by the time you read this, Suffolk will be a part of the City of Nansemond which already completely surrounds it. I am always pleased to receive such data as it takes a year or two to get into POD 26.

Here are the results of the 1973 MARAC County Hunters S.S.B. Contest and room per-

[*Continued on page 78*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Jan.	5-6	ARRL VHF Sweepstakes
Jan.	9-10	YLRL DX C.W. Contest
Jan.	12-13	DL QRP C.W. Contest
Jan.	12-13	YU 80 M. C.W. DX Contest
Jan.	15-17	OOTC C.W. Party
Jan.	23-24	YLRL DX Phone Contest
Jan.	**25-27**	**CQ WW 160 C.W. Contest**
Jan.	26-27	French C.W. Contest
Jan.	29-31	OOTC Phone Party
Feb.	2-3	ARRL DX Phone Contest
Feb.	8-10	QCWA QSO Party
Feb.	9-10	Ten Ten Net QSO Party
Feb.	9-10	Worldwide SSTV Contest
Feb.	16-17	ARRL DX C.W. Contest
Feb.	23-24	French Phone Contest
Feb.	23-24	YL-OM Phone Contest
Feb.	23-25	Vermont QSO Party
Mar.	2-3	ARRL DX Phone Contest
Mar.	9-10	YL-OM C.W. Contest
Mar.	9-10	Worldwide VHF Activity
Mar.	16-17	ARRL DX C.W. Contest
Mar.	23-25	BARTG RTTY Contest
Mar.	**30-31**	**CQ WW WPX SSB Contest**
Apr.	12-15	County Hunters SSB Contest
Apr.	20-22	Zero District QSO Party
May	11	World Telecomm. C.W.
May	18	World Telecomm. Phone
June	2	Minnesota QSO Party

DL QRP C.W. Contest

Starts: 1800 GMT Saturday, January 12
Ends: 1500 GMT Sunday, January 13

Power input is limited to 10 watts or less. Details in last month's CALENDAR. Mailing deadline for logs is February 15th to: Hartmut Weber, DJ7ST D-3201 Holle, Kleine Ohe 5, Germany.

YU 80 M. C.W. Contest

Starts: 2100 GMT Saturday, January 12
Ends: 2100 GMT Sunday, January 13

You can work everybody in this one, but YU contacts are worth extra points. Also covered in last month's CALENDAR. Mailing deadline is March 15th to: SRJ Contest Committee, P.O. Box 48, 11001 Belgrade, Yugoslavia.

DX-YL to Stateside YL Contest

C.W.: Jan. 9-10 Phone: Jan. 23-24
Starts: 1800 GMT Wednesday
Ends: 1800 GMT Thursday

The stateside YL's in the 48 states will be working the YL's in DX countries, including Alaska and Hawaii. (Canada?) The reverse applies to DX stations. KL7 and KH6 may work both DX and the 49 other states.

The same station may be worked on each band for QSO credit, net contacts are not permitted and only QSOs with other YL's are valid.

Exchange: QSO no., RS(T) and QTH. State for W/K, country for DX stations.

Scoring: One point for each QSO. Multiply total by states or DX countries worked. There is a power multiplier of 1.25 if power input is 150 watts or less, (300 p.e.p. on s.s.b.)

Awards: Trophies to Top c.w. and phone winners, both DX and stateside. Plaques to highest combined scores, both DX and states, and Certificates to second and third place winners.

Submit separate logs for each section and a signed declaration no later than February 10. They must be received before Feb. 28th so overseas entries better use air mail.

They go to: Christine Haycock, WB2YBA, 361 Roseville Avenue, Newark, N.J. 07107.

OOTC QSO Party

C.W.: Jan. 15-17 Phone: Jan. 29-31
Starts: 2300 GMT Tuesday
Ends: 2300 GMT Thursday

This party is for Old, Old Timers members only. Contacts can be made on any band and mode but only one QSO per station per band permitted.

Exchange: QSO no., QTH (state, province or country) name and OOTC number.

Scoring: 1 point for contacts between US and Canada, 3 points if it's a DX member.

DX stations score 1 point for QSOs within own country, 5 points for all other contacts.

Multiplier: One for each state, province or country worked on each band. Make it 3 multiplier points if it's on 28 mHz.

Final Score: Total QSO points × sum of multiplier points from each band.

Frequencies: C.W.—Between 30 to 70 kHz of the low end of each c.w. band, 3.5 thru 28 mHz. Phone—3895, 7230, 14280, 21355, 28600.

It is requested that you use official log forms which are available from W6BUK, include a s.a.s.e. with your request.

The c.w. logs go to: A. D. Brattland, K6EA,

*14 Sherwood Road, Stamford, Conn. 06905.

Area	Maximum D.C. Plate Input Power in Watts															
	1800 to 1825 kc		1825 to 1850 kc		1850 to 1875 kc		1875 to 1900 kc		1900 to 1925 kc		1925 to 1950 kc		1950 to 1975 kc		1975 to 2000 kc	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Alabama	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Alaska	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Arizona	1000	200	500	100	500	100	0	0	0	0	0	0	0	0	0	0
Arkansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
California	1000	200	500	100	100	500	100	25	0	0	0	0	0	0	0	0
Colorado	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Connecticut	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Delaware	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
District of Columbia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Florida	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Georgia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Hawaii	0	0	0	0	0	0	0	0	200	50	100	25	100	25	500	100
Idaho	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Illinois	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Indiana	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Iowa	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Kansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Kentucky	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Louisiana	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Maine	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Massachusetts	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Michigan	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Minnesota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Mississippi	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Missouri	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Montana	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Nebraska	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Nevada	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
New Hampshire	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	1000	200	500	100	100	25	0	0	0	0	100	25	500	100	1000	200
New York	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
North Dakota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Ohio	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Oklahoma	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Oregon	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Pennsylvania	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
South Carolina	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
South Dakota	1000	500	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Tennessee	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Texas	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Utah	1000	200	500	100	500	100	100	25	100	25	0	0	0	0	100	25
Vermont	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Washington	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
West Virginia	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Wisconsin	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Wyoming	1000	200	500	100	500	100	100	0	100	25	0	0	0	0	200	50
Puerto Rico	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Virgin Islands	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Swan Island	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Serrana Bank	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Roncador Key	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Navassa Island	500	100	100	25			0	0	0	0	0	0	0	0	200	50
Baker, Canton Enderbury, Howland	100	25	0	0	0	0	100	25	100	25	0	0	0	0	100	25
Guam, Johnston					0	0										
Midway	0	0	0	0	0	0	0	0	100	25	0	0	0	0	100	25
American Samoa	200	50	0	0	0	0	200	50	200	50	0	0	0	0	200	50
Wake	100	25	0	0	0	0	100	25	0	0	0	0	0	0	0	0
Palmyra, Jarvis	0	0	0	0	0	0	0	0	200	50	0	0	0	0	200	50

160 Meter Regulations.

1135 Magnolia Ave., Long Beach, Cal. 90813. Send your phone logs to: G. C. MaConomy, W6BUK, Space 45, 36770 Florida Ave., Hemet, Cal. 92343. Entries must be received by February 22nd.

French DX Contest

C.W.: Jan. 26-27 Phone: Feb. 23-24
Starts: 1400 GMT Saturday
Ends: 2200 GMT Sunday

Contest activity is not confined to the French continental stations, you can also work French DUF countries and the following prefixes. HB, LX, ON, 9Q, 9U, 9X and 4U1ITU.

Exchange: RS(T) report plus a QSO number starting with 001. (French stations will also include 2 figures after their call which indicates their department.)

Scoring: Each QSO counts 3 points. You earn a multiplier of 1 for each French department (95), each Swiss canton (22), each Belgium province (10), each DUF country, plus LX and 4U1ITU worked.

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

Awards: Certificates to top scorers in each country and US call area. Contest contacts may also be applied for the many French awards, DUF, DPF, DDFM and DTA.

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

ARRL DX Contest

Phone: February 2-3 and March 2-3
C.W.: February 16-17 and March 16-17
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

This will be the 40th running of this contest in which the DX fraternity concentrates on working as many W/Ks and VE/VO's as possible. The boys on this side of the pond of course will be looking for the DX. (Four week-ends should give them plenty of time.)

The fellows on this side will send a signal report and their state or province. The DX stations will add 3 digits to the signal report indicating their power input.

All the details will be in the current *QST*. It is recommended that you get and use the official ARRL log and summary sheet and their check-off list which are available by sending a s.a.s.e. to Headquarters.

Address all requests and your logs to: ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111

CQ WW DX 160 Contest

Starts: 2200 GMT Friday, January 25
Ends: 1600 GMT Sunday, January 27

Rules same as last year. This is a c.w. only contest, no c.w. to phone or cross band contacts will be allowed.

Exchange: RST and a three figure QSO number starting with 001, plus your state, or VE province. It is not necessary for DX to send their QTH, the prefix will identify them.

Scoring: For W/VE/VO, 2 points per QSO with other W/VE/VO stations. All DX contacts are worth 10 QSO points.

For all other countries, 2 points per QSO with stations in the same country, 5 points with stations in other countries. Except for contacts with W/VE/VO which count 10 points.

Multiplier: For all stations, a multiplier of one (1) for each US state, Canadian province and DX country worked. (KH6 and KL7 are considered as DX, the District of Columbia is same as Maryland, and remember that VE1 is divided into 3 provinces, New Brunswick, Nova Scotia and Prince Edward Island.)

Final Score: Total QSO points multiplied by the sum of the multiplier.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of the contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts will be

deemed sufficient cause for disqualification. Decision of the Committee is final.

Awards: Certificates to the top scorers in each state, VE province and DX country, additional awards if the score or participation warrants. A Plaque will be awarded by *CQ* to the highest scoring single operator station.

Log sheets and United States Regulations for 160 may be obtained from *CQ*. Include a large s.a.s.e. with sufficient postage to cover your particular needs.

Mailing deadline for contest logs is February 28th to: *CQ* 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Ten-Ten Net QSO Party

Starts: 0000 GMT Saturday, February 9
Ends: 2400 GMT Sunday, February 10

This is the annual QSO party for the Ten-Ten International Net of Southern California. By its name it's quite obvious that the action will take place on Ten Meters. The net's monitoring frequency is 28,800 kHz so that tells me it will be on s.s.b.

Exchange: Name, QTH and 10× number.

Scoring: One point for each member contacted, 1 additional point if it's with a DX member, YL/XYL or Chapter Head. (That's your score.)

Awards: 1st and 2nd place certificates to leading scorers in each US and VE call areas, KH6 and KL7. And to 11 continental and sub-continental areas over the world.

Logs go to: Grace Dunlap, K5MRU, Box 445, La Feria, Texas 78559. They must be received by March 15th. Include a s.a.s.e. for results.

World SSTV Contest

Two Periods
1500-2200 GMT Saturday, February 9
0700-1400 GMT Sunday, February 10

This is the 4th annual Slow Scan TV Contest sponsored by *CQ Elelctronica* magazine of Italy.

Contacts must be made on SSTV only, any band 3.5 thru 28 mHz. (The TVers have their own established spots).

Exchange: Picture, signal report and QSO number starting with 001.

Scoring: One point for contacts on each band, except 28 mHz which are worth 2 points.

Score 5 multiplier points for each continent worked and 2 point for each DXCC country on each band. In addition W9, WØ and VE call areas may also be counted as a multiplier.

Final Score: Total QSO points × the sum of the multiplier from each band.

Awards: Free subscriptions to *CQ Electronica* to the three high scoring stations as well as those only receiving a picture. (s.w.l.)

Include a summary sheet with your entry with the scoring and a station description. You are expected to observe the fundamental rules of operation and courtesy.

Logs must be received no later than March 20th and go to: Prof. Franco Fanti, Via A. Dallolio n. 19, 40139 Bologna, Italy.

Claimed Scores
1973 CQ WW DX Phone Contest

The following are a few unofficial claimed scores for the CQ W.W. DX Phone Contest received at press-time. This listing is not intended to show winning scores, but rather to show typical entries from different areas, so don't be alarmed if you're not listed!

Single Operator
All Band

K1ZND	1,191,015
W3CRE	1,012,893
KH6IGE	1,009,010
W4UPJ	851,148
LA6HL	803,216
VE3BS	677,876
W9CTY	642,690
K4IRQ	552,000
K9WEH	470,834
W6PLH	452,914
W9LF	403,472
W5NMA	403,448
HS3AIG	382,356

28 mHz

VE2GBL	129,549
W6HX	94,689
WA4DRU	88,173
WA8QIY	71,604
W9DOB	68,801
W8IMZ	62,010
W4OZF	53,932
K2QBW	51,512
KV4AM	50,460
YU2RKC	47,783
JA7KTY	22,660

21 mHz

W4WSF	346,527
W8JGU	265,512
W2NIN	261,434
W1MDO	188,748
W6EYY	174,538
K6OZL	164,604
PY4KL	154,462
WA6RFX	128,932
DL9VS	122,540
JA3ERG	112,700

14 mHz

F2QQ	518,034
DL7AH	309,400
W8JGU	265,512
K2BQO	235,524
VE6MP	210,040
W3BRB	177,930
KV4IG	150,930
W9YRA	130,052
WA1SKV	109,710
JA2HGA	76,558

7 mHz

HR1RF	174,734
ZL4BO	81,972
W9RX	15,232
JA1BRK	9,087

3.8 mHz

KV4FZ	183,500
W4CRW	32,880
VE3BBN	24,531
VE5NW	15,201
K9PQG	5,439

1.8 mHz

PAØHIP	5,445
W1BB/1	967
VE5XU	384
WA2COS	98

Multi-Operator
Single Trans.

VP2M	5,048,388

Multi-Operator
Multi-Trans.

PJ9GIW	11,152,574
W1ZM	3,332,882

QCWA QSO Party

Starts: 0000 GMT Saturday, February 9
Ends: 2400 GMT Sunday, February 10

The 17th annual QCWA QSO Party is being sponsored by the Chicago Chapter this year.

The objective of the party is to meet old friends and make new ones. A simple scoring system adds a little spice to the activity. This year's rules have been simplified and streamlined by the new committee.

Exchange: QSO no., QTH, (state, province or country prefix) name and QCWA number.

Scoring: One point for each member worked. (A member may be worked only once regardless of the band, and only contacts between QCWA members are valid.)

Multiplier: One for each US state, Canadian province and DX country call-area prefix worked. (i.e., XE1, XE2, G1, G2 and etc. A

[*Continued on page 79*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

THERE was so much response to my column on the AN/ARC-96 electronic RTTY printer (*CQ* Oct. 1973) that I thought I would cover, this month, the available surplus teleprinter equipment, particularly for those readers to whom RTTY is a new and fascinating mode of amateur or s.w.l. communication.

Several of those who wrote me about the AN/ARC-96 wanted basic data about receiving RTTY signals off the air, so I will outline what is needed. The subject is covered quite completely, in detail and with clarity, in *CQ's* publications *RTTY From A to Z* and *New RTTY Handbook* ($5 and $3.95) so I will only sketch what surplus is needed and available.

Fig. 1(A) is a block diagram of a typical RTTY station, with a receiver, demodulator, printer, RTTY transmitter (keyboard or tape reader), transmitting modulator, and transmitter. Fig. 1(B) is a diversity setup, a common military operation.

The key unit needed to receive RTTY, aside from the printer, is the demodulator, (or converter or tuning unit) which converts the audio tone pulses into a relatively high level direct current signal. This may be simple or quite complex, depending on the method of transmission. Wire lines or v.h.f. f.m. suffer little or no fade, thus demods for those modes can be simple. High-frequency circuits suffer severe propagation problems, and require sophisticated receiving systems, often in triple diversity, with complex corrective circuits to counteract fading.

The Navy CV-89/URA-8A is one of the most common surplus demods. It has a 'scope for tuning, accepts any common 'shift (spacing between Mark and Space tones) and is reliable and easy to use. The slightly older Bohme 5-C (*CQ* August 1967) is a bit bulkier, but also offers a tuning scope and has sharper, tuneable filters. The CV-57 is a i.f. version of the CV-89, with a smaller circuit. Where the CV-57 is for i.f.'s from 200-500 kHz, the companion CV-71 is set up for 50 kHz. The Frederick 1200 and 1203 are late models of solid state commercial gear, widely used by the military as well.

A common, but ancient, demod is the Western Electric AN/FGC-1. It stands six feet tall and is no better than the later gear except to hold down the shack in a high wind. The TT-40/SGC-1 (*CQ* August 1969) is an older demod which is supplied with oddball tone filters. The AFSAV-39C is a single-tone (wire line) demod, suitable only for 2-meter work, if that.

There are a number of multiplex units such as the Northern Radio 152, the AFSAV-133C (twinplex), the DEN-35, AN/FCC-3, and so on, which can be used for getting one's feet wet in RTTY cheaply, but the serious RTTY man will look for the CV-89, TMC CFA-1, Frederick 1203, etc. The rarer CV-60 is just as good as the CV-89—it is the same demod, packaged slightly differently.

A more complete roundup of RTTY demodulators appeared in this space in August 1966.

The demod is the heart of any RTTY receiving station. If it is no good you get nothing—even a poor printer can often be made to work with a little oil and swift kick, but the Demod is the point where you should, if necessary, spend your money. Even a cheap receiver—an old Command set for example, will copy RTTY pretty well, if you have a decent demod.

The printer is, electrically, the simplest part of the RTTY system. The receive side is simply an electro-magnet, operated by the demod loop

*1502 Stonewall Rd., Alexandria, Va. 22302

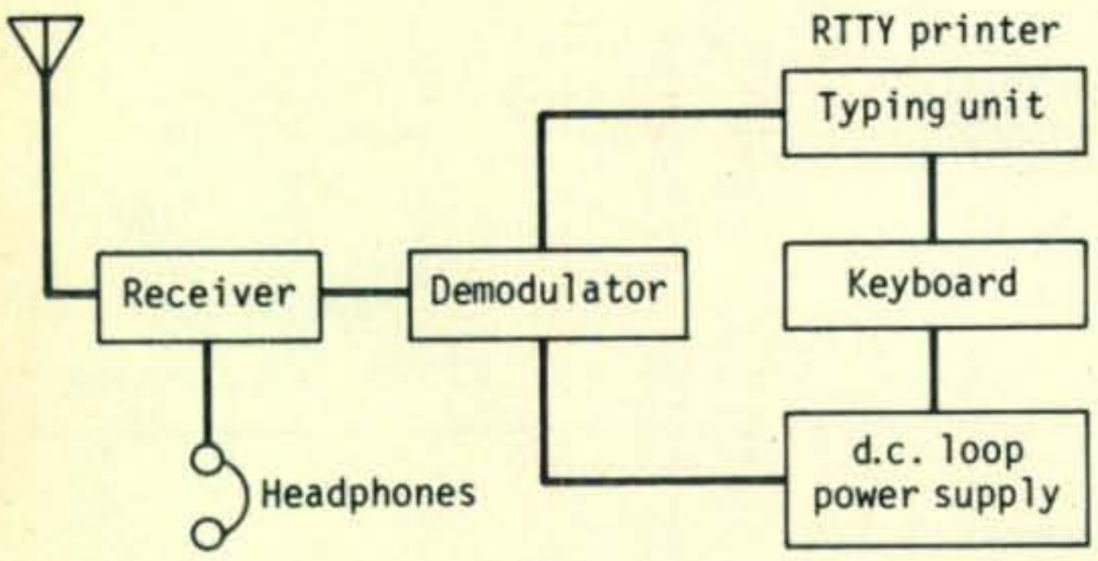


Fig. 1 (A)—typical setup of receiver, demodulator and RTTY printer. (B) one method of setting up to receive diversity for RTTY communications to improve receiving reliability in the face of adverse propagation. Antennas may be spaced ½ wavelength or more apart, and receivers tuned to the same frequency, or the same signal may be transmitted on two or more frequencies simultaneously.

current. After that, it's all mechanical, except in CRT displays, or electronic printers such as the AN/ARC-96, which are fairly uncommon even today.

The books cited above go into printer theory in detail, so I will say only that the magnets operate levers which control a series of code bars from which the printing mechanism itself is actuated by a small electric motor. On the send side, the keyboard simply opens and closes a set of contacts.

The send contacts are connected into a sending modulator or keyer which drives the station transmitter. Again, this may be as simple or complex as one desires. Most amateurs arrange a set of diodes to shift their carrier by the appropriate value, nominally 850 or 170 cycles per second. More complex military keyers are the Northern Radio type 105 Model 6, and the O-5-B. These units have crystal ovens to keep their sensitive oscillators exceedingly stable, and their shift circuits are thoroughly engineered and calibrated for accurate values. They can be adjusted over a wide range, and offer a degree of flexibility and reliability that few amateurs build into their home-brew FSK circuits.

The teleprinter selection in surplus is becoming wider and wider, from the few #19 machines still turning up to such state-of-the-art items as the AN/ARC-96. The surplus hound can select something to satisfy almost any purse or any technical need.

The #19 and #15 sets are the old familiar Teletype printers, used in newspaper and telegraph offices from the 1920's through the 1950's, indeed many are still in use, though they are no longer produced. The #19 is a larger unit, with tape punch and "Tee-Dee" or reader. In military nomenclature it is often seen as AN/FGC-8, AN/FGC-9, AN/FGC-11, AN/FGC-42, TT-7, 8/FG and other numbers. The Model 15, the page printer with keyboard, is AN/FGC-10, 13, 17, 18, 34, 41, etc., or TT-5/FG, TT-6, TT-11, 22, 39, 49, 50, 51, 55, 78, 90, etc. (The TT-71/FG is a projector, built to put the TTY message on a screen, in a carrier briefing room).

Model 14's, the tape reperforators and Tee Dees of the same era, are seen under dozens of nomenclature, too numerous to mention here. These are all useful older sets, good for the beginner, or the man who wants only to communicate occasionally on RTTY, at speeds no higher than 75 words per minute. The Model 14 tape reader and the reperf will run at 100 w.p.m., but not the #15 and #19 page printers.

The Model 28 Teletype gear is the most commonly seen in surplus. It comes in a wide variety of units, of which the KSR corresponds to the #15 page printer. In surplus it may be labelled TT-34/FG, TT-35, TT-47 (the most common number), TT-48, 69, 70, 128, 129, 130, 131, 171, 176, 183, 184, 187, 192, 234, 242, 243, 244,

247, 248, 261, 275 (receive only), 283, 306, 307, etc.

There is quite a bit of Kleinschmidt TTY gear in surplus now, at attractive prices. The Kleinschmidt's are generally not as sought-after as the Teletype Corp. units, and can be found at downright cheap prices. If you take time to find one that works well, and don't plan to do exotic things like install a gear shift or auto-call, maybe Kleinschmidt is the way to go.

The TT-4/TG (Kleinschmidt Model 100) is a common KSR model. Others are the TT-65, TT-61, TT-72, TT-97, TT-98, TT-99, TT-100, TT-117, TT-118, TT-120, etc. There is a newer Kleinschmidt set, using a great deal of solid-state circuitry, with far higher speeds, the Model 311. See this column for June '71 p. 85 for details of that version.

I plan to add a bit more detail to the picture of surplus RTTY gear next month, and to answer some of the questions most often posed to me. ■

Awards [*from page 72*]

mits listing just the top 5 winners in each category: (Courtesy of Jim Willingham, KØARS)

Fixed		Mobile	
1. WAØTKJ	1,100,640	1. K4RQX	92,340
2. WAØWOB	148,341	2. WA7GOO	18,224
3. WA1NRV	145,232	3. WA7KKN	7,112
4. K7LTV	113,094	4. WA4RIJ	5,950
5. K1OME	94,355	5. K9KKX	4,624

DX

1. SK6AW 1,452

The first place winner in each category received a MARAC Plaque and the Top 10 winners in each category received certificates.

The 1974 MARAC Annual County Hunters S.S.B. Contest will be from 2200 GMT, Friday, April 12th to 0500 GMT, Monday April 15. Remember you get no credit for contacts on the 14.336, 7,243 or 3.943 S.S.B. Nets. See CONTEST CALENDAR by Frank Anzalone, W1WY for full rules.

All the best for you & yours in 1974. How was your month?

73, Ed., W2GT.

Math's Notes [*from page 69*]

All credits relating to dehigner and source of the op-amp (including prices, of course) will also be given.

In the new item area, we have received several bits of information we would like to pass on at this time.

GC Electronics, 400 South Wyman Street, Rockford, Ill. 61101, has published a 13 page printed circuit handbook that is interesting to newcomers in this technique. It literally takes you step-by-step through all of the phases of making a printed circuit board (with their

products, of course) by most of the commonly used methods. Included in this booklet is a handy "trouble shooting" guide for those who "just can't understand what went wrong". If interested write for FR-128-G. I do not know whether the 50¢ price on the cover is valid.

A new catalog (#173) from a company called AMTECH has recently reached us and it is one designed just for hobbyists. While slanted to amateur radio and communications, general experimenters may find it interesting. Included is a line of monolithic crystal filters at 10.7 mHz and 16.9 mHz, 455 kHz ceramic filters. V.h.f. power transistors, r.f. integrated circuits and several related components. The catalog is well written, plenty of design and application information for what is being sold is given, and the minimum order is only $1, which is quite reasonable in these inflated times. Write to them for a copy of this catalog if you are any kind of communications experimenter and please mention *CQ*. The address is:

AMTECH, P.O. Box 624, Marion, Iowa 52302

Our last item this month will appeal to the v.h.f. and u.h.f. enthusiast. Plessey Semiconductors, 170 Finn Court, Farmingdale, N.Y. 11735, the U.S. office for this British based company, has announced a series of fast counter chips suitable for use as pre-scalers in frequency counters, synthesizers, pulse counting applications, etc. There are six devices at present, the SP640 to SP643 and the SP646 and SP647. These chips may be externally programmed to divide by either 10 or 11 at frequencies up to 1 GHz (1000 mHz). All units may be directly coupled to ECL chips and require only 2 external resistors to interface with TTL chips. All ECL outputs can also drive 50 ohm loads, thus matching many counter inputs directly. Prices range from $18 to $80 (1-24 pcs.) depending on the unit desired and data sheets describing the devices in detail are available.

A very healthy and happy New Year to all of our readers.

73, Irv, WA2NDM

Contest Calendar [*from page 75*]

multiplier may be counted only once. KH6 & KL7 considered DX.)

Final score: Total QSO points × sum of the multiplier.

Frequencies: C.W.—50 kHz from low end of each c.w. band. Phone—3900, 7240, 14270, 14340, 21390, 21435, 28600. RTTY—3595, 7095, 14095, 21070, 28070. Within 5 kHz.

The Committee has prepared 350 commemorative tokens which will be awarded to the top 350 scorers who submit a log. The Headquarter's Plaque goes to the "Top Banana" in the Party, and will be retained permanently by the member winning it three consecutive years. (W3IN already has one leg on it).

Mail your log by March 11th to: Ken Hedrick, W9KO, 122 East Slade St., Palatine, Ill. 60067. Include a s.a.s.e. if you think you are in the running for a commemorative token.

Editor's Notes

How about those conditions for the Phone week-end? W3ASK really hit that one right on the nose. Excellent on Saturday, good on Sunday. Nice going George.

During a contact with one of the rarer stations in the contest, I reminded the operator to make sure he sent us his log. Was somewhat taken aback when he replied that he had not planned to submit his log, he was just handing out contacts for the fun of it.

I wonder if fellows with this attitude, and there are many of them, ever stop to consider that the opportunity to have this fun would be non-existent if it were not for the activity we have created.

The deadline for mailing your phone logs expired last month. You have until the 15th of this month (Jan.) to send in your c.w. entry.

And another reminder, this one regarding our 160 contest. Please keep the "DX Window" (1825-1830) clear of W/K and VE contest operation. We are just not going to hear the weak DX signals if they are covered by the strong stateside stations. As for working them on frequency, forget it, they are listening down at the low end of the band.

It is also hoped that stateside phone stations and others that are not contest minded will also observe this request during the contest week-end. It's only a once a year request. Good luck.

73 for now, Frank, W1WY

DX [*from page 63*]

CR8AM—To WB6BGQ
CT2AE—c/o K9ECE, Don Wibel 5115 Delaware Ave., Fort Wayne, Ind. 46805
CT2WB—Via CT1BH
DU1FAS—To Box 7, Diliman, Philippine Islands
ET3DS—c/o VE2FCY
EL4B—Via K8LUH
EP2DO—To KL7BJW
FB8XA & FB8XC—c/o F2MO
FP0II—Via WB2MAN
FP0KX—Via WB2KXY
FP0XX—Via K1DRN
GC3PYK—To WA1KYW
HL9VR—c/o K4CIA
HI8LC—Via W2KF
IB0PV—To I0PV
JA1OCA/C21—c/o P.O. Box 1409, Tokyo, Japan
JD1AIV—Via JA3GZN
JT0AE—To OK3YAO
JW1SO—c/o LA1RO
K5QHS/CE0Z—Via Dr. Sanford Hutson, Box 218, Broken Bow, OK 74728
KB6CU—To WB6IKI
KC6SX—c/o JH1ECG
KH6HDB/Kure—Via WA3HUP
KJ6DI—To K4RHU
KP4DIW—c/o W3HNK
MP4BIN—Via WB2FVO
MP4BJR—To K9KXA
OJ0AM—c/o OH0MA
OR4VN—Via ON4VL
OX5AY—To K9YPW
OZ8WH—c/o W2BBK
PJ8AA—Via W2BBK
SV0WXX—To R.W. Grigg, 322 S. Blvd., Petersburg, VA 23803
SV0WY—c/o K0UOP
TU2DO—Via WA2DHF
TU2DV—To WA6NFC
TU4AG—c/o WA6NAM
VP1EG—Via K7DVK
VK9DH—To W6LYC
VK9MC—c/o K6ZDL
VP2KX—Via WA2IUV
VP2M—Via W5MYA
VP2MAH—Via W4GSM
VP2MDX—Via W4PRO
VP2VAV—To K4CDZ
VS9MJ—c/o G3LQP
XF4YK—To XE1J, Box 200, Colima, Col., Mexico
XW8FB—Via W3KT
XW8ET—To JA0GRF
YB1AB—Via K9DCJ
YJ8BD—c/o I0IJ
ZF1WF—Via K4CDZ
ZF1KXJ—To WA0KXJ

ZF1FBI—c/o WA2FBI
ZK1AI—Via W6KNH
ZK1TA—To W6KNH
3B6CF—c/o JA0CUV
3D2JA—Via John Anthony, Quaker Bridge Road, Croton, N.Y. 10520
3D2FM—To W7YBX
3V8DM—c/o VE6AIF
4M1A—Via YV1LA
4X4BL—To WB2EDV
5R8AC—c/o W3ABC
5W1AU—Via W6KNH
7P8AM—To G3SGK
7Q7DW—c/o G3AWY
8Q6AC—Via 4S7YL
9G1GG—To WA2MVQ, Bob Neukomm, 494 O'Brien Court, Wycoff, N.J.
9G1HE—c/o VE3FCL
9M2GV—Via W5ZD
9M8FDS—To GW30JB
9U5CR—c/o ON5TO
9X5VA—Via W2PPG
9X5NA—To W7LFA
9Y4TR—c/o WA5GFS, G.L. Black, Box 462, Chickasha, OK 73018

73, John, K4IIF

QRP [*from page 44*]

other side of the circuit. The r.f. source and the dummy load are reversed, and the lower reading will now appear on FOR position. Adjust C_2 (which is now at the r.f. input side of the circuit) for a null. It may be necessary to repeat the process. Mark the input coax receptacle and the FOR-REF positions once a satisfactory null in both direction is obtained.[1]

Calibration of the wattmeter can be achieved by using one of the methods discussed in the last column. In my case, a calibrated r.f. power meter was available with built-in dummy load and greatly simplified calibration. One can simply plot a graph of microamps vs. watts if ease is desired, but it is relatively simple to remove the front cover of the meter and insert a new calibration scale. I used regular stick-on label stock for the face, and did the marking with a fine point ballpoint pen.

The instrument described above, when calibrated carefully, will yield a high degree of accuracy. With the small meter shown, for example, I can reset power to within 2 ua on the 200 ua scale of the power output meter used during calibration. While I prefer miniaturization for portability, the reader can use a minibox or other type of enclosure to suit his needs. In any event, this instrument will be a valuable addition to every QRPp station.

Well, that's our space for this month. By the time rolls around for the next column, I hope that some of you will have written us about your experiences, comments, suggestions. In themeantime, winter is the QRPp operator's season. Give it a try and you might be surprised at the results.

73, Ade, K8EEG

[1]This circuit is extremely sensitive, and a complete null may not be possible at the ten watt level.

Q & A [*from page 14*]

the connection entry and with the other pair do your bending. This method takes the strain off the entry connections.

Electric Toaster "I"

"I know you have covered just about every electrical appliance capable of causing interference but how about an electric toaster? When mine is used it is impossible to hear a thing on any band."

Most toasters use thermostats and as these age they can create a lot of noise. No amount of filtering or by-passing will help and a new thermostat should be installed (if you can tear the toaster down).

Voltage Control

"I live in a Western coal mining town. During the day or whenever the mine is being worked the line voltage in my shack drops to around 90 volts. When the mine is not working it shoots up to around 130. I have replaced two diode rectifier stacks thus far. What is the answer to my problem?"

A variable voltage transformer (Variac®) that is metered. Another solution is to contact the power company (or mining company) serving your area and explain the situation to them. Seems to me there should be some TV trouble in your area too.

Dummy Load

"I have a number of wirewound resistors which I would like to use to make up a dummy load but I am told that these should not be used and that I should use carbon resistors. Why?"

Because wirewound resistors exhibit inductive reactance. The load should be resistive with as few reactance components as possible.

18A VT/WB Antenna

"I recently bought a Hy-Gain 18AVT-WB vertical antenna and installed it on the ground, without radials. I have been getting good reports. There is nothing in the instruction bulletin relative to radial lengths for 75 meters. When I install a radial system should I include the 75 meter radial? What length (overall) should it be?"

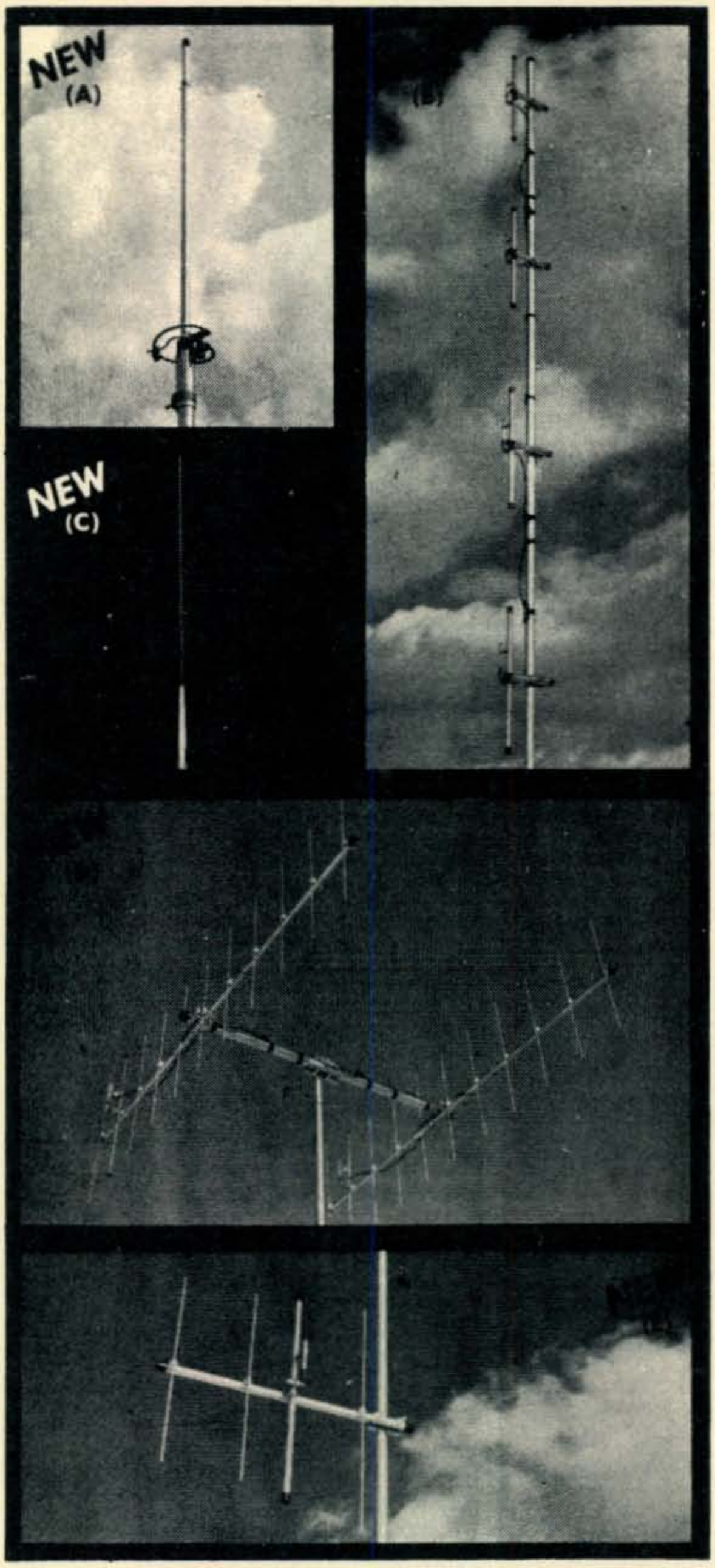
I suggest that you do use a radial for 75 meters. I occasionally use the same antenna and I cut my 75 meter radial for 62 feet—each side of the antenna—for a total of 124 feet. I have found that a foot or two does not make much difference when the ground is good.

Happy New Year!

I wish to thank all of you who wrote to me in 1973 and especially those who sent in trouble-shooting information and various good technical tidbits, some of which has already been published. If you had trouble with a transceiver or other amateur gear during the year and found it or someone else found it for you, why not send us the information so we can pass it along? By doing so you will be *helping* a lot of fellow hams. Q&A does not have *all* the answers but it tries exceedingly hard.

73, Chuck, W6QLV

MORE GREAT BUYS FROM ARROW



Cush Craft

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AR-6	100 watts	50-54 MHz		**18.50**

(B) 4 POLE: A four dipole array with mounting booms and coax harness 52 ohm feed up to 9 db gain.

AFM-4D	1000 watts	146-148 MHz	**$42.50**
AFM-24D	1000 watts	220-225 MHz	**40.50**
AFM-44D	1000 watts	435-450 MHz	**38.50**

(C) FM MOBILE 3 db GAIN: Fiberglass 5/8 wave professional mobile antenna for roof or trunk mount. Superior strength, power handling and performance.

AM-147	146-175 MHz mobile	**$26.95**

(D) 11 ELEMENT YAGIS 13.2 db GAIN: The standard of comparison in VHF communications, now cut for 2 meter FM and vertical polarization.

A147-11	1000 watts	146-148 MHz	**$17.95**
A449-11	1000 watts	440-450 MHz	**13.95**

(D) POWER PACK 16 db GAIN: A 22 element, high performance, vertically polarized FM array, complete with all hardware, mounting boom, harness and 2 antennas.

A147-22	1000 watts	146-148 MHz	**$49.50**

(E) 4 ELEMENT YAGI 9 db GAIN: A special side mount 4 element FM yagi can be fixed or rotated–good gain and directivity.

A144-4	1000 watts	146-148 MHz	**$ 9.95**

(F) FM TWIST 12.4 db GAIN: A Cush Craft exclusive — it's two antennas in one. Horizontal elements cut at 144.5 MHz, vertical elements cut at 147 MHz, two feed lines.

A147-20T	1000 watts	145 & 147 MHz	**$39.50**

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Propagation [*from page 67*]

Central USA	07-09 (1) 09-12 (2) 12-14 (1)	06-07 (1) 07-08 (2) 08-13 (3) 13-15 (4) 15-16 (2) 16-18 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-14 (2) 14-17 (3) 17-18 (2) 18-20 (1)	17-19 (1) 19-20 (2) 20-03 (3) 03-04 (2) 04-06 (1) 19-20 (1)* 20-22 (2)* 22-01 (3)* 01-03 (2)* 03-05 (1)*
Western USA	09-11 (1) 11-14 (2) 14-16 (1)	06-07 (1) 07-08 (2) 08-14 (4) 14-15 (3) 15-16 (2) 16-18 (1)	06-07 (2) 07-10 (4) 10-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	16-18 (1) 18-19 (2) 19-22 (4) 22-02 (3) 02-04 (2) 04-09 (1) 19-20 (1)* 20-22 (2)* 22-04 (3)* 04-05 (2)* 05-07 (1)*

Homebrew Counters [*from page 25*]

with an oscilloscope (5 mHz bandwidth or better) and a v.t.v.m. I found that an ammeter in series with the +5 volt supply was a valuable asset (+5 volts at 1.3 amperes in my counter) in watching increases in total current drawn as each IC was plugged in. An IC Tester (Logic Probe)[2] would have been very useful. However, my counter appeared to be working properly and I was about to do some last minute touch-up on a couple of soldered joints when a clip lead (+170 volts for the NIXIEs) accidentally came loose from a terminal and dropped into a "nest" of +5 volt connections. ICs designed to work at +5 volts don't like +170 volts even for a microsecond! I "lost" about 6 or 8 ICs in that microsecond or two! Fortunately they were of the 25¢ to 50¢ variety and I had others that I could use. So be careful.

After correcting the damage that was done by the "loose clip lead" I found that all of my frequency measurements were about 10% high. After much time-consuming checking, testing, frustration, etc., I found that one gate in an SN7400 IC was not functioning properly and allowed my one-second count gate to be "open" for 1.1 seconds; and this was a brand new SN7400! I replaced it and all measurements were within the accuracy of my 10 mega-Hertz clock.

As in the original circuit by McLeish, the counter "counts for one second;" during the next 0.2 seconds the count is transfered to the NIXIEs and the decade counters are reset to "0." During the next count period, the NIXIEs display the previous count, and there is no "rolling" of the display.

I can connect the output of my BC-221 to the counter and read its output frequency; or I can connect a short whip antenna to the Input and read the output frequency of my transmitter in the TUNE/cw position.—takes about 2 to 3 seconds for a count. Or, I can upset the carrier balance control to about 100 milliamperes of plate current and read the "carrier" frequency when on s.s.b. and not have to worry about the offset of the TUNE/CW position.

It has been a very rewarding experience, I have learned a lot about ICs and I'm sure that from now on my construction projects will be "solid state" rather than tube type. Additionally I feel that the Butterfly Net Members have all profited by the project, helping one another and we now have at least two counters on the net with several more in various stages of construction and several other members who are thinking very strongly about profiting by the experiences thus far to build more counters.

I surely do want to acknowledge the "support" (?), help, guidance, advice, counsel, etc., by such staunch members of the Butterfly Net as WA4GVE, K3DLC, W3OJQ, K3TEZ, W3EET, K3IGA/4, W4ST, WA3PRW, W4OMR/3, K4LBZ, W3CKU, W4IWZ, W3LIR, etc. ■

[2]Rogers, KØGKB, "The Vest Pocket Logic Probe," *QST*, Aug. '72, p. 46.

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Heath Counters [*from page 31*]

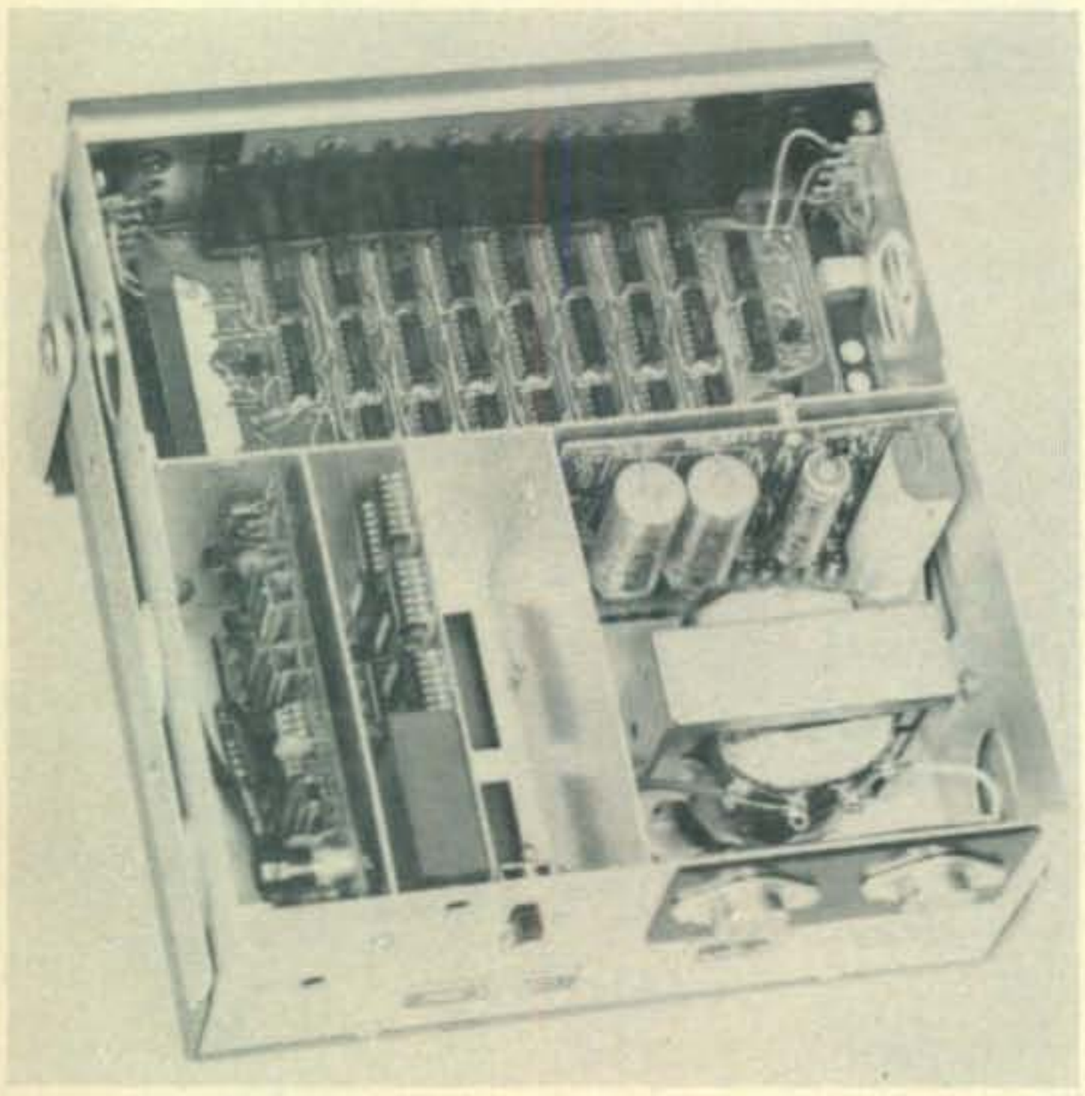
The size of the instrument is 3⅝" × 8⅝" × 9¼" (H.W.D.) and it weighs 8¼ lbs.

Performance and Other Specifications

Our unit went together in 13½ hours. No adjustments are required to get the counter operating properly, inasmuch as the TCXO has been factory-adjusted to an accuracy of ±1 p.p.m. and the triggering level is automatic. Sensitivity on our unit turned out to be better than the rating, amounting to 20 mv, and it counted correctly to 135 mHz.

Other specifications for the time-base stability are: Short Term—Better than ±0.5 p.p.m. in 1 second; Line Voltage Effect—±0.5 p.p.m. with ±10% line voltage change. In the event the oscillator should need readjustment at any time, it may be trimmed to ±10 p.p.m. This must be done against a standard 1 mHz signal of 10^{-8} accuracy.

The sampling rate is approximately 500 milliseconds between two openings of the counter gate. Input impedance is 1 meg. shunted by 15 pf. Maximum input potential is 120 v. r.m.s. up to 20 mHz and dropping to about 17 v. at 120 mHz. The external time-base input requires a 1 mHz signal with stabilty of at least 10^{-7} with a maximum potential of 3 v. r.m.s. across the time-base input impedance of 1000 ohms. The operating-temperature range for the counter is 10°-40° C. Power requirements are 110/130 or 220/260 v.a.c. 50/60 Hz at 30 watts.



Interior view of the IB-1102. The counting section with the display tubes is in the background. In the foreground, left-to-right, are the input, time-base and power-supply compartments. The power transistors on the rear panel are voltage regulators.

Other Notes

Once a display has been produced on the IB-1102, the reading can be held while the measured frequency is removed or changed. This is accomplished by "stopping the clock" which can be done, in effect, by switching from the internal time base to the un-connected external time-base input.

A number of suggested ways of using these frequency counters with amateur gear will be found in our earlier review on the IB-101.[1] One of the most useful applications we have employed is in connection with monitoring a c.w. or a.m. transmitter simply by connecting a small pickup antenna to the counter input. Other applications, besides those shown previously, may involve servicing, laboratory or other bench tests.

The IB-1100 and IB-1102 frequency counters are supplied in kit form as products of The Heath Company, Benton Harbor, Michigan 49022. —*W2AEF*

Inquiring Spectator [*from page 33*]

tions. The FCC Annual Report of 1972 shows only 2,229 authorized fixed and base station transmitters and only 13,797 mobile stations sharing this allocation. *In the entire United States, the CB population in this v.h.f. assignment runs to only 154 stations per channel!*[2]

This wasteland, it seems, is virtually unoccupied by the Citizens Radio Service. It would seem, to this writer, that the concept of establishing a new "VHF Citizens Radio Service" when a long established v.h.f. service has never been used efficiently is in direct contradiction to the principles of efficient spectrum management. As the ARRL forcefully states in their comments, "The conclusion is inescapable that a far more efficient use must be made of the class A frequencies before an entirely new service on new frequencies is even considered."

A.R.R.L. members or Affiliated Clubs can obtain a complete copy of the comments be sending a self-addressed 10 × 13 inch envelope with 56 cents postage attached to Headquarters.

[2]Specific frequencies are assigned in the class A service

* * * * * * * * * * * * *

And now the Commissioners must grapple with this can of worms. Is it in the public interest to "reward" the CBers with brand-new frequencies? Does a need exist for the new CB radio bands? Or is the proposal merely the brain-child of a bunch of eager manufacturers, anxious to make a quick buck on the sale of millions of new CB radios? We'll all have to sit back and wait for the FCC to make its important decision which will affect the fate of both CB radio and the Radio Amateur Service. 10-4?

We Haven't Heard the End of It Yet

A sign of the times is the recent proposal put to the Federal Communications Commission to open up a portion of the 420—450 mHz radio amateur assignment for a new emergency medical communications system. The proposal has been formulated in FCC Docket 19880. *Electronic News,* the weekly newspaper of the communications industry, says of this proposal, "The Federal Communications Commission is expected to approve in 2 or 3 months a new emergency medical communications system which is currently funded at $200 million."

"FCC officials last week said the commission is preparing to move quickly because of the need for the service and the interest of Congress."

"The White House's Office of Telecommunications Policy last week also proposed that establishment of a separate category of the rules for medical radio services with specific frequencies related to various medical functions."

As far as radio amateurs are concerned, the proposal itemizes three channels, (each 25 kHz wide) to be removed from the amateur assignment: 449.850 mHz, 449.900 mHz, and 449.950 mHz. This means, for all practical purposes, that the top 150 kHz of the band will be lost to amateur radio.

Once again, this proposal is a breach of the Radio Regulations of the International Telecommunications Union, an international body, to which the U.S. is a signatory power.

The proposal is powerfully supported. It would seem that poaching on another Communication Service frequency assignment is good ethics and pays big dividends these days. How far will these encroachments be allowed to go? No doubt, Washington, D.C. is a queer city. ■

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Speaking French? I am interested to find teachers, students or individuals not necessarily fluent in French willing to speak French on Ham Bands with high school students. Catalina Radio Club, 3645 E. Pima, Tucson, AZ 85716.

WANTED: Wireless gear, old receivers, msc. parts, catalogs, etc., regardless of condition. Horvath, 522 Third St., San Rafael, CA 94901.

Organize & enhance your QSL's with 20 pocket plastic holders. Two for $1.00, seven for $3.00. TEPABCO, Box 198 Q, Gallatin, TN 37066.

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, W5 RZJ, Louisa Sando, 4417 - 11th St., NW, Albuquerque, NM 87107. Please enclose two 8 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 W5 RZJ, $3.00 postpaid.

VACUUM VARIABLES: UCS 300 complete with tuning head mounting flange 1/4" shafts. W4GD, 3087 Carnes Ave., Memphis, TN 38111.

WANTED: SAMS AR (Auto Manuals) 2-7, 9-17, 38-up individually or set; Need old car radio dial heads, speakers, speaker cables and plugs, tube boxes (receivers) or single (unitary) car radios (6 volt and originals) any condition, metal fuse holders and connectors, knobs, vibrators, parts; Supreme manuals 1952, 1953, 1955, 1960-up; Delco manuals, Philco yearbooks pre-1939; Riders (radio) manual Vol. 23, Vol. 4; 6C7 tubes. W. Huneycutt, Box 411, Hartsville, SC 29550.

QSL'S — New hobby ideas, samples 25 cents (WA2BQI) Burdette's Elite Printing, 15 Bush St., Jamestown, NY 14701.

WANTED: C.B.'ers Everywhere!: to sell the world famous "Rambling Redskin." Goodies at breaks and jamborees. P.O. Box 564, No. Bergen, NJ 07047.

YAESU FTDX570 with cw filter, FV401 VFO, $525. WA2EKW, (716) 873-5582.

SELL: 19 ASR/paper WDR $100, 14 ROTR, $35, 28 R/T $50, TTL-2 Converter, $100. Mike Sorochka 95-01 243 St., Bellerose, L.I. (516) 488-3166.

COLLINS 75A1 SrNo3 with mech. cw fil and Central Elec "B" SSB slicer $200 f.o.b. Steve Prescott, Number I, Col Cr, Storm Lake, IA 50588.

WANTED: Drake TC-2, TC-6 and Receiving Converters. Gonset 2 mtr SSB Xncvr and 500 w. 2 mtr amp. WA8 ZCO, 16245 Beechwood, Birmingham, MI 48009.

WANTED: Small radios or parts made before 1927. Edison Cylinder records in good condition. Robert Ireland, Pleasant Valley, NY 12569.

WANTED: 220 mhz Gonset Communicator. Must be mint condition. State lowest price in 1st letter. W6 DOR, 2921 Loyola Dr., Davis, CA 95616.

SELL: Swan 1200 w Linear. Excellent. $149. J. Larson, WB6 KWM, Rt. 1, Rosamond, CA 93560.

TRADE EVEN: Carengella Compressor-PreAmp ACP-1 for Omega Antenna Noise Bridge with instructions. W5 OLQ, PO Box 163, Lufkin, TX 75901.

COLLEGE HAM CLUB just organized. Seeks donation of gear (rcvr., xmtr., Antenna, spare parts, etc.) Will pay shipping costs. Campus Amateur Radio Club, c/o University Library, 4304 University Dr., Wichita Falls, TX 76308.

NATIONAL NC 125 Rec. with matching speaker and manual. First class cond. 55 to 36 MC; Heards Lowry, 915 Madison St., Manchester, TN 37355.

FREE: Research report and schematic. Capacitive Discharge Ignition Systems. K6 ICS, Dr. Gauthier, 9418 Florence Ave., Downey, CA 90240.

If David, slayer of Goliath, had lived today, he'd be a QRPp man. You too can take on the giants with a few watts and emerge triumphant. Read THE MILLIWATT, all about QRPp. Vol I, $4.00, II-III, $3.50 each; sub $3.40. To Ade Weiss, K8 EEG, 213 Forest, Vermillion, SD 57069.

SELL: Various and interesting electronic items. Reasonable. SASE pls. Lisaius, 116 Orton, W. Caldwell, NJ 07006.

GE PROG-LINE XCEIVER on 146.94 mc w/control, $90., FM 50 mc xceiver w/control, $15. Want: Hy-Tower 18-HT. K6 KZT, 2255 Alexander Ave., Los Osos, CA 93401.

TRADE: HW-32A Transceiver for 2m A.M. Transceiver of equal value. K8 KGR, 541 High St., Elyria, OH 44035.

HEATHKIT TRANSCEIVER HW-16 plus HS-24 speaker. Well-built, plus assembly manuals, plus 4 crystals. Price $85.00. W2 AMI, Sidney Weinberg, 252-08 Cullman Ave., Little Neck, NY 11362.

U PICK UP Brand new rack-mounted H.B. 500 w. CW Xmtr 80-10 $50.00 (cab alone worth $60). WA4 BJI, 263 Tram Rd., Columbia, SC 772-3419.

WANT SB303 any condx give details & price first letter. Sell mint FTDX560 no cw filter. KP4 BCL WB28 Urb. Los Angeles, San Juan 00913.

FOR SALE: 872A; 304TL; 75T; D21. Make offer.— W6 OFD, 941 College Ave., Modesto, CA 95350.

2 MTR HALLICRAFTER SR42A and VFO H.A. 26, $125.00. BC348 Rcvr, $100.00. Heath Twoer, $35.00. K2 UFW, (212) 320-2764.

LORAIN Sub-Cycle Solid State freq converter 60 to 20 Hz at 20W for tel ringing circuits. Best offer. C.D. Coleman 1039 Missouri, Alliance, NE 69301.

SELL: TR-6 with NB/AC-4/MS-4 absolutely mint. 2 yrs. old and no scratches. $630 ppd. WA8 UUY, 104 Henrietta St., Ravenswood, WV 26164.

HAMMARLUND 170 AC-VHF Brand new in carton, $250.00. Transcom SBT-3 180 watt PEP Triband SSB Xcvr. with AC & DC supply, $250. WA1 DTN, Box M, Fall River, MA 02724. (617) 674-9162.

QRPp Handbook, over 450 pages of under-five watt articles, construction projects, operating news. First four years of THE MILLIWATT: $13.40 all; Vol I, $4, II-III-IV, $3.50 each. Ade Weiss, K8 EEG, 213 Forest, Vermillion, SD 57069.

SELL: SB-33, Heath EC-1 Analog Computer, new, FM-2X w/AC, 3" refractor telescope. SASE, John Wagner, Rt. 2, Box 142A, Caro, MI 48723.

EICO TR410 Triggered Sweep Oscilloscope brand new and guar. $250.00. Eico 330 Solid State Signal Generator, factory wired also brand new. $50. Others. SASE for list. Colella, 105 18 131 St., Richmond Hill, NY 11419. (212) 641-2559.

FOR SALE: DX-100 xmtr, $95.00; Ameco TX-62 xmtr, $95.00. Both good condx. No ship. F. Kurz, P.O. Box 347, Zion, IL 60099.

CALL LETTER LICENSE PLATES wanted for collection. I'll pay postage. Art Phillips, WA7 NXL, 3401 N. Columbus, Apt. 5-O, Tucson, AZ 85712.

WANT: KODAK 616 Size "Monitor" Camera. Sell: 6 Element GM Beam, brand new, $25. WA8 MLV, 1008 Englewood Dr., Parma, OH 44134.

HP Manuals excess: 524B, 525A, 525C, 526B, 5243L, 5245L, 5251A. SASE. Smith, Rt. 7, Box 315, Franklin, NC 28734.

QSL's printed on glossy cards. Sample 15 cents. The Print Shop, P.O. Box 353, Lockport, IL 60441.

CODE TAPE PERFORATOR With keyboard. Bohme System, made by Teletype. Make offer. FOB. L.T. Smith, 3108 N. Lincoln, Stillwater, OK 74074.

FOR SALE: HT37 $130. Johnson Courier Amp., $110, TR108 two-meter transceiver kit, $95. W6 HJ, 243 Ocean View Ave., Newport Beach, CA 92660.

MEASUREMENTS 80, Model 19, 14 & 28 reperfs, Navy RCH, ART-12 w/s.s. pwr. sup., Bird 43, RTTY T.V., 813's, 4-125's, 4-250's, phone patch. Best offer or trade. WA8 QBJ, Clinton, OH 44216.

MINI-BEAM, HQ-1, CD AR22 Rotator and Heavy-duty 4' tripod, all excellent condx. Months old. WA2 CDV, Art, 21 Karen Dr., Tonawanda, NY 14150. (716) 695-1223.

COLLECTORS' ITEM: Original HRO built in 1936, $150. SB10, $60. W7 CSD, 3740 Summers Lane, Klamath Falls, OR 97601.

MANUALS for most ham gear, 45/65. Send SASE for specific quote. W0 JJK, Box 864, Council Bluffs, Iowa. 51501.

HEATHKIT DC Power Supply, HP-13A professionally wired, $45. BC-453 200, 500 khz rcvr pwr sup, $18. W6 BLZ, 528 Colima St., La Jolla, CA 92037.

HAM MAGAZINES. Wide range of CQ, QST, Ham Radio and 73, some as early as 1930 for sale. Send SASE for list. Also, we still need some magazines. Send you list if you want to trade. Chuck Morrison, WA4 BXR, 5605 Sedgwick Lane, Springfield, VA. 22151.

ANTIQUE RCA Radiola 18, all tubes; original finish; fb mahogany cabinet; table model, no spkr. W5 EOS, 5507 Keystone Dr., San Antonio, TX 78229.

CHICAGO AREA: Mint HT37 and mint HQ170C package deal, $285 or swap for clean SB100, HW-101, or KWM-1, AC. K9 ARZ, 338 Sophia, W. Chgo., IL 60185.

SELL: Heath DX 60B txmtr, $40. HP13A pwr supply, $20. Spkr in old radio cabinet, $12. All for $52. Mike Mason, 677 Berry Ln., Lexington, KY 40502.

FOR SALE: 20 issues Oriental Ham Magazine (10/69 - 4/72). WA1 NYV, Box 363, Uxbridge, MA 01569.

HAM-M CONTROL BOX WANTED. Please advise price. Jim, K4 VBH, Box 268, Americus, GA 31709.

GOOD NEWS: SRRC Hamfest June 2, 1974 at a fabulous new site in Princeton, Illinois Fairgrounds. SRRC/W9MKS, RFD Number 1, Box 171, Oglesby, IL 61348.

TEN LB. ELECTRONICS PARTS, $10, tubes for sale too. Williams, P.O. Box 7057, Norfolk, VA 23509.

SELL: Collins 75S-3B, $600. Hallicrafters HT-44 W/PS, $225. HT-45 linear w/PS, $300. Johnson KW matchbox, $75. All mint w/manuals. Swan 260 transceiver, needs DC PS work, $225. WB2ETI, 42 Hudson Rd., Bellerose, NY 11426. Phone (516) FL4-6792.

TREASURE COAST HAMFEST March 9-10. Sponsors Vero Beach Amateur Radio Club, Inc. and St. Lucie Repeater Association, Community Center, Vero Beach, FL 32960. Free continental breakfast. First prize 80-10 transceiver. Dozens of others. Speaker. Swappers row. Tickets and information, write Ike Roach, K4QM, Box 3088, Vero Beach, FL 32960.

HEATH Hx10 $110, SB620 Scanalyzer $80, FR4 Freq. meter, $40, Heath impedence bridge, $75; Telequipment D54 $475. WB4UZT, 271 Tollgate Trail, Longwood, FL 32750.

QSL CARDS printed on Super-High Gloss Card Stock from $8.95/1,000. Full-color catalogue and samples; $1.00. Lijon Graphics, Box 48, East Longmeadow, MA 01028.

FCC type test answers general advanced extra first second class, $10. Specify. Dixie Tec, Box 8352, Savannah, GA 31402.

CANADIANS Free 120 page Electronics Catalog. ETCO, 464A McGill, Montreal.

SAFETY BELTS Tower Climbing, Nylon (new), Lanyard/snap (used), $23.50. Link, Rt. 111, Monroe, CT 06468.

QSL's — Samples 10 cents. K5HYB Press, Rt. 8, Box 546, Pine Bluff, AR 71601.

WANT: HW18/HP-23A. WANT: HW18-1/HP-23A—. WANT: HW 18-1/HP-23A. Edgar Bernal, 10827 Vanderford, Houston, TX 77072. Tel: (713) 498-1964.

RUBBER ADDRESS STAMPS. Free catalog, 45 type styles. Jackson's, Box 443F, Franklin Park, IL 60131.

FREE with the purchase of a new Genave GTX-200 at $259.95: 18 crystals of your choice. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Standard, Clegg, Regency, Midland, Hallicrafters, Tempo, Kenwood, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Sony, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, Inc., R. R. Number 25, Box 403, Terre Haute, IN 47802. (812) 894-2397.

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

P.C.'s. Need a project for winter? Send a S.A.S.E. for list of available boards. SEMTRONICS, Charles R. Sempirek, Rt. 3, Box 1, Bellaire, OH 43906.

FOR SALE: Heathkit SB-303 perfect condx with am and cw filter, price $300. Philip Petix, WA2-RPG, 408 Thomas Ave., Lyndhurst, NJ 07071.

FOR SALE: SX-100 in mint condx., $125. FR4/U freq. meter, $50.00. Homebrew linear with pr. 813's and power supply, $50. Pick up only. T. Coddington, WB6AWC, 7825 Scotts Valley Rd,, Lakeport, CA 95453. (707) 263-5534, evenings.

WANTED: Tubes, Phillips, German, French, British, etc. Pre-1923. Need not be working. W9LHG, 610 Monroe Ave., River Forest, IL 60305.

2 METER FM DENSHI (Ross-White) 10 watts. Crystals for .94/.94, .34/.94, .31/.91, .25/.85, .52/.52, 147.81/147.21, 147.21/147.21. Original carton. Will ship, $120. Roger Rapp, W2GLE, 87 Little Plains Rd., Huntington, NY 11743.

WANT TO BUY: Antique wireless code keys. T.G. Soukup, WA1AWX, 161 Bob Hill Rd., Ridgefield, CT 06877.

R-3901. Clean, good condition, electrically, mechanically, $465. Includes crating and shipping. W6ME, 4178 Chasin St., Oceanside, CA 92054.

WANTED: Modulation Meter or Motorola Modulation/Frequency Station Monitor. W.G. Emory, WA4HGF, Box 55, Union, SC 29379.

HEATH TRADE GD-48 metal locator for Heath HW-Mono Transceiver, J.M. Cardenas, YNI-JMC/W5, 9326 Meadowglen, Houston, TX 77042. 782-5073.

HEATHKIT: Tuner PT-1, Preamp SP-2, Two W4-M Amplifiers. Complete $125. Cabinet, $35. Estate W8IMU, 7390 Bartholomew, Cleveland, OH 44130.

VHF: Poly-Comm 62B/2M AM xcvr 18W AC/DC---/VFO mic mobile mount manuals spare tubes vy gd condx. $125. Shipping incl. WA1NTF, 33 Bates Ave., N. Kingstown, RI 02852. (401) 295-0411.

WANTED: B&W 850 tank coil. Please state price. W7VRO, Box 981, Bellingham, WA 98225.

SWAP: HP-13B, new. Also two 4X500A, like new. Make offer. Dave Powell, WA4BRI, RR8, Lexington, KY 40504.

WANTED: DELCON T-210 Linear Amplifier and/or major parts for construction of same. Have P.S. State price, condx first letter. Bob Houston, W6UUX/KA2AX, Box 73, APO S.F. 96525.

FOR SALE: Henry 3K-A, $850. KWS-1, 75A-4, $650. R-390, $325. Invader-2000, $400 (or trade). ST-6, $295; 32V-3, $145. Measurement: Model 65, $225; 80 $200; 95, $175. James Craig, 29 Sherburne Ave., Portsmouth, NH 03801.

SELL: 24 hr. clock in orig. box, $6.95. Want crank down or tilt tower. Local. WB9JHS, 6092 Chase, Downers Grove, IL 60515.

WANTED: CW Code Adapter for SB-34, also want crystal calibrator. Gregory Young, WA9WVJ, 7333 So. Phillips, Chicago, IL 60649.

LARGEST DX & AWARDS HUNTERS' CLUB in the world. World copyrighted DIRECTORY of AWARDS, $5.00. SASE to IARS/CHC/FHC/SWLEHC, Box 385, Bonita, CA 92002.

SELL: TR-6 with NB/AC-4/MS-4 absolutely mint. 2 yrs. old and no scratches. $610 ppd. WA8UUY, 104 Henrietta St., Ravenswood, WV 26164.

RTTY PACKAGE- S.P. 600 J&J Demod 15 Printer Teletype Perforator and Tape Sender, $355.00. W2FWV, East Williston, NY. Cash, no shipping.

COLLINS 75A3 w/prod. det. Mint cond., $200 or swap for Heath Line Transceiver. J. Coda, 9130 S. Hoyne, Chicago, IL 60620.

HEATH HW-12, $75 plus ship. Panasonic 9" portable, mint, $35. SWTPC FET preamp, $40 or offer. Steve Thurber, 316 Island View, Int'l Falls, MN 56649.

COUNTER- Heath IB-1101. Up to 112 mHz. Write for details. Harry McCollum, 1010 W. First St., Mt. Pleasant, TX 75455.

SELL: Complete NOVICE station; HW16 transceiver, HG10B VFO coax, earphone, key. Best offer or trade for 35mm camera. Lora Schlicht, 3025 Smith Dr., Brookfield, WI 53005.

SELL: DX-40 w/manuals; $30. CB-MC-6, $25. WN5JXD, 900 N. Willard, Altus, OK 73521.

MINT US PLATE BLOCKS and Largest Autograph Collection (Philatelic) in World, for sale or will break up for best ham gear. Loyce B. Fuqua, W4WBD, Maple Street, Box 6, Eddyville, KY 42038.

MOTOROLA FILTERS K9241, K8436, TU145, vibrators w/center pin 48-803700 48-825604 Rec, xmit coils. Much more. SASE for list. T. Adams, 9707 Hansford, Austin, TX 78753.

TEST QUESTIONS & ANSWERS. FCC 1st and 2nd Class Exams, $5.00. Autopatch Systems, Ltd., Box 291, Western Springs, IL 60558.

KW ROTARY INDUCTOR with counter dial, $15. RCA 40281 VHF power transistors. $2.75. W4HXY, 5731 Cannon Ln., Alexandria, VA 22303.

FOR SALE: 24 hour clocks mfg. by Franklin Inst. Co. Battery or electric. For details and prices, write: Steve Antosh, WB5BNM, 1524 N. Okla., Shawnee, OK. 74801.

WANTED: A Heath SB-500 in good condition. George S. Peck, Jr., 204 N. Boyd St., Caldwell, KS 67022. WA0RIO.

HEATHKIT IO-14 delayed and triggered sweep oscilloscope with probe. 8 Mhz Bandwidth. (201) 429-8880. Glenridge, NJ 07028.

FOR SALE: HW-100, SB-600, HP-23 Heath Station, $225; Heath HW-22A, $80; Swan 120 with mobile P.S., $80. HO-10 scope, $40. Pickup. K3MGO, (215) 374-9342.

FOR SALE: Drake 2B with speaker, Q Multiplier, 100 KC. Crystal Cal. Plus owners manual. Mint condition. Price $150. H. Banks, WA2RKC, 62-60 99th St., Rego Park, NY 11374. Phone 897-4252.

WANTED: Old battery radios of the early 1920's, need not be in working condition. Also want old crystal sets. Write Model and price. P. McKenzie, 1200 W. Euclid, Indianola, IA 50125.

SIGNETICS WON'T HELP ME, WILL YOU? Need info on Type 545 Dolby "B" Chip. W. Adams, POB 324, Fishkill, NY 12524.

SELL: HW17 Heath 2 mtr AM xcvr with FM adaptor. A-1 cond., $95. Ben, WA9RFO, 14420 State, Riverdale, IL 60627. Phone: (312) 849-1855.

6 ELEMENT 6 METER YAGI. $25. New, in box. Want 1.8 Takumar 55mm lens. WA8MLV, 1008 Englewood Dr., Parma, OH 44134.

OMEGA-T TE7-01 wanted. Anderson, 639 N. Wahsatch Ave., Colo. Springs, CO 80903.

FOR SALE: Heath Twoer, excellent, postpaid in U.S., $35. W0NY, 717 Crest Fort Dodge, IA 50501.

WANTED: CW filter for Swan 700CX or 500CX. Contact WA9DLT, 1302 S. Prairie, Arlington Hts., IL 60005.

FOR SALE COLLINS GEAR: KWM2, $625; KWM2A (rejection tuning), $725; 516F2, $125; PM2, $85; CP1 Xtal Pack (110 xtals), $185. Want to buy: Collins 312B5. Phone (215) 289-8050 days, and 884-6010 nites. Shapiro, WA3IFQ.

SELL: Alltronics-Howard Model "K" RTTY Converter, excellent condition, $80. A.E. Johnson, K1IIK, P.O. Box 77, West Dover, VT 05356.

CENTRAL ELECTRONICS 200V, good condition, $275. W9UZC-Southwest Acres, RR2, Harrisburg, IL 62946. (618) 252-7064.

SELL: Heathkit SB-401; DX60 & VFO; AR-1500; Allied SX-190; AKAI Taperecorder. WB8HWF, 546 Oakwood Ave., Newark, OH 43055.

FOR SALE OR TRADE: Sam's AR Manuals, B&K 1076 Analyst, Sylvania Polymeter, Old type radio tubes and Ballasts, controls, etc. 2 Atwater Kent radios, National Geographic Magazines. P.L. Williams, 106 S. Jefferson St., Lewisburg, W VA 24901.

CALL LETTER LICENSE Plates wanted for collection. I'll pay postage. Art Phillips, WA7NXL, 3401 N. Columbus, Apt. 5-O, Tucson, AZ 85712.

300 Watt SSB Xcvr for sale. Galaxy 300 with ac console. Best offer. WA3FMF, 113 Whitemarsh Rd., Ardmore, PA 19003.

Claimed Scores For The 1973 CQ WW DX Phone Contest
On Page 75

S.A.S.E. For large list of ham gear, parts, tubes, for sale. D.W. Langston, W5BBV, 9643 Altacrest, Dallas, TX. 75217. (214) 288-4046.

SELL: HW12A 80 mtr SSB with HP-13 mobile d.c. and a.c. supply, $140. W6BLZ, 528 Colima St., La Jolla, CA 92037.

SELL: Mosley TA33 Jr. 10-20 mtrs., 3 element, excellent. $65.00. WA2IRO, 36 Gaffney, Willingboro, NJ 08046.

TRADE RADIO EQUIPMENT FOR OLD CAR. Willing to trade Collins KWM-2, 516F-2, 312B5, Henry 2K, 20-40 meter Mosley full spaced antenna (antenna cost $1,000) for your old touring car of equal value. Your car may be the one I am looking for. Must be a pre-war car. Ed. Lubowicki, 543 Middlesex Ave., Metuchen, NJ 08840. Tel (201) 549-2222, 1 to 5 p.m.

SELL: Transceiver, National NC200 5 band SSB with AC supply and xtal calib. Mint cond. with manual, $250. Hallicrafter SX-100, mint w/manual, $125. Others. T. Coddington, 7825 Scotts Valley Rd., Lakeport, CA 95453.

SACRIFICE 16mm Movie Studio, value approx. 1600 dollars for clean 75S3B or what have you. Write for details. W6AT, 367 Northwest, Vacaville, CA 95688.

STAR 700E rcvr & 300 wt PEP xmtr, 80-10 mtrs, xclnt condx, cost $790, urs for $395. Silbert, WB2GWP, P.O. Box 77, White Sulphur Springs, NY 12787.

FT101, like new. $475.00. Swan Mark I 2kw amp, $300. Warren Cann, 12 "I" St., Hampton Bch., NH W1HSC. Phone: 1-603-926-2359.

HEATH SB-640, $125. Drake R-4B, $330. Drake TR-4B w/NB, $475. All mint. A. Emerald, 8956 Swallow Ave., Fountain Valley, CA 92708.

WANTED: CREI course 201 Engineering Tech. All letters answered. WA6VUE, 485 S. Euclid Ave., Pasadena, CA 91101.

MOTOROLA CRYSTALS. 6 and 2 meters. Write for list. Harry McCollum, 1010 W. First St., Mt. Pleasant, TX 75455.

SWAN TWINS: 600R/SS16. Custom Receiver w/ cw filter, 600T Transmitter, vox, 330 vfo, sp600 spkr. $800. Local only. WA2RYC, 25 Meacham St., Belleville, NJ 07109.

MOSLEY 40 mtr kit for adding 40 mtrs to your Mosley Beam, $30. W3HUS, RD1, Box 103, Malvern, PA 19355. (215) 827-7374.

WANTED: Manual/Schematic for General Radio impedance Bridge type 650-A. Buy, rent or borrow to copy. C. Heuberger, WA1IUR, 51 Maynard Ave., Seekonk, MA 02771.

SELL: 40 foot E-Z Way Tower, TR-44 rotor, Quad. Pick-up deal. $150. W. Karl, 24 Mill St., Cooperstown, NY 13326.

Ham sentences in 54 languages! Just copy what you want. K3CHP's DX QSL Guide, $3.95. Joe Mikuckis, 6913 Furman Pkwy., Riverdale, MD 20840.

WORKED SO. AMERICA CERTIFICATE. Work all 13 countries. Send list and $1. HC1TH, 4805 Willowbend Blvd., Houston, TX 77035.

PL-172 4/1000A/4-400A/250A/125A tubes; SP-600/SRR-13A rcvrs; 32S1/516F2 xmtr; Hmbrw 4-400A amp; Boehme 5C TTY TU; Various Vac-Var's; G. L. Hale, (804) 857-1507, Norfolk, VA.

JOHNSON Thunderbolt Linear, low bands. Mint. $275. Knights, 121 N. McKnight Rd., St. Paul, MN 55119.

HEATH TWOER, $30 w/DC Power Supply and manuals. K. Talen, 5114 Geneva, Friendswood, TX 77546.

WANTED: Heath SB-200 Linear. I pay shipping. WB8IEC, Box 175, FPO, NY 09518.

JOIN the greatest Ham club in the world. For information, send to Joseph Schwartz, K2VGV, 43-34 Union St., Flushing, NY 11355.

WANTED: Service manual for Hickok 665 scope. Will copy, return and pay postage both ways. W8KGR, RR2, 16B Wooddale, Hull, GA 30646.

SELL: HT44, PS150, SX117, $400. Heath Amz $10. Warrior kw $100. BN1, $5. Compreamp, $15. K5MWZ, Box 16099, Ft. Worth, TX 76133.

WANTED: Spark and early a.c. gear; variables, coil forms, verniers, gaps, helix, hardware. Need AT-1, SW-3. Cohen, 1883 Ravenwood Way, Atlanta, GA 30329.

STANDARD 146-A still in factory carton with warranty card and battery pack and stubby antenna, $248. W4OAQ, Box 17222, Nashville, TN 37217. (615) 834-8999.

SELL: SB100 AC PS es spkr, $300. HW20 "Pawnee", best offer. Both mint in condx. WA8RXL, (216) 757-1891, S. Hurtuk, Struthers, OH.

VIDEO Bandscanner, Squires & Sanders Model SSIV, $80 with manual and A-1 condx. Jim, K4-VBH, Box 268, Americus, GA 31709.

SELL: SX117 mint cond, $160. Sell Heath counter and scaler, pair $250 prepaid. Want Collins 75S3 with power supply. W4AIS, 300 Thornwood, Taylors, SC 29687.

GOING RTTY. Need Model 15. Prefer within driving distance. WA0UAG, Box 97, Bird Island, MN 55310.

COMPUTER printout of all intermed. products. Any frequency, $5. CRD Associates, Box 291, Western Springs, IL 60558.

WANT: Manual for AN/UXH-2 fax recorder, halftone storage CRT or scope, cheap SP-600 receiver, any fax equipment or paper. Ken Johnson, 701 Carolyn Ave., Austin, TX 78705.

QSL CARDS: For sample cards send 20 cents. Mail to: The Print Shop, P.O. Box 353, Lockport, IL 60441.

FREE: Pick up only. One Acme Telephoto Transceiver Model FNP-IS. N. C. Moseley, Beechwood Dr., Tarboro, NC 27886.

SELL: Drake TR-22, mint condition, many extras. E. Leviton, 1817 N. Quinn St., Apt. 407, Arlington, VA 22209.

SELL: Heath HW-16 with 3 xtals, $85. Johnson Viking Valiant, $95. Fox, P.O. Box 895, Greeley, CO 80631.

REGULATED 100 VDC at 100 ma. Model RM110 Trans. Elec. Supply; has 2 4" meters, $15. HP415B $25. HP452A Cap. Volt. Divider, $25. J. M. Hoffer, 24 Cherry Road, Framingham, MA 01701.

WANTED: Yaesu FT-101 and FL2100 Linear in good condition at reasonable price. Sell: SX-100, mint at $125 and FR4/U freq meter at $50. Tom Coddington, WB6AWC, 7825 Scotts Valley Rd., Lakeport, CA 95453.

SELL: Atwater Kent Schematics and others, 20 Rider's Manuals. Knight T60. Ed Taggart, R4, Nashville, Indiana 47448.

WANTED: GE Progress Line High Band Transmitter strip. State condx, and type no. K5BCQ, 5114 Geneva, Friendswood, TX 77546.

SELL: HR-10B with xtal calibrator $49; RME HF 10-20 Converter, $19. Combination makes hot novice set-up. You pay shipping. W6NVA, 15426 Patronella Ave., Gardena, CA 90249.

SELL OR SWAP: 2" Waterman Pocketscope, perfect condx., $20. W5RIQ, 4908 Broken Bow Pass, Austin, TX 78745.

DRAKE 2 MTR FM ML2, 1 yr. old, with mobile mount and Hustler Antenna, Ringo Antenna, $225. Wayne Sarno, D.P.M., 447-86th St., Brooklyn, NY 11209. Cash or cert. check only.

FOR SALE YAESU FT2 auto 8 chan. scanning 2 meter 10w. xcvr w/complete set xtals, mint $325. Marvin Moss, W4UXJ, Box 28601, Atlanta, GA 30328.

SELL: One owner HW-12, $60. HW32-A, $75. Eico 753, $90. Collins 32S-1, 516F-2, 75S-1, 312B-3, $725. WA2RJV, 301 Blacksmith Rd., Camphill, PA 17011.

SELL: Antique Heath stuff; HD11, TO1, EA1, A7, DX20, EF2, HM10A, O12, also BC221 Q, Breting 40. WB6CPE, Loyola, 1901 Venice Blvd., L. A., CA 90006.

WANTED: Old foreign tube made before 1920. British, French, German, etc. Also need DeForest "Audion." W9LGH, 610 Monroe Ave., River Forest, IL 60305.

WANTED: 200pf, 1000pf variable capacitors for 2kw H/B linear. Bob Martin, WN0GGD, 5107 Red Barn, St. Joseph, MO 64503.

CALL LETTER LICENSE PLATES wanted for collection. Will pay postage. Art Phillips, WA7-NXL, 3401 N. Columbus, Apt. 5-O, Tucson, AZ 85712.

WANTED: HV Transformer for Viking Thunderbolt. Jim Fleming, K9FRZ, 6N705 Harvey Rd., Medinah, IL 60157.

FOR SALE: AC Adaptors, 6 VDC 150 MA, standard plug, brand new. $3. Postpaid. K2MFY, 2 Nutley Ct., Plainview, NY 11803.

RYDER MANUALS: Complete set. Best offer and postage. K9VPS, Bill Zandrew, 3110 Wisconsin, Berwyn, IL 60402.

WANT: 24 hour clock for HQ180. K7HGZ, 6410 W. Sells Dr., Phoenix, AZ 85033.

HEATH GC-1A Mohican, $35. Omega Noise Bridge, TE7-07, $17.50. MARS SWR meter, $6. All in good condx. You ship. J.R. Scheurer, WB6WIW, (714) 842-9142.

SELL: HW32 minus power supply, $50. Plus shipping. W4YCZ, 1951 Kingston Ave., Norfolk, VA 23503.

WILL PAY $200 for a Marconi 106D in good condition. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood City, CA 94062.

DRAKE TR4 with NB AC4, RV4, firm $525. Local only. WB2ZGI, (212) 886-1184, after 6.

GREAT NOVICE RIG! SX-111 very good, $125. DX-60B excel/w VFO $65. Both $182. Sorry, NYC area only or you pay shipping. WB2MAN, 516-487-7452.

SELL: B&W Model 361 codax solid state keyer, $50. R.W. Randall, 1263 Lakehurst Rd., Livermore, CA 94550. Tel: (415) 443-4482.

EARLY RADIO and WIRELESS material such as receivers, transmitters, books, catalogs, magazines, handbooks, and tubes wanted for amateur collection. E. Rasmussen, 164 Lowell St., Redwood City, CA 94062.

WANTED: 6 Meter Linear. Swan, Henry, etc. Please contact: R. Mollentine, WA0KKC, 7139 Hardy, Overland Pk., KS 66204.

PLS SND CARDS! Also, discounts on units. Send make and number for quote. M. Horowitz, Union Valley Road, Mahopac, NY 10541.

WANTED: Collins 312B5 VFO. Also 75S3B Receiver. J.P. Ashcraft, WB5BFZ, Phone (214) 361-6611, days. 5641 Dyer St., Dallas, TX 75206.

FOR SALE: Hallicrafters HT-32. Excellent. Conditioned, $150. You pay ship. Jerry Macari, 138-23 59th Ave., Flushing, NY 11355. WA2KDB.

WANTED: Hallicrafters HA20 DX Adapter must be perfect condition. Will pay cash. Send details and price. WA9HRN, Craig Pitcher, 5 Whitehall Ct., Buffalo Grove, IL 60090. (312) 537-4655.

FOR SALE: Spectra Physics 2.0 mw 071-2 HeNe laser tube, brand new with power supply schematic, $110.00. WA2NDM, 5 Melville Rd., Great Neck, NY 11023.

2 METER FM— Icom IC21, AC and DC supply built-in, 24 channels (16 xtals included) SWR meter, incremental tuning, discriminator meter, a real buy at $300. T. Field, WA3DHV, Days, phone (215) 884-6010.

HAMS WANTED: Join 4,200 member Morse Telegraph Club. Open to General Class (or higher) licensees. Modest Annual dues include subscription to great slick paper club newspaper, "Dots and Dashes", Hundreds of hams already belong. Send $3 to Dr. W.C. Hess, W6CK, MTC Director, P.O. Box 19-M, Pasadena, CA 91102.

FT DX 560, DX100B, HQ180AX, best offer, K6-HTM, 875 Lindo Ln., Chico, CA 95926. (916) 342-0044.

RUBBER STAMPS FOR HAMS: Free catalog. Same day service. Brock's, K9OSC, 11021 W. Jeffrey Ct., Milwaukee, WI 53225.

DRAKE TR4/DC supply, $390. Collins KWM2/AC supply, $800. Elmac PS-2V AC supply, $25. Shure 55C mike $25. F. Lento, W2AIT, 74 Ann Terr., Park Ridge, NJ 07656.

HAMMARLUND HQ110 with Collins Filter plus Heath AT-1 Transmitter. Good for novice $95.00 or best offer. John Boyce, 24 Hobart Ave., Short Hills, NJ 07078. Phone: (201) 467-8067.

WANTED: 220 mHz trans or trans. convt 1296 R.F. amp, low loss coax uhf. WA1NGR, P.O. Box 76, Chester, CT 06412.

HELLO to my DX friends worldwide! W6UUX/KA2AX is now licensed to operate as JR1YIE full time from Tokyo. Bob Houston, Box 73, APO SF 96525.

MOBILE PACKAGE: T.R. 4 with N.B. Adcom Supply Mike and Mount rig and Antenna Hustler with 4 resonators all cables, $495. TA-33 beam, Ham M. CDR Control 100 ft. cable and RG-8 on pipe mast. You dismantle and take. Terms pick up my QTH. Cash, no cherry pick. No shipping. W2-FWV, East Williston, NY.

SSTV or dust control project high voltage transformer. 1800 volts at 4 millamperes, 115 volt primary. $10.00. WA4RDV, W. Carr, 1145 Kerns Ave., Roanoke, VA 24015.

POLARAD SG-55/URM-34 Signal Generator 2150-4600 mhz, with manual, 400hz power, $45 FOB. L.T. Smith, 3108 N. Lincoln, Stillwater, OK 74074.

SELL—TRADE— Hunter Bandit 2000B; SP-600JX, 75A4, Clegg Thor VI, AC, others. SASE for list. J.B. Forman, W4EMI, Box 2201 EADS Stn., Arlington, VA 22202.

DESKFAX Facsimile machine, $10 picked up. Goodman, 5826 S. Western Ave., Chicago, IL 60636.

SELL: HT44, PS150, SX117, $400. Heath AM2 $10. Warrior KW $100. BN1 $5. Compreamp, $15. K5MWZ, Box 16099, Ft. Worth, TX 76133.

WANTED: ROBOT Model 80 camera and MAGNUM SIX for COLLINS. Mike Ludkiewicz, 143 Richmond Rd., Ludlow, MA 01056.

WANTED: Set of plug in coils for a Hammarlund "Comet Pro" receiver. Alley, W1DMD, 48 Judson St., Raynham, MA 02767.

NEED XEROX COPY of 160m. Ham Station as appeared in Electronics Illustrated. WA9DLT, 1302 S. Prairie, Arlington Hts., IL 60005.

'71 CQ & QST mags. Oct-Dec $2.50 -postage. '72 QST complete year $4.50-postage. George Clark, 123 Davis Ave., Hackensack, NJ 07601.

YAESU Ft 100 Transcvr., Xtal cal, VOX, solid state, AC DC supply, $300. Excellent condx. Cash or cert. check, only. WA2AFX, 2332 E. 24th St., Brooklyn, NY 11229.

JOHNSON VIKING II w/122 VFO, $89. Good novice xmtr. NYC-LI area. Auslander, 1499 N. Meadow Rd., Merrick, NY 11566.

WANTED: Crank up or tilt over tower, tri band beam, rotor, etc., or any one of above. Cash. WB9-LUE, Neal Krugman, 396 W. 17th St., Chicago Hts., IL 60411.

NATIONAL NCL-2000 in A-1 condx. Sell local, no shipping but will deliver within 100 mi. N. of Boston. W1JGJ, J. Haskell, Jr., 135 Country Club Rd., Melrose, MA 02176.

SELL: Xcvr Eico 753 with SS Vfo, Manual, $85. Heath HP13 P.S., manual, $40. WA6GCJ, P. Lelong 5408 Simpson Ave., No. Hollywood, CA 91607.

FOR SALE: GT550 with calibrator and AC550-supply $350. Ameco PT preamp, $35. W8IIT, 281 Jenny Ln., Dayton, OH 45459.

WILL TRADE RME CONV. Model VHF-126 and RME VHF 602 Transmitter both excellent for General Coverage receiver in good condx. K8OUQ, 268 Annis Ct., Chillicothe, OH 45601.

COLLINS 75S3C s/n 13187 w/cw filter and extra 10m. xtal (28.7-28.9) $1055. W7UD, 3637 W. Grandview, Tacoma, WA 98466.

GALAXY III 300w. pep, needs more audio on rcv $130.00. PS for same, $65.00. Remote VFO to match, $30.00. W7UD, 3637 W. Grandview, Tacoma, WA 98466.

SELL/TRADE Deluxe 16mm movie equipment. Camera and silent/sound on film projector with amplifier, spkr and c. cases. What have you, SASE for list. 367 North West, Vacaville, CA 95688.

FOR SALE: Math for radiomen & Elec.-Cooke; Transistors-Kiver, Application of Electronics- Grub & Kiver. Radio Eng. Principles, Tower & Browne, above $4 FOB, Radio Eng. Hdbk, Terman, $5. Douglas, 2254 Pepper Dr., Concord, CA 94520.

HW-100 Transceiver professionally wired by radio engineer, $185 plus shipping. Certified check. Willie Carr, WA4RDV, 1145 Kerns Ave. S.W., Roanoke, VA 24015.

WANTED: Old or recent books on direction finding. State condition, price. Worcester, RD 1, Frankfort, NY 13340.

WANTED: 4CX250B or R tubes. W6RTD, 31 Celine Dr., Santa Barbara, CA 93105.

GONSET 2M. VFO & Pre-amp Model 3024, $20. Prepaid UPS W9DI, 22 S. Clay St., Hinsdale, IL 60521.

MANUALS NEEDED: Johnson Viking Thunderbolt Linear, Sprague TO5 Analyzer, and SSB converter CV-1694/GRC-129. J. L. Lay, WA5SKP, Rt. 2, Box 277-A, Florence, MS 39073.

CQ AR DE MT NB NV NM ND UT VT WY de EA7AD 15-16-17 Jan, 1600Z 21, 100 cw 1630Z 21,280 ssb/WB0CWA, Box 33, B602, FPO NY, NY 09540.

TRANSFORMERS REWOUND. Jess Price, W4CLJ, 507 Raehn St., Orlando, FL 32806. (305) 425-7251.

SOUTHERN CALIFORNIA: Trade Slate Pool Table: Want Swan 500-500C-500CX, etc. WA6-WCN, Gene Lewis. (805) 642-1198 or 642-9624.

ROBOT SSTV & Accessories, mint AIL nf Indicator, VHF & UHF gear, shack cleanup. List SASE. W4API, Box 4095, Arlington, VA 22204.

24 HOUR CLOCK, $9.00. 12 VDC to 120VAC Power Supply, 350 watts, never used, $65. HW7, with superfex headphones, $59. Want Mobile rig, 40 meters transceiver and transistor ham receiver. Ken Hand, WB2EUF, Bridgehampton, LI, NY 11932.

WANTED: Hallicrafters HA-16 VOX unit for use with HT-46 xmtr. A. C. Smarr, W4BTZ, P.O. Box 52701, Atlanta, GA 30305.

WILL PAY CASH for Collins gear if the price is right. State Model and Serial No. and condition, also lowest price. W4AIS, 300 Thornwood Dr., Taylors, SC 29687.

QST Magazines 1942 to 1973 few missing. CQ 1947 to 1973. Some missing. Radio Electronic and Radio News, 73 Magazines. Offer for all. Cash, carry. DuPont, 15 Fitchdale Ave., Box 187, Bedford, MA 01730.

SELL: 75A4 Serial 5329 -3 filters, $350 firm. Heath DX60B, $60. Write. Oberstein, 55 Knolls Cresc., Bronx, NY 10463.

SELL: Plate Xfmr 3600-0-3600 at 1 amp, 110/220 pri $30. Valiant f.w., excellent $140. DX-35 $30. W0AIH, 814 4th St., Virginia, MN 55792.

PHOTO BUGS retired professional selling Graflex, Rollieflex, Nikons, what do you need? Mace, 8600 Skyline Dr., Hollywood, CA 90046.

WANTED: Ship's clock for shack. es R/C gear-planes. WA3LKV, 22W Ridge St., Lansford, PA 18232.

ANTIQUE RADIOS, parts, tubes, etc. SASE for list. W2GHF, CPO Box 603, Kingston, NY 12401.

FOR SALE: Drake 2C with noise blanker, xtal cal., Q-mult/spkr: $220. Damon Ginbey, WA5EEM, 4307 Ramsey, Austin, TX 78756.

SELL: Collins KW1, $1500. Link 250 UFS, $150. Link 5OUFS, $75. SASE. List ham, Motorola svc parts, test equipment. Sams, 1 thru 1289, AR, TR, TSM. W8VZ, Anderson, 520 - 3rd St., Marietta, OH 45750.

WANTED: Collins cabinet for 32V series transmitter. WA4NMQ, 1630 Venus St., Merritt Is., FL 32952.

DRAKE 2B, 2B Mult. Xtal Cal. 2 extra rcv xtals, manual, excel., $185. WA2PPV, (516) RO4-9077.

95% DX QSL RETURN. Write in 54 languages! K3CHP's DX QSL GUIDE, $3.95. Joe Mikuckis, 6913 Furman Pkwy., Riverdale, MD 20840.

WANTED: Galaxy III or V Xcvr only. Joseph Schwartz, 43-34 Union St., Flushing, NY 11355.

SWAN 240 Tribander DC supply, H.B. AC supply, exc. condx., $250. 150m. Radius Atlanta, will deliver. K4TBN, (404) 941-0915.

FOR SALE: Swan 500CX 117XC power supply like new, $450. WB4MTE, 1612 Stone Ave., Crossville, TN 38555.

FOR TRADE OR SALE: HW-101 used about 5 hrs. LFP 300 lowrance fish IO-K-TOR, new. Would like amateur equipment. W4LQI, PO Box 709, Paintsville, KY 41240.

SB-620 Scanalyzer, factory wired excellent, also Drake 2LF. Need Genral coverage rx stable enuf for RTTY. Box 1842, Ft. Stockton, TX 79735—.

WANT: Cheap, but repairable gen. cov. rcvr and 2 meter converter, Ken Johnson, 701 Carolyn Ave., Austin, TX 78705.

MOVE--SALE: Drake sta. R4B, T4XB, C-4, L4B, MN2000, Classic 33, Ham M Rotor, W2MGD, 3301 Foxcroft Rd., Charlotte, NC 28211 (704) 364-8697.

SELL: Hammarlund HQ-140XA $50. Prefer local pick-up. W6YZW, G. Burge, 228 No. Glenroy Ave., Los Angeles, CA 90049.

WANT: 6m skeds. cw or ssb. Vermont, R.I., CT, DE, and WA State. T.N. Colbert, WA8MLV, 1008 Englewood Dr., Parma, OH 44134.

WANT TO BUY Your unfinished or non-working kits. Also want good CB gear. Send list, price. H. Dalton, P.O. Box 641, Easley, SC 29640.

2—HT3L Transmitters, $150 each. NC303RX, $175. New Johnson Matchbox, $75. Ranger Trans., $75. New Eico 12V SS supply, $60. Eico Sig Tracer, $25. DuPont, 15 Fitchdale Ave., Bedford, MA 01730.

SIX-METER TELREX 4 element beam, $10. WA2-PCL, 101-23 Lefferts Blvd., Richmond Hill, NY 11419. (212) 849-8458.

FOR SALE OR TRADE for Ham gear. Choice U.S. mint plate blocks. and F.D. covers. L.B. Fuqua, W4WBD, Box 6, Eddyville, KY 42038.

WANTED: Heathkit Apache Transmitter in good condition, send info to: WN9MTL, 600 No. Newlin St., Veedersburg, IN 47987.

28 KSR Floor Console Cabinet LESU and cabling good. 28 TD and Typing Reperf, need repair. 28 Reperf Ribbon Mechanism and Int. Gear Assembly good. D. C. Harrington, 1620 Gardena Ave., Fridley, MN 55432.

BC-221J Frequency meter with AC P/S and original calib. book. $40, L. Hamilton, K6JVE/3, 9019 St. Andrews Pl., College Park, MD 20740.

NEED: Hams for off-road races in Ariz/Calif. K6ICS, Gauthier, 9418 Florence Ave., Downey, CA 90240.

SELL: RTTY- Hal tuned sT6-T, R. (auto start, antispace, 170&850& AFSK-AK1). Also Model 28 KSR. Ship all, $475 and f. WA5ZUH, Rt. 1, Box 58, Lonewolf, OK 73655.

FCC 1st and 2nd Class Questions for Memorization, $5.00. Autopatch Systems, Box 291, Western Springs, IL 60558.

USED, SURPLUS OR DISCARDED COPIES of: CQ, QST, 73, Ham Radio, Radio-Comm Wanted. Write. R. Rampersad, Robin 9Y4EH, 51 Moody-Stuart St., San Fernando, Trinidad, W. I.

WANTED: Waters Q-Multiplier/Notch Filter, Mod. el337-S1 (337-75S1). Rubin, WA6AHF, 17494 Via Alamitos, San Lorenzo, CA 94580.

W0YVA/4, Bob Sullivan, is starting a CX7 net for the purpose of information exchange. He will listen and call CQ CX7 at the following times and freqs: Every Wednesday at 1600 GMT on 14242 and every Sunday at 2000 GMT on 14242.

MOVE--SALE: Drake Sta. R4B, T4XB, C-4, L4B, MN2000, Classic 33, Ham M Rotor. W2MGD, 3301 Foxcroft Rd., Charlotte, NC 28211. (704) 364-8697.

FOR SALE: Martin D-35-12 string guitar, with case. John L. Wentz, Box 102, West Liberty, OH 43357.

CONAR COLOR TV Model 600, new, completed N.R.I. course don't need. $150 you ship. Frank Miller, 111 Clarkson, NE 68629.

KNIGHT TR-108 and VFO 12/117 P.S., $75. Lafayette 6MT HA-650 transistor xcvr, $65. K6-THQ, 1205 Cloverglen Dr., Valinda, CA 91744.

PARTS TRAYS: 3 for $1. 12 sections each tray. Santana, P.O. Box 3477, Los Angeles, CA 90028.

NEED SCHEMATIC or INSTRUCTIONS for ASM-473390 50/60 cycle w/D 473391E - EC114008C 12V power supply (1964). L. A. Price, 576 E. Archwood, Akron, OH 44301.

WANTED: Unassembled or partly assembled electronic kits. Give description, state of completion & cost. W4UPE, 3127 Oriole Dr., Louisville, KY 40217.

FOR SALE: Heath Oscilloscope IO-12, $50. Eico Capacitor Checker Mod. 950B, $25, Eico Signal Generator Mod 324, $25. Precision Signal Gen., Series E-200, $35 and Mod. E-400, $35. Ronald Kendall, 54 Parkgate Ave., Youngstown, O 44518.

BRAND NEW ZERO METAL DETECTOR with headset. Detects a dime at 6". T-R type. Will ship p.p., $100. Barry Ford, 305 N. 5th, Millville, NJ 08332.

JOIN A SWL CLUB. Make contacts, get SW news. Info. 10 cents. Rob Harrington, 3181 So. York St., Englewood, CO 80010.

14AVS for parts, CQ & QST cheap, Heath SWR, $8, Federal Foto Enlarger, $75, movie and still equip. List, travel trailer parts, want HW12-A, K0TQH, Frentz Deerwood, MN 56444.

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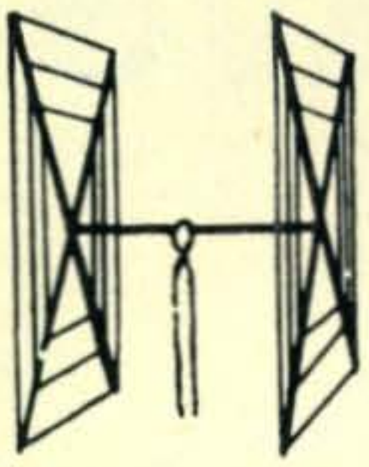

W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount: uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.: 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished): 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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(all use single coax feedline)

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!

Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

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3 EL 20	31*	7 EL 10	38*
4 EL 20	38*	4 EL 6	24
2 EL 15	21	8 EL 6	34*
3 EL 15	25	12 EL 2	31*
4 EL 15	31*	*20' Boom	
5 EL 15	34*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK, OZ4H, and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$18.95
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Tomorrow's Transceiver Today: 20 tubes plus 50 silicon semiconductors, passive crystal filter (6 pole), velvet smooth tuning, superb noise blanker, standard electrical parts. This is truly the best buy in the amateur field today. See your local dealer for brochure & demonstration.

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