CQ

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75¢ July/August 1970

Interlaced Beams for 10 and 15

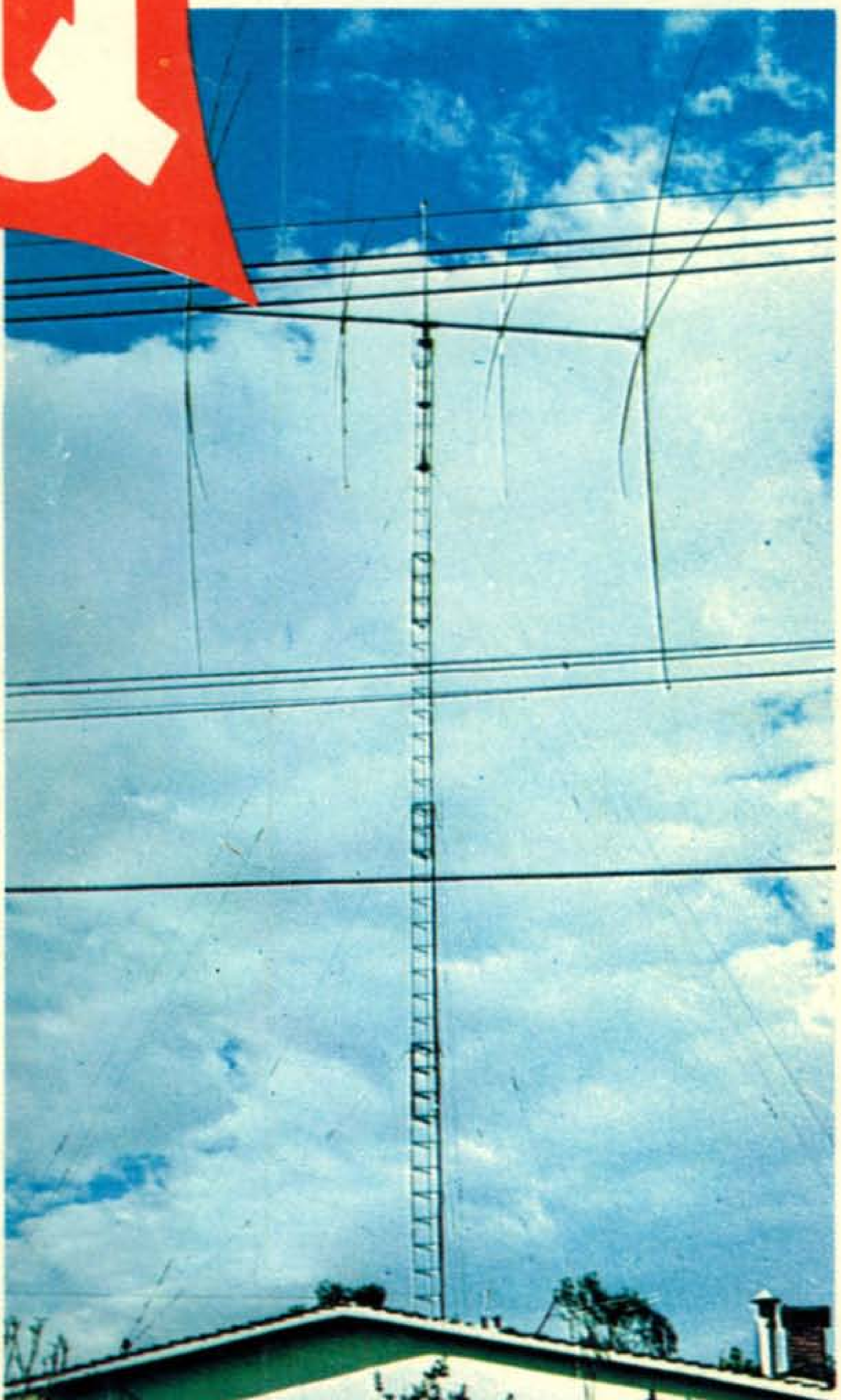
UNDERSTANDING SKIN EFFECT

A Digital Readout Transistorized Receiver

A "SOMETHING-FOR-NOTHING" C.W. FILTER

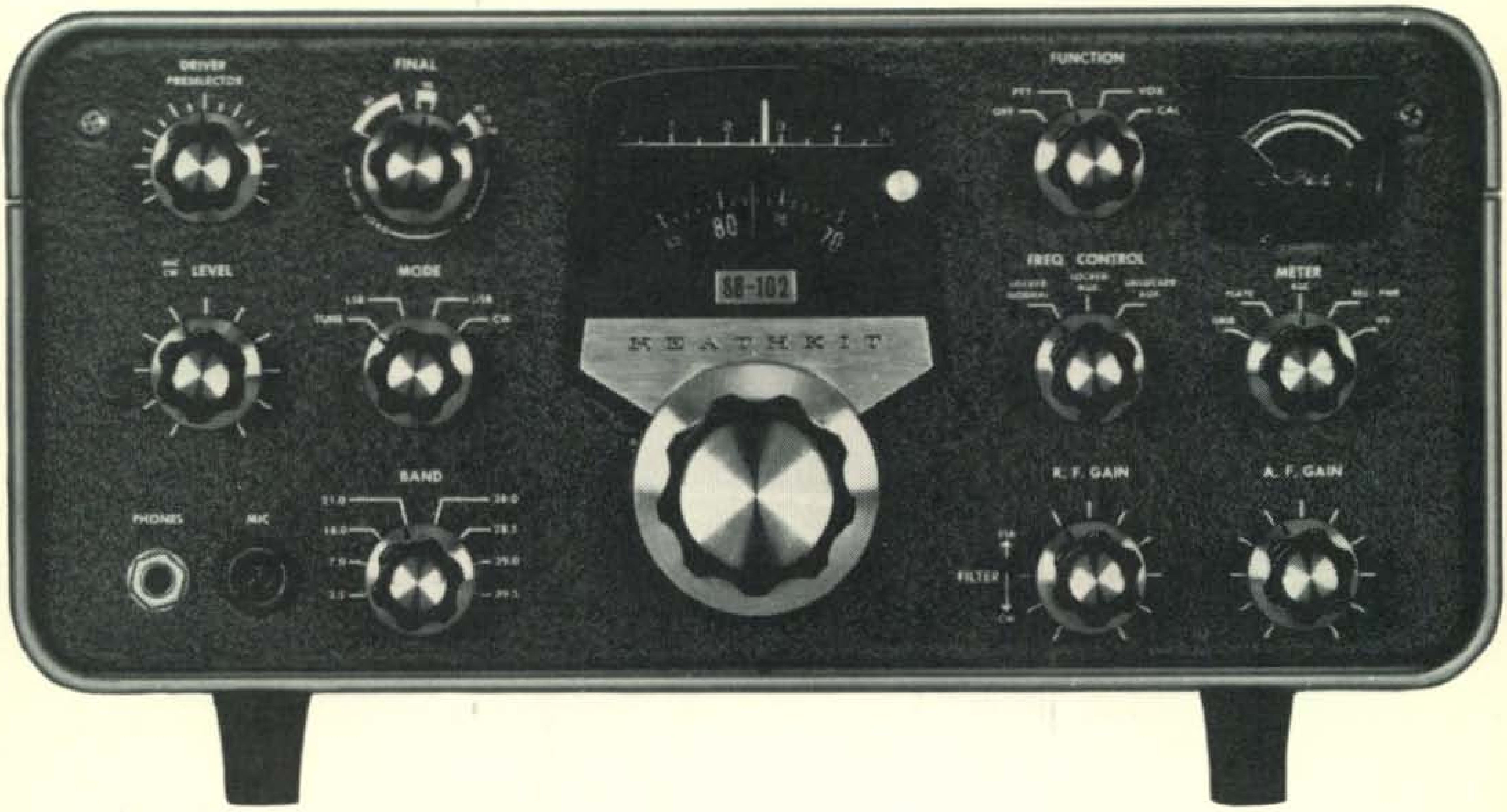
Solid State Current Regulation

MODEL CONTROL BY RADIO—PART II



DX CONTEST PHONE RESULTS—PAGE 47

The Radio Amateur's Journal



Want to start a pile-up?

The New Heathkit® SB-102

Direct descendent of the most popular sideband rigs ever produced — the famous "100" & "101" Series. With an ancestory of top performance, high reliability and unbeatable value, you expect the new "102" to be a better rig . . . and it is.

The frequency stability and linearity of the "101" were second to none. The "102" is even better. An all solid-state Linear Master Oscillator cuts stabilization time in half; offers far greater tracking accuracy.

Hot new receiver circuitry delivers improved sensitivity . . . now less than 0.35 uV for 10 dB signal plus noise to noise. This increase gives you solid copy longer when the band is on the way out.

The new "102" brings you all the flexibility and performance that made the "101" the standard of comparison on the air, plus important new features. Start your Maxi-Rig now . . . with the SB-102 — from the Hams at Heath, of course.

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

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

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


Eimac
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JULY/AUGUST, 1970 VOL. 26, No. 7

CQ

The Radio Amateur's Journal

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DEPARTMENTS

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

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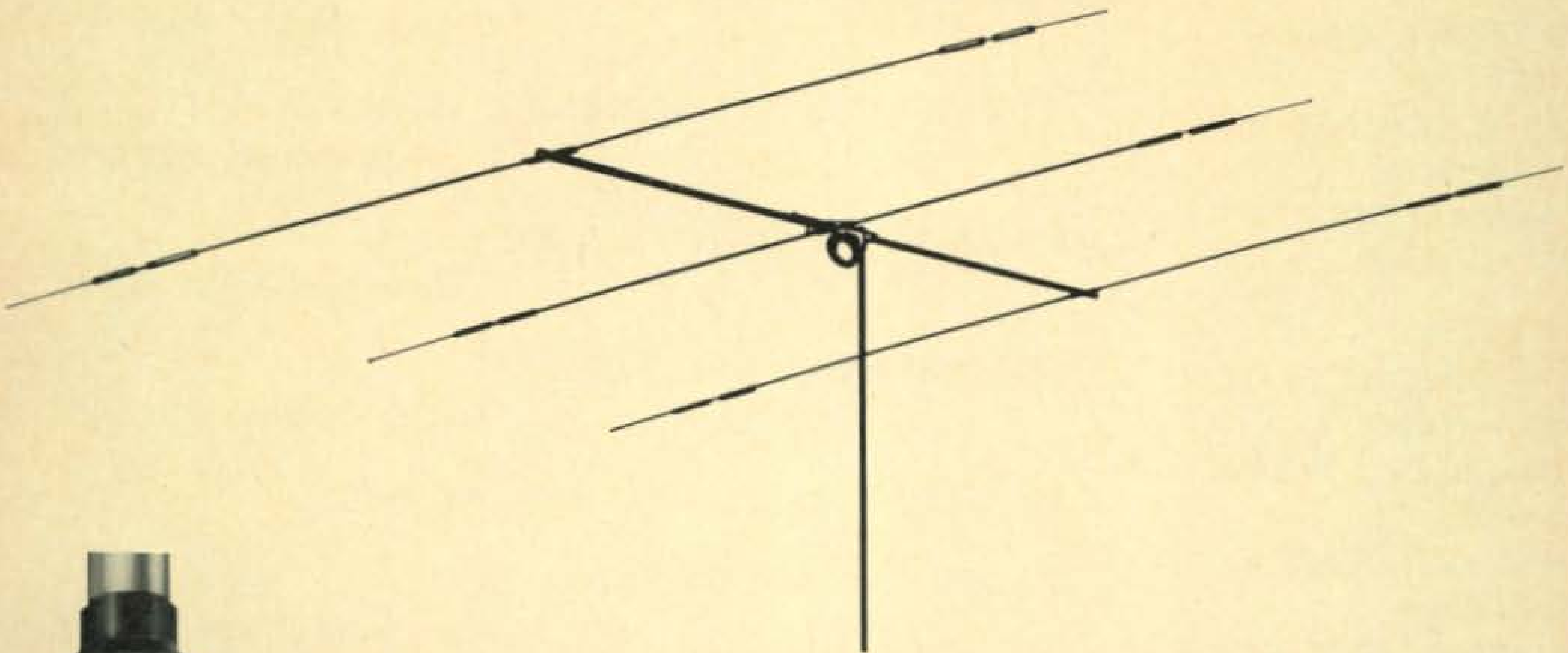
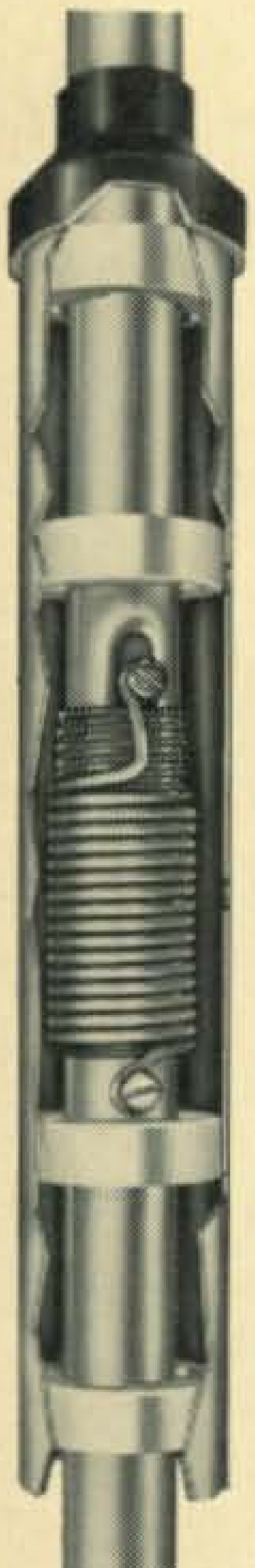
See page 102 for New Reader Service

For the most powerful antennas under the sun!

The Voice Heard Around the World

...HY-GAIN THUNDERBIRDS





TAKE THE SUPER 3-ELEMENT MODEL TH3Mk3 for 10, 15 and 20 meters.

Separate Hy-Gain Hy-Q traps for each band are electronically tuned at the factory to insure optimum performance. In addition, exclusive Beta matching achieves balanced current distribution and patterns that are not skewed off to one side, while providing DC ground for lightning protection.

These features along with optimum spacing of the elements on a 14 foot boom all add up to:

- Up to 8 db gain
- 25 db front-to-back ratio
- SWR less than 1.5:1 on all bands
- Accepts 1 KW AM; 2 KW PEP

Rugged construction features include:

- Machine-formed boom-to-element brackets
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- Injection molded insulators.

Order No. 388 – suggested retail price $144.95

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HY-GAIN ELECTRONICS CORPORATION

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

 See page 102 for New Reader Service

ZERO BIAS

The peace and sanctitude of our amateur bands was disrupted a short while ago by happenings on the air which, I believe, have no precedent. I don't claim to have an extraordinary memory, nor am I old enough to have intelligently witnessed much more than post-World War II History, but, I think it's safe to say that the recent Student Information Network episode was unique in amateur history.

With the killing of four Kent State University students by Ohio National Guardsmen, and the almost simultaneous US-South Vietnamese excursion into Cambodia in May of this year, emotions ran deep and both pro and counter demonstrations erupted both on and off the college campuses. Student protest strikes were the order of the day. We respect the right of students to so voice their opinions. We feel, however, that it is vital to the existence of amateur radio that our amateur bands remain beyond the reach of campus and/or civil unrest.

This, unfortunately, was not the case last May. At the height of campus tensions, the Student Information Net was formed, originating on the West Coast, on 7269 kc and slowly growing to national proportions on 14,295 kc. The net was intended to coordinate campus strikes on a regional and then a national basis.

We received a flood of radiograms and phone calls regarding the Net's activites, but despite the personal feelings of the callers, the Net's operations were apparently legal, if not popular among amateurs. The callers seemed to feel that the mere on-the-air mention of a student strike was counter to FCC rules and regulations, but that's just not the case. On the other hand, the widespread intentional jamming of the Net's transmissions was in direct and obvious violation of FCC rules and regulations.

Our feelings are that amateur radio should not be used as a sounding board for politics, although no such limitation is legally imposed on us. It is also our feeling that intentional jamming of any legal transmission is to be abhorred, although the person doing the jamming may sincerely feel he is doing his part to defend the American Way of Life. And we remind both factions that the way to any valid goal is not through disregard for law, history, and morals, but through constructive, reasoned change.

New Publishing Schedule

As too many amateur magazine readers are painfully aware, the U. S. Postal Service has been wreaking havoc with magazine deliveries to the extent that the June issue of one of the ham magazines may not arrive until well into the month of June when it may be partly outdated. *CQ* has suffered as much as or perhaps more than the other ham publications because of our out-of-the-way Florida printing and mailing point, which causes additional distribution delays.

We've tried diligently over the past two years to rectify the situation from our end by putting *CQ* on the press earlier than ever before, but the time we gained was quickly devoured by the Post Office.

Therefore, *CQ* is making a major change in its publishing schedule which will hopefully hold the line on magazine deliveries for several years. Perhaps those years will see sufficient Postal reform to preclude any further schedule adjustments.

What are we doing? We're adjusting this month's time-critical material so that it is as suitable for the next two months as we can make it. This issue is dated "July/August," and will be in the mail at its usual time of June 20. The next issue will be dated September, and will be in the mail on July 20, and so forth. So, in reality, all we've done is change the date on the magazine, and adjust the content accordingly. You'll receive a magazine at the same time each month, but it will be a magazine for a later month. You *will not* receive any fewer magazines nor will you receive any less useful material.

Subscriptions now in effect have all been extended by one calendar month to ensure that subscribers receive as many issues as they have paid for. New subscriptions will be automatically corrected.

Items which have been adjusted this month are the Propagation column and Announcements. Next month's issue (dated September) will carry slightly adjusted DX and Contest Calendar columns. This month's Propagation column contains text and Last Minute Forecast good for July *and* August, while the Short Skip propagation charts are good from July 15 through September 15. This month's Announcements are for all of July and most of August; the remainder of August Announcements as well as September's will appear in the September issue.

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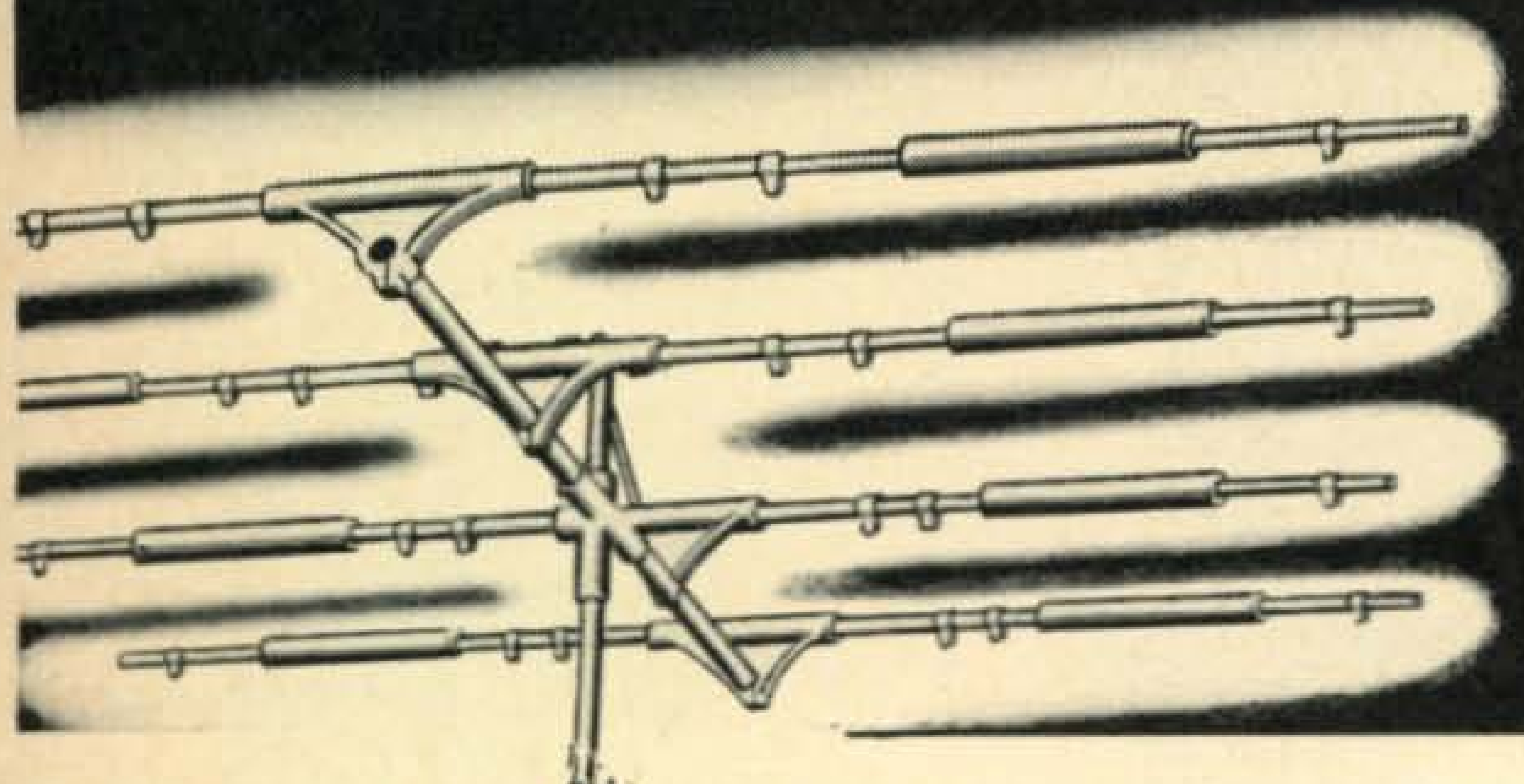
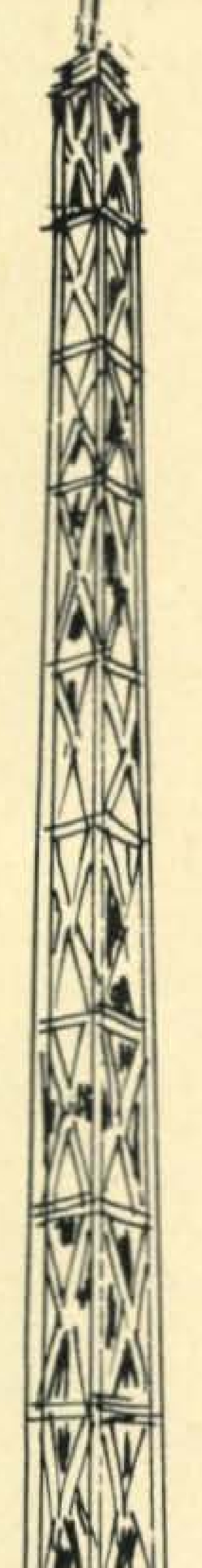


single band performance with

SWAN BEAM

FOR 10, 15,



EXCLUSIVE FEATURES:

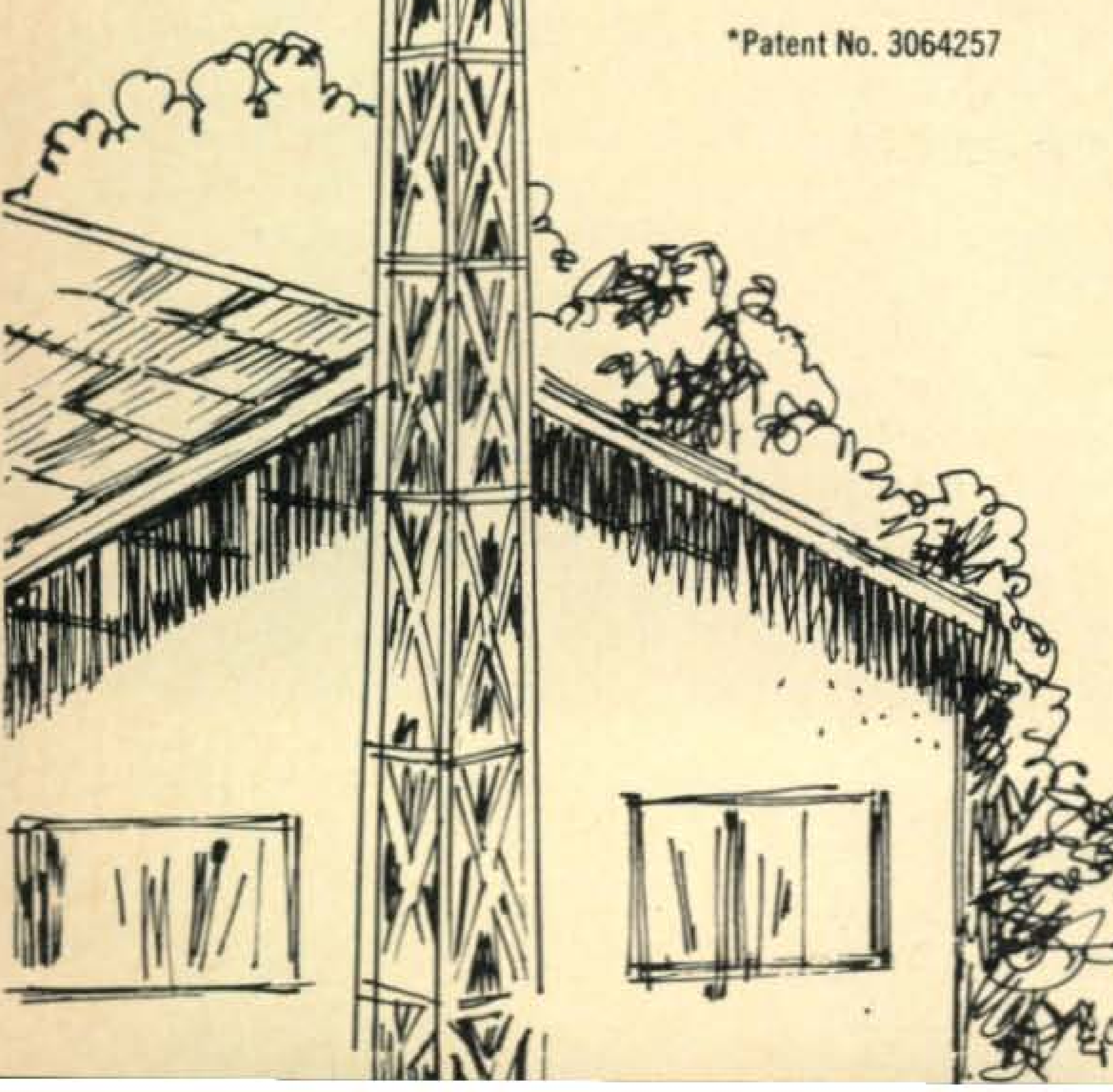
Swan Triband Beams feature a patented* trap design which permits precision factory adjustment. This results in maximum forward gain and front-to-back ratio from each and every Swan antenna. Their outstanding performance is comparable to single band antennas having the same number of elements.

The electrical principals employed in a trap type multi-band antenna are quite simple. The "trap" is a parallel resonant circuit consisting of a high Q inductance with a coaxial sleeve capacitor connected in parallel. At resonance the impedance across the trap is very high, and its effect is the same as inserting an insulator at that point. Thus, the electrical length of the antenna element can be altered by insertion of a parallel tuned trap. Each element in a Swan Triband Beam has two traps for 10 meters, and two traps for 15 meters. (None are required for 20 meters since the elements are full length on this band). It is vitally important that the traps are tuned to exact frequency, or antenna performance will not be optimum. Normal manufacturing tolerances in the coil and capacitor assembly create considerable variation in resonant frequency. Unless the trap has some means for precise adjustment, its resonant frequency will be pretty much a hit or miss affair. The exclusive precision tuned traps in Swan antennas* explain why they give consistently superior performance.

2000 watts P.E.P. power rating: All models of the Swan Triband Beams are rated at the full legal power limit.

Low SWR. Swan Triband Beams are designed for a near perfect match on each band with 52 ohm coaxial cable. Standing wave ratio will be down as low as 1.2 at band center, resulting in extremely low transmission line loss. There are no gimmicks or gadgets in the feed system. It's very simple, and works very well. In fact, we offer no magic whatsoever in our antennas, except that they are designed to provide maximum performance on each band, and mechanically built to withstand severe weather conditions for a long long time. Ask any ham who owns one. The Swan antenna is an improved Hornet design, manufactured formerly by Hornet Antenna Products. Compare the Swan Tribander feature for feature with other brands. Ask your dealer to open up the shipping carton and let you inspect the Swan antenna. We think you'll like what you see, and like its performance even more.

*Patent No. 3064257



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A Subsidiary of Cubic Corporation

For better ideas in amateur radio.

OUR READERS SAY

Sudden Death

I am taking this opportunity to inform you of the untimely and sudden accidental death of my father, Alex J. Dolgosh, K8HRS.

He was working on his 4-1000A linear amplifier and apparently forgot to turn off the plate voltage. I think the rest of the story is self explanatory. Death was instantaneous. The story in the enclosed newspaper clipping is very factual, including the plate potential of 7,000 volts.

Most of us tend to treat these happenings lightly, until it closely touches us. I hope *CQ* magazine will be able to use this horrible happening in some way that will again remind us all, if only for a short while, of the potential dangers of our hobby.

Alex F. Dolgosh, K8EUR
Ashtabula, Ohio

Honest Error

Editor, *CQ:*

We feel that the readers of *CQ* are entitled to know that with reference to our advertisement recently of selling a v.t.v.m. that the product was not a v.t.v.m. but a v.o.m. that the advertisement was conceived belatedly and at the last minute, and that I, who wrote the advertisement, knew as well as anybody else that it was a v.o.m. and not a v.t.v.m. I have so written and indicated to our customers. This was a gross mistake compounded because in the first instance the advertisement was too late, having been sent in just prior to a trip around the world, and because I was not back on schedule it was reproduced a second time by the staff at *CQ* without their having been notified of the error. Our advertisements are unusually candid and truthful at all times, except for mistakes like this, and we further seek to be as informative as possible in our editorial type of advertisement providing information which is ordinarily not found in reference texts.

Herbert W. Gordon
Harvard, Mass.

West Coast Novice Net

Editor, *CQ:*

I am trying to organize a West Coast Novice net on 40 meters. Any help would be appreciated. For all details, please write to me at the address below. A certificate will be issued.

Clair Bruce, WN7ONC
1474 Court St., N.E.
Salem, Oregon 97301

Outdated C.W.

Editor, *CQ:*

I am getting awfully sick and tired of hearing and/or reading about c.w. being "on the way out," "outdated," etc. I have bad news for these people.

Having just returned from a two week swing through Central America (mainly Nicaragua and Corn Island where I was fortunate to obtain an HT license) and I can assure one and all that c.w. is far from dead.

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I had occasion to visit three military, one commercial and one aeronautical radio installation and you had better believe it, c.w. is the order of the day. The one exception to any degree was the aeronautical station where the personnel leaned more on a.m. for a number of reasons. The most modern receiver I saw was the HQ-100!

Incidentally, all the knobs on the bugs or speed keys were missing—"paddles only" and the size of it being about three or four times that of the standard equipped bug. Most traffic was handled in the area of 40 w.p.m.—c.w. at its best.

An isolated case you say? Hardly! If such modes are still being used exclusively so close to home—consider what type of communications are in use in say JT, TA, 5T5, 9N1, AP, HZ, etc.?

Granted that more sophisticated modes are coming into acceptable useage here in "Gringoland" as a result of economical growth. But to say in broad terms (which is universal in effect and scope) that c.w. is "going by the boards" or old fashioned in not being very realistic.

Due to innumerable variables I would venture to say that universal discontinuance of c.w. will never occur in our life time—if ever!

G. L. Baker, HT4IM/W5QPX
Dalhart, Texas

24-Hour Clock

Editor, *CQ:*

I have read with interest the article by Douglas L. Jones, K3AAY, entitled, "A 24-Hour Clock for the Shack."

Eliminating a bit of experimentation and development with semi-conductors, a pleasant construction project and other factors, it seems a most unusual way to acquire a 24-hour clock.

Enclosed is a print of a 24-hour movement complete with motor manufactured by the Hansen Manufacturing Company, P.O. Box 23, Princeton, Ind. which will certainly accomplish the purpose and make an excellent time piece. Hands for this movement can be purchased from Empire Clock Co., 1295 Rice St., St. Paul, Minn. This leaves only the dial and whatever case the amateur may wish...

For those who might be interested the movement can be acquired for approximately $7.25 plus a dollar or so for postage. I have no price on hands but I am sure they are not too expensive.

I pass this on for those who may not wish to build a frequency converter, but who wish to have a nice 24-hour clock.

F. Britt, WA9VVI
Princeton, Ind. ..

Japanese Reciprocity

Editor, *CQ:*

Re April 1970 *CQ* George Pataki, ex-YO2DO letter regarding reciprocal operating in Japan, a few misconceptions appeared that should be straightened out.

Military personnel residing in the Japanese community, lawyers, missionaries and businessmen cannot operate; only US military and Civil Service personnel residing on a US Military Reservation (my XYL, WB AGZ, could *not*

[*Continued on page 89*]

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Announcements

Correction

Several errors crept into the "Upgrading the Heathkit SB-10 Sideband Adaptor" article which appeared in the May issue on page 22. Starting on page 22, the values of coils L_3, L_4, and L_5 should read .56, .39, and .22 microhenries respectively. On page 23, paragraph 1, the part number for the Cambion tuning tool should be No. 2375-1. In step 4 on page 23, the numeral 1 should follow the word pin. On page 24, 1st sentence, 2nd column, the sentence should have read "It wastes a resistor but it certainly saves your patience by eliminating some work in very close quarters." In step 10, same page and column, the word "correction" should have read "connection." The photo caption on page 26 should have stated that it was the front panel that had been removed and that the paralled resistors were 100 ohms instead of 10 ohms. Page 23, has step F) starting with the word Operational, this should be Optional. The word "positions" was deleted from the second sentence of the Additional Modifications section, 1st column, page 26. On page 26, 2nd column, the 3rd paragraph should have started with the word "providing" rather than the word "previously."

The author, Hubert H. Wheeler, is now K3KWN, and can be reached at Box 26Y, RD1, Beech Creek, Pa. 16822.

Linwood, Indiana

The Madison County Amateur Radio Club will hold its annual Hamboree on Sunday, July 12, 1970. Doors will open at 11 A.M. at the county Civil Defense Control Center located 4 miles north of Anderson at Linwood. Activities include a general get-together and flea market. Door prizes will be awarded thru the afternoon, and refreshments will be available. Talk-in frequencies: 50.4, 145.35, and 146.94.

Baraboo, Wisconsin

The Wisconsin Amateur Radio Picnic, sponsored by the Wisconsin Nets Association will be held in Oscher Park in Baraboo, on July 12, 1970. Activities will include code receiving contest, softball game, ladies activities, and eye-ball QSOs. Refreshments are included with registration but bring your own lunch. Registration begins at 10 A.M. ($1.50 single, $2.50 family).

Missoula, Montana

The 36th annual Glacier-Waterton International Peace Park Hamfest will take place in Glacier National Park, July 18th and 19th, 1970. Amateur radio operators from Montana, Idaho, and Washington as well as those from Alberta, Saskatchewan and B.C. Canada are expected to attend. For complete details contact: Jerry Nelson, K7IMZ, 1324 Sherwood Street, Missoula, Montana 59801.

Canterbury, England

A special amateur radio station, GB2CF, has been set up for the Becket Festival (Thomas Becket) being held in Canterbury, England from July 19th through the 26th, 1970. Amateurs are urged to make contact with GB2CF and other amateurs in local towns and villages which surround Canterbury. They are: Ash, Aylsham, Bekesbourne, Bridge, Chilham, Chartham, Faversham, Herne Bay, Herne, Ickham, Kingston, Littlebourne, Patrixbourne, Sturry, Selling, Stelling, Wye, Wingham, and Wickhambreux. For further information contact: D. L. Smith, G8CUC, 7, Old Fold, Chestfield, Whitstable, Kent, England.

Niagra Falls, New York

The annual combined convention of The International Certificate Hunter's Club, The International Flying Ham's Club, The International Shortwave Listeners Club and The International Amateur Radio Journalistic Society will be held the three days of July 30-31 and August 1st at the Parkway Inn, 401 Buffalo Ave., Niagara Falls, N.Y. Write to Valerie V. Ortega, K2KQC, 187 Main St., Hamburg, N.Y. 14075 for further information.

Frankfort, Illinois

The 13th annual hamfest of the Six Meter Club of Chicago Inc. will be held Sunday, Aug. 2, at the Picnic Grove on U.S. 45, 1 mile north of U.S. 30, 5 miles south of U.S. 6, Frankfort, Illinois. Food and drinks will be available, Prizes awarded, and a swap & shop section. Advance registration $1.50, admission at the gate $2.00. For tickets and further information contact Mike Corbett, K9ENZ, 5215 West 73rd Court, Argo P.O., Illinois 60501.

Bangor, Michigan

The 17th annual South Western Michigan VHF Picnic will be at the Allegan County Park, August 2nd, sponsored by the Van Buren County Amateur Radio Club, W8JUU, Bangor, Mich.

Fort Wayne, Indiana

In the interest of acquainting amateurs with f.m. techniques, the Fort Wayne Repeater Association is sponsoring an annual F.M. Picnic. The event will take place at Crooked Lake near

[*Continued on page 95*]

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SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Oh boy, oh boy, oh boy, Hackensaki! it surely are exciting to be in on grounded floor of some new amchoor development. Something just happening to me that up to now I only reeding about.

I talking about Long Delay Echos, or L.D.E.'s Surely you are heering about them, Hon. Ed? Somebuddy is having a QSO, then sineing off, and he heering a repeet—an echo—of his or the other guys signals after each is off the air.

When I first reeding about L.D.E.'s, I knowing how astounded I being. Where can echo coming from? After all, signal can going around the world in . . . hmm, let's see, 186000 miles per second . . . hmm, divided into circumference of earth . . . ok, I got it. It taking a little over a tenth of a second for signal to go around world and being heard as an echo.

Now, some guys are reporting echos as long as five minutes! Wowie!! Where could signal be stored for five minutes? It not just bouncing off the moon and coming back—that only taking cupple seconds. This are being reel space mistery.

Of coursely, I never expecting it to happen to me. It like winning a contest or a raffle. That never happening to me (or even to anybuddy I knowing, as a matter of fackly).

But, it did happening to me! Let me see if I can explaneing it as it happening.

The sun was just settling behind the mountains and the sky was an orange glow. Typical Arizona sunset. I walked into shack, turned on the lite, and sat down at the operating table.

Are next opening up the log, looking for a sharp pencil, finding I not having one, so getting up, going to file cabinet, which having pencil sharpener on it, and sharpening a cupple of encils.

Sitting down again at operating table, turn-

See page 102 for New Reader Service

ing on desk lamp, hitting the switches on the reseever and xmitter, and just that suddenly I heering a seek-you being called on see-w. Signal sounding kinda familiar. When the callsign coming, you could knocking me over with a feather! It good old Scratchi's call what being sined!!

Just as suddenly as it starting, it stopping. My first reackshun is that somebuddy is using my call. My second reackshun is that it is my fist that I heering. Now I reely whamboozled. What happening??

Then I remembering artickle I reeding on L.D.E.'s. Maybe this is it!! I looking at log. Last nite at about the same time I are sending seek-you just like the one I heering. Hokendoke Hackensaki! I are heering an L.D.E. with a delay time of twenny-fôur hours!!

Where has that signal been? In twenny-four hours a signal traveling at 186,000 miles per second will have gone . . . hmm, 60 times 60 times 24 times 186,000 . . . is 86,400 times 186.000, is—Gracious to Goodness it's more than 16,000 million miles!

Where on earth could that signal have been? No, not on earth It having to go around earth a million times to being gone that long, and just the thought of that is making me dizzy.

I so astounded at hole thing that I turning around in my chair, stuffing a piece of paper into my tiperiter, and riting you this letter. Hon. Ed., you thinking I holding a record for L.D.E.? Maybe I being famous for little while?

Excoosing me, Hon. Ed., but my Hon. Brother Itchi are just coming into the shack...

Oh boy. Oh boy. Well, that was the shortest time I was ever famous, Hon. Ed. You can forgetting the hole thing. I'm not even sure that I going to waste six cents on a stamp for this letter.

Brother Itchi just asking me if I liking the present he giving me. When I asking him what present he talking about, he telling me that he buying me a little recorder so I can recording incoming calls. He also wanting to know if he wiring it up rite when he installing it.

Sure enough. I looking, and there it is. Only it wired up wrong. It wired up so that I heering a recording of whatever I sending last. Like last nite.

Oh well, Happy Amchoor Day,

Respectively yours,
Hashafisti Scratchi

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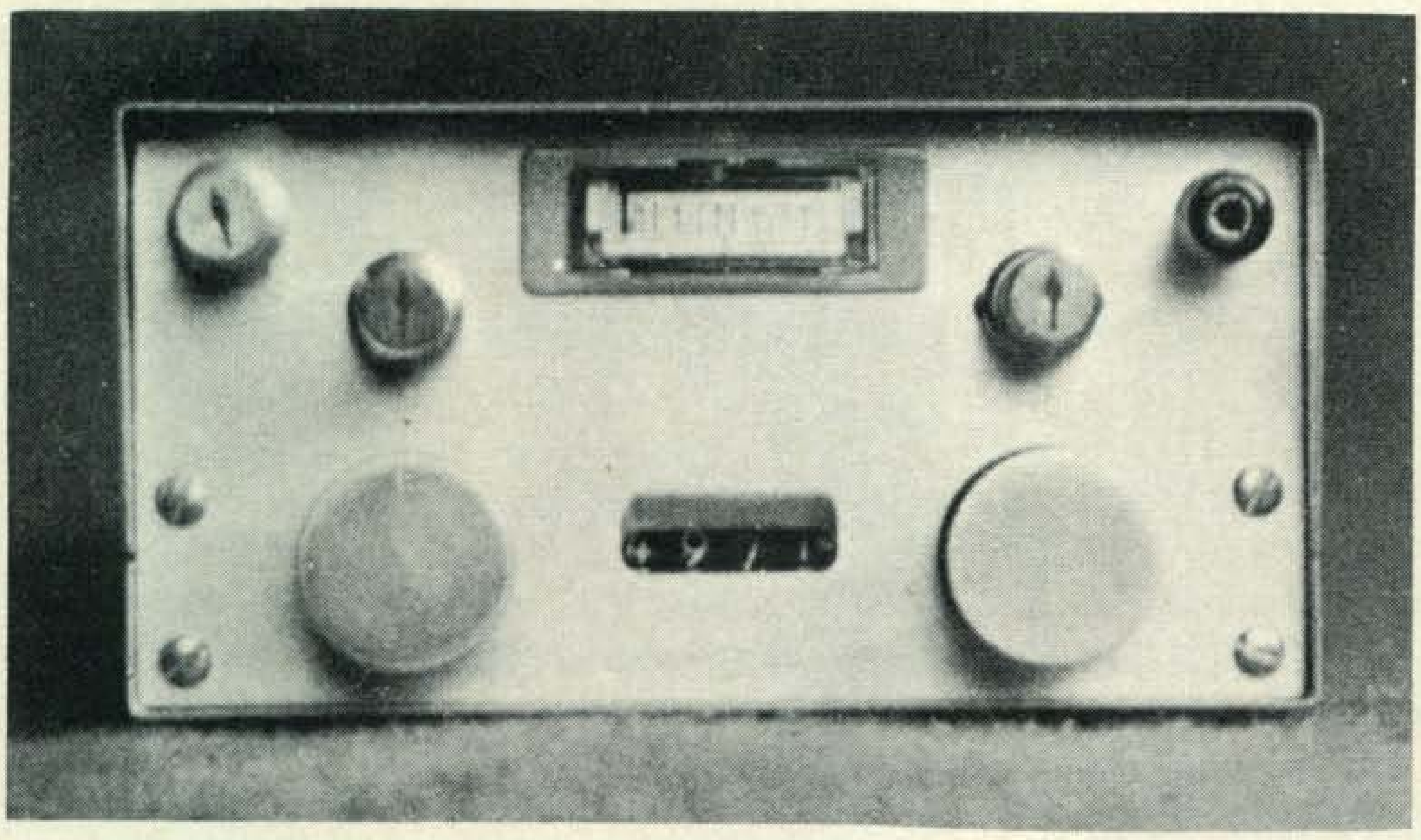

Front view of the receiver shows the counter dial at the bottom center under the S meter. The controls are from left to right, upper row, A.F. Gain, R.F. Gain, Antenna Trimmer, Antenna Input jack. The left bottom knob is for Frequency Set for Zeroing the dial by the use of a 100 kc calibrator and at right is the main tuning knob.

A TRANSISTORIZED COMMUNICATIONS RECEIVER WITH DIGITAL FREQUENCY READ-OUT

BY JACK PEROLO,* PY2PE1C

AFTER hamming for some years, in 1954 I went over to shortwave broadcast listening. This might explain the oddity of my present call. What might be more difficult to explain, however, is why I use my Collns 75S-3C so little. This is the exact purpose of this article and I would suggest to those of you who have scanned the simple block diagrams that are on the following pages to hold tight a while and let me develop the logic that dictated the construction of my own transistorized receiver with a digital read out dial.

Many hams have at one time or another tried their hand at building some piece of receiving equipment. There are, however, justifiable complaints about either the performance or appearance (or both) of the receiver. Having been in the hobby since 1949 I admit to have seen very few homebrewed receivers with the performance *and* appearance of commercial gear. It is, however, definitely possible to build good looking equipment at home and W7DET[1] is just one example.

When it comes to performance, it *can* be accomplished at home. This may sound strange since within the ham fraternity commercial gear is synonomous with good performance. But is it really? I have read in a catalog description of a commercial communications receiver selling for better than $1,600 that, "all internal spurious are less than 1.0 μv equivalent signal except two discreet responses at 2.75 and 3.0 mc." In a review of a less expensive receiver ($400) the *CQ* lab noted "a suck out on all bands plus

*POB 2390, Sao Paulo, Brazil.

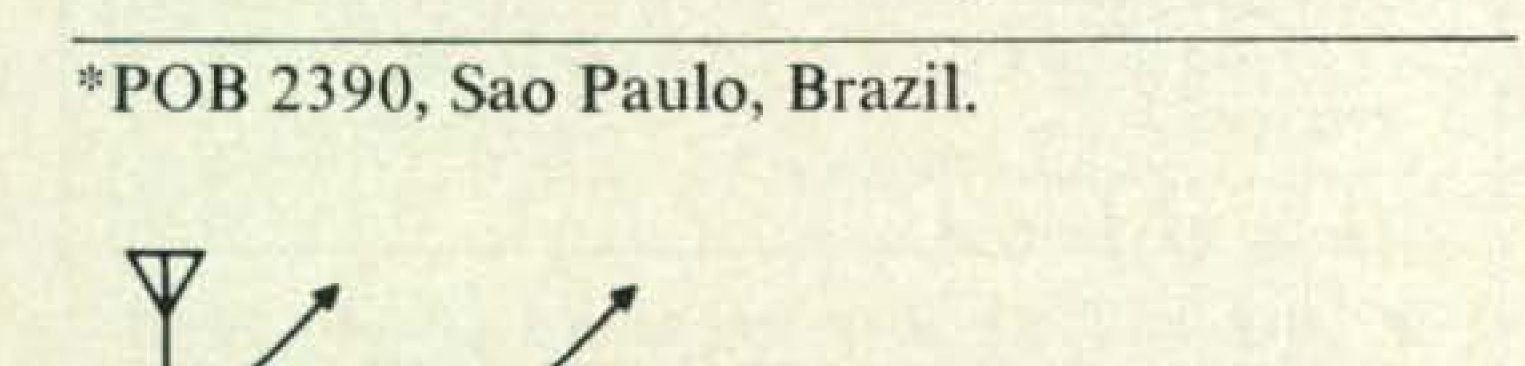

Fig. 1—Block diagram of the GP-23, a high performance single band, single conversion receiver.

[1]W7DET, Seattle, Washington, *QST*, July 1957, p. 74.

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several spurious above ratings."[2]

After building twenty-two receivers, none of which were satisfactory, I sat down to do an autocriticism. Why were the receivers showing birdies, suckout and sensitivity changes from band to band? The answer was plain; the task was too formidable. If reputable commercial manufacturers with their well equipped labs and skilled specialists had problems, I was certain to have them too. The solution seemed to be simplification; give up some features to permit the performance to be truly professional. But what could I give up? Surely not selectivity nor appearance. Selectivity had already been solved by the use of mechanical filters.

The problem of spurious responses stem from the mixer primarily as many frequencies, in addition to those desired, are created.[3] By the simple expedient of avoiding multiband operation and multiple conversion the spurious response could be improved considerably. The same approach also provides a startling improvement in flatness of gain over the entire receiver coverage. It was further observed that compromises were no longer necessary and simple circuit could be operated at peak conditions.

After a five year interval (with a course in EE in the US packed between), the 23rd receiver came into being. (The GP-23) It was a 14 transistor job covering 4,650-5,150 kc with direct frequency readout to the last kc throughout the band. A block diagram of this receiver, shown in fig. 1, was considerably simpler than its predecessor which featured continuous coverage from 3 to 32 mc in six band and double conversion as shown in fig. 2.

Receiver GP-23 used extensive shielding throughout and it paid off in good performance. There were no birdies, the response was flat over the entire band and all stages were operated at peak performance. Since I own no equipment that can accurately measure receiver performance, the Collins 75S-3C was used as the standard of comparison. The Collins S meter is factory calibrated to read an average of 4 db to one S unit. The S meter of the GP-23 was calibrated to give an S9 reading for a signal that produced an S9 deflection on the Collins S meter. The same procedure was followed to produce S5 and

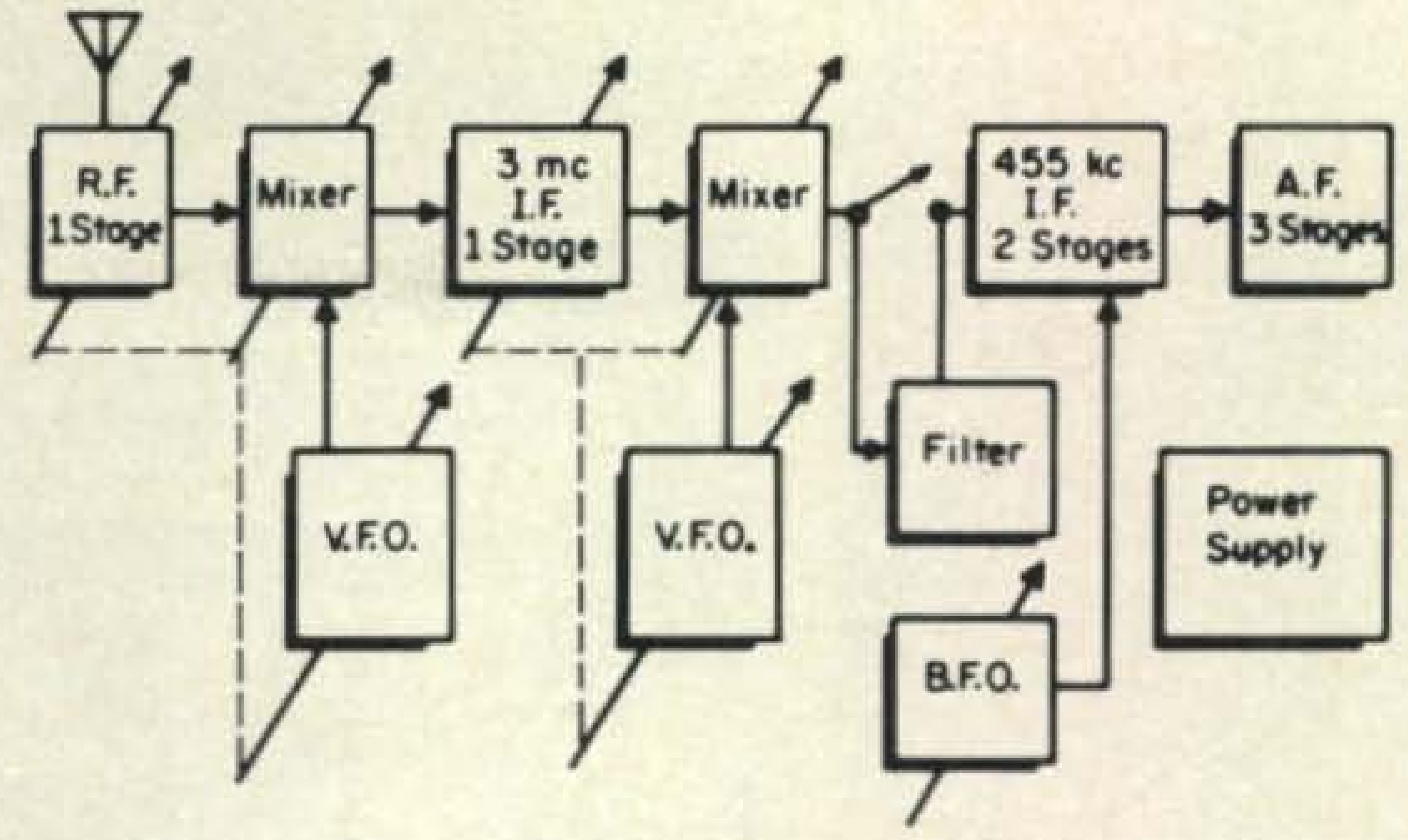


Fig. 2—Block diagram of the GP-22 a multi band dual conversion receiver that was full of bugs.

S0 readings on both receivers. At this point (within reason), whichever receiver produced a higher S meter reading for the same antenna input signal would be considered the more sensitive.

The results were somewhat surprising as all the signals in the 60 meter band consistently read at least 2 S units better (about 8 db) on the GP-23. The Collins was fully checked again but its S meter stubbornly refused to rise as high as the one in the GP-23 no matter how well the antenna impedance was matched to the receiver.

Appearance

Having finally satisfied the performance requirements work was started in the direction of professional appearance. I was fortunate in having the use of a machine shop available, and, with its lathe, vertical mill and 16 ton press, making a presentable cabinet and front panel was no great problem. What I tried to improve even more than the exterior appearance was the interior of the receiver. When building prototypes, components are consistantly being changed or relocated to improve wiring and thus performance.

The GP-24 was born as a cleaned-up version of the GP-23 but with an internal con-

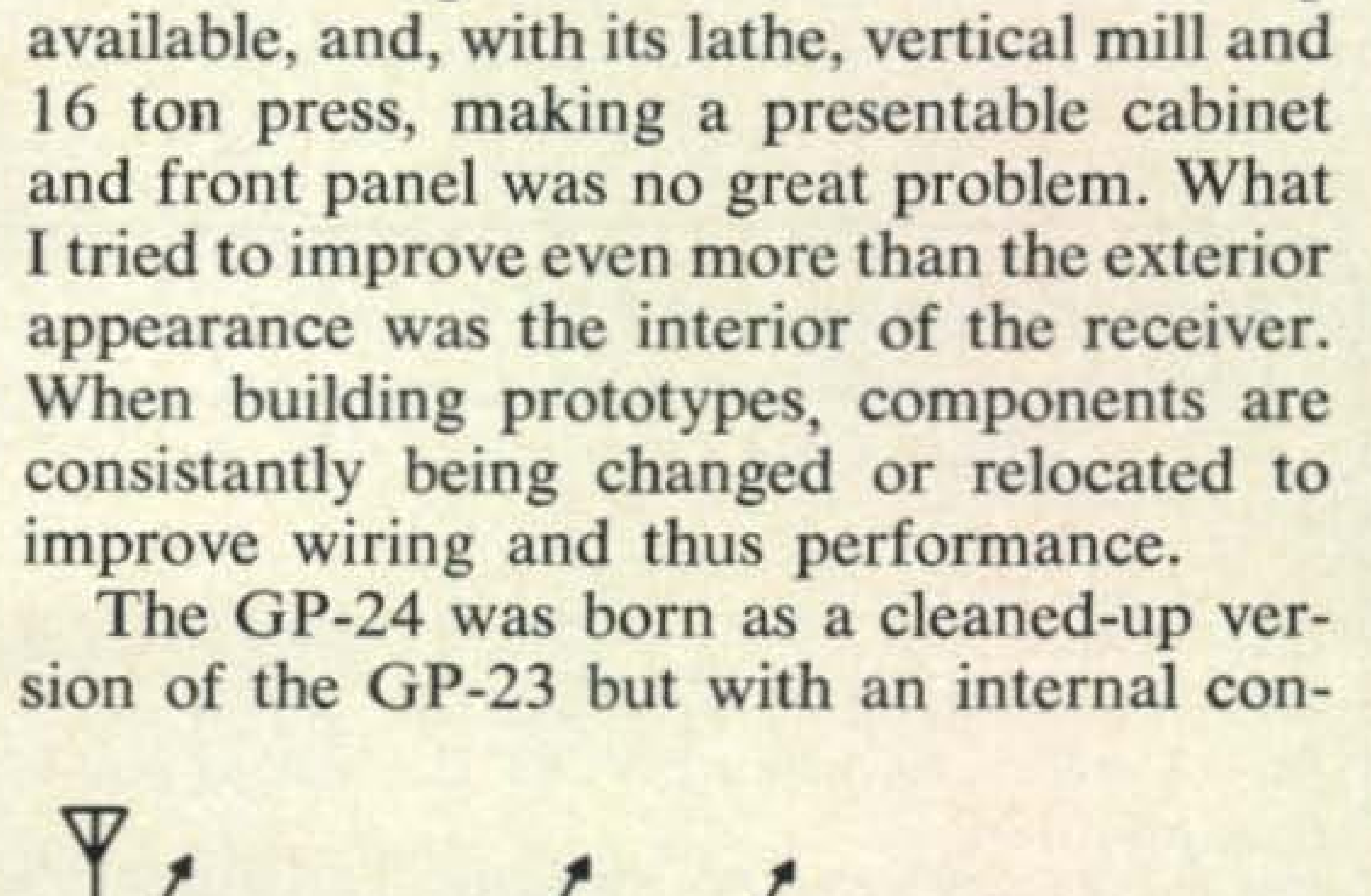
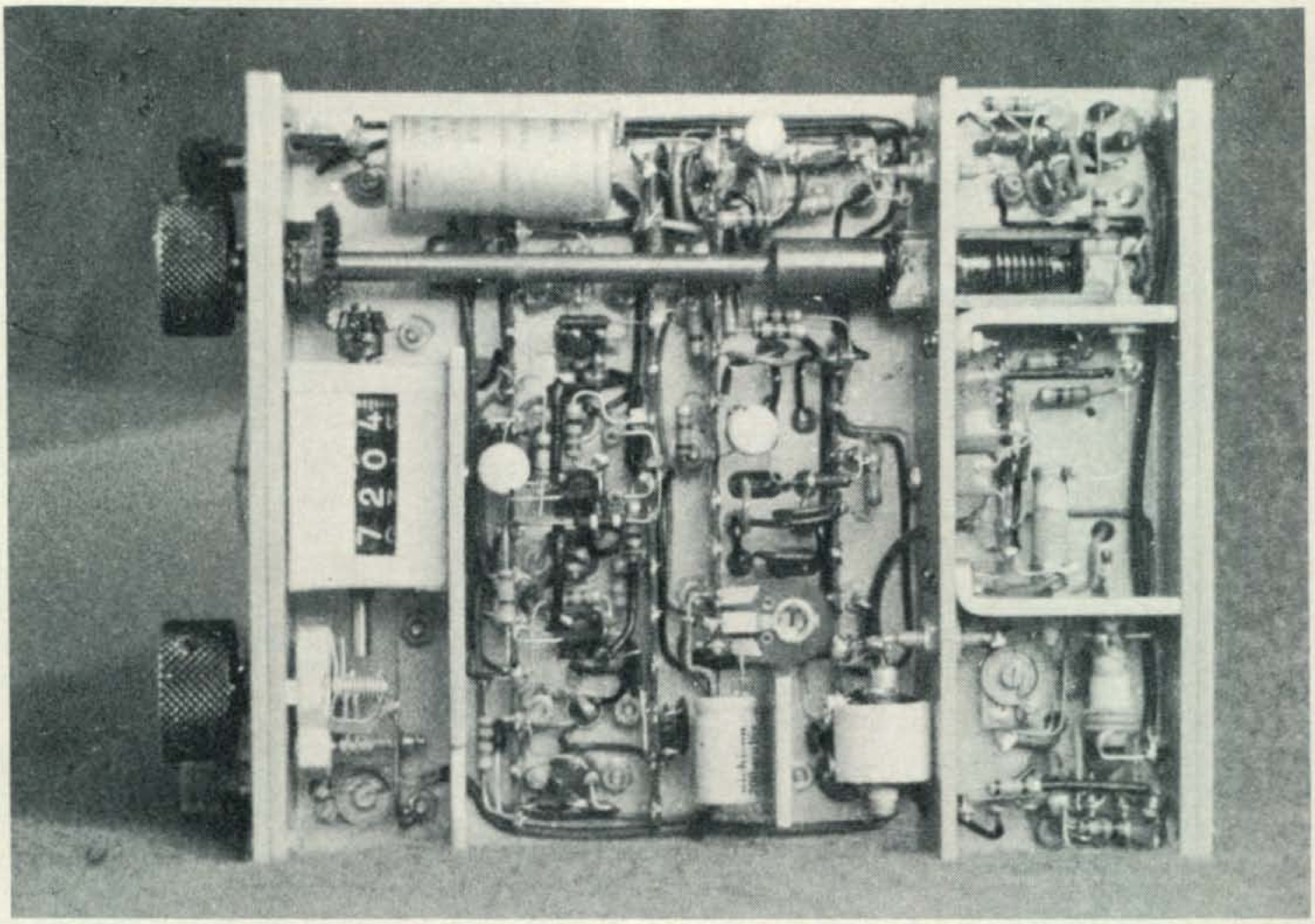


Fig. 3—Block diagram of the GP-27 and all later models. For ham band coverage a.b.f.o. was added.

[2]Scherer, W. M., "CQ Reviews," *CQ*, December 1969, p. 64.

[3]Lee, J. G., "Mixer Spurious Frequency Analysis," *CQ*, September 1965, p. 42.



Bottom view of the GP-29 monoband receiver with the cabinet removed. The counter mechanism can be seen at the left center of the chassis together with the beveled gears and the main tuning shaft. The worm gear that drives the main tuning capacitor is visible at the right end of the shaft. The counter support bracket also acts as a shield for the frequency control. The three shielded compartments at the right are, from top to bottom, 3rd r.f., v.f.o. mixer. The small shield at the bottom center separates the input and output terminals of the mechanical filter and the large object to the right of the shield is the 10 mh r.f. choke. The small pot just above the shield is the S meter Zero set. The i.f. strip runs from top to bottom along the counter support bracket.

Fig. 4—Circuit of the GP-29, a single band receiver. All resistors are 1/4 watt. All capacitors less than one in value are in mf. Capacitors one or more in volume are in mmf. All capacitors marked with an asterisk are silver micas. The receiver weighs about 7 lbs. and drains 40 ma at 7.5 volts.

CR_1—Diode, OA-79
CR_2—Zener diode, GE Z4XL-6.2B
M_1—S meter, Kyoritzu EW-20, 0-1 ma or equiv.
Q_1—MPF 102
Q_2, Q_3, Q_6, Q_7, Q_8, Q_9—AF 14
Q_4—AF 178
Q_5—BF 115
Q_{10}—AF 115
Q_{11}—OC 71
Q_{12}, Q_{13}—AF 128
T_1—455 kc r.f., Spica #8365-02 or equiv.
T_2—455 r.f., Spica #9633-02 or equiv.
T_3—455 kc r.f., Spica #8367-02 or equiv.
T_4—Drive transformer, Audium 9450/6 or equiv.
T_5—Output transformer, Audium 94570/6 or equiv.
Z_1—Mechanical Filter, Collins F455, A21.

Band	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
75 M	3	42	3	42	3	42	3	36
60 M	2.5	36	2.5	36	2.5	36	2.5	30
40 M	2	28	2	28	2	28	2	24

Coil Data—All coils are wound on 1/4" diameter slug tuned ceramic forms. Windings L_1, L_3, and L_7 use #22 plastic wire close wound on the cold end of the coils. Windings L_2, L_4, L_5, L_6 and L_8 use #26 enameled wire, close wound.

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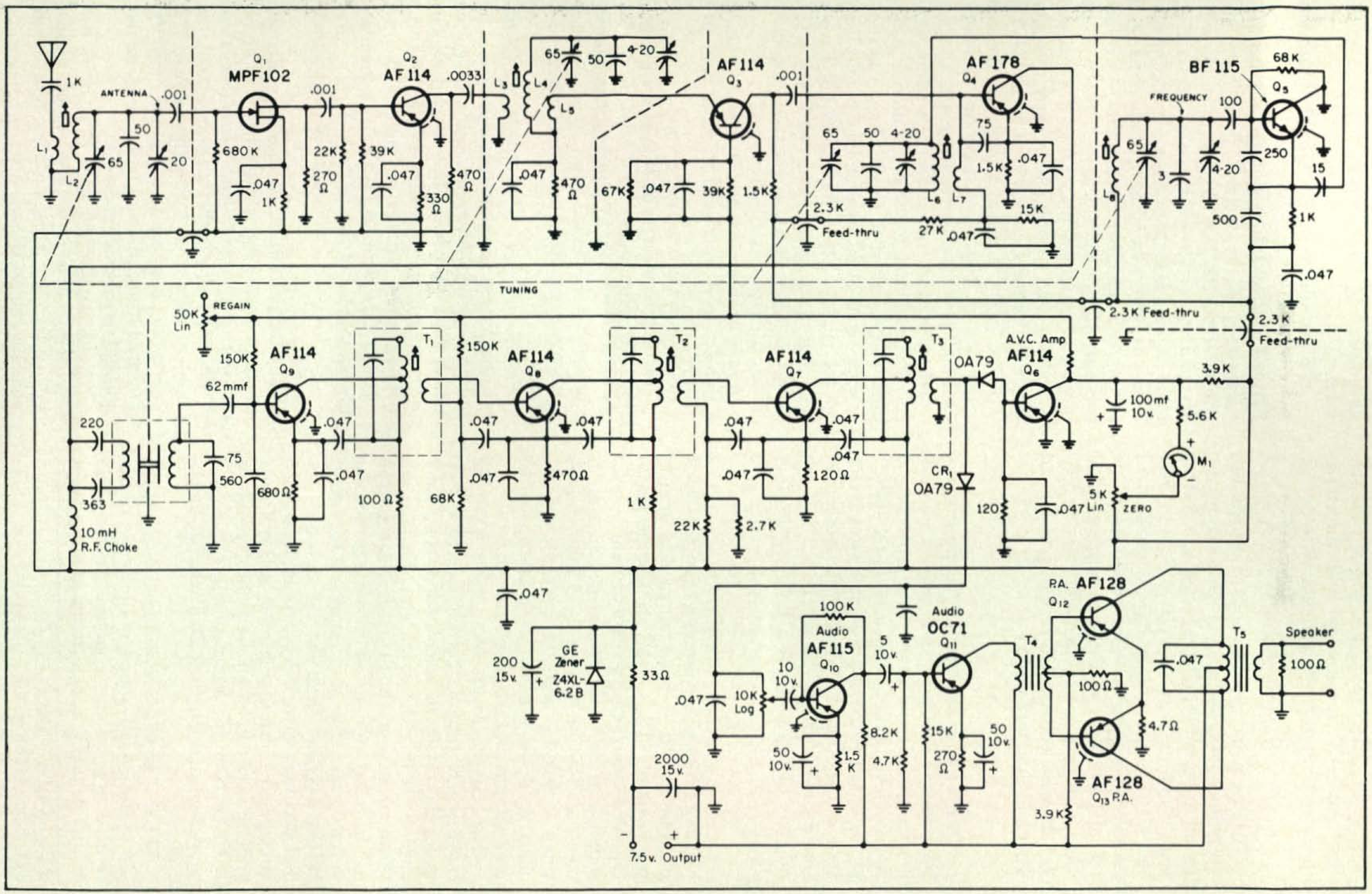

ANTENNA
MPF102
Q1
AF114
Q2
AF114
Q3
AF178
Q4
BF115
Q5
FREQUENCY
TUNING
REGAIN
50K Lin
AF114
Q9
AF114
Q8
AF114
Q7
A.V.C. Amp
AF114
Q6
T1
T2
T3
0A79
CR1
0A79
M1
5K Lin
ZERO
2.3K Feed-thru
2.3K Feed-thru
2.3K Feed-thru
10 mH R.F. Choke
62 mmf
100 mf 10v.
GE Zener Z4XL-6.2B
Audio AF115 Q10
Audio OC71 Q11
R.A. AF128 Q12
AF128 Q13 R.A.
T4
T5
Speaker
10K Log
7.5v. Output

verter for extra coverage. The GP26 featured an HRO surplus dial with direct frequency calibration on the dial skirt.

Modularzation

At this point the a.f. and r.f. strips had been thoroughly tested and their performance found to be stable and very adequate. Rather than building these sections over and over the GP-27 was a modular or sectionized receiver and it proved to be very handy. The a.f. and i.f. strips with the mechanical filter were built into one cabinet and just the converters were constructed resulting in a great saving in time and money.

Images

Since I live in an area that supports many high powered short wave broadcast stations, images proved to be a considerable problem at times. This situation was cured in the GP-27 by the construction of a solid state preselector seen in the August 1968 *CQ* magazine[4] but suitably modified for this receiver. The block diagram of this unit, the GP-27, is shown in fig. 3.

The GP-29

The GP-28 was patterned after the block diagram of fig. 3 but contained a built-in power supply. The GP-29, the last one (gasp) followed soon after; it did not contain a power supply and so could be reduced in size. It measures 3½" × 6½" × 7½" and that is as small as possible with the available components. It is the GP-29 that is shown in the photographs and described further.

The GP-29 covers the 4,550-5,350 kc range which roughly corresponds to the 60 meter short wave broadcast band. Ham band coverage will be discussed later. The dial is a Veeder Root unit with digital readout coupled to the v.f.o. tuning shaft through surplus beveled gears. This was a standard feature of all the receivers from the GP-27 on as the dial accuracy proved less troublesome than anticipated. The tuning rate is 20 kc per knob revolution and the frequency readout is ±0.5 kc over the entire tuning range. The equivalent dial length is 20.8 feet per megacycle.

The dial backlash *(not tuning backlash)* is 250 cycles and is almost entirely due to the construction of the counter. There is no detectable *tuning* backlash due to the use of a surplus spring loaded worm gear used on the v.f.o.

The sensitivity of the GP-29 is substantially better than the good old 75S-3C and is flat to less than 3 db over the entire band.

Because of the "series" production approach from the GP-23 on, I stuck with germanium transistors in order to stabilize parts values. Departures were made in two instances. One was an FET for the front end to improve selectivity and reduce crosstalk and the other a silicon unit for the v.f.o., a modified Colpitts oscillator for a high degree of stability. No v.f.o. buffer is used in this or the earlier models, as was used in the GP-23. (See the block diagram of fig. 1.) Since a single tuning control is used the oscillator "pulling" is constant over the entire range.

All r.f. and i.f. stages are Zener stabilized at 6.2 volts. No detectable variation in b.f.o. pitch can be recorded for a voltage variation of ±0.5 volts over the nominal 7.5 volts used for the supply. The GP-29 does not have a b.f.o. but many of the others had. The b.f.o. circuit, if it is to be used, is exactly the same as that of the v.f.o.

A.m. signals are readable without retuning within a 6 to 10 volt range of input voltage.

Construction

The chassis and all the shields were made from 1/8" aluminum sheet, bent on the 16 ton press previously mentioned. The cabinet is formed in two halves from 20 gauge steel. The component layout is shown in the various photos.

With the exception of the MPF-102, all the transistors used are manufactured locally by Phillips and aren't readily available in the U.S. A unit built by a friend used all GE silicon transistors of the epoxy line and was made operative without too much difficulty.

The i.f. transformers (455 kc) are Japanese imports. (Spica brand—see fig. 4) They seemed to be the most efficient compared to the others available.

The tuning capacitor requires particular attention. To my knowledge there are no 65 mmf four gang double spaced small variables on the amateur market that can take the beating of having one section filed down. The solution here has been to buy a 400 mmf 700 volt transmitting unit (similar to the Hammarlund MC series) and modify it.

The unit is screwed to a 1/4" brass box with machined slots to allow perfect adjustment of the two capacitor terminals. Some plates are removed and, after the capacitor

[4]Onesky, W. J., "A Wideband R.F. Preamplifier," *CQ*, August 1968, p. 70.

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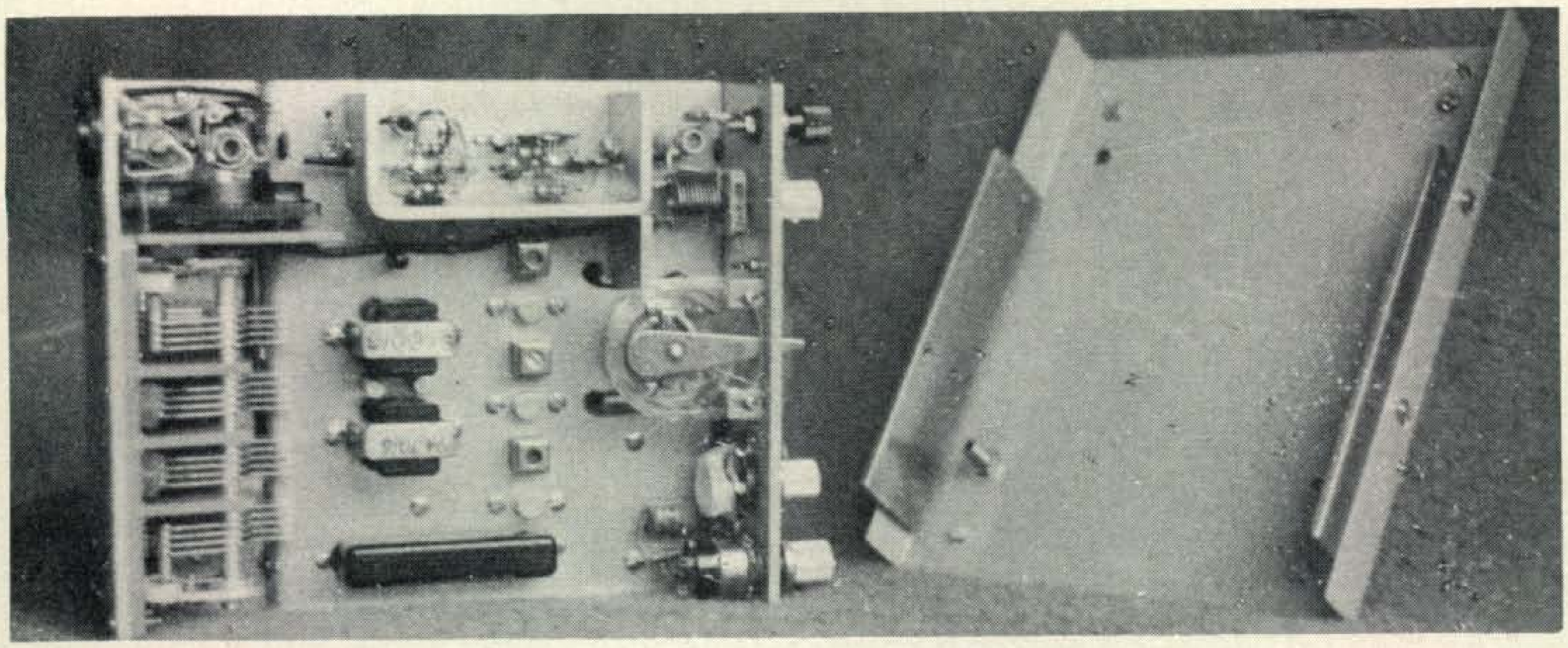

Top view of the transistorized monoband receiver chassis and bottom half of the cabinet. The r.f. strip is visible along the top edge of the chassis with the antenna input trimmer and coil in the first compartment. The third r.f. stage is at the extreme left above the 4 gang tuning capacitor. The a.f. and i.f. components can be seen in the center area of the chassis with the mechanical filter on the bottom.

is fastened to the base, the side rods are sawed off at the proper spacing to remove the central section of the stator. The removed section of the stator is used to prepare the two small (inner) stators to form the four gang capacitors. The front and rear stators are held in place by their original ceramic strips. The two inner stators are each fastened to a plexiglass base that is in turn fastened to the 1/4″ brass base. While the original capacitor had 31 plates, the newly formed 4 gang unit has five plates per section for a capacity of 65 mmf per section. Three r.f. shields are formed from 1/8″ brass plate and soft welded to the 1/4″ base.

Only the v.f.o. section has to be filed to obtain proper tracking and dial calibration. This is performed prior to mounting the capacitor on the chassis leaving the finishing touches for the final dial calibration.

Particular care must be given to the entire capacitor construction to prevent backlash from creeping in.

Alignment and Calibration

The alignment is routine and needs no special description here. The i.f.'s are set at 455 kc centered on the mechanical filter. The S meter is used as the indicator for resonance. The r.f. and mixer stages are tuned in the conventional manner except for the v.f.o. tuning capacitor. Before starting the final filing of the v.f.o. capacitor be sure all the coils are properly doped. File slowly and carefully as excessive filing will require replacement of the section or worse the entire variable.

Ham Band Operation

The GP-28 was operated successfully in the 40 meter band prior to fixing it permanently in the 60 meter band. Only the proper coil substitution is necessary for operation on any of the lower frequency ham bands.

For operation above 7 mc the images are excessive and a higher i.f. is desirable. The use of a McCoy 9 mc filter and a 9 mc i.f. system would be essential. A unit made by PY2GP performed well up to 56 mc. Conversion noise is not a problem as the r.f. stage preceeding the mixer determines the noise figure of the whole receiver and provides enough gain to permit the mixer to operate at a low amplification level.

Conclusion

Over the years the average amateur has developed the belief that a homebuilt receiver can't match commercial gear. I believe that if you make the necessary concessions (single conversion—monoband) and take proper precautions (extensive shielding and decoupling) together with specialized construction (custom variables, pressed chassis and cabinets) professional results can be obtained. It is more a matter of will and time than money; the GP-29 required about 140 hours of actual work and cost about $130 (US) for all brand new parts.

Thanks goes to Maiso, PY2GP for his technical and moral support and his resigned patience while I took over his workshop. ■

SOLID STATE CURRENT REGULATORS

BY EUGENE DUSINA,* W4NVK

MANY hams have, used a zener diode as a voltage regulator or have used one of the handy transistor voltage regulator circuits that use a zener as a reference. This is necessary where higher currents are to be handled. However, far fewer of us are aware that you can regulate the current applied to many circuits and produce just as good results as when regulating voltage.

By now, many of you have read about the new current limiting diodes. These are diodes which will pass only currents up to a certain value, and no more, regardless of the voltage applied to them. For example, such a diode, with say a 1 amp rating, in series with a lamp that draws 1 amp at 6 volts, would operate the lamp at correct voltage no matter what supply voltage you connected the circuit to. This lamp would, therefore, operate on a 6, 12, or 24 volt battery with the same brilliance, and this is a pretty handy device. Many loads such as oscillators, amplifiers (class A), buffer amplifiers, drivers, *etc.*, operate with essentially unvarying current demands. In all such circuits, one may regulate current as well as voltage and get essentially the same performance.

In many solid state circuits, where the saving of money is not a prime object, the current regulating diodes are used to control current. However, these diodes still cost considerable money as they are relatively new. The amateur can accomplish about the same result, however, with inexpensive diodes and transistors. Using a very simple circuit, one can regulate the current to v.f.o.s and other circuits so easily as to make inclusion of a regulator practical in even the most simplified hardware.

*Dusina Enterprises, 571 Orange Avenue West, Melbourne, Florida 32901.

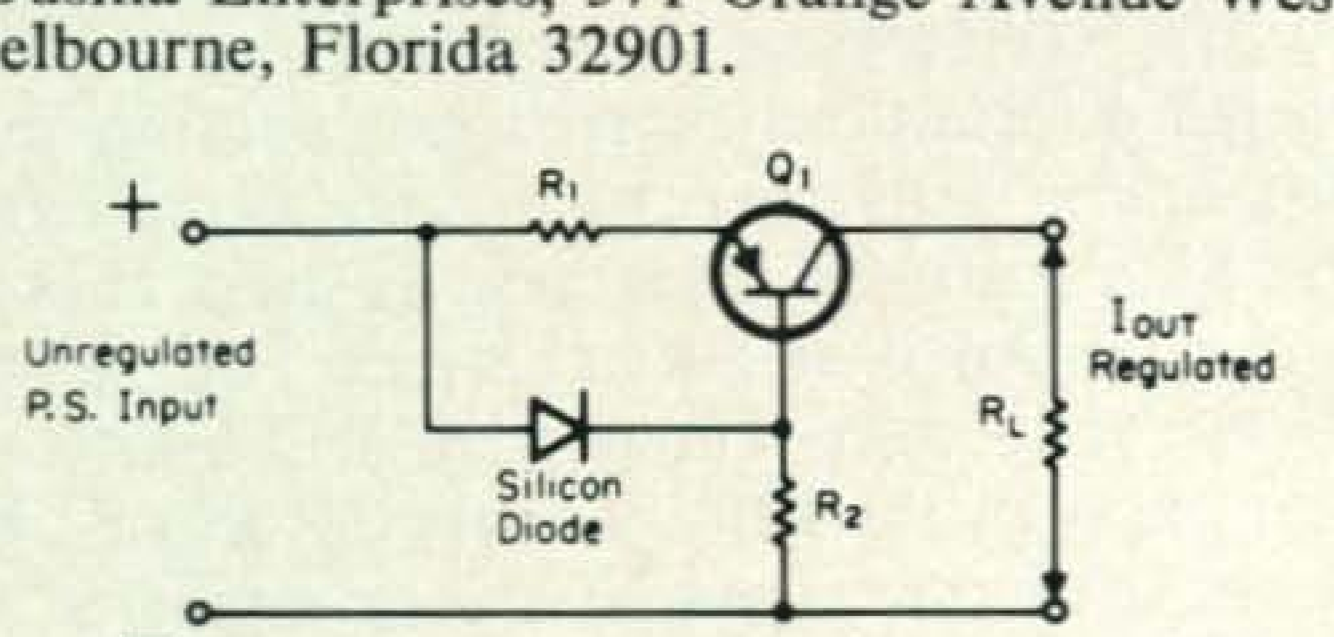

Fig. 1—Positive lead current regulator circuit uses an inexpensive diode and transistor. The formulas for calculating R_1 and R_2 are given in the text. Transistor Q_1 may be any germanium PNP transistor that can handle the current and voltage drop across it.

How It Is Done

The circuit is very simple, as shown in figs. 1 and 2. To understand how the circuit works, recall that a transistor can only turn on if the base voltage rises about 3/10 of a volt higher than the emitter voltage. The polarity of this voltage is always the same as the polarity of the collector for whatever type of transistor you are using. If the collector is negative (a PNP type) the transistor is totally turned off until the base reaches 0.3 volts more negative than the emitter. Then, the transistor can turn full on with just a tiny fraction of a volt more bias.

Referring to fig. 1, the resistor R_2 and the diode cause a minus 0.75 volt drop between the positive input line and the base. This bias will turn the transistor full on. The transistor will stay full on until a load is attached. The current will then increase to a value which causes about a 0.5 volt drop across R_1. At this point, the transistor will partially turn off, and will give pass no more current than the load value, whether you short the output or whatever you do. You can get any value of current up to this critical limit, but no more, and neither increasing the input voltage nor lowering the load resistance will cause any more current to flow.

Resistor R_1 sets the value of the limit current, and the value can be approximately calculated by figuring the resistance that will cause 0.5 volt drop when the limit current is flowing through it.

$$R_1 = \frac{0.5}{I_{\text{Limit}}}$$

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Resistor R_2 can be most any value, but a good value may be calculated from:

$$R_2 = \frac{E_{IN}\ Pur.\ Supply}{2\ \frac{I_{Limit}}{\beta}}$$

These circuits are designed to conserve input power, and only the smallest amount of current is run through the reference diode. As a result, the regulation will be a compromise between best possible current regulation, and minimum wasted power. This feature is very important in battery equipment, but is less important in vehicular or home equipment. If saving a small amount of power is not a big factor in your application, decrease the resistance of R_2, until the current flowing through the diode is about a quarter of the diode's rated value. This much current runs the voltage of the diode up into the saturation region, and the diode acts as a much better reference source for the regulating transistor. Most of the change in output current with varying input voltage is due to small voltage changes across the diode. These changes are greater (and thus the regulation poorer) if the diode is starved for current, than they will be if a hefty current is flowing through the diode. Usually the diode (silicon) will have about 0.9 volt across it when the good regulating portion of the VI curve is reached.

Note also, that fig. 1 and 2 are for germanium transistors, and that the diode is silicon. Practically any diode will do in this circuit, since it is always forward biased. This means the reverse breakdown voltage rating is not important, and the very inexpensive low voltage diodes can be used.

The current of fig. 1 is for a positive line regulator and fig. 2 is for a negative line unit. Notice the diode is reversed in fig. 2, but R_1 and R_2 and calculated just as in fig. 1. If you want to use silicon regulating transistors, use fig. 3. Note that two silicon diodes are needed for these configurations. The formula for R_1 in these circuits is:

$$R_1 = \frac{0.75}{I_{Limit}}$$

General Notes

In all of these circuits, make sure that the voltage drop from emitter to collector, multiplied by the limit current does not amount to more wattage than your transistor can dissipate. If the voltage or the input supply is

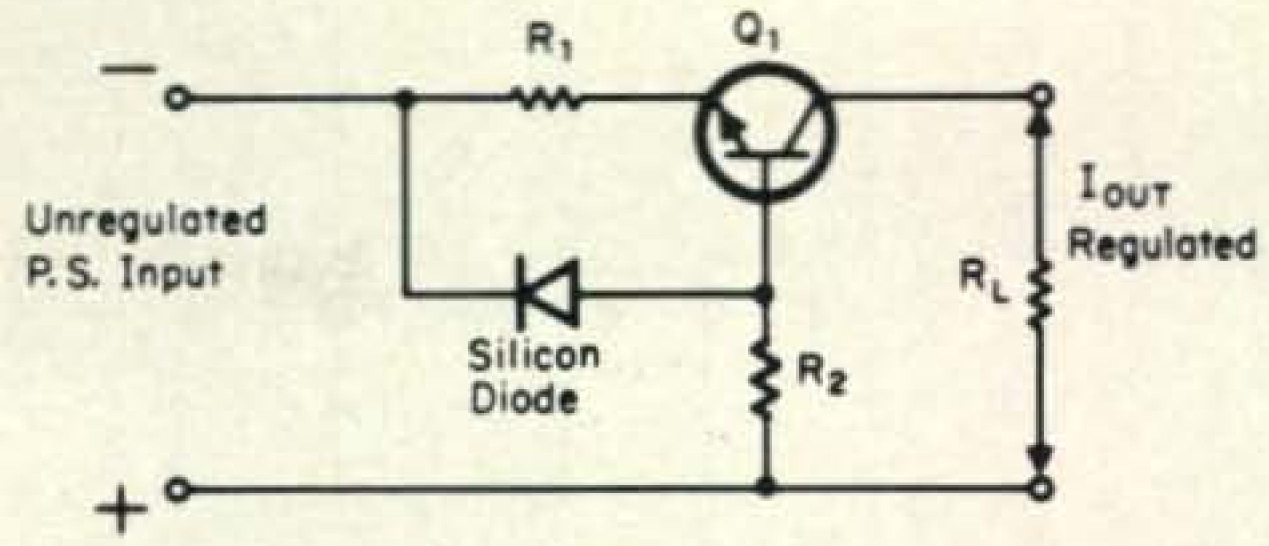


Fig. 2—Negative lead current regulator circuit is essentially the same as that of fig. 1 but requires an NPN type germanium transistor for Q_1. Note, also, the polarity reversal of the silicon diode.

pretty high compared to the voltage across the load, put a series resistor in the hot lead to drop some of the voltage. Using this method the transistor will only have to drop a part of the total voltage.

The largest resistance permissible in series with the regulator, is a value which will let enough voltage reach the unit for it to function. This is about 1 volt more than the load requires. The maximum series resistance is therefore just:

$$R_{Series} = \frac{V_{min} - (1 + V_{load})}{I_{Reg}}$$

where Vmin is the least input voltage ever to be applied, and Ireg is the limit value setting for the regulator.

Typical Performance

Figure 4 shows a typical regulator feeding a 1K load, with an input supply that varies

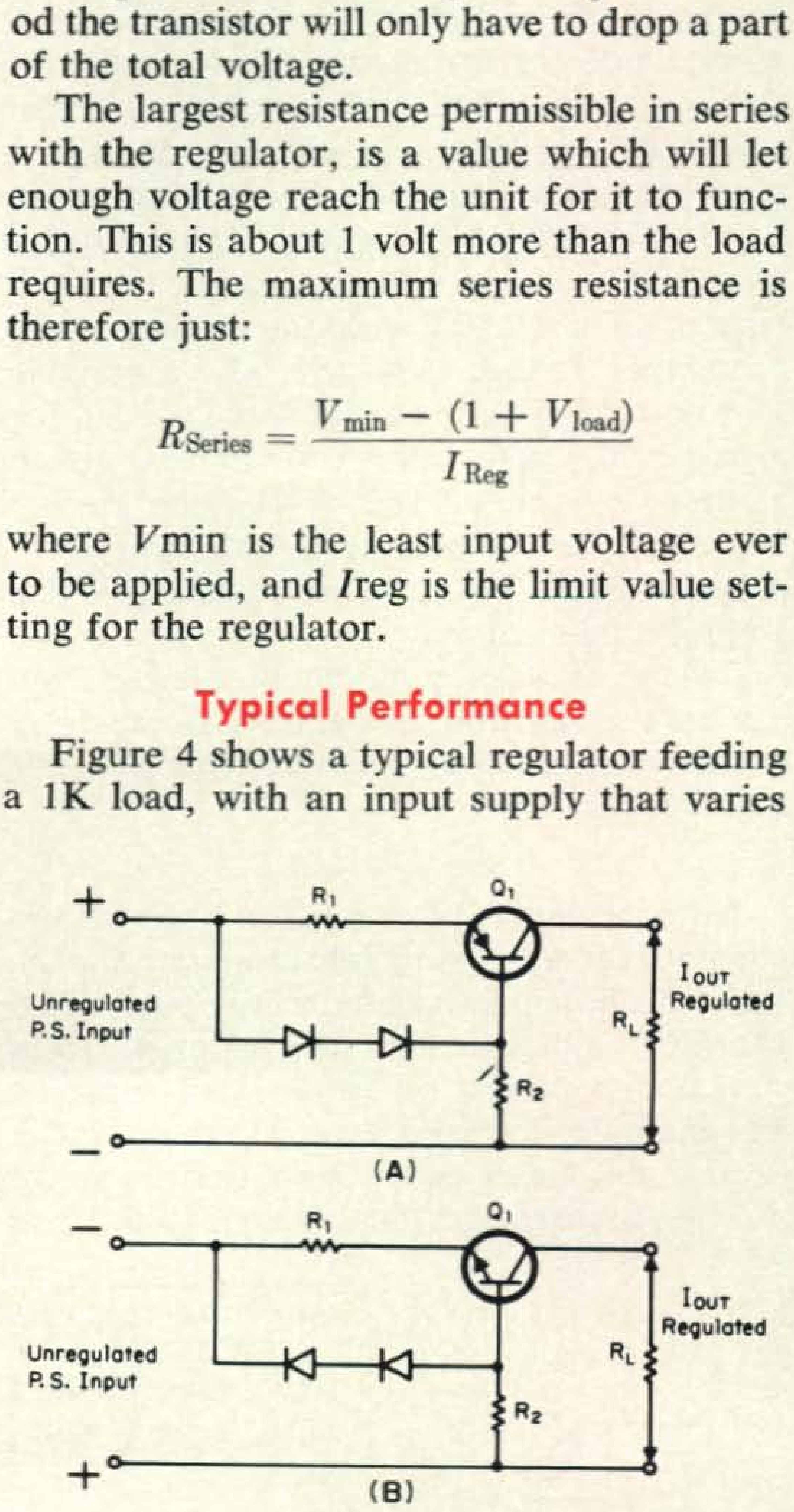
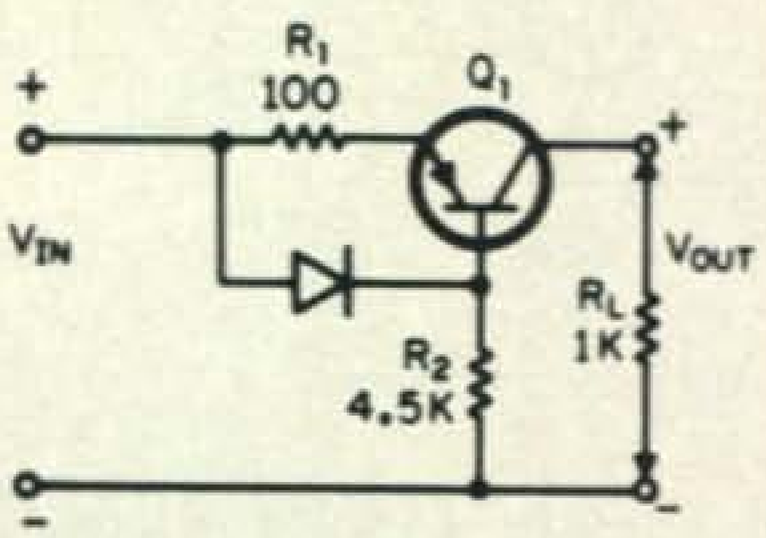


Fig. 3—Current regulator circuits using PNP and NPN silicon transistors require two silicon diodes in series to provide the proper bias. Resistor R_2 is calculated using the same formula as used in fig. 1. The modified formula for R_1 is given in the text.



V_{IN}	V_{OUT}	I_{OUT} (ma)
6.0	5.2	5.2
8.0	5.4	5.4
10.0	5.6	5.6
14.0	6.0	6.0
20.0	6.5	6.5
25.0	6.8	6.8

Fig. 4—Typical regulator circuit and its performance for a varying input. Transistor Q_1 has a beta of about 50.

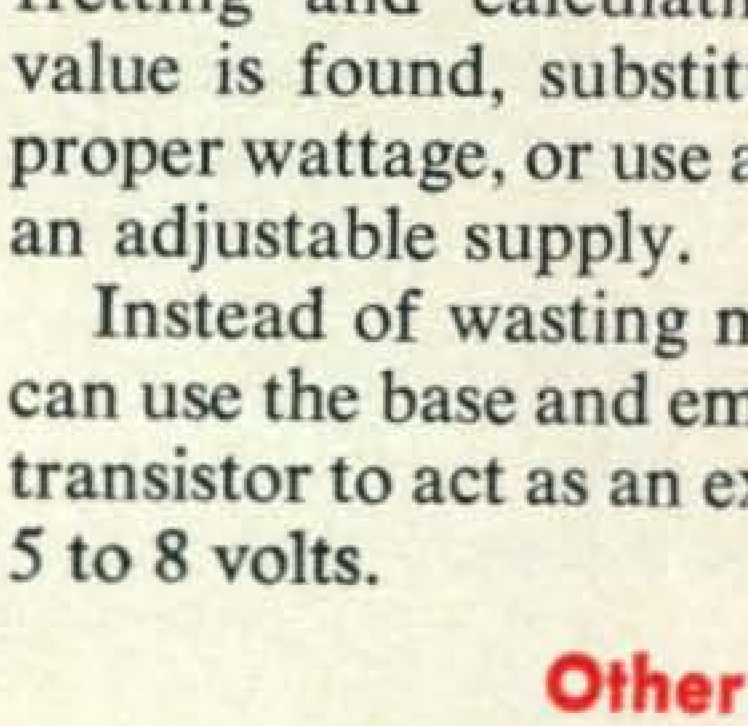
from 6 to 25 volts. Notice that the voltage across the load remains fairly constant regardless of the input value.

If you require better regulation than this, decrease R_2 considerably, or substitute a zener diode for the regular diode in any of these circuits. The more voltage created across the zener, the more precisely will a given transistor regulate current as shown in fig. 5. With a zener, however, R_1 must be increased to cause a voltage drop at the limit current of about 0.5 volts more than whatever zener voltage you have. Use a variable R_1 to quickly find the exact value needed for a particular current and you can save much fretting and calculating. Once the proper value is found, substitute a fixed resistor of proper wattage, or use a power pot to give you an adjustable supply.

Instead of wasting money on a zener, you can use the base and emitter leads of most any transistor to act as an excellent zener of about 5 to 8 volts.

Other Uses

An excellent application for these simple current regulators is to substitute one for the series dropping resistor normally used when charging nickle cadmium batteries from vehicular supplies, or unregulated supplies. For example, in a solid state v.h.f. unit I have, the 7.5 volt nickle cadmium batteries require a 20 ma recharge current. A circuit similar to that of fig. 1, using a small transistor, permits me to charge the receiver from any source greater than about 9 volts, without worry about ruining the batteries. The current stays within about 10% of 20 ma whether plugged into a car at 11 to 15 volts, or an aircraft at 24 to 35 volts.



V_{IN}	V_{OUT}	I_{OUT} (ma)
14.0	6.8	6.8
20.0	6.85	6.85
30.0	6.9	6.9
40.0	7.0	7.0
50.0	7.1	7.1

Fig. 5—Improved regulator circuit uses a Zener diode for the reference element. This transistor also has a beta of about 50.

Another use that can save you money and trouble is to use a current limiter in series with your power supply. Set the limit current just a little above the peak current your circuit normally should draw, and if you have a short or some other malfunction you won't blow all your transistors. When used this way, adjust R_1 for the short circuit current you want.

Summary

This discussion has described a very simple and inexpensive circuit for regulating current in power supplies. This circuit has found much use here, and has saved many transistors in experimental circuits. The use of very inexpensive surplus components permits hams to achieve good regulation which is more than adequate for many practical everyday uses. The unique feature of the circuits presented is that they do not need a zener diode, and are therefore much less expensive than others seen before. They are also capable of very low voltage drop of about 1 volt or less, so they will regulate until the input voltage is just slightly greater than the output voltage.

The concept of current regulation has been largely ignored in the past because the only inexpensive regulators available operated on voltage. Current regulation can be just as effective as voltage regulation in many circuits, however, and is easily obtained. ■

"The antenna here is supported by a balloon."

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*
**
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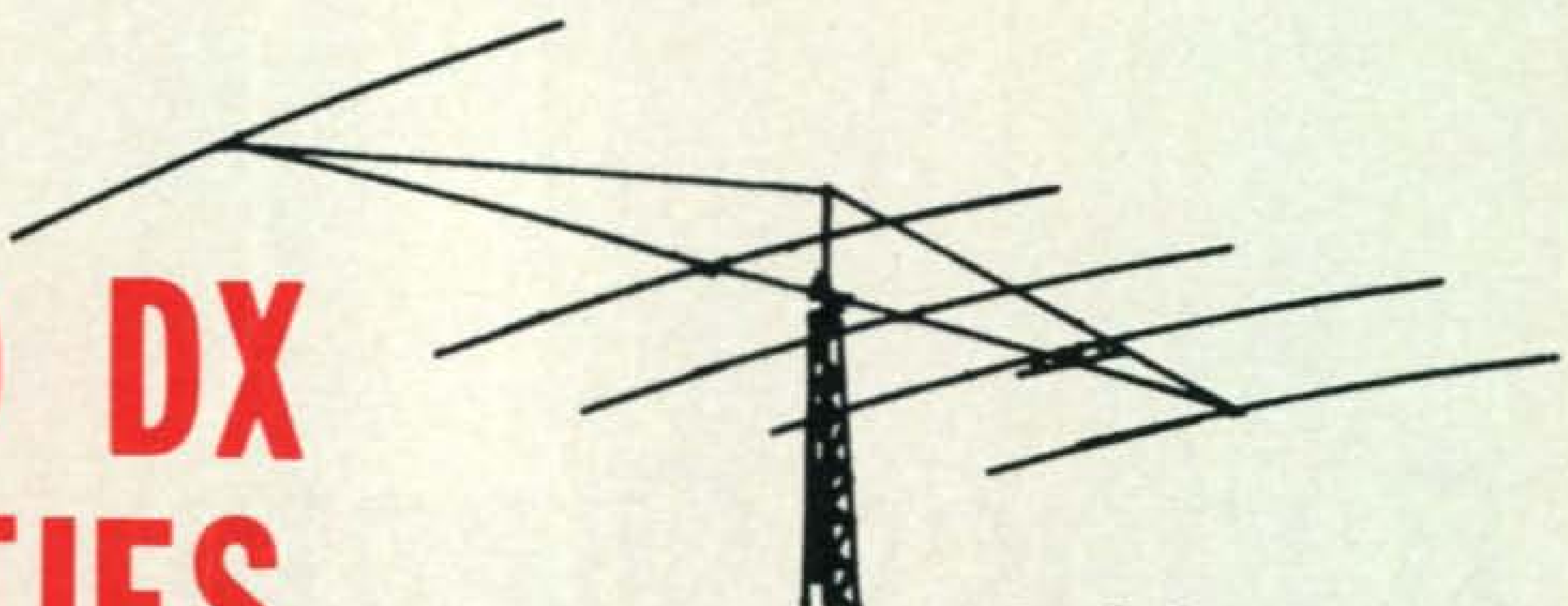

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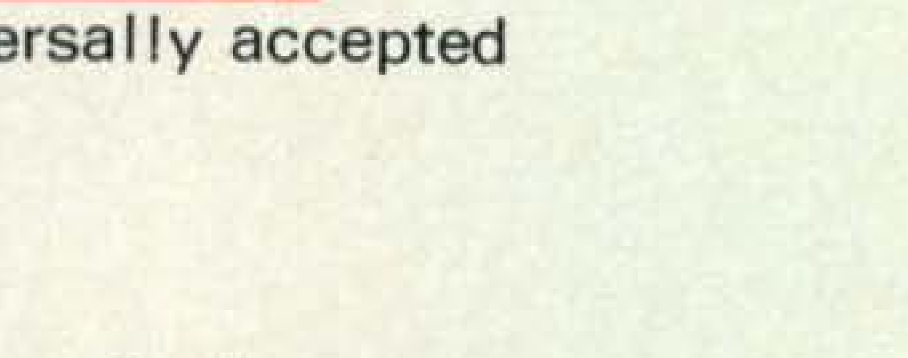

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A SOMETHING FOR NOTHING C.W. FILTER

BY FRED BROWN,* W6HPH

A good audio filter can easily make the difference between copy and no-copy in c.w. QRM. This one can be constructed from readily-available components at a cost approaching zero.

VERY few communcations receivers fully exploit the 100 c.p.s. bandwidth potentiality of c.w. In fact most have a minimum bandwidth 5 to 30 or more times as wide as needed. Although a c.w. bandwidth can be achieved at intermediate frequencies, it is much easier in the audio frequency range, and a great number of audio filter designs for c.w. reception have appeared in past amateur publications, both of the R-C and L-C types.

The R-C filters suffer two shortcomings: they are not passive, *i.e.*, they require tubes or transistors; and they provide a very poor skirt-steepness ratio.

The L-C filter described here uses only two tuned circuits, but even so it gives a skirt-steepness ratio far better than any of the R-C (as well as some of the L-C) types. Its other claim to fame is that it can be built at a cost of practically nothing–assuming the builder has access to junked radio and/or TV sets.

Coils

The heart of this filter are two inductances made from plate-to-voice coil output transformers of the type found in every old tube-type radio, TV set, phono amplifier, *etc.* TV set vertical output transformers are another possibility. The turns-ratio and inductance values are not particularly important, but a pair should be found that are approximately the same physical size.

Most of the L-C c.w. filters described in the past would lead you to believe that high Q inductors are needed to make a good filter. This is not really true. The inductors used in this filter had an unloaded Q of less than 6 at 1 kc, but the filter gives excellent results. Actually, a very high Q would be disadvantage since it would cause ringing and critical

*Pine Cove, Idyllwild, California 92349.

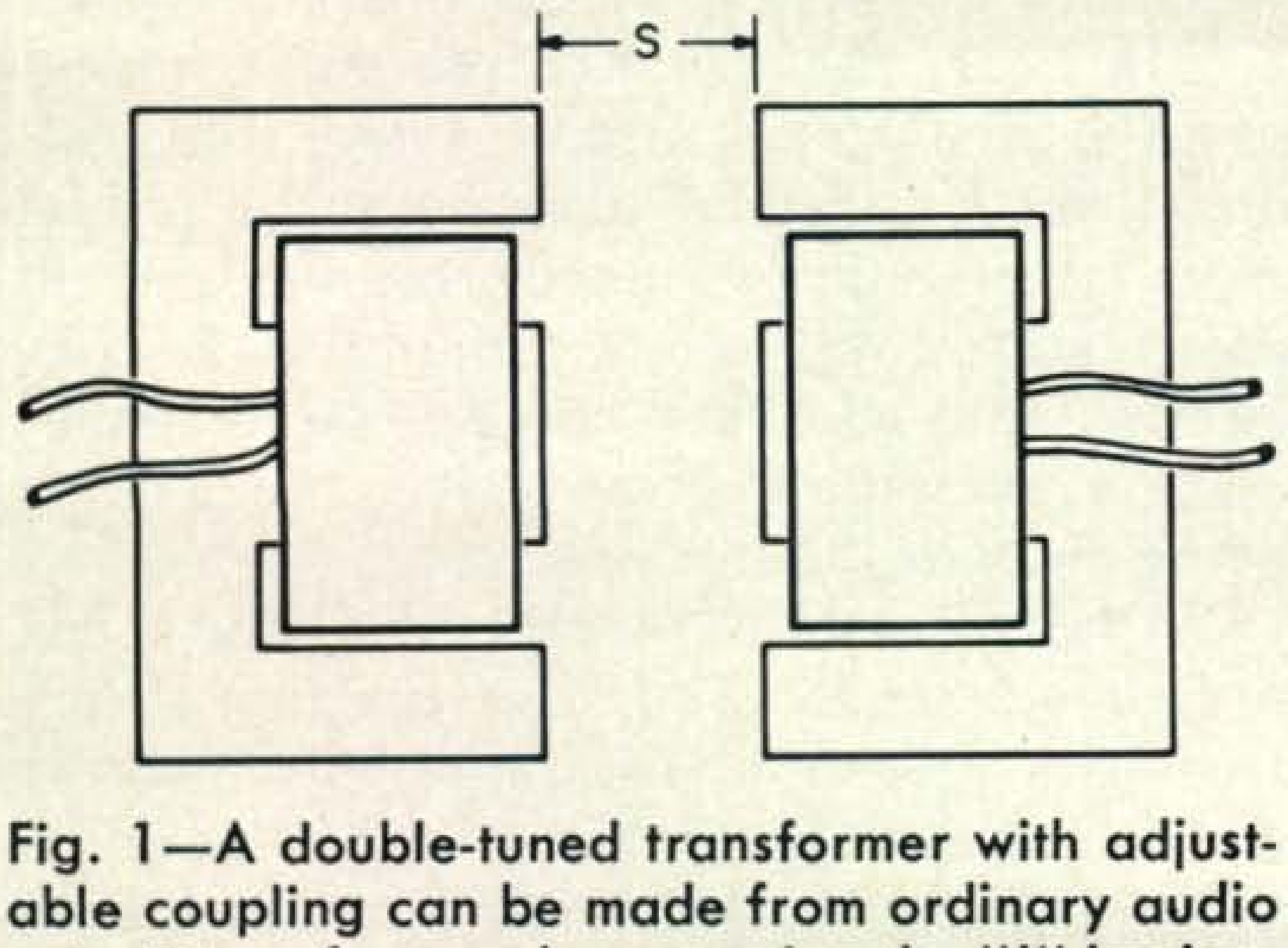

Fig. 1—A double-tuned transformer with adjustable coupling can be made from ordinary audio output transformers by removing the "I" laminations and mounting them as shown. The spacing, S, determines the coefficient of coupling.

All components for the outboard c.w. filter are mounted on a 4 × 5 inch piece of 1/2 inch plywood. The two inductors, at the rear, are held in place with straps cut from light-guage sheet aluminum.

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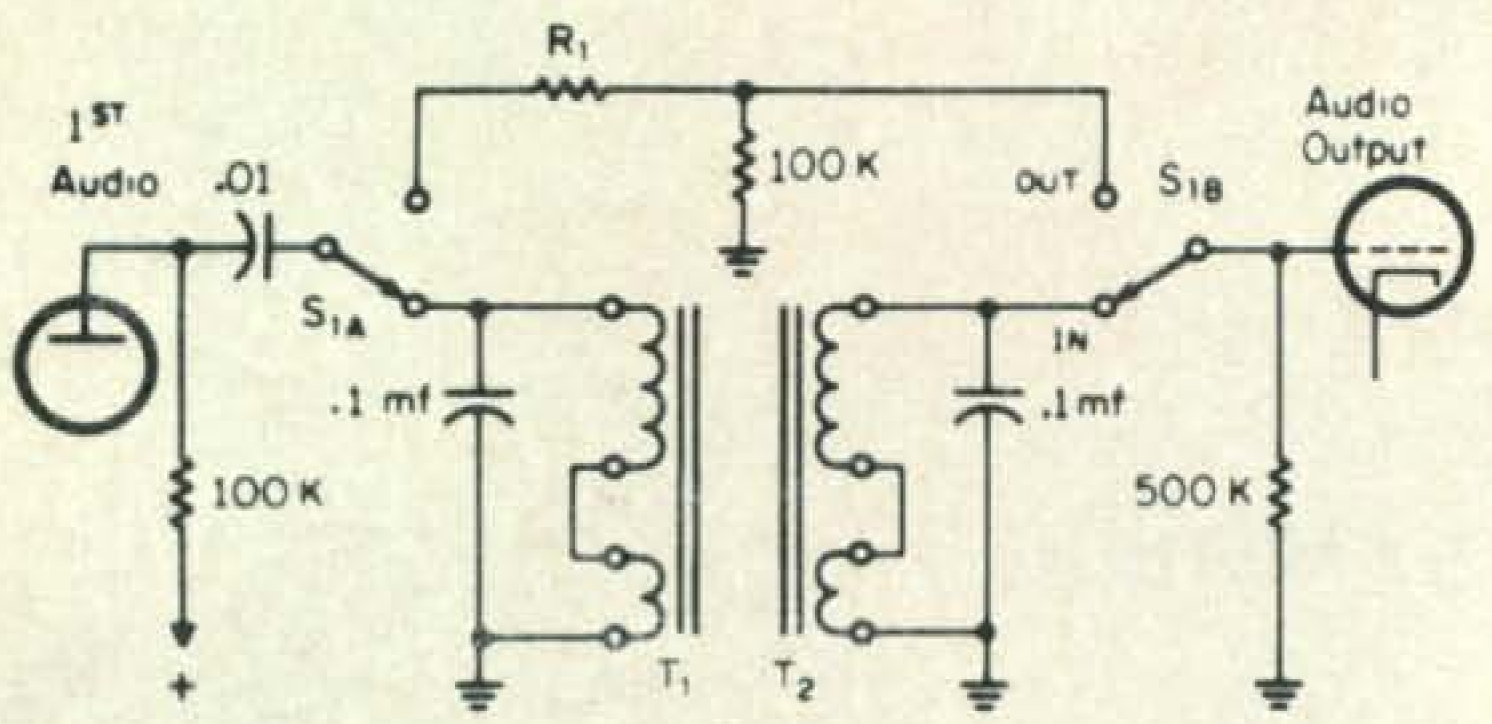

Fig. 2—Circuit of the c.w. filter as used between 1st and 2nd audio stages of a typical communications receiver. Transformers T_1 and T_2 are audio output types 10K plate to 3 ohm voice coil), modified as explained in the text. Switch S_{1A} and S_{1B} can be a d.p.d.t. toggle switch.

tuning. The skirt-steepness ratio, which is more important to performance than bandwidth, depends on the number of tuned circuits and is independent of Q.

When you have located your audio output transformers, remove them from their mounting frames, and you will see that the core is made from E-shaped laminations. Across the poles of these E laminations are rectangular-shaped "I" laminations which should be removed and discarded. The two outermost E laminations have longer "fingers" than the others. These two should be removed and the fingers snipped off to the same length as the others, and replaced. If they cannot be forced back inside the transformer winding they can be left off permanently.

The transformers used here had E laminations of about 1 inch by 1.4 inches, and a primary inductance of 1.7h. unmodified. The d.c. resistance was 275 ohms and the Q was 2.6 at 1 kc. Removal of the "I" laminations raised the Q to 5.6 and dropped the inductance to 0.41h. This value of inductance conveniently resonates with a 0.1 mf capacitor

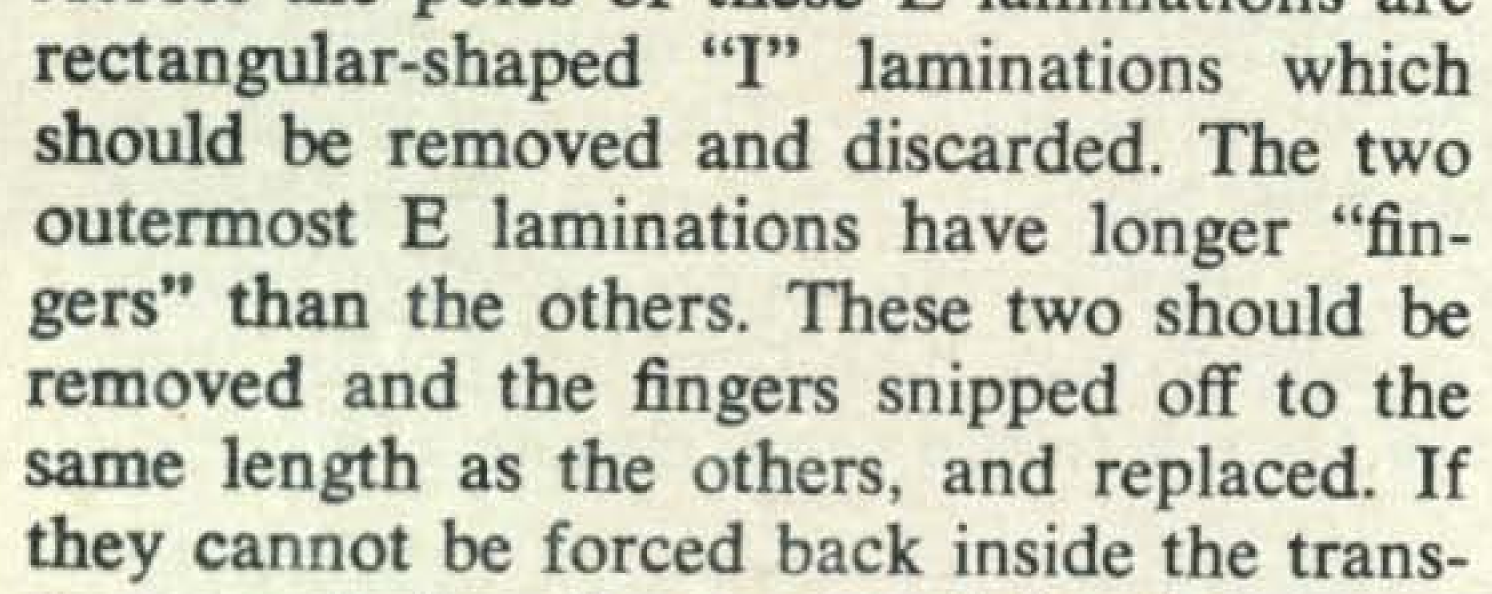

Fig. 3—This version of the audio filter can be built external to the receiver and plugged into the speaker jack. It should be used with headphones of 200 ohms or more impedance. Transformers T_1 and T_2 are as in fig. 1.

to about 780 c.p.s.—a very comfortable frequency for c.w. reception.

As shown in fig. 1 the two coils are arranged into a double-tuned transformer to do the audio filtering. This is an exact audio equivalent of a double-tuned i.f. transformer of the type used to separate stations in your communications receiver. But since the filtering is done at audio frequencies the bandwidth is much, much less. A typical 455 kc i.f. transformer will have a Q of about 50, some 10 times what we have with our modified audio output transformers. On the other hand, 455 kc is roughly 500 times as high in frequency as 780 cycles. Dividing 500 by 10 gives 50, and so we would expect our audio filter to have about one fiftieth the bandwidth of a typical i.f. transformer, which is just about what it measures.

Figure 2 shows the filter circuit between the 1st and 2nd audio stages of a receiver. The only requirement is that the filter must be fed and terminated with a fairly high impedance, greater than 50K, to maintain the coil Q's. This impedance level exists between the 1st and 2nd audio stages in a typical tube-type communications receiver. There will be some reduction in audio gain due to insertion loss of the filter but since most receivers have a surplus of gain this loss will not be a problem. Resistor R_1 can be adjusted so that the gain remains the same with the filter in or out.

Outboard Version

If you don't want to dig into your receiver, and don't mind using headphones, you can make the outboard form of the filter shown in fig. 3 and the photograph. This filter was designed to plug into the receiver speaker jack and should be used with high-impedance (200 ohms or greater) headphones.

In this case the signal is inserted in series with the first tuned circuit rather than in shunt. Since a typical communications receiver audio output impedance is about 3 ohms, and the resistance of the primary coil is a few hundred ohms, you can see that the coil Q is not going to be adversely affected by adding another 3 ohms in series.

The headphones are tapped way down on the second tuned-circuit by placing them across the voice coil winding. This insures that the secondary Q will not be lowered significantly by the headphone loading. Because of the impedance mismatch the insertion loss will be rather high, on the order of 20 db. Since any receiver that will drive a

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loudspeaker will have a great surplus of gain for headphones, this mismatch loss will be of no consequence.

Construction and Adjustment

When connecting the primary and secondary windings in series be sure to properly phase the voice coil winding so that it is connected in series-aiding rather than series-opposing with respect to the primary.

Since the filter works at audio frequencies parts placement is unimportant and any convenient mounting arrangement is OK. The two transformers are oriented with their poles facing one another as shown in fig. 1. The spacing between pole faces, *S*, should be carefully adjusted for correct coupling.

Start out with 1 inch or more between pole faces and tune your audio oscillator for maximum signal through the filter. If you don't have an audio oscillator you can use the variable beat-note from your receiver. For an output indicator preferably use an a.c. v.t.v.m. connected across the entire second tuned circuit. An ordinary multimeter on a.c. volts will probably lower the tuned circuit *Q* too much to be usable. If you don't have an a.c. v.t.v.m. you can use your hi-fi amplifier with its high impedance input connected across the filter and its output connected to a multimeter. (Now I suppose someone wants to know what to do if they don't have a multimeter.)

If the filter's peak frequency is not where you want it the values of the two resonating capacitors will have to be changed, of course. Also, you will probably find that the two tuned circuits do not resonate at exactly the same frequency. Even if your inductances are identical the resonances may differ because of capacitor tolerances; a deviation of 20% from the marked value of fixed capacitor is not uncommon. The resonant frequencies can be checked by carefully tuning your audio generator to the exact peak of response as indicated on the output meter. Then, while watching the meter, first shunt one, then the other coil with a 0.005 mf or 0.01 mf capacitor. The meter reading should go down about the same amount in both cases. If it goes up, it means that particular tuned circuit needs more capacity.

When the two tuned circuits are properly resonated to the same frequency the correct value of spacing can be determined. Set the generator to the exact peak of response with very loose coupling between inductors

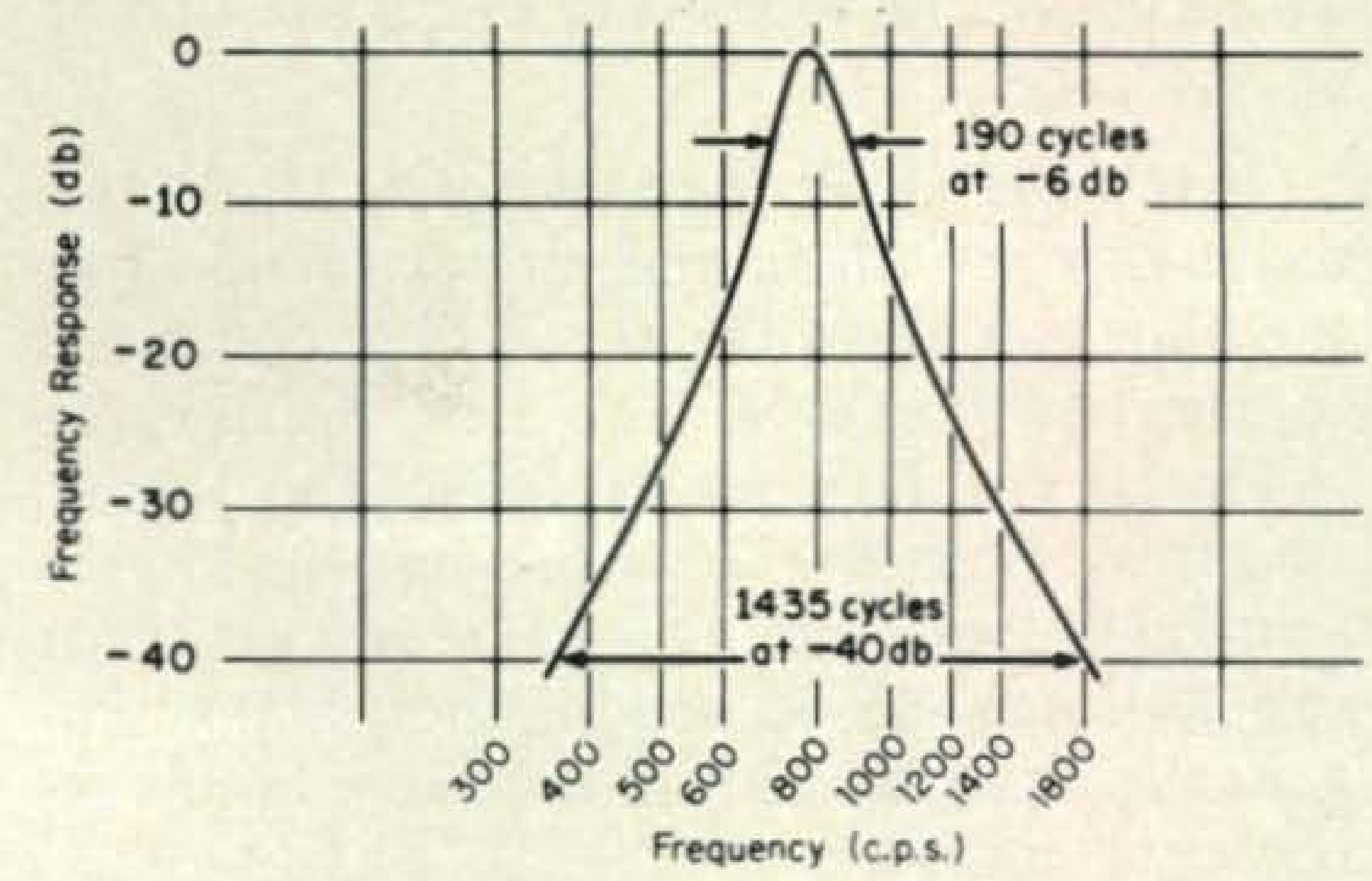

Fig. 4—Measured frequency response of the two-pole filter shown in fig. 3.

(spacing of 1 inch, or more). Now watch the output meter as you decrease the spacing. It will first rise to a maximum, and then fall as coupling is increased. The peak in output is where *critical coupling*[1] occurs. The spacing should not be less than that which gives critical coupling. If the coupling is too tight you will end up with the classical double-humped response curve of over-coupled tuned circuits.

A reduction in coupling below critical will reduce the bandwidth somewhat at the expense of increased insertion loss. There is no point in reducing the coupling below 3 or 4 db down from critical as the further improvement in selectivity will be negligible. I set my coupling at a point 2 db below critical, as a good compromise between gain and bandwidth.

Once the correct spacing is determined the inductances should be clamped or otherwise secured in place so that the spacing will be permanently maintained. If you now plot response versus frequency you should end up

[1]Also sometimes called *transitional coupling*.

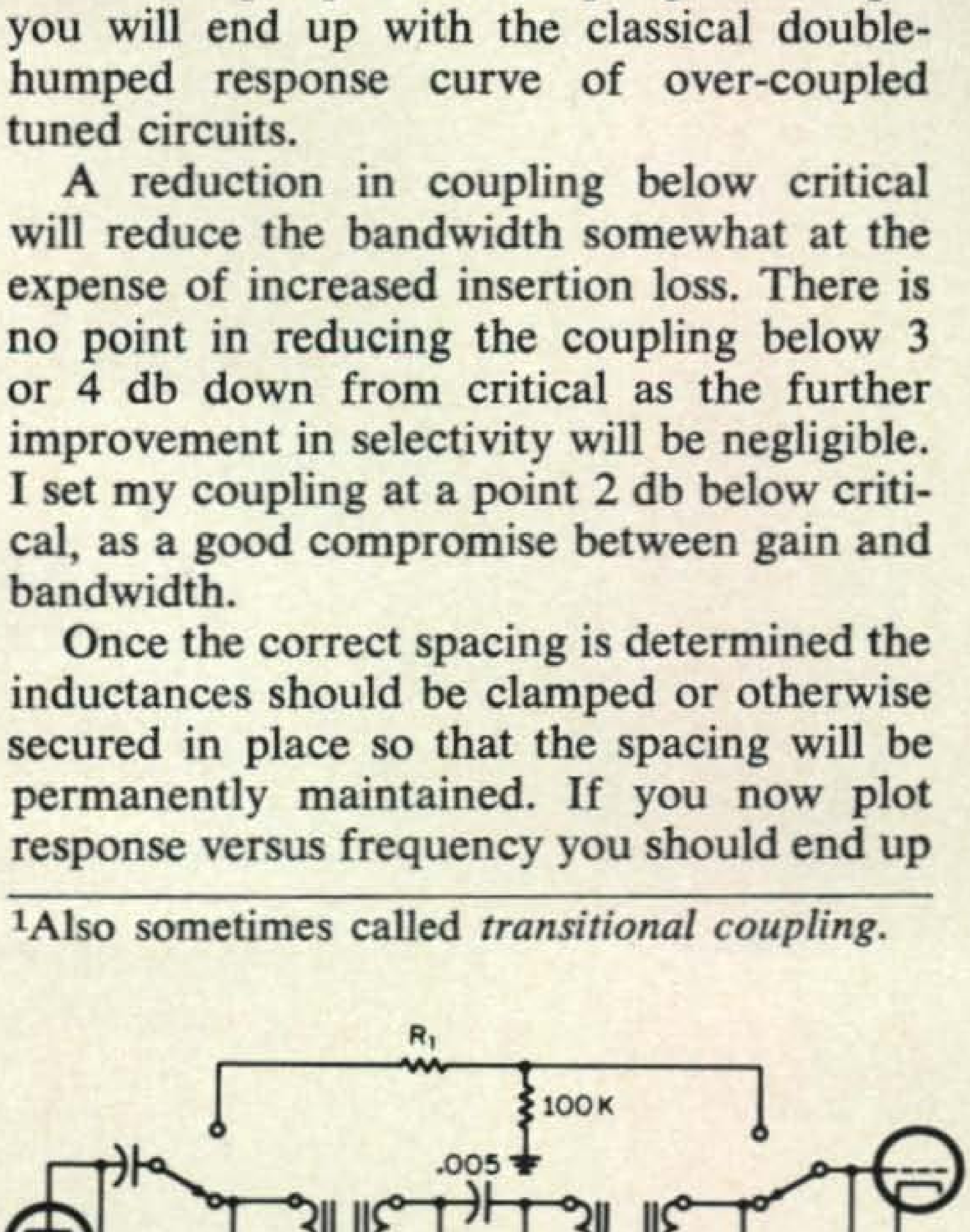

Fig. 5—A more elaborate c.w. filter can be built with two double-tuned transformers, capacitively-coupled as shown. Resistor R_1 should be chosen for equal signal level with the filter switched in or out.

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with a curve that looks very much like that of fig. 4.

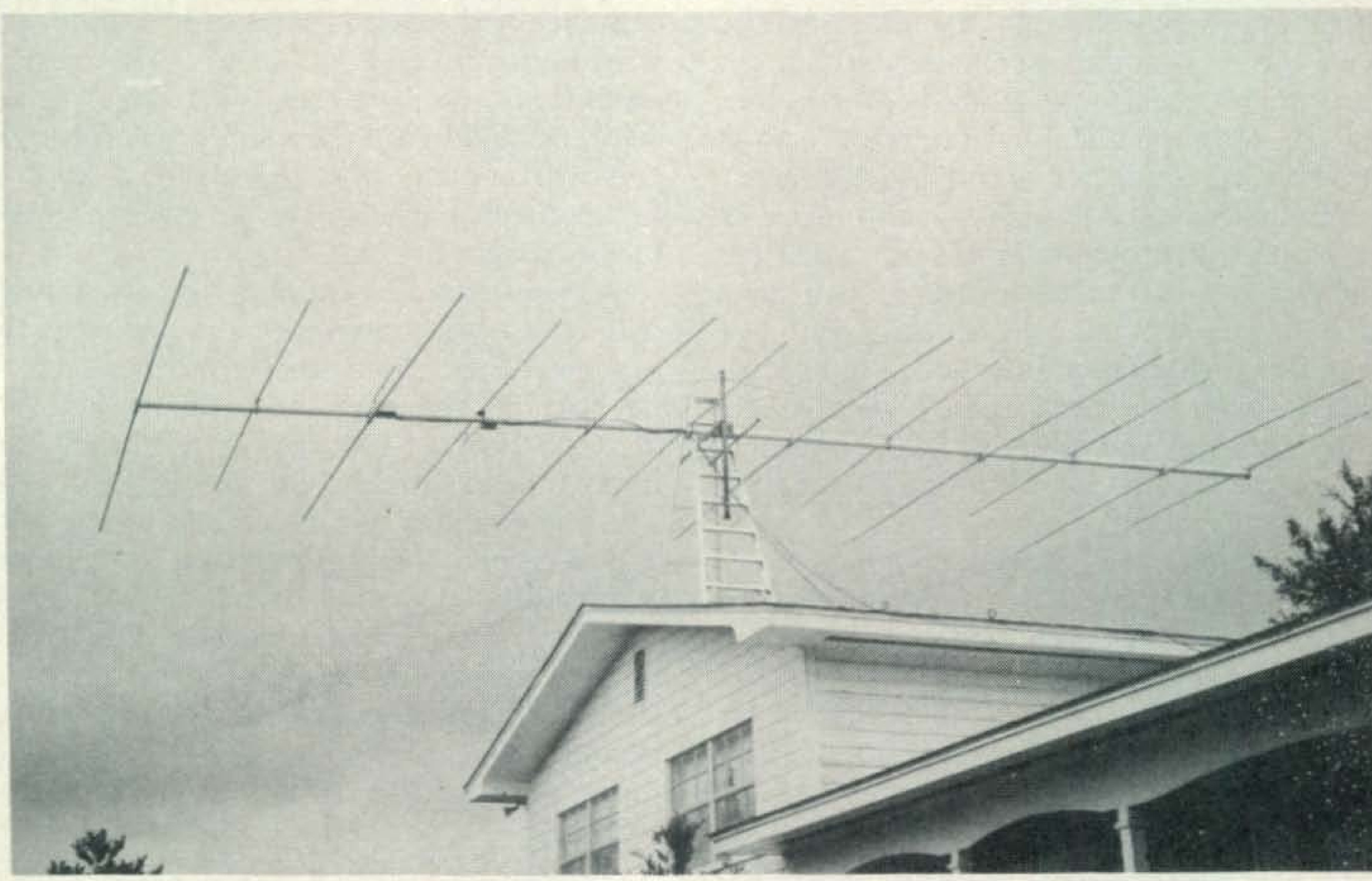
That's about all there is to it. I included an IN-OUT switch in the circuit of fig. 3 so the filter can be switched out when you want to listen to the QRM. The 3.3K resistor, R_2, makes up for the insertion loss of the filter so that there is no level change when the filter is switched in and out. This value is correct for my 200 ohm HS-30 headphones; higher impedance headphones will require a larger resistor, of course.

The 12 ohm resistor on the input is to properly load the audio output stage of the receiver; Some output stages do not like working into a high impedance.

Cascading

If you really groove on c.w. operation you will probably want to cascade two or more of these filters for improved performance. The response curve for two double-tuned transformers in cascade will be very much like fig. 4 with all the db values doubled. That is, 10 db down will be 20 db, *etc.* A suggested method of cascading by "top coupling" is shown in fig. 5. The value of the coupling capacitor may have to be adjusted slightly for best results.

Alternatively, you can cascade your double-tuned transformers using a tube or transistor between transformers. Just remember to keep impedances above 50K ohms to avoid excessive loading. ■



A 10 & 15 METER INTERLACED BEAM

BY DOUG GAINES,* W4AXE

WHAT a dilemma. For contesting, I would like six elements, wide-spaced, on each of the high bands, 10, 15 and 20 meters and at least two elements on 40 meters, plus what dipoles, low frequency arrays and other assorted garbage I can hang on my tower. Unfortunately, I do not like to be distracted by the thunder of falling steel and aluminum resulting from stacking too many, too heavy antennas on too long a mast sticking out of too high a tower, in too high winds. I either had to lower the antenna height or reduce the number of elements, and reduce the resultant gain. Neither of these alternatives

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appealed to me, so I set out to conjur up something that would give competitive gain and yet, keep the wind and torque loads down.

Now, I consider Ol' Thunder, my six element 20 meter beam, inviolate and untouchable. No tinkering allowed there. But I wondered if I could fudge a little and decrease the stacking space between the 10 meter and 15 meter beams to a minimum, maybe even to zero. The results of this cerebral meandering is two beams built on the same boom. *Voila!* A six element wide-spaced 10 meter Yagi, and a six element wide-spaced 15 meter Yagi, interlaced.

Results? A measured forward gain approaching the theoretical maximum for single-band, six elements, typical six element radiation patterns, wind area about equal to a four element 20 meter beam and a total weight under 75 pounds. Oh yes, and one of the funniest looking antennas to threaten a neighbors peace of mind. Interested? Okay, here's how.

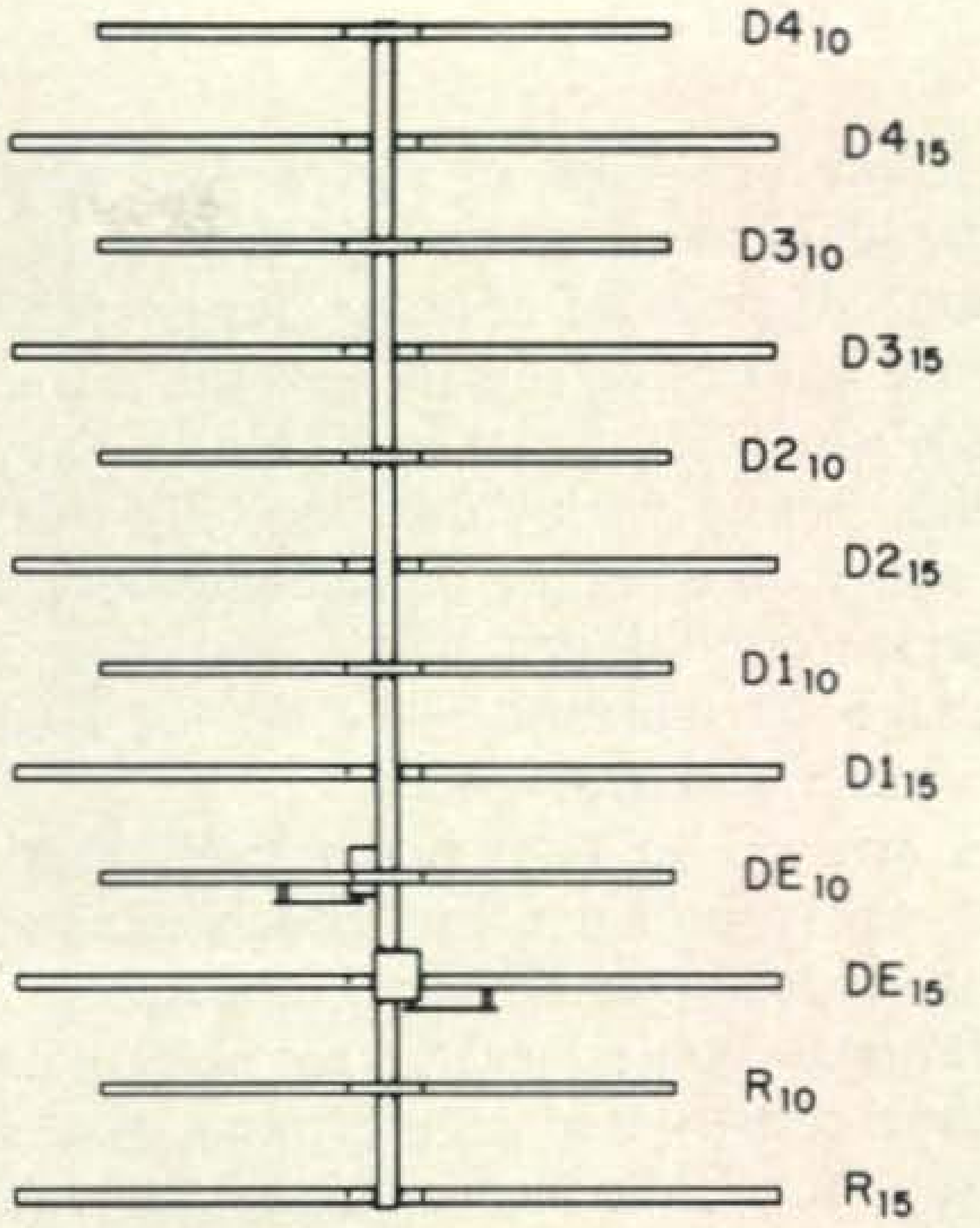

Fig. 1—Element arrangement for the 10 and 15 meter beam. The 10 meter elements are mounted on top of the boom, the 15 meter elements on the bottom. The gamma matches are staggered, one left and one right, for minimum interaction.

Design Description

Total boom length is 36 feet, but actual boom length for each antenna is 33 feet. Spacing of all elements for each beam is 6 feet, 6 inches, or approximately 0.2 λ on 10 meters and 0.15 λ on 15 meters. The elements are arranged, as shown in fig. 1, so that the 15 meter reflector is mounted at the rear of the boom, the 10 meter reflector is 3 feet 3 inches ahead of it and so on, down the boom for the rest of the elements, ending with the 10 meter 4th director at the front end. To reduce interaction between the matching sections, a problem I had encountered in an earlier design, I mounted the 10 meter gamma rod and capacitor on the lower left, and the 15 meter gamma rod and capacitor on the upper right side. Both antennas are matched to 50 ohm coax using the conventional gamma match.

Construction

I used a light weight boom and small elements to reduce weight and wind area, within reasonable limits. The boom is 3 inch O.D., 6061ST aluminum tubing of 0.062 wall thickness, thinner than I would use again. With this many elements on a 36 foot long boom, the flexibility is a little spooky. I would recommend 0.084 wall thickness for this application.

The elements are 1 inch O.D. in the center section, sleeving down to 7/8 inch tips with wall thickness of 0.034. The 10 meter elements are mounted on top of the boom and the 15 meter elements are mounted on the underside, using commercial clamps by Kirk Electronics. The boom is reinforced at the center with a short section of 3 inch I.D., 1/4 inch wall pipe. This adds stiffness at the point of maximum bending, and provides a rigid area on which to clamp the boom-to-mast mounting plate. This is a 14 inch square steel plate, 1/4 inch thick, drilled for 2 inch U-bolts for the mast and 3½ inch U-bolts for the boom. As fast as I like to turn my antennas in a contest, (often better han 2½ r.p.m., 55 volts on a modified prop-pitch motor!) I figured this was no place to spare the strength. The boom is guyed with a single diagonal backstay to pull out vertical sag.

Element	15 m	10 m
Refl.	23′ 8″	17′ 9½″
Dr. Elem.	22′ 3″	16′ 8″
Dir. #1	21′ 2″	15′ 10″
Dir. #2	21′	15′ 8½″
Dir. #3	20′ 8½″	15′ 6¼″
Dir. #4	20′ 6¼″	15′ 4½″
Gamma Rod	19″	16″

Table I—Element sizes for the interlaced beam. The gamma rod spacing is 6″ for both bands.

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Tuning and Testing

There are a lot of old wives' tales about interaction and stacking, just as there are about all areas of antenna design. This beast either ignores or refutes several. All element dimensions are given in Table I. They agree quite closely with those used by this writer in many other single band beam designs. The interlocing did not affect resonant lengths enough to warrant retuning, as is demonstrated by the tests below.

I wanted to convince myself that I was not compromising too much performance with this approach, so I constructed good reference dipoles on 28.6 mc and on 21.3 mc. I first constructed single band, six element beams for both bands, using the same elements and boom length. Reasonably careful gain measurements were made with the help of a local amateur across town. Both beams demonstrated about 12 db forward gain over the reference dipoles. Please note, I said "about." The reference dipoles were probably not perfect and I do not believe in Santa Claus when it comes to antenna gain figures. However, these numbers made a good reference for comparison after the beams were interlaced.

Interlaced, the antennas demonstrated the same gain over the same path. No apparent degradation of gain or pattern was noted, except for a decrease in front-to-back ratio on the 15 meter section. Lengthening the 15 meter reflector to that shown in Table I corrected this.

Tuning of the two gamma matches was affected in what appears to be dissimilar ways. In the 15 meter beam, the R component of the feedpoint impedance was increased by the interlacing, as evidenced by the need to shorten the gamma rod from 28 inches to 19 inches. The 10 meter rod did not require changing, but the capacitor required about a ten percent decrease in capacity. Lab type interpretation of this assymmetrical effect is beyond the scope of this article. The antenna was matched to the coax while mounted on a step ladder on the roof of my house, approximately 25 feet above apparent ground. Only minor tweaking of the gammas was required after the monster joined the 20 meter and 40 meter beams on top of the tower.

An earlier experiment with this type antenna with closer element spacing and probable severe coupling between matching sections created wierd tuning effects. I was not able to match the 10 meter section at all using many combinations of gamma rod, capacitor and driven element length, but found that tuning the 15 meter gamma section grossly affected the s.w.r. on the 10 meter beam. I suspect that the two driven elements, only about 16 inches apart, acted as one inefficient broad-band element. I was doubtful of the validity of any measurements taken on such a setup.

Performance

Forward gain figures do not tell all the story about the performance, but this antenna *feels* good. Okay, I know that is not very technical, but it is at least as accurate as some of the claims of antenna manufacturers, and I made the same judgement about my six element beam when I put it up 125 feet high. This "feel" seems to be justified by the measured gain figures (I still stick to my guns with the 12 db figure), a nice narrow frontal lobe of about 45 degrees between 1/2 power points and a low angle of radiation, and a front-to-back ratio of 24 db at resonant point. Bandwidth is *good* and this surprised me. I suspect, once again, that the interlacing with wide spacing actually broadbands the whole works. All of 15 meters, phone and c.w. can be operated with less than 1.6:1 s.w.r., c.w. and the first 500 kc of 10 meters can do the same. Verrry interesting! My I/O factor (time Into and Out of contest pile-ups) is also excellent.

Conclusion

I estimate that this design has eliminated approximately 11 square feet of wind area, at least 6 feet of mast stacking height and about 40 pounds of dead weight. This adds up to a lot of strain eliminated from my rotor and the top section of my tower, to say nothing of my sleep on windy nights. I believe this antenna could be fed with single feedline but this would be a disadvantage for contest work. Besides, I am not sure I am up to the Chinese fire drill this matching procedure would be.

However, since I have had success with this design approach on ten and fifteen, I wonder if Ol' Thunder would mind a few 40 meter elements hung off its backside? Hmmmmm. ■

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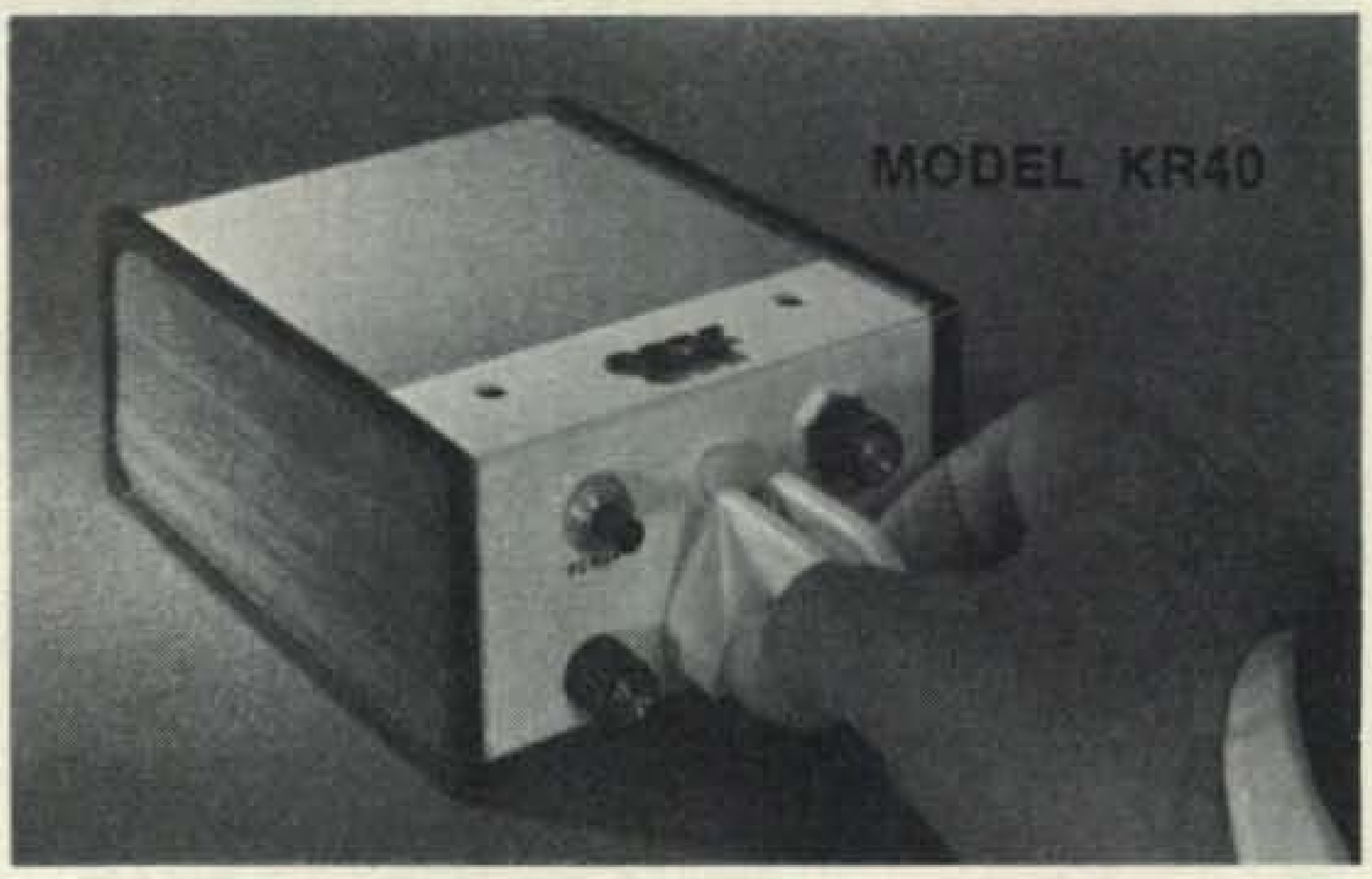

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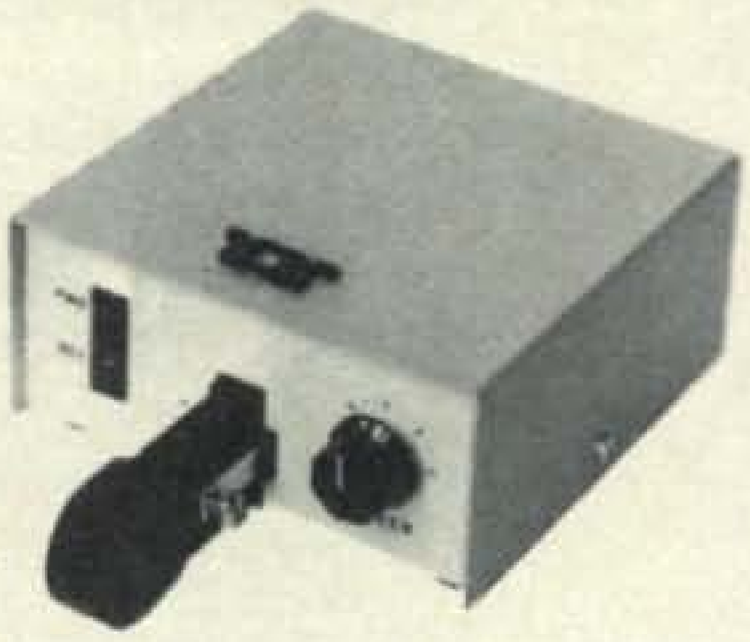

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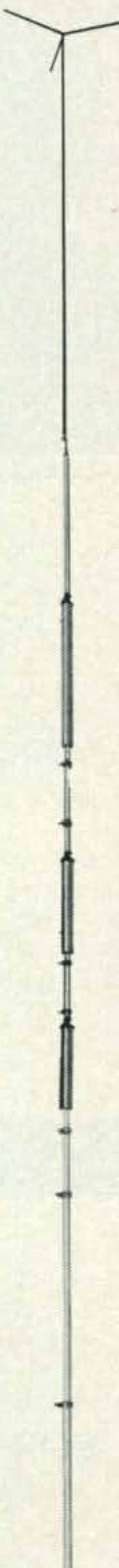

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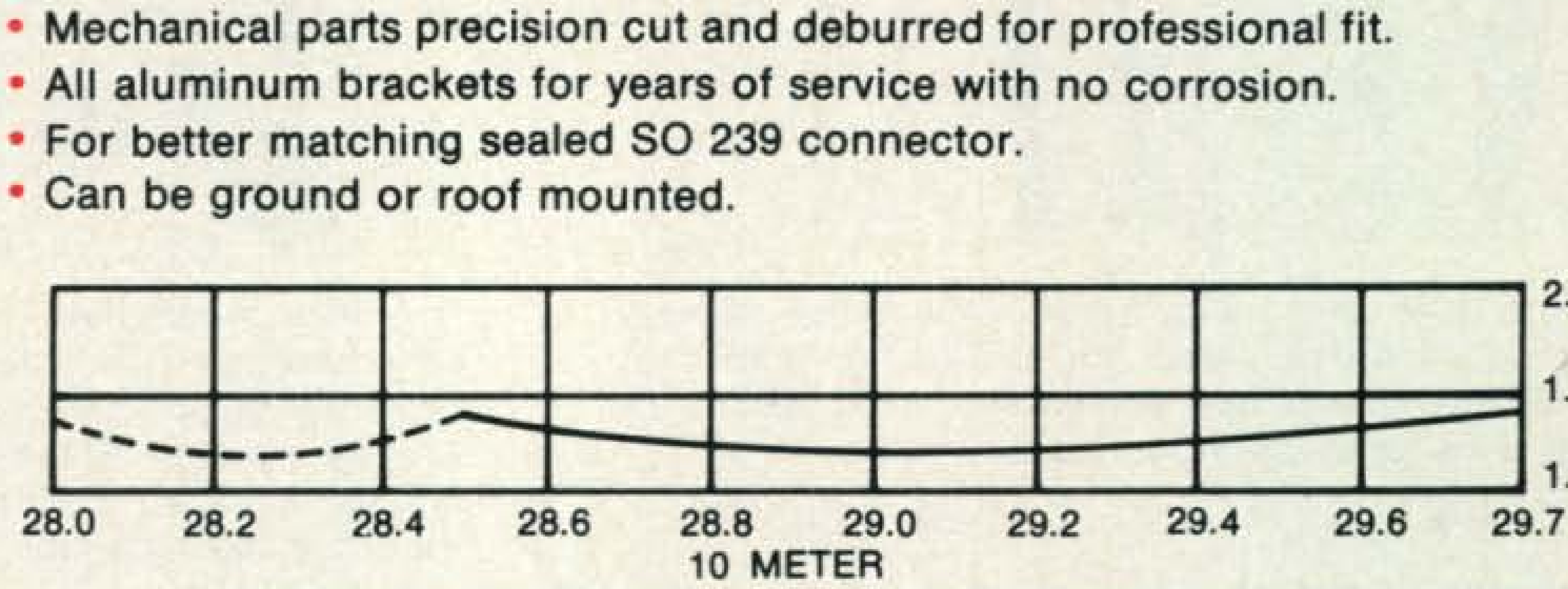

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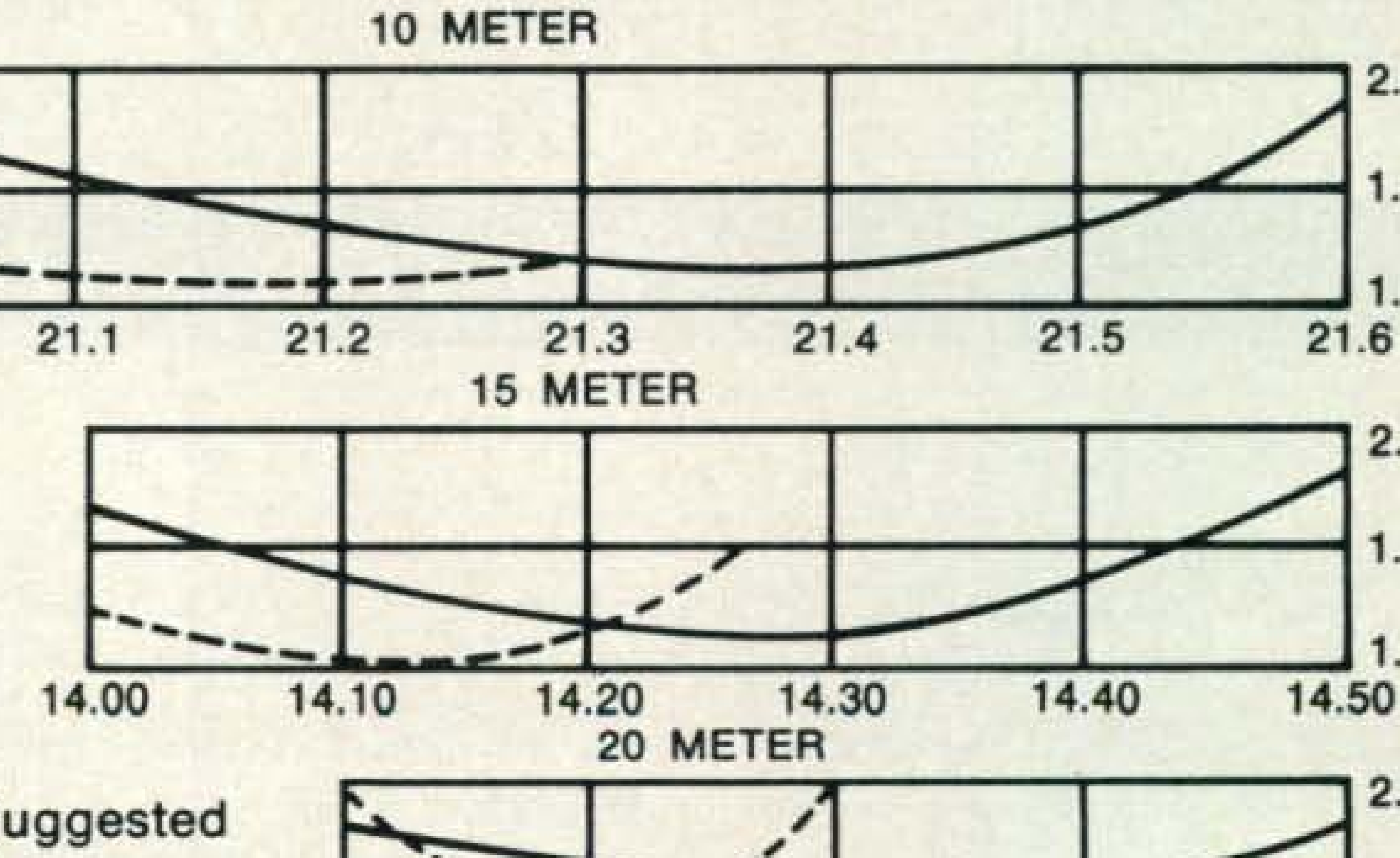

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UNDERSTANDING SKIN EFFECT

BY EUGENE DUSINA,* W4NVK

Presented below is a simplified but accurate description of the cause and results of skin effect. The coverage is virtually non-mathematical and is ideal for Novices, beginning technicians (and oldtimers too).

Most technicians have heard about skin effect, but I wonder how many are really satisfied that they understand the why of this phenomenon or how it really operates. An understanding is especially important when one uses a conductor of different shape than the usual round cross section which most skin effect discussions restrict themselves to.

Understanding skin effect and how it operates, will open up a new insight for the technician into many facets of electronic equipmment. For example, grounding of r.f. currents or designing coils with best *Q* will be much more obvious to the technician that understands the why of skin effect and its effects on various shapes of conductors.

Skin Effect Fundamentals

To grasp the fundamentals of skin effect one must think about parallel wires for a moment. A large conductor can be thought of as many small wires in parallel. If all these wires are the same length, and of the same diameter, they all have the same d.c. resistance, and each will carry equal current when d.c. is passing through the bundle. If a.c. is substituted, each wire will still carry equal current if their impedances are equal. Since all wires have a small amount of inductance, which causes a reactance to a.c. in addition to the d.c. resistance, the impedance of any wire is always higher for a.c. than it is for d.c. At all a.c. frequencies above the low audio range, the total impedance presented to the current by any wire is due more to the inductance than to the d.c. resistance of the wire. At all but very low frequencies, the actual resistance of the wire becomes greater than it was at d.c. because of the skin effect. As the frequency goes higher, this effect becomes more severe quite rapidly. The well known cause is that the a.c. currents are forced, in some manner, to flow only on the outer parts of a wire, and hardly flow in the center area.

An example of how severe effect is may be helpful, at this point to give the reader a feeling of its importance. The skin effect forces practically all the a.c. to flow in the outside 2/10,000 of an inch of a copper conductor at 100 megacycles. The practical implications of this are that if a technician uses a tinned copper wire at this frequency, he is actually using a tin wire with all the high resistance that tin has, although he may think he is using good old copper to carry his r.f. current. A technician will encounter other problems due to skin effect whether he deals with r.f. or very fast digital pulses. For this reason, it's advisable to get a deeper understanding of skin effect.

The analogy of a heavy conductor as merely a large bundle of smaller wires all in parallel is very handy to develop an understanding of skin effect. Assuming our large solid conductor to be a bundle of smaller wires in parallel, it is intuitively obvious they will all carry equal current if each has equal total impedance.

Consider what makes up the impedance of each wire for a moment. The resistance of each tiny wire is self-evident, but the inductance component of the overall impedance is

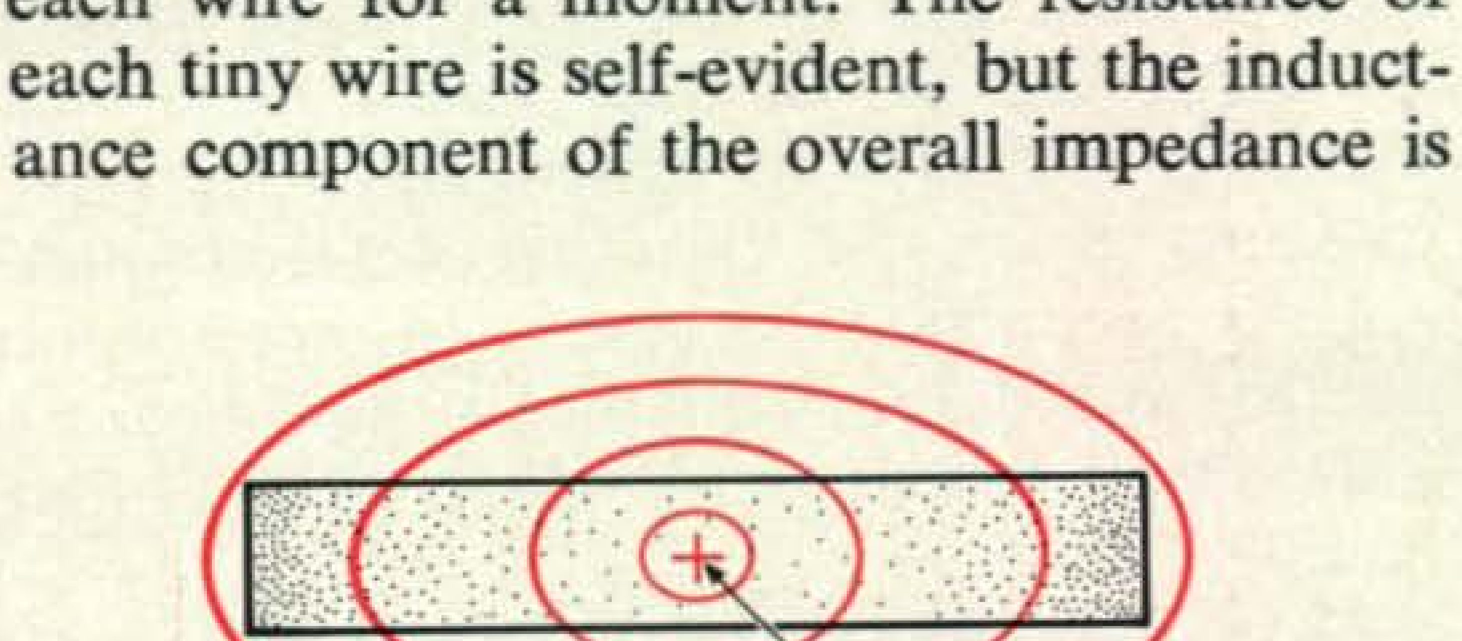

Fig. 1—Cross section view of a flat strip conductor shows the eliptical flux lines, the geometric center of the current flow and the areas of r.f. current concentration.

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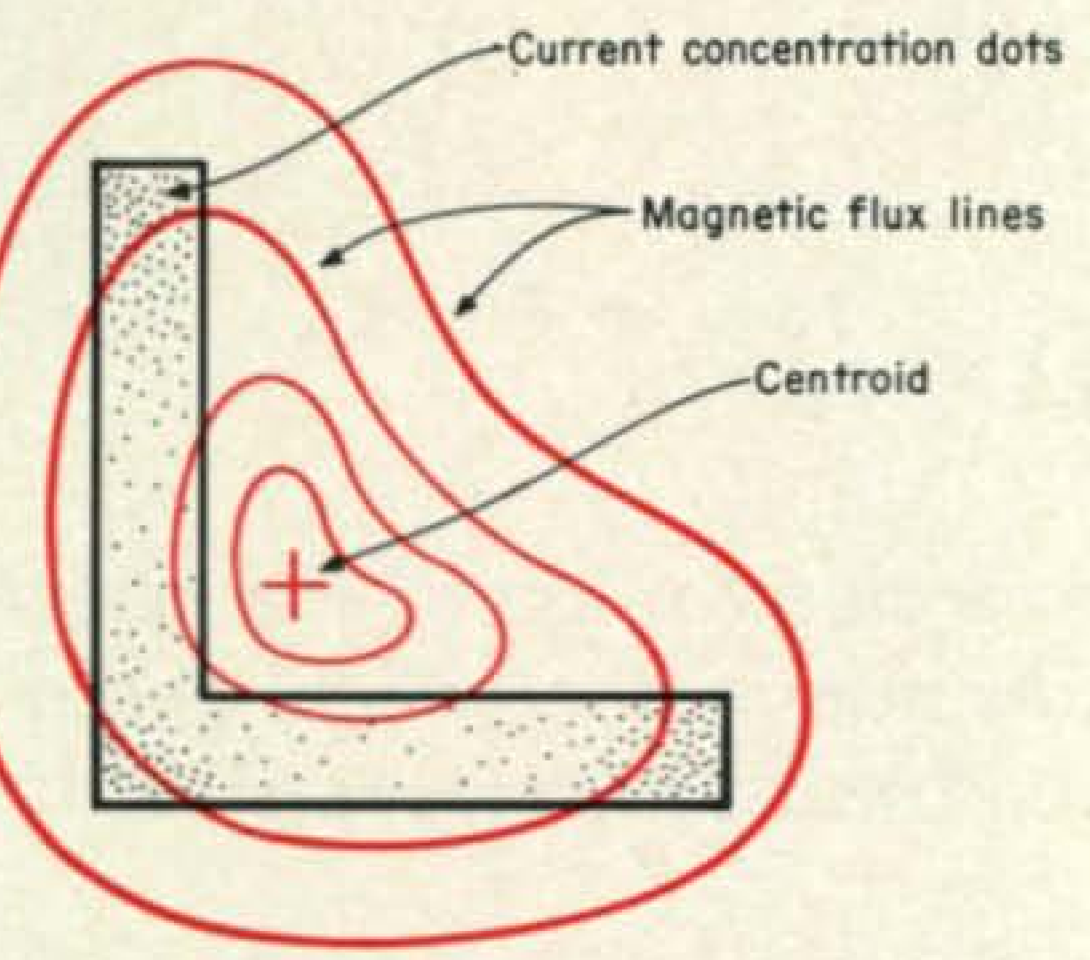

Fig. 2—Cross section view of angle stock showing magnetic flux lines, the centroid and the areas of r.f. current concentration.

caused by the magnetic field that surrounds any conductor carrying current. Remember that inductance is controlled by the number of lines of magnetic flux which surrounds a conductor. Well, the bundle of wires we described above has a flux around it when current flows. Some of the flux is outside the bundle of wires and some is inside the bundle because magnetic flux passes through the wire with ease. Now, since the flux of a magnetic field is always concentrated around the center of current flow, which is not necessarily the center of the conductor unless the cross section is round, it should be rather obvious that some wires in our bundle are going to have more around them than others.

Round Conductors

In a round conductor, the maximum flux is concentrated at the geometrical center of the conductor, and hence the wires in the center of the bundle have more flux around them than those on the outer surface of the bundle. Ths occurs because the magnetic lines of all the individual fields of each wire in the bundle add together and form a very intense field at the center of the bundle. This intense flux means that center wires will have more inductance than will the outer wires. Inductance is proportional to the total flux around a wire, so different amounts of flux means a different inductance for each wire of our bundle.

Since more inductance causes more impedance for any individual wire of the bundle, less current will flow in those wires that have more impedance than others of the bundle. Remember that the ends of the bundle are at the same voltage so each wire of the bundle is forced to have the same voltage drop across it per unit of length of the conductor. The higher impedance of some wires will then cause less current to flow in those wires. Since the inner wires have high impedance, and carry little current, most of the current goes through those wires with the smallest inductance. These are the outside layers in a round conductor.

The outside layer is not where the maximum current flows in other conductor shapes though, and because many skin effect discussions stop short at this point, most technicians and many engineers assume, incorrectly, that the outside surface of all conductors is where the maximum current is flowing. Therefore, don't jump to any conclusions about other conductors yet. Also of importance is that the impedance variation has only to be moderate to cause most of the current to seek the outer wires.

Returning for a moment to the bundle of wires used for the analogy above, consider that it makes no difference whether the wires in the bundle are insulated from each other or not. There will be no desire on the part of the current to leave one wire and cross over to its neighbor that may have a lower impedance. This is so because each wire has exactly the same voltage drop across it per unit of length. Hence, one inch down each wire in the bundle the voltage is precisely the same on each wire, and no cross currents would flow as no difference of potential exists to cause them. Whether the individual wires are insulated from each other or touch, makes no difference. In fact, in a solid conductor the wires are considered to be in perfect contact with each other everywhere, and the exact same effect occurs for most practical purposes. There are of course some subtle second order effects that keep our bundle of wires analogy from being a perfect equvalent, but it serves well its purpose of giving a simplified mental picture of what goes on to cause skin effect.

Summarizing what we have covered about skin effect, we can make a simple rule for technicians to use in place of the common assumption that a.c. travels on the surface of a conductor. That rule is "Alternating current always tries to get as far away from the concentrated part of the magnetc field as it can." Alternating currents will travel to some peculiar parts of a conductor to do this. The net result for some oddly shaped conductors is that the technican may be furnishing a very generous amount of metal for the current to flow through, but the current may be

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huddling together in a tiny corner of the metal and ignoring most of the available path. Consequently the supposedly low resistance path furnished by the technician may be, reality, a high resistance path poorer than he could have provided with a lot less metal of another shape. This not too well known fact causes the current to do some unexpected things in non-round conductor shapes, as these examples will demonstrate.

Strip Conductors

Take the case of a flat strip conductor. Most persons erroneously hold to the idea that currents flow on the surface of such conductors. This is partially true, but the average technician or engineer makes an unwarranted assumption that *all* the outer surface of a flat strip conductor carries current. If you will nail them down on it many will admit that they *feel* the current is equal in all parts of the outside surface of such a conductor. This is far from the truth. Look at fig. 1 and you wll see a cross secton view of a flat conductor. This is the end of a flat wire, and the current is flowing in and out of the page for purposes of explanation. This conductor is symmetrical, and the center of the magnetic flux is, therefore, also at the center of the conductor. Recall that the current pushes as far from this center of flux as it can. Therefore, the current will concentrate in the ends of the rectangular cross section which are the edges of the flat conductor. Very little current will flow near the surface of the conductor except on the outer edges. Consequently, this shape of conductor will *not* have the lowest a.c. resistance that one could get for the amount of metal used to make the conductor. Therefore, a technician who winds an r.f. coil with flat conductor to seek high Q may be defeating his purpose.

Angle Conductors

Now, lets look at another non-round conductor shape, which could be the corner of a chassis as a practical example. Figure 2 shows the cross-section of a right angle conductor. Here we have an example of a non-symmetrical cross section, and the center of flux concentration winds up being outside the conductor entirely. Since the current pushes as far away from this center of magnetic flux as it can, it ends up out on the two extreme ends of the angle, which are shaded darker to indicate the relative current concentration. Not all the current flows in the ends, because the

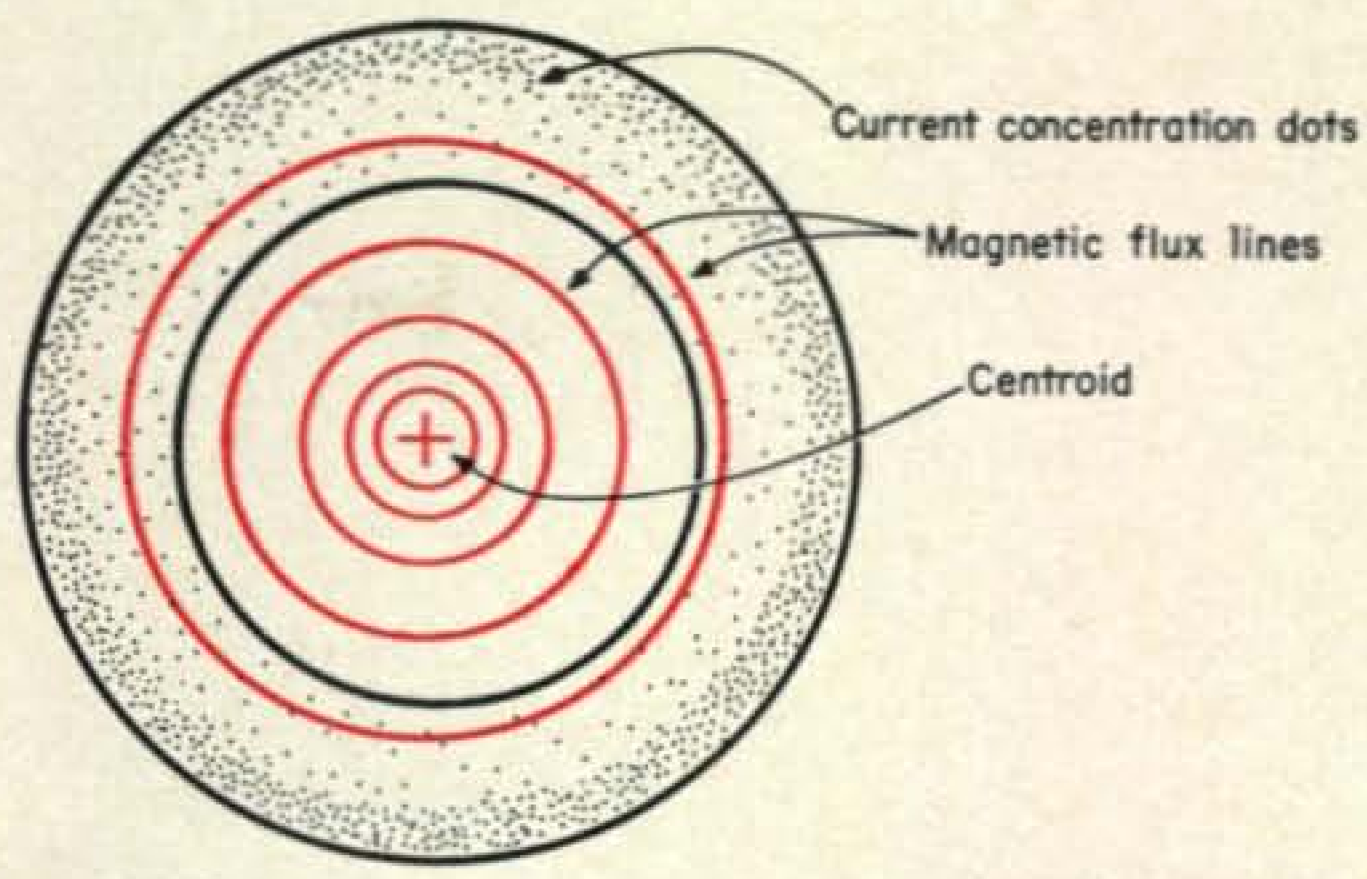

Fig. 3—Cross section of cylindrical tubing showing the magnetic flux lines, the centroid and the areas of r.f. current concentration.

right angle bend of the metal is also pretty far from the center of flux and some current also flows there.

For angle stock where length L is short, as illustrated in fig. 2, current will flow in the three parts shown. In large angles though, like a metal box, the current will tend to concentrate in the corners. If a large angle that is open, like a metal box that screws together so that very imperfect contact is made, the edges of the metal may carry heavy current and the corner little or none. This of course would be more interesting to technicians involved with r.f.i. suppression, as the r.f.i. tends to leak out at the points of maximum current flow.

To complete the examples, fig. 3 shows a round tubular conductor, like a piece of copper tubing. In this shape the center of flux is equi-distant from the outer surface of the conductor so each area of the outer surface carries equal current. This is the only shape in which this is true, and because this shape makes best use of the available surface, it is the cross section and shape that has the lowest r.f. resistance for a given amount of metal.

Effective Thickness

In all these figures the concentration of current is shown by the shading. The shading is more gradual than actual, however, to permit drawing the figure. The major part of the current actually flows in very very thin parts of the conductor. In actual practice, on the figures drawn, the total current, for all practical purposes, would flow in a thickness no greater than the ink line showing the edge of the drawing for any frequency above about 100 kilocycles.

For the technician that may want to calculate how much of any conductor is actually

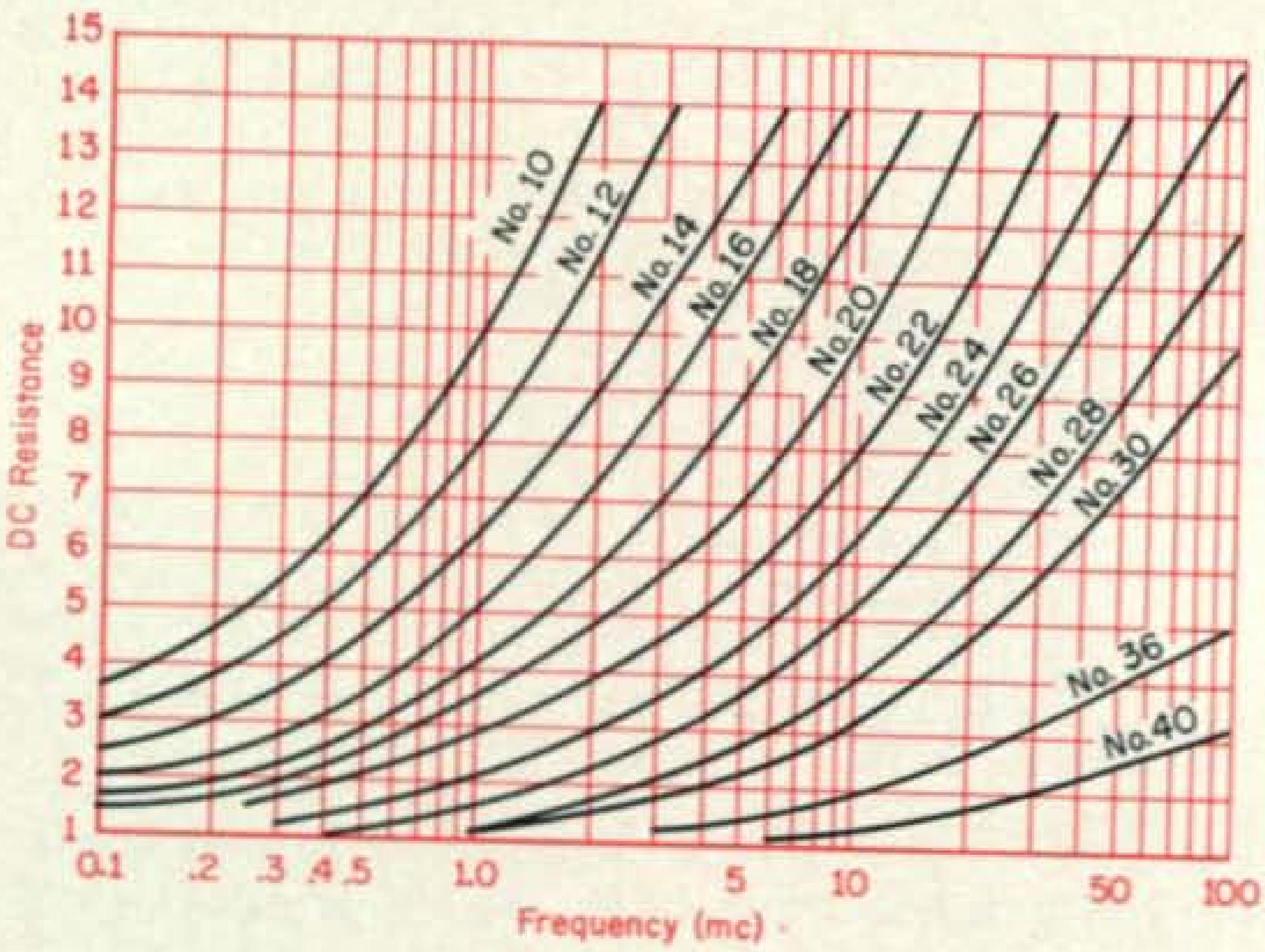

Fig. 4—A graph of the ratio of r.f. to d.c. resistance versus frequency for various diameters of wire.

used by the current, the thickness in which 63% of the current flows is:

$$\textit{Thickness in inches} = \frac{2.6}{\sqrt{F}}$$

where F is in cycles per second. The thickness at 1 mc is 0.0026 inch.

A further item of knowledge will help make the technician's understanding far more practical. This concerns the skin depth calculated in the above formula. While 63% of the total current flows in the first thickness of 0.0026 inch at 1 mc, only 37% flows in all the rest of the metal regardless of *how* thick it may be. Also, practically no current flows at a depth three times the thickness given by the formula. For the sake of numbers which are very important to the practical man, we can say that of all the current which flows, 63% is in the first thickness (0.0026"), 23% flows in the second thickness, 9% flows in the third thickness, 3% in the fourth thickness, 1.2% in the fifth thickness and so on. The practical statement that all the current flows in the first three thicknesses or layers is thus 95% correct, which is good enough for most practical applications.

Plating

One other bit of knowledge is useful in practice. Suppose one wanted to plate a conductor with a high conductivity metal like silver to reduce its r.f. resistance. If the metal to be plated is applied only one skin depth thick as calculated by the formula, then its resistance will be just 1.5 times the resistance such metal of equal cross section would have at d.c. This derives directly from the 63% current: 37% current ratio given above. If the metal is plated two depths thick, the resistance will be about 1.14 tmes greater than the d.c. resistance of a two depth thick cross section of metal. Therefore, of the plating metal is very expensive, two depths thickness is the place to stop for practical results versus cost.

One last item that must be brought out: the above mentioned fact that the r.f. resistance of a 1 skin depth thickness is only 1.5 times the d.c. resistance does not justify a conclusion that the r.f. resistance of a wire *won't* be greater. In a round wire, the r.f. resistance will not be greater than 1.5 times the d.c. resistance of a *thin shell of the same metal forming a very thin tubing in which the wall thickness is 1 skin depth thick*. The d.c. resistance of a solid wire will come from *many* such thin shells, all one inside the other, to make a solid wire with a resistance far lower than that of any one of them. To clearly get this point across, refer to fig. 4, which shows the r.f. resistance of many common round wire sizes at various frequencies, compared to the d.c. resistance that you would measure with an ohmmeter.

Effect On Inductance

So far, we have thoroughly explored the impact of skin effect upon the r.f. resistance of a conductor. Equally important to many technicians through is its effect upon the inductance of a conductor. The general rule for explaining what happens to inductance is that the farther the current is permitted to get away from the center of flux concentration, the lower the inductance of the conductor per unit length. This directly follows from an analysis similar to that used to show where the current would flow in odd shaped conductors. Since inductance is proportional to the amount of flux surrounding the current flow, if one selects a small diameter round wire which forces the current to stay very close to the flux, the inductance will be maximum. A tubular shape conductor lets the current get somewhat away from the strong magnetic field in the center of the conductor, so it has less inductance per unit length than the same amount of metal in a solid cross-section.

An angle shape lets the current get even farther away than does tubing, and it therefore has a still smaller inductance per unit length than tubing containing the same amount of metal.

The smallest inductance occurs in the flat

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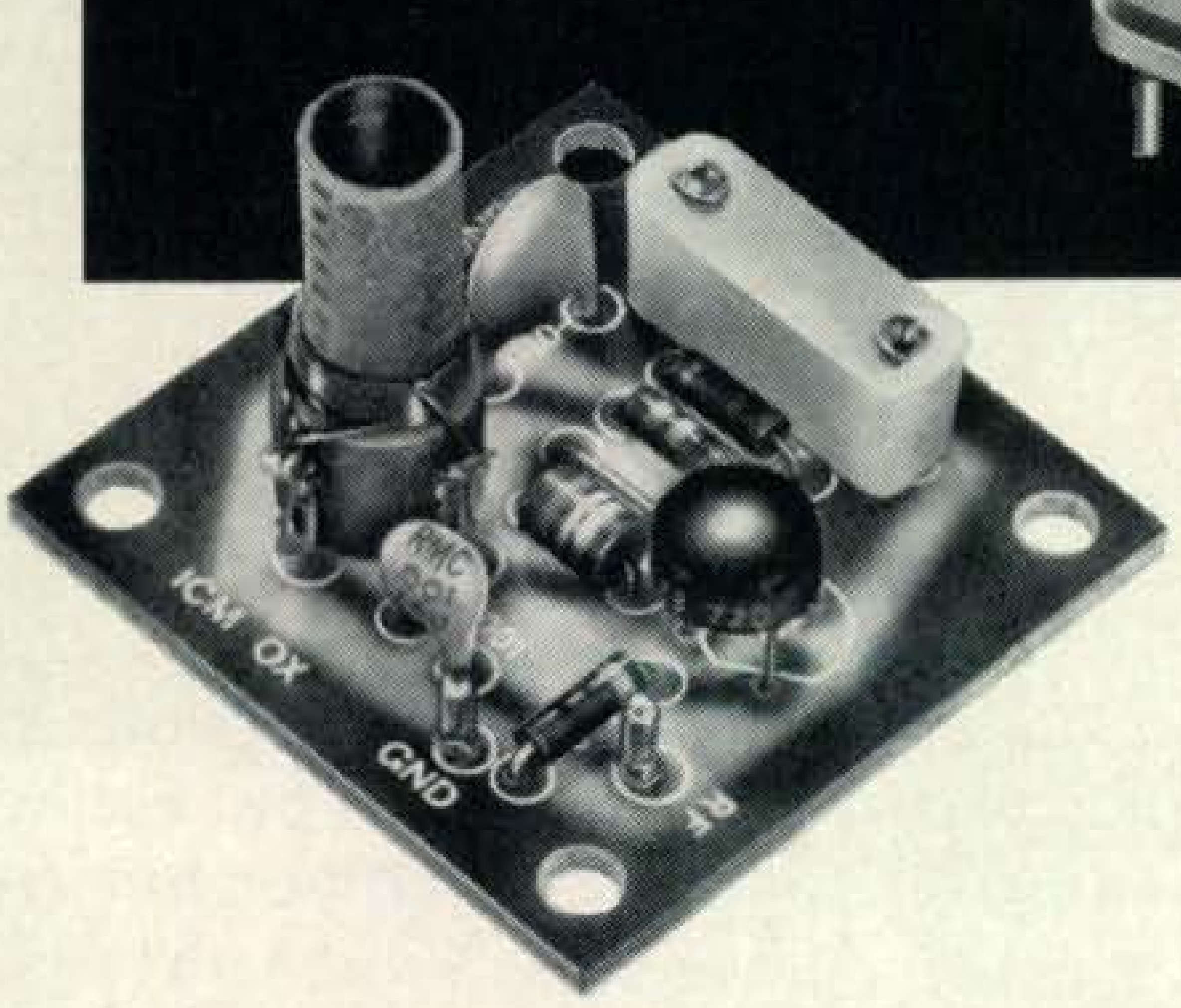

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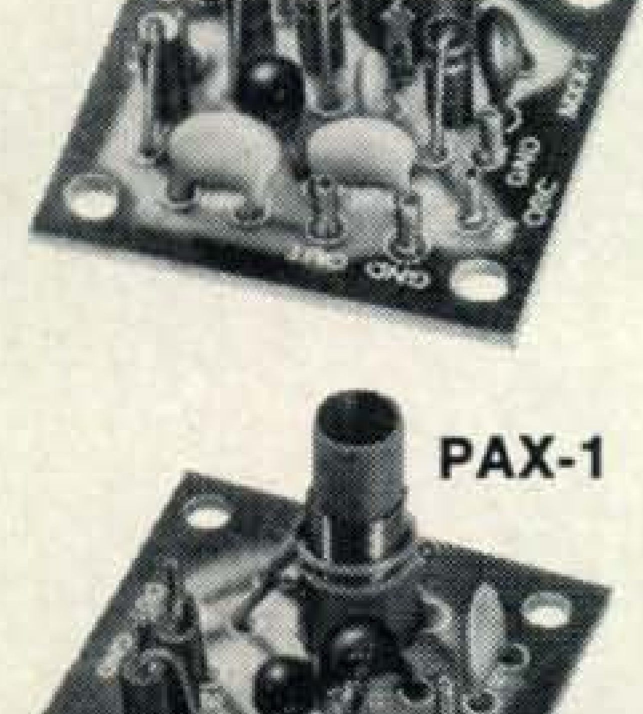

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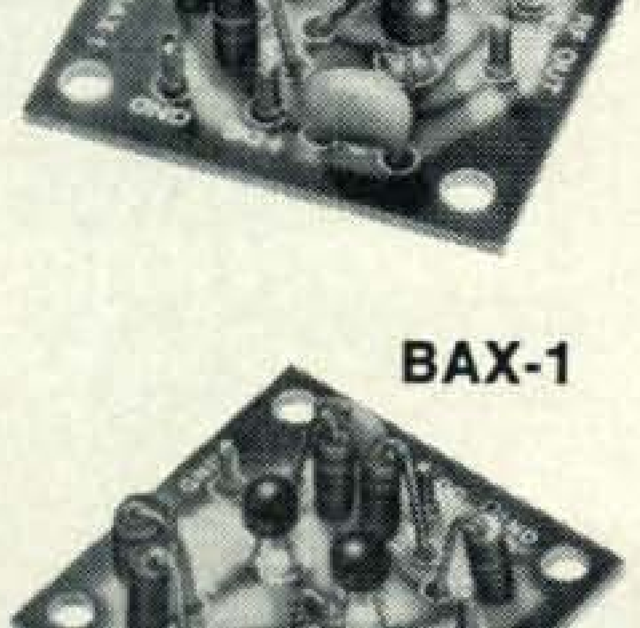

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strap conductor as it allows the current to move the maximum distance away from the magnetic field. To get even smaller inductance than can be obtained from a flat strap, one should use wires or straps of small width separated many wire diameters, and hooked in parallel. To get the idea, notice in fig. 1, that you could cut all the strap away but the outside thin edges, and have the same r.f. circuit, since all the current flows in the outside few thousandths inch. Since no current to speak of flows in the inner parts of the wide strap, whether you cut it away or leave it makes no difference to the r.f. current, nor to the inductance presented to that current. This means that two small round wires replacing the outer edges of a wide strip, with nothing in between will have practically the same low inductance and r.f. resistance of the strap. This is of great practical use in grounding high frequencies.

The above does not hold where one is trying to ground *all* frequencies including high ones. R.f.i. applications and digital pulse circuits require the strap, because they contain low frequencies that do not travel so far out in the edges. The strap center area is used by the lower components of a signal, and the substitution of two wires for the edges of such a strap will cause poorer grounding in such applications. In radio work, and lightning grounding though, where you want minimum inductance, parallel conductors widely spaced will be considerably better than straps.

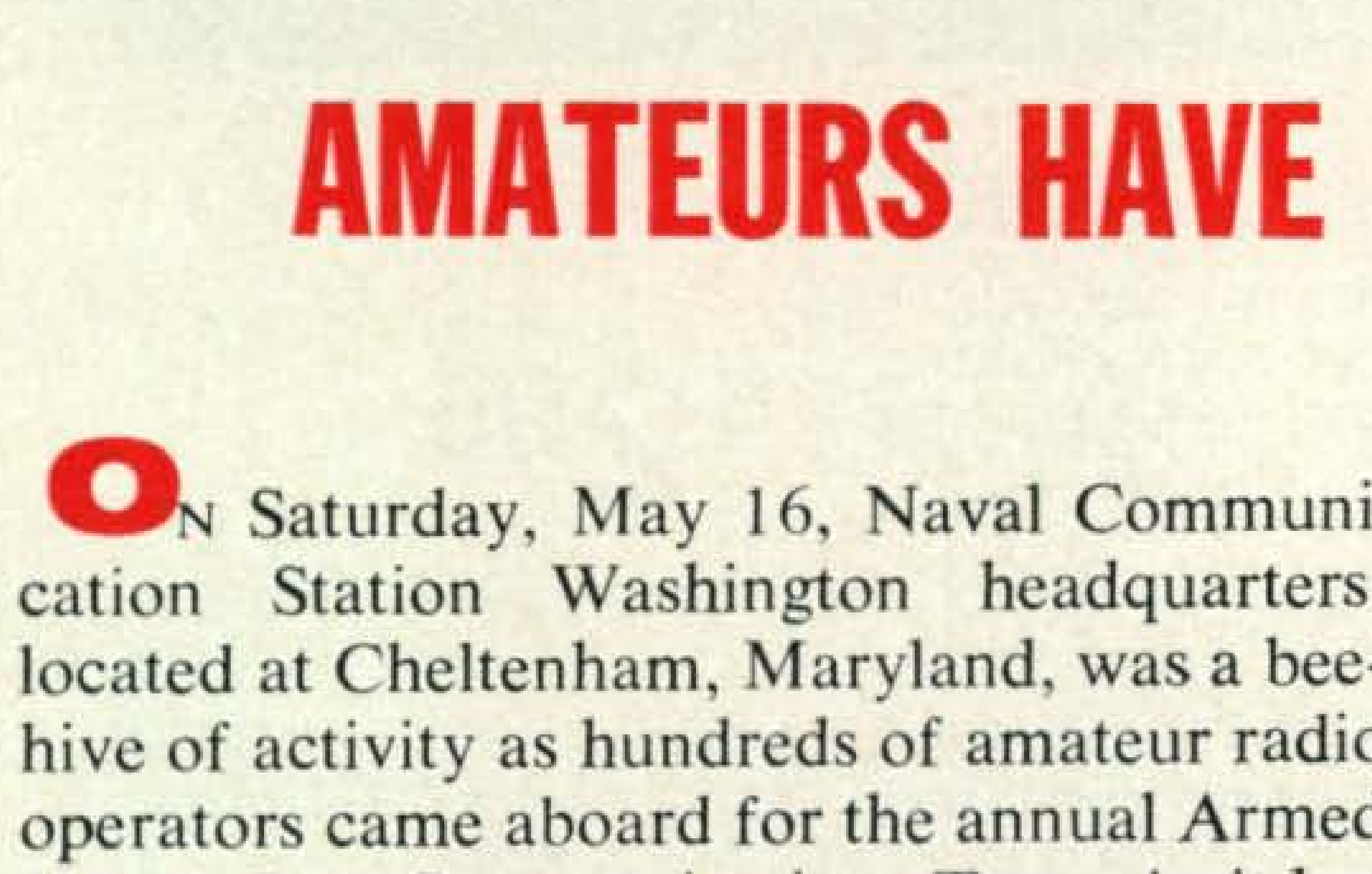
Skin effect is not a complicated subject when it is properly understood, but it does not tolerate jumping to hasty conclusions. The fact that the effects of skin currents can not be directly measured by any common instruments has led to many false assumptions concerning them. ■

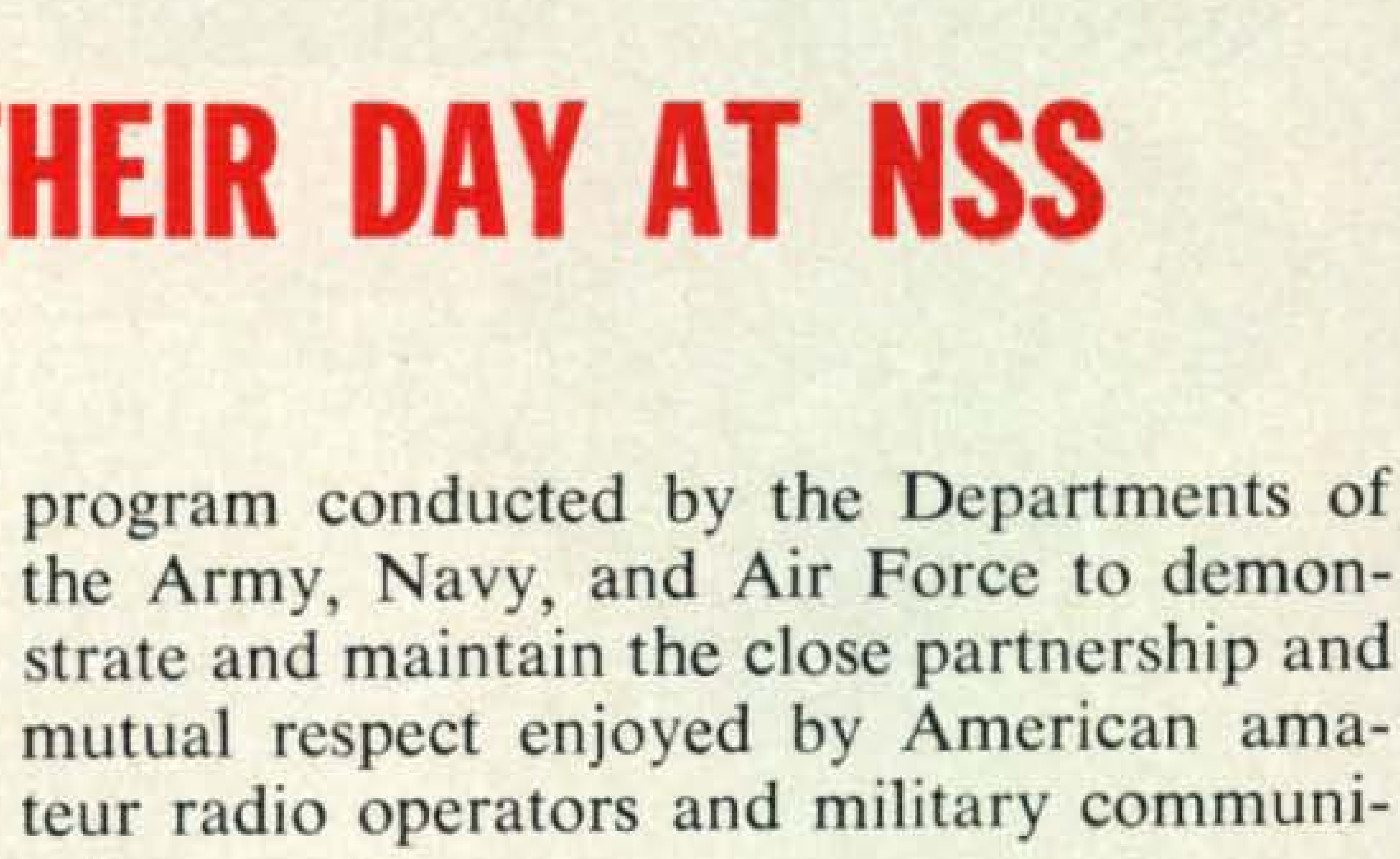
AMATEURS HAVE THEIR DAY AT NSS

ON Saturday, May 16, Naval Communication Station Washington headquarters, located at Cheltenham, Maryland, was a beehive of activity as hundreds of amateur radio operators came aboard for the annual Armed Forces Day Communications Tests. As it has done every year since 1951, NSS (the Washington call sign) turned over a portion of its facilities to the amateurs who took full advantage of them in logging almost 3,000 contacts in a twelve hour period.

This year's tests were part of an annual program conducted by the Departments of the Army, Navy, and Air Force to demonstrate and maintain the close partnership and mutual respect enjoyed by American amateur radio operators and military communicators.

1970 Marks the 45th year of broadcasts to amateurs by Naval Communications Station Washington in tribute to the fine relationship that both Navy and amateur radio operators have shared for many years. ■





Some of the activity that went on at NSS this past May 16. (Official U.S. Navy photograph)

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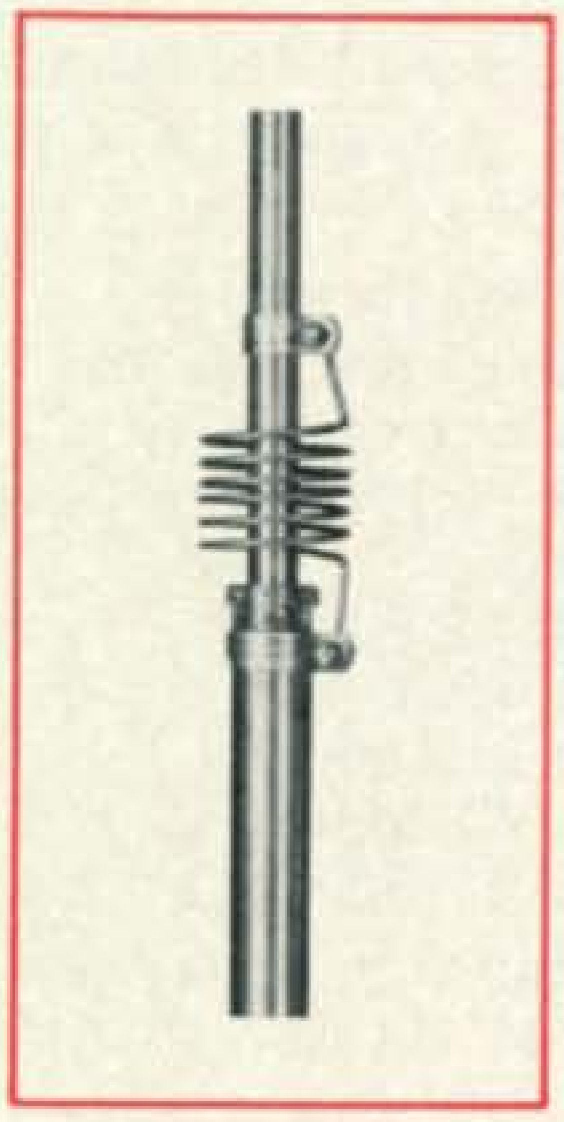
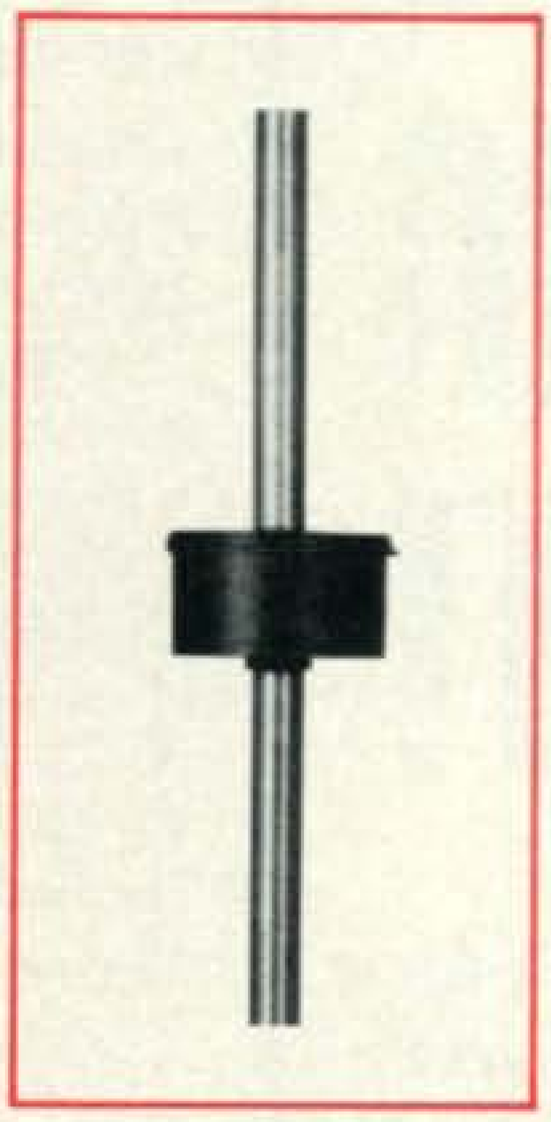


1958



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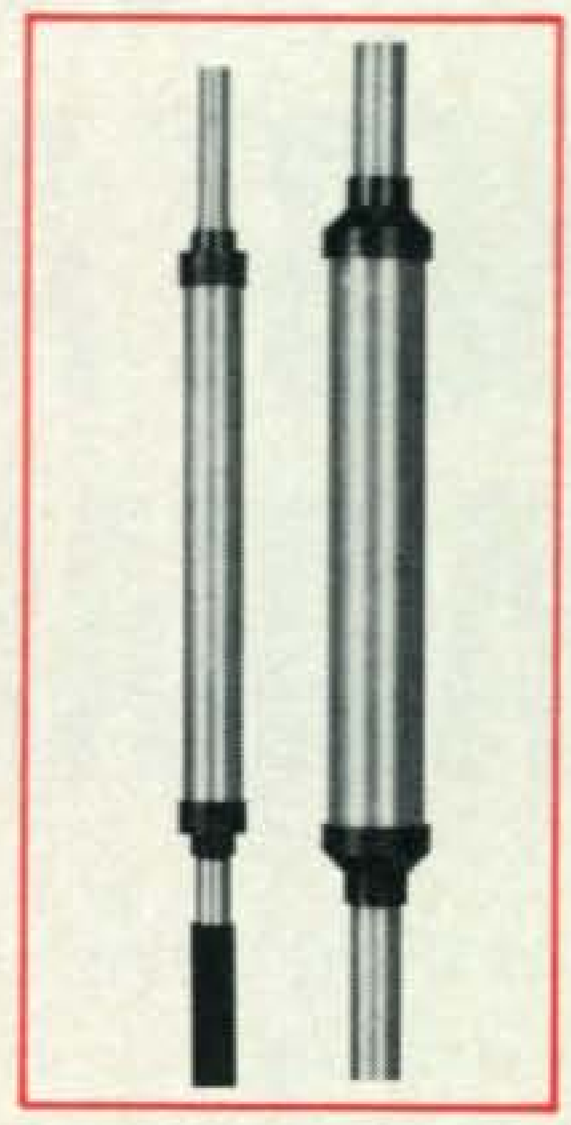

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MODEL CONTROL BY RADIO

BY HOWARD G. McENTEE,* W2SI

Part II

The second installment of this two part article covers present day control systems and the future expectations for radio control.

PROPORTIONAL control is king in R/C today, from the simplest systems to the most complex. Both are explained below. But first a few words on the "previous generation" of equipment (widely popular only 5 years ago but now completely outmoded), both in the simpler systems and in multi-control. For rudder-only, often extended to control engine throttle, so-called escapements were very popular. Operation, requiring just a pushbutton on the transmitter, was of the sequence variety. The rudder went from neutral, to right, to neutral, to left and so on, in a fixed sequence. Escapements were electrically triggered, but control moving power came from twisted rubber bands. These units were light in weight, low in cost, but had limited power and were bothered by engine vibration. Forgetting to wind the rubber band could be fatal; so could winding it too tightly! The Japanese had, meanwhile, perfected what might be called "motorized escapements;" these had a similar operating sequence but were entirely electrical in operation, had lots of power and are still used to some extent today.

Reed Systems

In the multi-control field, so-called reed systems were top dog. The transmitters could send out as many as a dozen different audio tones; these tones were fed to a "reed bank" in the receiver. There was one reed for each tone, all vibrated by a common magnetic field. Since each reed would only respond to a tone width of 2-3 cycles, all reeds could be tuned within a single musical octave; this was mandatory to prevent harmonic problems. The transmitter case had a lever switch for each *two* tones; with levers centered no audio was transmitted. Pushing a lever either way would send a tone to drive the associated servo to one or the other of its limits. Most systems could send two tones at once, so one could actuate two servos simultaneously. These systems were highly refined and very reliable. Due to sharp reed response they were relatively immune to interference.

Early reed systems were confined to four or five tones. They eventually developed 10 to

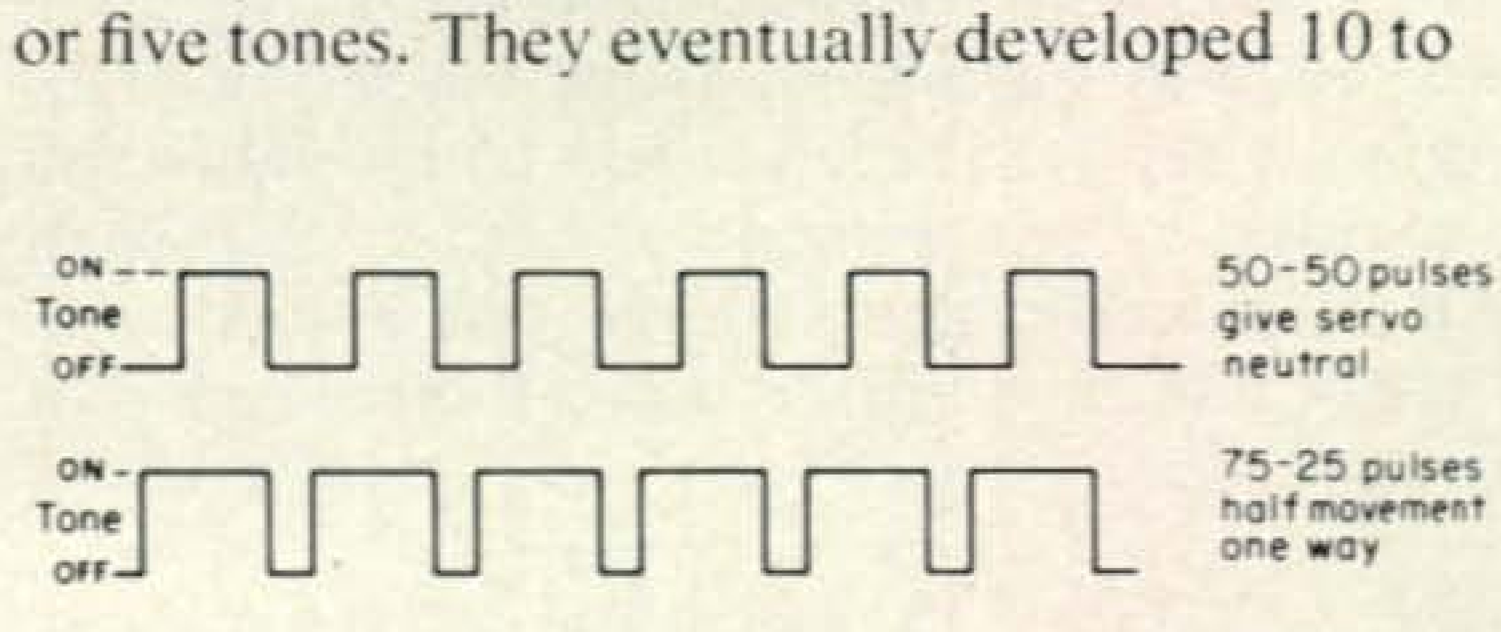
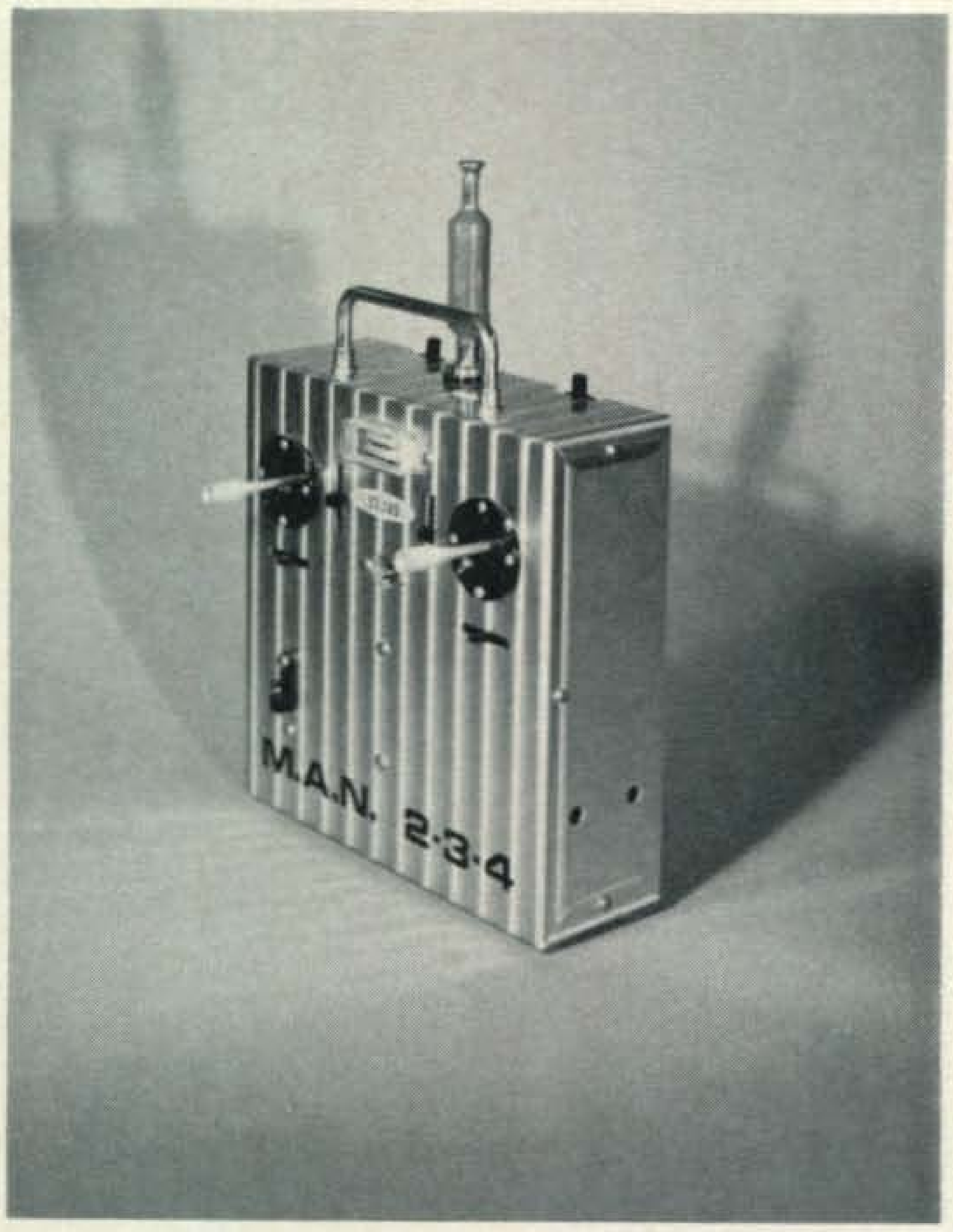


Fig. 1—Pulses require neutral and half movement to each side in a pulse propo system. Actually, infinite variation of pulse length is possible. Full Off (100% to 0%) of Full On (0% to 100%) tone gives maximum control movement in the simple systems. The pulses are usually rounded at the corners to prevent splatter.

*490 Fairfield Avenue, Ridgewood, New Jersey 07450.



A digital transmitter made by World Engines Inc., handles six controls. Each stick moves two controls (user puts thumbs on sticks when flying) and two more controls are operated by the levers at the top of the transmitter.

12 tone units which were able to handle 5 to 6 servos. The first reed receivers had each reed (all of which were fitted with electrical contacts) connected to a relay, which in turn worked the servo. By the time the reed and relay count had reached 10-12, however, sub-miniature relays were required to hold down receiver size and weight, and some very successful but tiny relays were developed. With the advent of transistors all relays could be eliminated; transistor amplifiers, triggered directly by each reed, drove the servos. This greatly reduced receiver size and weight—and boosted system reliability. Oddly, European R/C manufacturers developed similar systems, but they utilized tuned filters instead of reeds.

Pulse Proportion Systems

The earliest proportional systems were termed "pulse proportional." A pulser in the transmitter keyed the signal on and off at a fixed rate, around 3-6 p.p.s. As seen in fig. 1, equal on-off pulsing produced neutral rudder or other control. Changing the ratio of on-to-off moved the control off neutral one way or the other. In the simplest pulse systems, full tone or no tone at all gave maximum control movement. The big advantage of pulse proportional (propo) over escapements or reeds was that you could get any degree of control movement to either side, by varying pulse length. Also, there was no sequence to remember, as with escapements. Early pulsers were usually driven by electric motors; then came tube-type multivibrators, and finally semiconductor pulsers in wide use today for simpler systems.

As noted in Part I, a California experimenter (Rockwood) had published some of the elements of pulse propo in 1939, but he used a constant pulse length and did not vary it as we do today[1]. (Rockwood, an avid amateur and tinkerer, developed some of the earliest successful multi-control reed systems.) The late Jim Walker was awarded patents during WWII for pulse propo systems basically like those we use now. These early pulse systems all used motor driven servos; in the late forties, George Trammell introduced us to propo "actuators," simple and light electromagnetic units, the shaft of which would turn only about 45° each side of neutral, under varying pulse lengths. Refined units of this type are popular today in simpler systems.

Other experimenters found one could vary both pulse length and rate simultaneously; through suitable receiver circuitry these variations could handle two servos simultaneously. Further modifications made it possible to operate a third control unit, usually connected to engine throttle, but not proportionally. Here then we had "simple" pulse propo for rudder and elevator, plus "trimmable" throttle. An other experimenter, Dr. Walt Good, developed his TTPW system using two pulsed tones, which was, in those days, often more reliable than the pulse-length-rate system, and was considered to be a true "multi" system.

Feedback Servos

Pulse proportional had undeniable advantages over escapement and reed systems, but never attained real popularity prior to perhaps 1960, since there was little ready-made equipment on the market. It remained a field populated mostly by avid experimenters, as opposed to those escapement and reed users who simply wanted to fly-fly-fly. In 1960, however, a California manufacturer started the move to widespread multi-propo with an advanced four control systems; all four con-

[1]McEntee, H.G., "Model Control by Radio," *CQ*, June 1970, p. 16.

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trols could be operated simultaneously and proportionally without interaction (well, without *much* interaction, the bugaboo of propo systems handling more than one control). It was called "Space Control," was fully transistorized, utilized nickel-cad power at both transmitter and receiver, and had what are termed "feedback" servos.

Most previous propo systems utilized spring-centered servos—both in the magnetic styles (actuators) and the motor-driven category. Springs tend to keep the servo at neutral, and to drive it back to neutral after a displacement to either side. Such servos work fine but they draw continuous battery power, even when at neutral. When they are moved to either side some of the torque is "wasted" in tightening the springs. All non-feedback pulse propo systems exhibit "wiggling" controls; the surfaces flap back and forth in time with the pulse rate. This flapping is much reduced with motor-driven servos where high gear ratios are utilized. Feedback servos draw motor current only when they are actually moving, or holding a control displaced against the airstream. Thus they consume much less average power (waste no power on centering springs, there is less wear on moving parts and *no* surface wiggling whatever. Feedback servos were not new with the Space Control system but this concern reduced them to model size (and cost), starting a trend that continues right up to the present. This system was a combination of the Good TTPW and pulse-length-rate propo techniques.

Digital and Analog Propo Systems

Quite a few "analog" propo systems were marketed following Space Control, some operating on entirely different principles. Most all utilized feedback servos. Then in 1965 came a system that was to revolutionize the multi-propo field, introducing a technique that is supreme in this field today. The Bonner Digimite was marketed; it was called a "digital" system (hence the trade name) to distinguish it from the previous multi propo systems, which were termed analog. The latter operate by smooth and continuous variation of some system parameter—pulse length or rate, audio tones, etc. The servo moves in smooth response to such variation. Digital systems operate to some extent like digital computers, much of the circuitry is either full on or full off with no in between variations. This brings several advantages. The servos always receive full power, even when they

Simplest digital control system provides only one control. The superhet receiver is at the left and the feedback servo is at the right.

are to be moved only a short distance. (Not true of analog systems.) Digital systems are relatively easy to "tune up" at the factory, most analog systems are not. No fussy audio filters are required, key elements in the majority of analog rigs.

A digital outfit operates by sending a series of pulses, but they are far different from analog system pulses (fig. 2). For a five-control system, six very narrow pulses are trans-

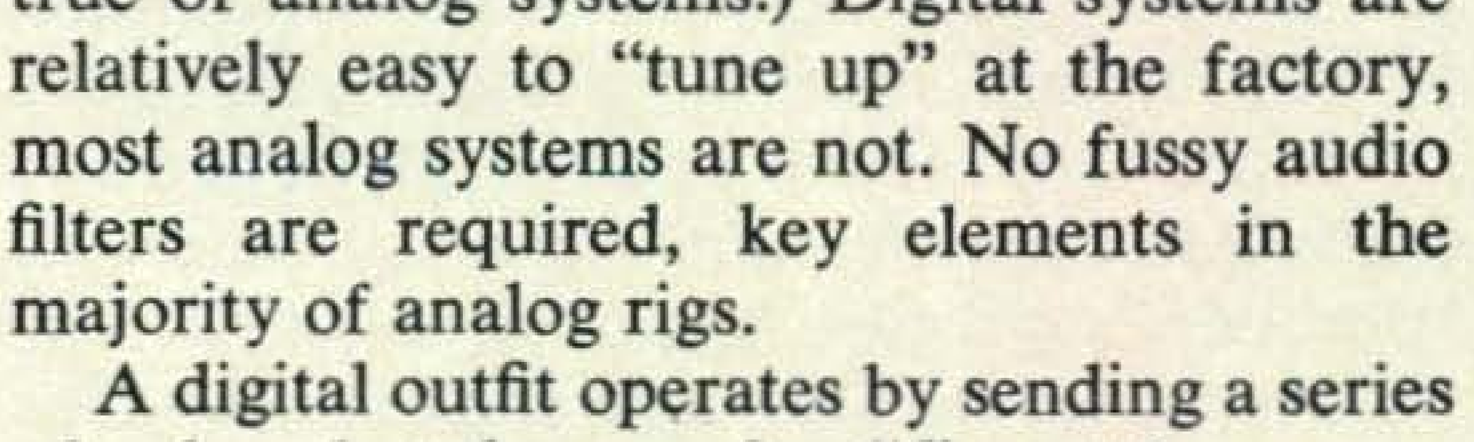

Fig. 2—Pulse presentation of the Heathkit 5 control digital system. The reference pulse never moves. The control pulses move to the right or left from the neutral position shown. When any control pulse is moved, all pulses to the right of it move the same distance. Note that the Channel 4 pulse has been moved to the right (dotted line) Channel 5 pulse has also moved right an equal amount, but actually Channel 5 has not changed its spacing from Channel 4 so, in effect, it has not moved. Any pulse can be linked to any servo.

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Pulse proportional servo made by Ace Radio Control. It allows rudder, elevator and throttle operation via pulse length rate changes. The small side arm is linked to throttle. Note the heavy centering spring.

mitted, followed by a relatively long "synchronized pause." As seen in the drawing, the transmitter sends a steady c.w. signal which is keyed-off to produce the pulses. (Sharp on-signal pulses would work as well, but the receiver would be much more open to interference.) A set of pulses followed by the synch pause is called a "frame." Frame repetition rates run around 50-100 per second. After the first pulse at left, each succeeding pulse represents one servo in the system. Moving each pulse a little to one side or the other, accomplished in the transmitter by pots on the control sticks and an associated "encoder," will move just one servo accordingly. After the incoming signal is detected, a "decoder" separates the pulses, sends each to the proper servo. The servo amplifier actually receives a series of short sharp pulses, but these are "stretched" to provide practically smooth d.c. for the servo motor. These servos, being of the feedback variety, draw no motor power (or very little) unless servo movement is called for, or they have to hold against external pressure.

Digital systems can easily be expanded for more controls by increasing the frame length and putting in more individual off-pulses. A wide variety of digital outfits are available today, providing from one control up to eight.

Early digital systems were unbeliveably complex in terms of component count, at least compared to the analog outfits of the day. Most of them included what is termed "fail-safe" which contributed greatly to this complexity. Fail-safe, which had been a feature of most all analog systems, moves all servos to neutral (and the throttle servo to low speed) if signal is lost for any reason, also in some cases of interference. Digital systems, however, have been refined and simplified (fail-safe was dropped from them early in the game) and present day parts counts are quite reasonable.

It was originally felt that very high quality test equipment was a vital necessity in order to check the accurately-timed pulses and digital manufacturers all do have such equipment. But it has been proven by several makers of digital kits that such systems can be assembled and tuned up with practically *no* test equipment whatever. The Heathkit system, for example, may be completely checked using only the output meter of the transmitter, temporarily reconnected to various test points. Very careful kit engineering is vital to allow such simple tuneup.

Digital systems may sound like Utopia, but they do have some weak points. For example, during those off-pulses any interference present can partially or wholly fill the off-signal periods, and wreak chaos with the circuitry—and the servo positions! This interference doesn't have to come from other transmiters; hash produced by servo motor commutators can cause trouble. So can most any two pieces of bare metal in the model, just rubbing together! Real care is necessary in installation, therefore, with metal-to-metal joints eliminated wherever possible. Control horns, linkage components and other small plane parts made of nylon help here. The digital makers have done a fair job of designing this noise-sensitivity out of their receivers. There is still some way to go, however, before digital systems can be considered as interference-resistant as analog propo systems. They have still farther to go before the levels reached by the very sharply-filtered (by the reeds themselves) reed systems are attained.

The Future

What of the future? There'll probably be more miniaturization for both simple analog and complex multi-digital systems. Certainly we'll see wider use of integrated circuits which are used to only a modest extent in R/C so far. We need better reliability (which includes better noise and interference immunity). There will be rapid chargers for our nickel-cad batteries; these are available right now in the photographic field. Some makers are trying f.m. systems; they see no great advantages so far but further work may change this view. Will we go to still higher frequencies? Only the FCC can determine this. In any case, it's certain that model R/C will continue to advance at possibly an even more rapid pace than it has in recent years. ■

See page 102 for New Reader Service

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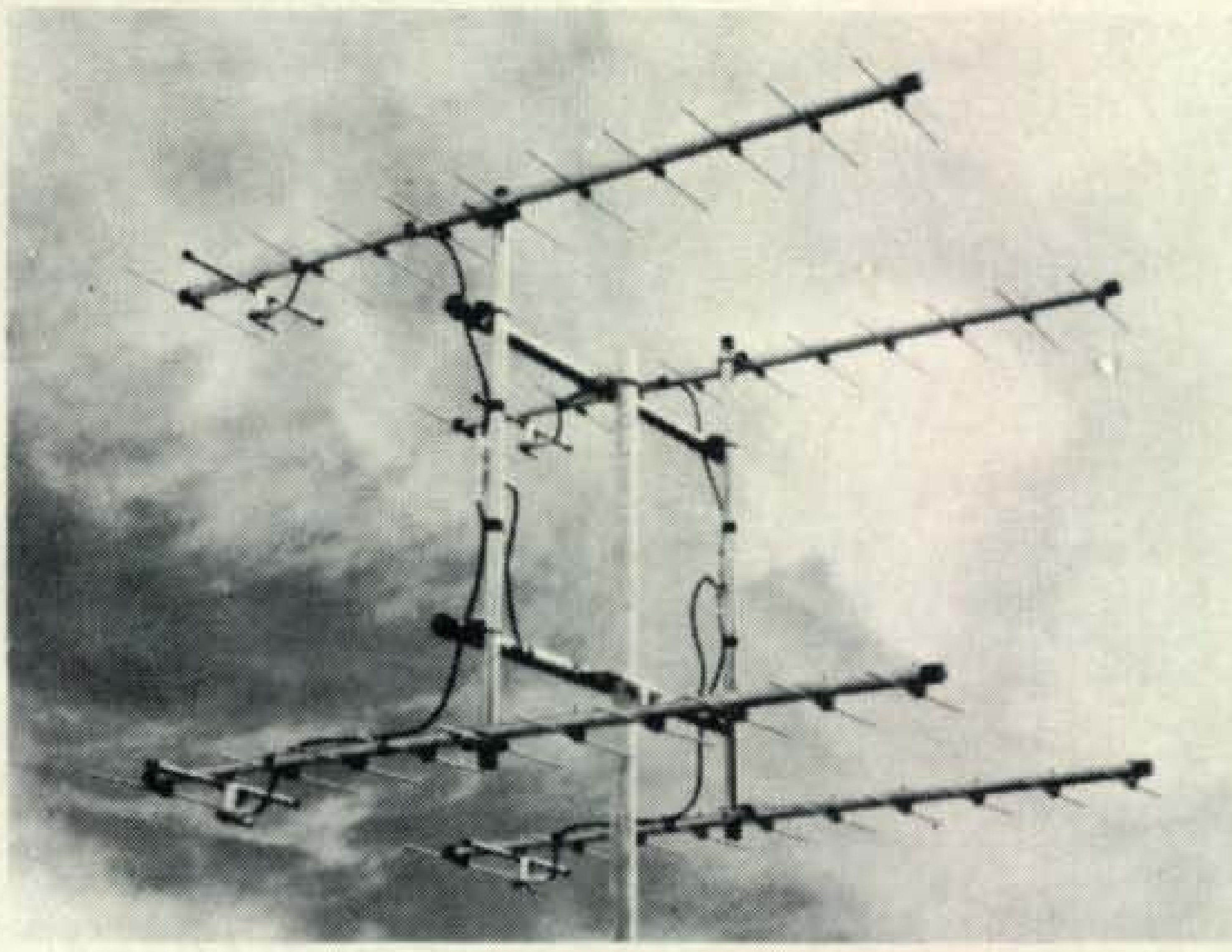
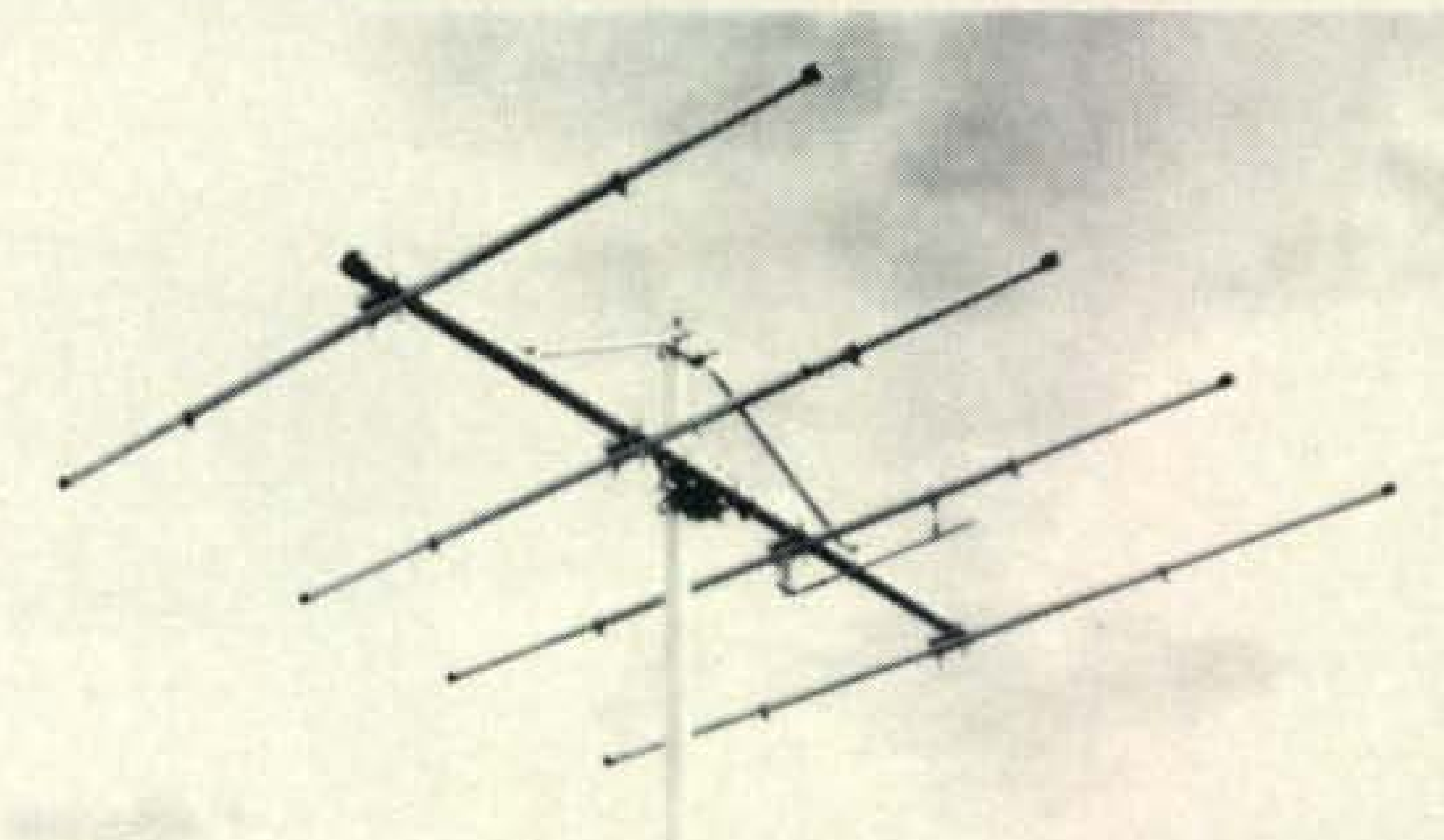
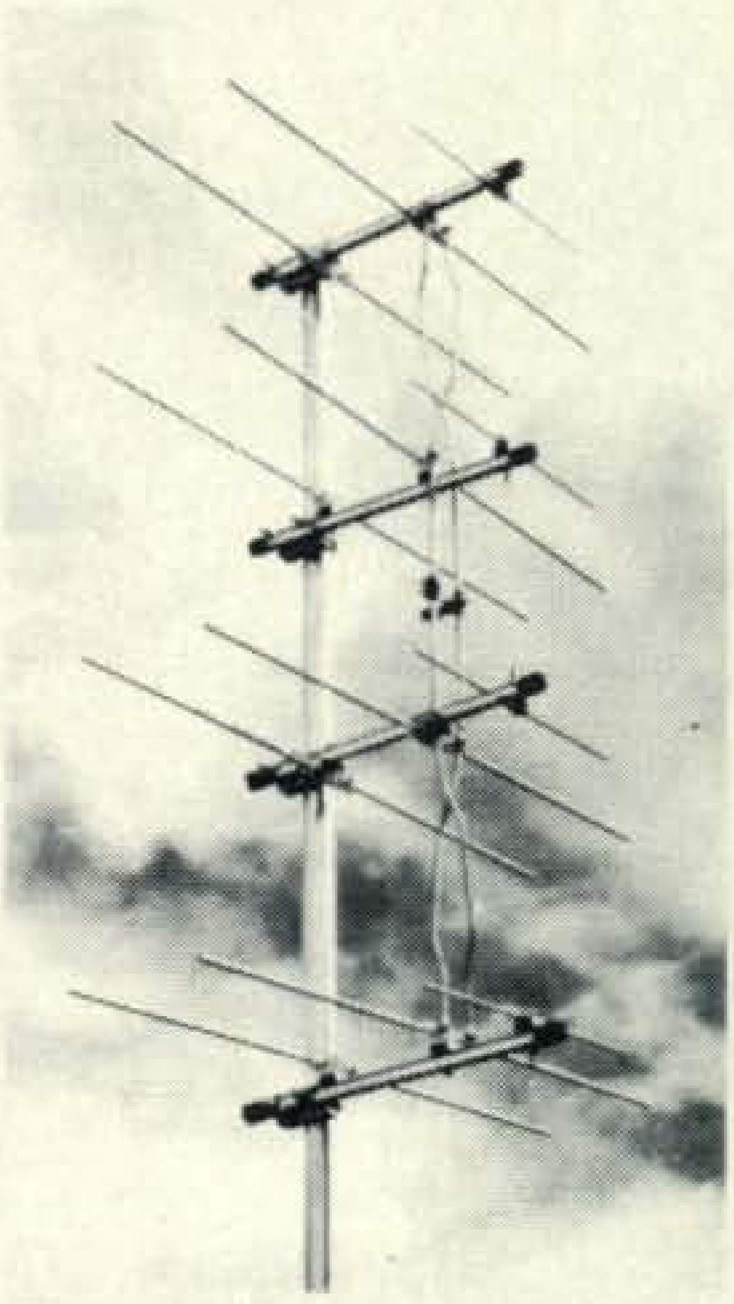
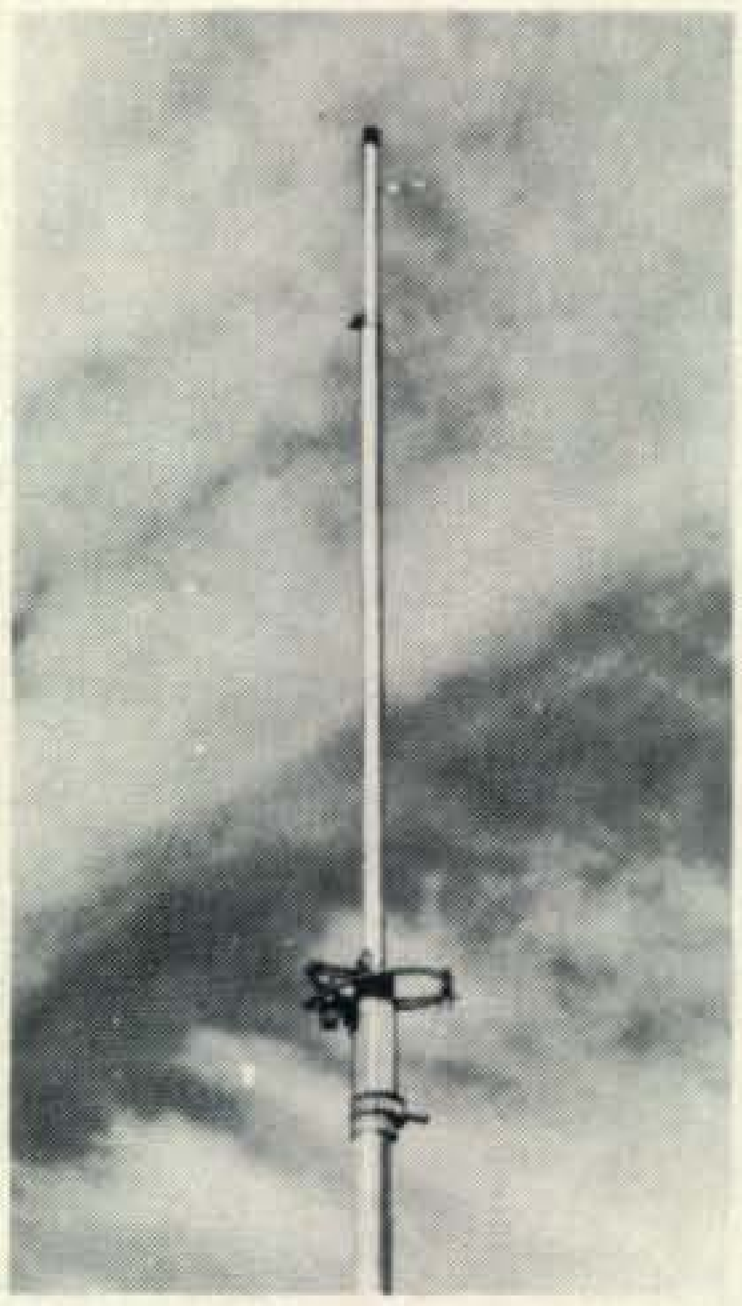
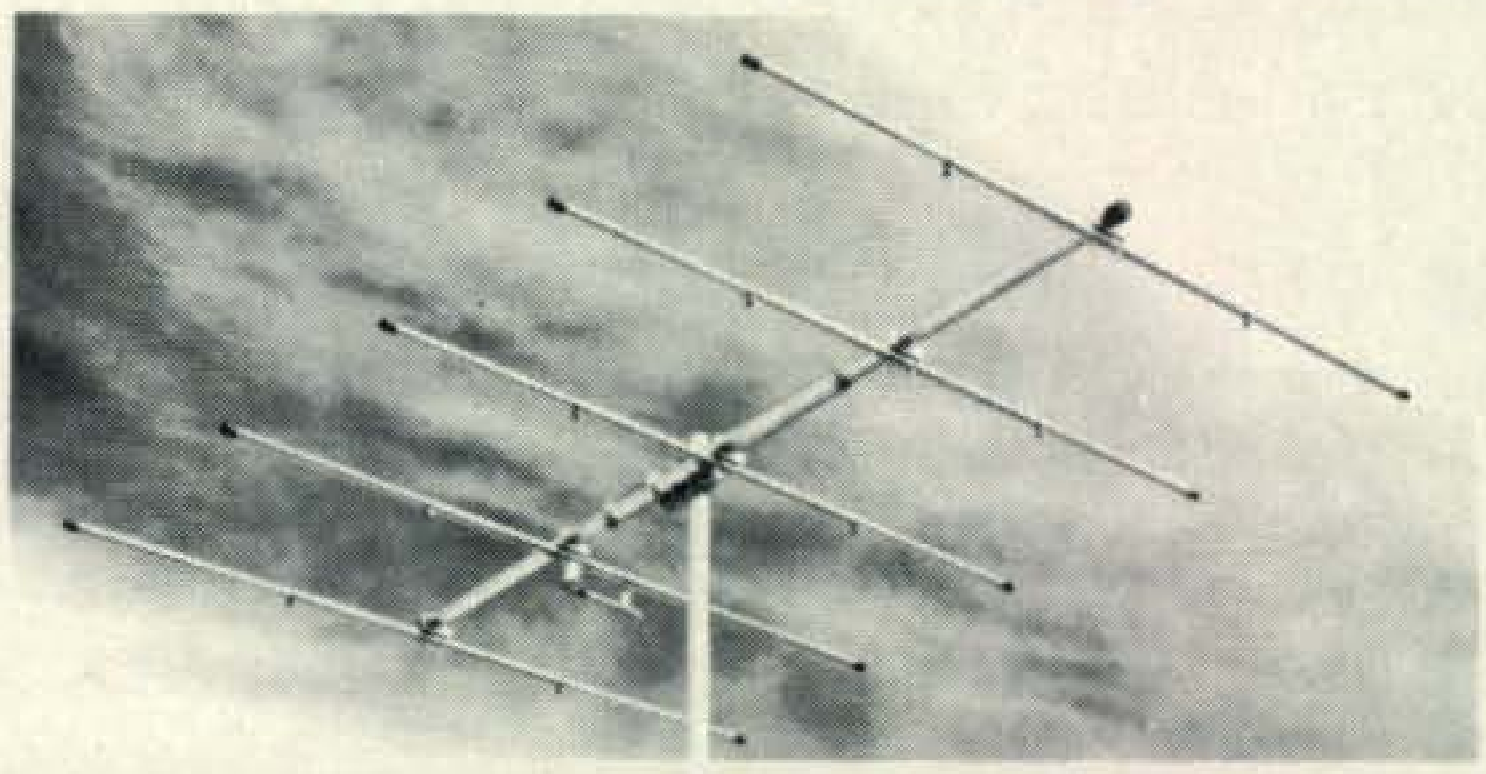
ANTENNAS WITH A "PATTERN OF FIRSTS" IN COMMUNICATIONS











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Galaxy hit the bull's-eye!

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See page 102 for New Reader Service

Results of the
1969 CQ World Wide DX (Phone) Contest

BY FRANK ANZALONE,* W1WY

WE had another good one back in October, even surpassing the 1968 Phone Contest which I had predicted as probably being the greatest one of them all. Practically all areas will show new scoring records. I counted over 20 new continental and world records.

A total of 1377 logs were received, a modest 3% increase over last year. This in spite of a 4% decrease in US entries, but which was more than compensated by a 40% increase out of the USSR.

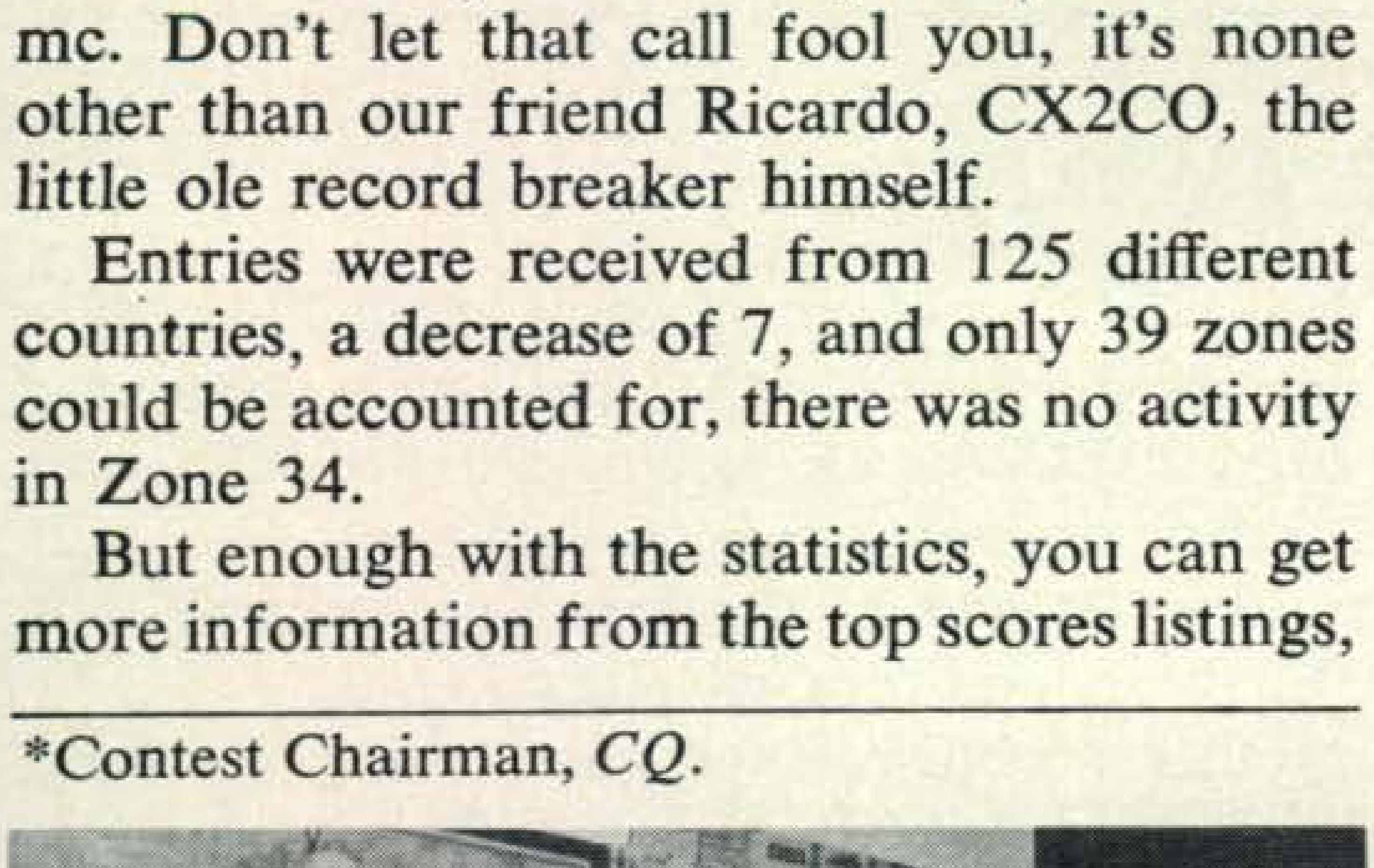
There seems to be a trend to multi operation, which does cut down on the number of entries but increases the on-the-air activity.

Breaking a million by the single operator all banders is now commonplace, a total of 44 stations made it this year. But breaking a million on a single band is something else. This was finally achieved by CWØAA on 21 mc. Don't let that call fool you, it's none other than our friend Ricardo, CX2CO, the little ole record breaker himself.

Entries were received from 125 different countries, a decrease of 7, and only 39 zones could be accounted for, there was no activity in Zone 34.

But enough with the statistics, you can get more information from the top scores listings,

*Contest Chairman, *CQ*.



Would you believe that this attractive YL has a 23 year old son ready to take over the operation of YV1-YC? We welcome multi-operator stations, but we would rather exchange contest numbers with you Irmgard.

PLAQUE & TROPHY WINNERS

Single Operator, Single Band

WORLD—North Jersey DX Association. Dr. Harold Megibow Memorial Trophy. Won by Talma Drummond, PY4OD.

CANADA—Gene Krehibiel, VE6TP Trophy. Won by Martin Rosenthal, VE3MR.

CARIB./C.A.—Gus Huether, HR2GK Trophy. Won by Pedro Piza Jr., KP4AST.

Single Operator, All Band

WORLD—Bill Leonard, W2SKE Trophy. Won by James B. Neiger, 9Y4AA.

U.S.A.—Potomac Valley R.C. Trophy. Won by John Lawrence, K1KTH.

EUROPE—W4BVV Operators' Trophy. Won by Klaus Kuhlemeier, DJ4PT.

OCEANIA—Jack Chaulk, KS6EJ Trophy. Won by Edward DeYoung, KH6GLU.

CARIB./C.A.—Harold Fox, W3AA Plaque. Won by Eloy Marez, YS1XEE.

AFRICA—Gordon Marshall, W6RR Plaque. Won by Carlos Silva, CR6LV.

Multi Operator, Single Transmitter

WORLD—John Knight, W6YY Trophy. Won by Station ON4UN (OPrs. ON4UN, DK1FW, G3XVY.)

Multi Transmitter, Multi Band

WORLD—Radio Club Venezolano Trophy. Won by Station PJØDX (Oprs. K1-ANV, K3EST, K3NPV, K4AQQ, PJ2CC, W3AZD, W3MSK, W3ZKH, W4BVV)

Contest Expedition

WORLD—Stuart Meyer, W2GHK Trophy. Won by Station PJØDX.

Special CQ Plaques

WORLD—Single Band Champion. Ricardo Sierra, Jr. CWØAA.

EUROPE—All Band Champion. Robert Snyder, LAØAD.

See page 102 for New Reader Service

Single Operator – All Band

Station	QSO's						Zones						Countries					
	1.8	3.8	7	14	21	28	1.8	3.8	7	14	21	28	1.8	3.8	7	14	21	28
9Y4AA		121	300	844	792	999		14	19	35	33	29		39	47	101	82	86
KV4FZ	40	334	310	1107	762	1122	8	19	18	34	30	27	12	59	54	92	66	81
LAØAD		114	115	393	440	1363		10	14	32	27	27		34	38	71	61	67
HC1TH		42	119	751	521	800		8	15	30	25	17		15	32	76	64	52
DJ4PT		70	107	487	640	568		10	14	27	36	30		36	35	70	68	65
I1BAF		47	117	808	347	582		8	12	30	30	29		32	41	75	65	57
I1FLD		43	66	708	565	657		7	10	34	28	29		28	29	87	58	56
VS6DR		4	30	607	731	867		3	11	39	33	33		4	16	101	74	66
KH6GLU		46	92	412	744	852		11	13	31	28	26		12	16	78	58	42
OZ1LO		110	119	340	599	583		11	15	34	27	32		35	39	76	66	65
U.S.A.																		
K1KTH		78	71	254	360	359		19	16	33	36	34		39	35	87	85	82
W6RR		33	85	205	549	456		13	15	30	35	31		19	32	71	79	75

Multi-Operator – Single Transmitter

Station	QSO 1.8	3.8	7	14	21	28	Zones 1.8	3.8	7	14	21	28	Countries 1.8	3.8	7	14	21	28
ON4UN		143	208	1177	1138	673		18	23	39	35	34		55	54	129	95	75
OH2AM	9	88	90	1160	1291	628	2	10	15	39	36	34	7	45	52	132	98	94
CW3BH	7	18	67	499	1183	1749	3	8	17	32	32	29	7	14	25	73	72	77
UA9KAX		73	283	1032	412	578		11	19	38	29	34		36	58	127	81	100
DLØWR		76	97	886	817	961		10	14	35	30	30		40	61	96	72	78
PJ1AA		136	278	682	759	969		9	17	36	26	24		25	42	106	63	54

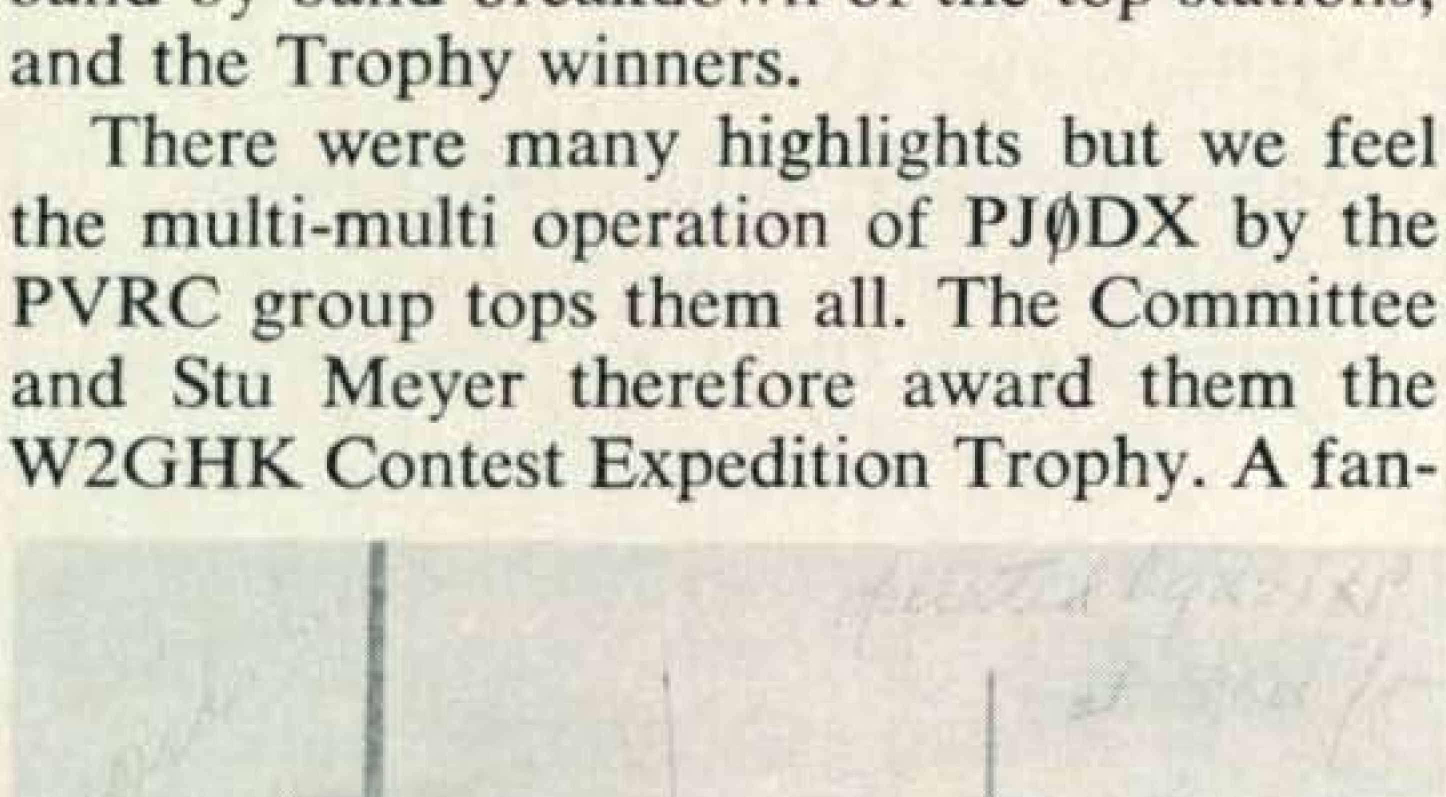
Multi-Operator — Multi-Transmitter

Station	QSO 1.8	3.8	7	14	21	28	Zones 1.8	3.8	7	14	21	28	Countries 1.8	3.8	7	14	21	28
PJØDX	36	452	929	2739	2699	2415	4	22	24	39	35	32	8	60	70	146	116	88
4M1A	22	395	608	2352	2098	1882	4	15	23	38	34	32	7	46	70	146	97	88
OH5SM	30	309	513	1813	2304	1802	2	12	27	39	37	36	8	52	78	153	120	115
WA2ZAA	4	127	228	936	1183	1012	3	19	29	39	38	33	3	46	78	138	126	103
OH1AA	15	202	416	1681	1203	1017	2	8	26	39	33	36	6	33	73	135	92	96
W6VSS	9	78	267	625	1265	683	4	16	28	36	36	36	3	30	57	127	98	97

Band-by-band breakdown of top scores.

band-by-band breakdown of the top stations, and the Trophy winners.

There were many highlights but we feel the multi-multi operation of PJØDX by the PVRC group tops them all. The Committee and Stu Meyer therefore award them the W2GHK Contest Expedition Trophy. A fantastic 10,014 contacts were made, but they did not all figure in the scoring. A computor dug out 744 dupes, leaving a net of 9270 and a score of better than seventeen and a half million. It was also interesting to note that 5653 conacts were W/Ks.



The fixed mobile location of C3ICQ and the camper used by K2IXP high in the mountains of Andorra. Larry experienced freezing temperatures at this 8500 ft. altitude.

Oher Contest Expeditions of note were FG7TI/FS7 by PJ7JC, W9ZRX and VE3-EUU; ZF1CC by WB4MKU, W4DGY and W4ZRZ; VP2VP by VP2VI, VE3ACD and VE3GMT; Lord Howe by VK2BKM; OHØAM by OH2BH; C31CQ by K2IXP who operated fixed mobile from a camper in freezing temperatures; and DJ6QT/CT3 which was sadly terminated prematurely because of the death of Walter's infant daughter while the family was spending a vacation in Madeira.

The call 9Y4AA may be new but not its operator. Jim Neiger, ex-ZD8Z again had the extra QSO point advantage for all those W/K contacts and nosed out Herb, KV4FZ for top honors.

See page 102 for New Reader Service

The 10 meter position of the West Coast Multi-Multi "Big Gun" W6VSS. That's Cam, W6QY and Dick, W6ICJ doing their share in putting Dale Hoppee's station at the top of the list in zone 3.

Another donnybrook was the one between I1BAF and I1FLD with Mino avenging last year's defeat by Antonio by a very narrow margin.

The OH DX Ring was not able to round up a full crew for multi-multi operation, so they joined the Single Transmitter catagory. However a surprise new entry in this category, ON4UN took top honors.

A new call that had everybody scratching their heads was WA2ZAA. It was none other than old K2GL reorganized to operate in the Extra portions of the bands.

The openings on all bands were good but exceptional on 28 mc. It seemed to me that everybody flocked to 10, some because of the fine opening, other because of the unrestricted frequencies on that band.

To quote W5EU, "10 was beautiful, best opening I have heard in 38 years of hamming." And K4KJN was bemoaning the fact that he had to buck the "big guns" with only a TA 33 Jr., but Mickey had picked the right band and won himself a certificate.

Of course "Murphy" reared his ugly head as usual. W4VAN says he was Murphied to death. Don blew a trap on 40, followed by a balun and finally the rotor went kaput.

However, I don't think WA5LSM can blame Murphy for his difficulties. Marlin claims his linear blew up when a pretty YL walked under his antenna. (Boy! they sure must be wearing those mini's short down Texas way!)

And do you suppose Murf had anything to do with VE4ZP's cousin using John's home as a hide-out for their elopement and louse up John's contest week-end?

A common complaint was that some DX stations do not identify themselves often enough, adding to the confusion in a pile-up. But even a pileup has its moments of humor. An incident as told by Maurice Duke, ZM1TZ relates that during an unusually heavy W/K pile-up there was complete silence after he had given a report to a station. Suddenly a voice pipes up, "Who's dat wun for, Mr. Dook?"

JA1AEA yearly expresses disappointment that we do not have a continental Trophy for Asia. Well, how about someone in JA land donating one? All our awards are donated.

K5YMY had no complaints, he enjoyed the contest so much that he wants us to make it a two week-end affair for each mode. (That's a privilege reserved for ARRL only.)

If you want to fatten your 5 B DXCC total this is the contest where to do it advises WAØLYO, Perry added 26 new countries to his 10 meter total.

This is the 11th *CQ* Contest for the group at SM5AZU. They figure the fellows have been operating together for over 200 years. (I don't quite figure how they arrived at that.)

K6HN was disturbed by the incessant calling of some stations, even when the DX station was already working someone. But WA3JRY found everybody most gentlemanly, even in the closing hours of the contest. (By that time they were just numb. Hi!) I would add however that on the whole, operating ethics were generally commendable, the pattern being set by the operating procedure of the DX station.

Our week-ends are working days for the Muslim world, therefore YA1HD found it impossible to put in full time. We are grateful for the time Helmut did put in and give the boys a shot at a rare one.

Experience gained over-seas evidently pays off because K1KTH, the USA Trophy winner is ex-KA7AB. Nice going John.

K3CLA is the club call of the St. Joseph's Prep School Radio Club and the boys had a ball in the contest but didn't like the idea of spending an extra 48 hours in school. (I would suggest an organized operating schedule.)

The group at G3VUM had problems of another nature. The station was located in the same building as a dance hall. Came Saturday night they were forced to QRT because "CQ DX" was getting into the hall's P.A. system.

[*Continued on page 94*]

TOP SCORES

SINGLE OPERATOR

ALL BAND

9Y4AA 4,318,925	I1BAF 1,972,316
KV4FZ 4,180,500	I1FLD 1,962,492
LAØAD 2,512,692	VS6DR 1,913,680
HC1TH 2,183,024	**KH6GLU ..1,859,130**
DJ4PT 2,017,169	OZ1LC 1,825,600

SINGLE BAND

28 mc	7 mc
4X4JU 570,836	SM5BPJ 138,061
OZ3SK 448,500	VE3KZ 92,442
KG6AQY 435,528	G3NLY 62,880
SM6AEK 424,974	OH3VV 55,680
UV3GM 424,156	W2DXL 52,008
DL6EN 400,288	I1NU 34,036

21 mc	3.8 mc
CWØAA 1,068,552	CT2AT 51,129
G3HCT 832,016	DJ2YA 40,448
VE3MR 550,212	G3IGW 21,775
VE3FHO 467,852	K3UZE 19,229
HB9ZY 406,830	VE7BDJ 13,653
UA1DZ 399,455	OE1WO 12,322

14 mc	1.8 mc
PY4OD 919,068	VE3BS 1,947
CR6LK 742,755	GM3YCB 1,080
DL8NU 717,558	DL1CF 468
UA9DN 699,105	K1PBW 299
KP4AST 619,714	WA4SGF 216
DJ2BW 597,681	OK1MP 190

MULTI-OPERATOR SINGLE TRANSMITTER

ON4UN 5,117,716	UA9KAX ..3,673,969
OH2AM 5,091,228	DLØWR 3,623,616
CW3BH 3,944,460	PJ1AA 3,345,042

MULTI-OPERATOR MULTI TRANSMITTER

PJØDX 17,613,400	WA2ZAA ..6,743,880
4M1A 12,993,600	OH1AA 6,470,325
OH5SM 11,593,925	W6VSS 4,788,240

Number groups after call letters denote the following: Band (A-all); Final Score: Number of QSOs; Zones and Countries. Certificate winners are listed in **bold face.**

Phone Results

SINGLE OPERATOR NORTH AMERICA

United States

K1KTH	**A**	**1,523,820**	**1122**	**138**	**328**
W1OKG	**A**	**836,628**	**844**	**105**	**241**
K1KNQ	"	783,288	799	103	241
W1BIH	"	494,949	514	102	241
W1UYU	"	391,395	508	84	185
W1PYM	"	373,998	516	75	174
W1IXL	"	277,344	442	71	145
W1AX	"	161,491	217	88	189
WA1ANR	"	150,705	343	44	109
K1IMP	"	146,374	284	45	118
W1PCD	"	83,226	199	51	92
W1BHV	"	62,634	153	46	97
W1BPW	"	54,194	118	56	102
W1DIT	"	40,474	123	40	78
K1THQ	"	34,960	128	30	65
W1KXM	"	30,616	134	30	56
W1ETU	"	26,765	96	33	68
W1WY	"	20,610	85	32	58
W1PLJ	"	10,251	69	16	35
WA1KQM/1		8,642	54	22	36
WA9HHH/1		7,791	57	17	32
W1FLN	"	5,900	49	19	13
K1KDP	**28**	**274,747**	**705**	**32**	**107**
WA1HFN	"	175,680	503	30	90
WA1FBX	"	46,665	189	22	63
WA1FHU	"	13,050	84	17	41
K1HVV	**21**	**273,092**	**703**	**31**	**103**
WA1IRG	"	125,545	370	32	87
WA9NSR/1	**14**	**117,120**	**339**	**34**	**88**
W1ESN	"	90,594	245	35	91
W1TOU	"	18,834	79	29	57
W1EIN	**3.8**	**5,440**	**56**	**11**	**29**
K1PBW	**1.8**	**299**	**13**	**5**	**8**
W2PV	**A**	**1,501,164**	**1195**	**117**	**324**
WB2RLK	**A**	**1,011,852**	**1038**	**104**	**243**
WA2IZS	"	471 859	545	95	212
WA3BZA/2		450,575	585	85	184
W2YD	"	325,740	476	81	163
WA2LLK	"	313,684	473	71	167
K2QIL	"	305,467	433	75	176
W2UI	"	262,890	403	77	153
WB2UZU	"	250,418	401	66	151
K2OQJ	"	232,630	389	66	139
WA2RSX	"	188,700	332	63	141
W2LEJ	"	186,220	341	59	131
WB2IEC	"	179,025	294	67	150
K2KHR	"	160,300	327	58	117
W2EHB	"	157,182	279	64	137
K2PZF	"	111,048	231	57	111
WB2ZGI	"	87,600	214	45	101
WA2CSP	"	86,301	229	31	98
W2SNI	"	77,763	197	49	98
K2DDK	"	68,978	140	64	118
W2DIZ	"	65,550	154	61	89
W2UCV	"	64,527	164	45	92
WA2IRU	"	23,247	110	29	52
W2ITG	"	20,928	79	36	60
W2KZN	"	8,292	89	20	34
F3VN/W2	"	4,742	38	15	27
W2ZPG	"	2,101	25	12	21
W2YT	**28**	**233,856**	**629**	**32**	**96**
W2DKM	"	169,910	454	31	99
K2BK	"	131,157	386	32	85
K2ISP	"	96,120	305	27	81
W2EQK	"	50,800	216	21	59
WA2JGV	"	31,950	148	23	52
K2BMI	"	18,760	100	23	44
W2PU	"	12,545	72	21	44
WB2NXL	**21**	**146,625**	**405**	**31**	**94**
WB2WJO	"	104,620	352	26	69
W2ERO	"	37,098	168	24	57
WA8SMW/2		10,650	77	13	27
W2AIR	**14**	**104,784**	**309**	**33**	**85**
K2FCV	"	47,895	176	2ʋ	67
WA2AYP	"	28,028	156	21	56
WA2DTP	"	8,788	67	16	36
W2DXL	**7**	**52,008**	**238**	**23**	**65**
WA2UJM	**3.8**	**4,712**	**55**	**11**	**27**
W2EQS	1.8	81	8	4	5
W3MVB	**A**	**731,300**	**722**	**108**	**247**
W3DQG	**A**	**709,296**	**754**	**99**	**237**
W3CRE	**A**	**642,902**	**722**	**91**	**222**
K3TGM	"	516,559	612	84	209
WB2VQG/3		486,325	584	93	182
WA3CGE	"	451,233	580	83	194
W3AXW	"	434,145	545	86	195
WA3ATX	"	402,369	529	80	187
W3AES	"	331,289	487	77	166
W3KT	"	327,660	455	83	171
K3EUR	"	305,520	464	68	160
K3OTY	"	301,464	443	75	162
W3FDU	"	273,372	454	64	145
W3NX	"	273,182	385	75	172
W3DHM	"	257,907	405	73	148
K3AIG	"	212,888	413	57	121
WA3HGV	"	187,980	357	57	138
W3BYX	"	178,135	333	58	139
W3ECW	"	176,472	295	73	143
W3OV	"	175,244	322	58	135
W3GRS	"	155,844	260	73	161
K3UZY	"	146,452	285	61	127
W3DRD	"	139,104	268	58	126
WA3LKH	"	111,684	233	57	107
WA3JRY	"	99,385	236	40	99
W3HVM	"	70,083	211	45	72
W3NNK	"	69,823	189	43	88
W3EVW	"	65,940	164	49	91
W3GHD	"	52,706	131	60	86
W3CGS	"	52,200	155	38	78
WA3IXF	"	48,614	160	36	73
W3FHR	"	36,905	128	47	74
K3TVE	"	11,036	66	28	34
WA3KKL	"	9,169	64	18	35
W3CBF	"	6,355	53	12	29
WA3ENM	"	5,246	43	14	29
W3ML	"	4,794	36	23	28
W3FPP	"	2,184	41	26	31

A welcome station in a contest, KG4DS. "Doc" wanted to know if this was the first entry out of Gitmo. Its been a long time, but we had one back in 1960.

See page 102 for New Reader Service

K3HPG	28	276,080	676	36	104
W3VEQ	"	192,372	544	31	92
W3KDD	"	138,500	381	34	91
W4SXN/3	"	5,617	50	15	26
WA3ETT	"	1,150	22	8	15
WA3KXX	"	1,034	16	8	14
K3GKU	21	39,963	186	24	53
WA3JBN	"	26,973	126	27	54
WA3GUL	14	180,082	477	37	96
W3EAN	"	1,156	24	5	12
K3UZE	3.8	19,229	112	19	48
WA3KEG	"	8,305	62	15	40
W4ZCY	A	1,302,400	1120	120	287
W4NBV	A	762,870	757	114	240
W4QBK	A	720,288	699	109	257
W4SYL	"	704,182	658	108	271
W4DM	"	447,616	585	89	180
K4EZ	"	353,010	452	93	194
K4RTA	"	258,804	374	79	173
WA4FFW	"	242,511	375	73	156
K4SHB	"	232,022	322	79	172
W4TMR	"	202,908	339	76	146
K4PCL	"	187,532	385	51	122
W4EZ	"	163,237	259	81	158
W4HOS	"	144,576	269	63	129
K4ARP	"	140,220	282	62	118
WB4INE	"	124,780	255	58	112
W4WJJ	"	122,902	267	60	103
WB4JCV	"	117,779	221	64	109
W4ZXI	"	110,334	183	64	149
K4DSN	"	103,252	226	59	107
W4GZD	"	99,382	229	50	108
WB4GGA	"	94,080	226	52	108
W4DRK	"	89,920	203	50	110
K4KQ	"	74,643	159	70	129
W4TKN	"	60,656	166	48	88
W4JK	"	59,640	177	41	79
W4ZM	"	43,680	133	43	74
W4OMW	"	41,876	138	37	79
W4WBC	"	37,524	128	40	66
K2UOP/4	"	26,093	106	35	62
W4KMS	"	25,016	88	34	72
W9QGP/4	"	20,169	85	28	55
W4KFC	"	19,295	80	34	51
W4GF	"	14,861	68	30	47
K4FJK	"	12,797	68	27	40
WB4AMT	"	11,997	72	20	39
WA4YBV	"	9,222	66	20	38
W4WRY	"	7,018	47	21	37
K4BTQ	"	1,050	20	12	13
K4KJN	28	207,690	556	33	96
K4II	"	187,648	501	32	96
W4LBP	"	173,972	491	33	89
W4VAN	"	120,726	364	30	84
W4DFK	"	117,794	376	31	87
W4CRW	"	85,767	265	30	83
W4ZSH	"	82,362	270	29	77
W4DQD	"	82,005	273	28	77
W2GHK/4	"	46,870	189	21	65
W3ZNB/4	"	22,742	100	25	58
W4OGG	"	17,550	100	25	40
K4THA	"	16,352	82	23	50
W4BGH	"	9,894	72	16	35
W4DS	"	6,578	54	17	29
W4YHD	21	285,390	732	36	99
WA4UXU	"	198,731	531	34	105
W4NQM	"	186,450	591	30	80
W4FRO	"	145,083	404	35	102
K4SKI	"	133,596	435	31	77
K4SXD	"	105,108	326	30	84
K1BFX/4	"	73,629	257	29	72
W4DRW	"	72,814	261	26	72
WA4CCW	"	42,496	182	23	60
K4TWJ	"	18,655	112	23	42
W4BJ	"	15,087	108	18	29
W0YVA/4	"	16,464	110	20	36
W4ORT	14	107,085	300	33	88
K5FSE/4	"	42,185	177	33	72
W4ATC	"	9,328	66	17	36
W4BYB	7	25,992	130	20	56
WA4SGF	1.8	216	14	5	7
W5JAW	A	817,614	757	110	268
W5IOU	"	681,840	673	113	247
WA5LSM	"	104,625	293	55	80
K4ZDK/5	"	91,266	213	54	105
W5FCX	"	74,420	218	53	69
W5OB	"	57,972	136	50	84
K5IKL	"	42,416	169	32	56
W5RO	"	18,490	79	34	52
W5QNY	"	18,228	80	40	53
W5ULN	"	10,212	61	28	41
W5EDX	"	6,804	40	26	37

W5WMU	28	168,268	468	29	89
W5EU	"	136,904	429	30	79
W5NMA	"	131,312	400	28	88
W5YPX	"	125,419	327	36	97
W5RSX	"	87,675	295	29	76
WA5UCT	"	24,768	136	20	44
W5OJZ	"	16,632	96	21	42
K1DWQ/5	21	15,510	102	20	35
W5NOP	14	152,490	377	37	101
K5YMY	"	66,690	201	31	83
W5KC	"	55,076	206	30	68
K5YRK	"	8,684	65	21	31
WA5RTG	7	10,136	70	20	36
W5RTQ	1.8	168	8	5	7
W6RR	A	1,513,600	1328	124	276
K6AHV	A	1,194,960	1098	126	264
WA6IVN	A	906,825	916	113	226
K6ERV	"	722,535	825	112	207
WB6UDC	"	615,393	729	103	200
WA6EPQ	"	515,040	622	107	183

K6SVL	"	132,160	418	32	80
WB6AQF	"	111,628	324	34	84
W6CS	"	63,984	270	25	61
W6JKJ	"	7,200	53	20	28
K6YFZ	"	4,760	49	13	21
W6ERS	"	1,620	20	13	17
W6GBY	"	390	10	6	9
W6QJW	21	227,930	699	31	84
K6ZQP	"	213,642	650	34	83
K9ZMS/6	"	95,608	347	30	68
WB6FCR	"	78,684	343	27	52
WA6GMR	"	69,372	290	28	54
W6TCQ	"	61,776	253	25	63
K0KHP/6	"	51,128	221	29	54
W6GRV	14	108,053	325	36	85
W6EUF	"	90,000	249	39	86
K6YRD	"	68,016	223	33	76
W6VNH	"	55,230	185	35	70
W6BUD	"	15,456	74	29	40
W6ZKS	"	8,201	53	25	34
WB6AUH	"	221	13	6	5
W6KFM	7	13,776	91	22	34
W7AYY	A	258,510	439	75	135

Pedro Piza Jr. KP4AST winner of the HR2GK Trophy for the highest single band score in the Carib./C.A. area. Pedro did it on 14 mc, setting a new North American record for that band.

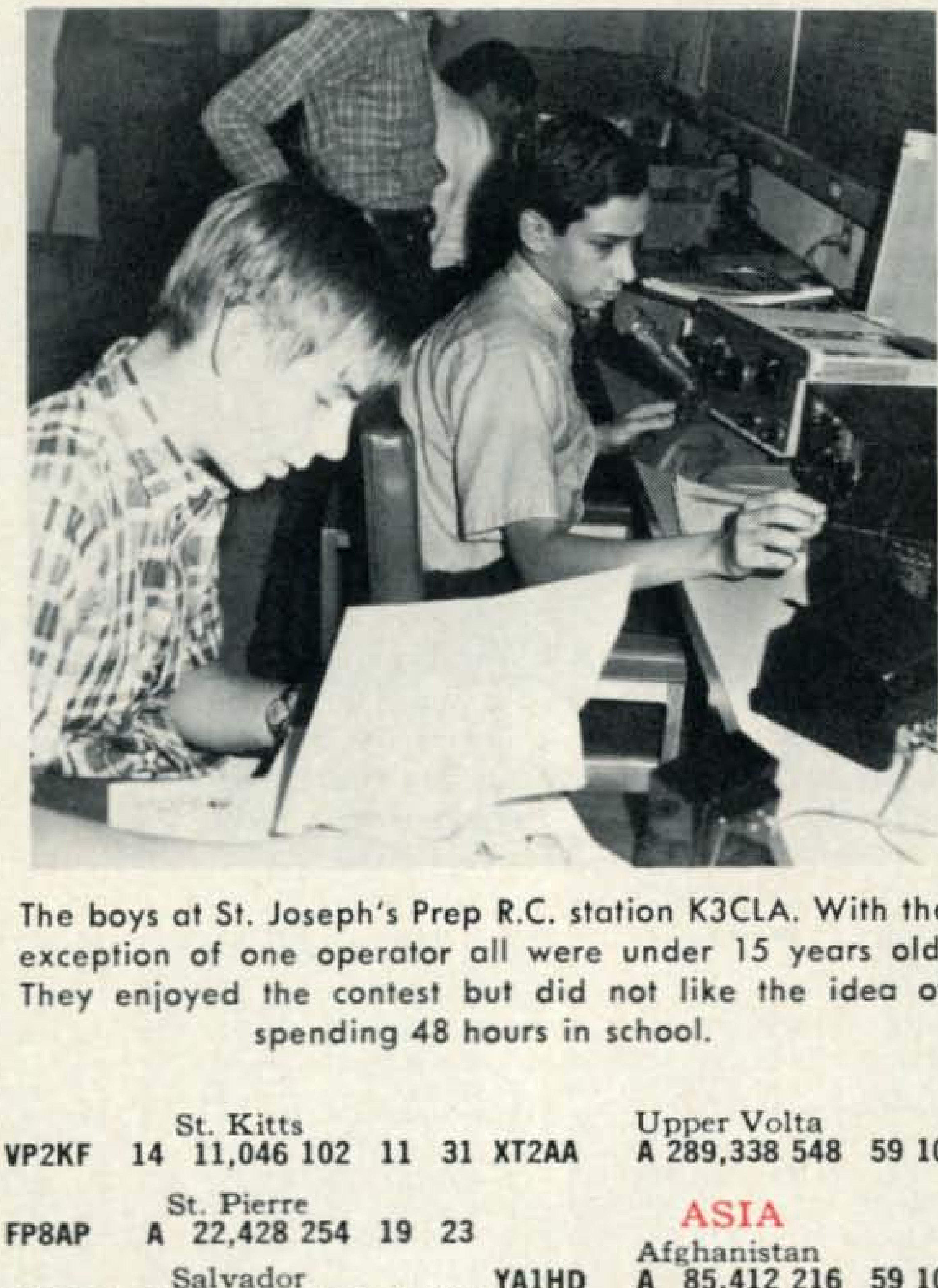
W6DGH	"	484,139	574	105	202
K6SXA	"	368,940	519	93	167
K6DYQ	"	292,404	428	90	146
W6NTQ	"	200,803	433	61	96
K6PIH	"	179,172	372	64	98
W6KJS	"	178,200	371	68	97
K6BTT	"	177,471	335	74	115
K6HN	"	177,016	265	75	157
W6ZKM	"	175,680	344	68	112
WB6KBK	"	159,424	323	77	111
W6EJJ	"	152,725	276	80	125
W6EYY	"	136,776	295	64	100
WA6AHF	"	135,569	266	69	112
K3OLG/6	"	111,450	276	59	91
W6JKR	"	102,176	217	79	127
WA6CRI	"	101,380	277	57	80
WA6BVY	"	9,322	214	59	95
K6GKU	"	88,090	276	44	71
WB6CQY	"	87,984	224	59	85
W6ZBS	"	81,837	170	69	104
W6WX	"	77,234	187	59	87
W6EBO	"	76,447	162	61	102
K6OC	"	63,196	176	50	72
K6MG	"	48,448	163	37	58
K6AO	"	37,760	112	50	68
WB6UOM	"	30,102	123	37	50
W6CLM	"	27,255	128	33	46
WB6YNK	"	18,850	99	29	36
W6EJ	"	16,195	76	31	48
W6OL	"	12,996	77	23	34
W6KHS	"	12,312	63	34	42
K6FK	"	11,495	74	22	33
K6MHD	"	5,966	56	14	24
W6RQZ	"	3,776	46	17	15
W6KG	"	3,060	26	19	26
K6TZX	"	1,860	25	16	14
K6NA	28	263,271	710	35	92
W6ED	"	185,094	556	34	92
W6ISQ	"	142,302	440	33	78
W7GUI	"	209,364	319	76	142
W7BJ	"	175,788	359	68	103
W7RI	"	104,220	215	67	113
W7TZL	"	89,614	215	72	101
WA7JCB	"	74,760	217	45	75
W7GVX	"	47,880	145	51	75
W7MBX	"	15,252	84	24	38
WA7MUY	"	5,586	67	24	18
W7UDG	28	63,457	246	26	63
W7EXM	"	58,236	230	30	62
K7RDH	"	37,315	167	24	61
W7FCD	"	1,875	26	11	14
K9LBQ/7	21	214,528	588	36	92
WA7ISQ	"	105,651	409	31	60
W7MSI	"	76,024	307	28	58
WA7GWL	"	68,874	305	28	50
W7YQG	"	52,065	291	23	42
WA7LRK	"	29,670	248	15	28
K7OSK/7	"	20,196	202	13	21
K7INE	14	87,438	269	37	77
K7YWZ	"	24,400	110	33	47
W7NG	"	21,912	117	24	42
K8HZU	A	1,043,696	1039	103	241
WA8ZDT	"	472,360	576	91	189
W8GEG	"	391,548	504	91	177
W8TWA	"	334,273	450	91	172
WA8OSE	"	320,479	428	79	178
W8DQL	"	275,628	422	75	148
K8GVK	"	225,280	363	72	148
W8AEF	"	150,212	284	64	124
WA8AJI	"	143,444	275	65	133
W8AQZ	"	114,880	254	52	108
W8AJW	"	113,816	264	62	102
WA8PRR	"	75,394	200	48	101
K8CMO	"	65,486	170	47	90
W3ZBW/8	"	48,600	146	42	78

K8ZLF	"	47,863	136	46	85
W8WUO	"	41,470	133	38	72
W8MBB	"	41,202	134	38	71
W8YGR	"	35,640	99	52	83
W8GMX	"	21,675	104	23	52
WB8AYH	"	21,560	86	32	56
WA8SGV	"	20,880	93	30	50
WA8PNS	"	18,849	103	35	68
WB8DKZ/8		7,695	62	17	28
WA8UHL	28	121,590	398	30	75
W8MKE	"	102,582	290	29	94
WA8SWV	"	60,912	219	29	65
WB8APJ	"	42,856	169	26	62
W8SMX	"	34,668	150	23	58
K8BPX	"	24,190	154	18	41
W8DC	"	16,900	99	24	41
WB8AVH	"	15,759	107	17	34
W8PCS	"	14,690	80	22	43
W8BQV	"	14,472	77	24	48
W8BDO	"	12,921	79	19	40
K8BVY	"	8,840	62	18	34
WA8ZNC	"	3,348	39	12	24
WA8LYF	21	197,169	548	33	90
W8HXZ	"	101,442	335	29	77
K8CGD	"	94,400	329	27	73
W8WEJ	"	64,504	265	24	64
K8ULU	"	58,125	218	27	66
K8IDE	"	50,200	180	30	70
WA8TKM	"	45,520	202	24	56
W8MVN	14	108,818	293	37	97
K8YPU	"	62,916	216	36	71
W8JFD	"	27,391	108	33	58
K8MMH	"	330	10	6	9
K8HLR	7	28,564	136	22	52
W8EDU	3.8	2,052	37	10	17
WA8VMQ	"	1,020	25	8	9
K9ECO	A	1,098,360	956	122	283
W9IOP	A	993,820	1005	101	239
W9DWQ	"	457,743	553	90	201
W9QQN	"	415,558	510	101	185
W9RER	"	403,512	556	82	176
W9KYZ	"	383,454	519	88	175
W9JJV	"	187,720	353	64	126
WA9REC	"	171,588	345	62	119
WA9HJM	"	133,332	357	78	142
WA9NJB	"	97,152	242	43	95
WA9BVY	"	91,322	214	59	95
K9LET	"	67,815	178	46	91
W9SDK	"	63,244	140	56	107
W9KRU	"	50,232	119	67	89
K9HDZ	"	49,664	177	35	62
W9CRN	"	48,952	154	43	73
K9BUG	"	26,059	94	42	61
WA9WXL	"	15,576	91	21	38
W9DY	"	15,066	63	36	57
W9GXH/9	"	13,172	64	28	46
W9WYB	"	9,897	68	20	31
K9VQK	"	4,920	43	17	24
WA9YYY	"	3,431	35	21	26
W9EXE	28	187,736	529	33	91
W9YYG	"	144,823	422	34	85
W9LKI	"	86,328	302	28	71
K9UON	"	71,238	270	27	66
W9RQM	"	67,900	236	29	71
K9VFF	"	25,530	123	22	52
WA9VLI	21	122,304	495	30	66
W9ZTD	14	146,070	403	38	97
K9CLO	"	13,340	89	19	39
WA9WVJ	"	538	16	9	9
WØEMS	A	730,458	788	113	221
WØACT	"	230,672	396	69	139
WAØKDI	"	188,739	335	69	132
WAØVBV	"	137,772	287	62	110
WØGYH	"	120,073	254	58	109
WØNZY	"	118,767	232	65	112
WØURN	"	79,695	192	61	100
KØEKR	"	69,948	194	47	87
WAØPRS	"	53,213	147	44	83
WAØOML	"	30,076	117	47	56
WØFWN	"	26,228	117	28	51
W4UDS/Ø	"	8,004	50	21	37
WØUCK	"	5,555	38	22	33
WØJYE	"	4,185	35	16	29
KØGJD	28	173,160	463	32	98
WØKBG	"	95,142	326	30	71
KØRNZ	"	93,197	303	31	76
WAØLYO	"	54,684	227	25	59
WAØGUH	"	43,800	200	21	54
WØAIH	"	40,716	186	23	55
WAØCVS	21	154,860	466	31	85
KØZIP	"	59,220	252	25	59
WAØMOJ	"	17,458	112	23	35

KØUKN	14	130,872	358	38	95
WØSEA	"	20,736	109	24	48
KØCVA	3.8	3,430	45	11	24
Alaska					
KL7EQG	A	101,052	536	38	46
KL7GJY	"	81,144	551	30	33
KL7MF	"	71,910	298	31	63
KL7JDO	21	262,660	1154	33	59
Barbados					
8P6CX	28	88,305	431	26	61
Bermuda					
VP9BK	A	202,272	370	63	133
VP9BY	14	290,760	935	31	89
Canal Zone					
KZ5AT	A	1,181,179	1781	83	186
KZ5WH	"	421,414	806	66	151
KZ5KZ	"	414,678	1025	67	116
KZ5II	14	168,795	618	32	83
Canada					
VO1AW	A	168,195	396	44	111
VE1SH	A	222,838	583	47	107
VE1EK	"	15,111	81	23	50
VE1ANZ	28	34,153	315	14	35
VE1AIH	21	152,190	504	30	84
VE2AYU	A	562,240	720	80	200
VE2IZ	"	98,974	281	44	98
VE2AFC	21	156,700	543	30	90
VE2WA	14	25,564	116	29	54
VE3WQ	A	707,490	863	98	217
VE3BMB	"	344,163	475	84	183
VE3AIU	"	330,240	479	75	165
VE3HJ	"	229,458	364	71	158
VE3ETM	"	56,160	162	43	87
VE3BR	"	50,490	184	34	68
VE3US	"	36,952	125	42	82
VE3DNR	"	21,560	71	41	69
VE3EDC	28	127,820	450	30	80
VE3MR	21	550,212	1292	39	117
VE3FHO	21	467,852	1109	36	119
VE3BPQ	14	164,674	413	36	101
VE3BSJ	"	152,180	444	36	104
VE3KZ	7	92,442	610	20	51
VE3BS	1.8	1,947	74	6	5
VE4ZP	A	52,178	182	46	69
VE4AR	"	4,576	50	8	24
VE4ZX	21	47,460	284	24	46
VE4RP	3.8	2,449	52	10	13
VE5US	A	1,032,731	1416	85	216
VE6AVR	A	347,655	620	85	146
VE6AAV	"	218,805	648	52	93
VE6TP	"	182,574	361	72	117
VE6AP	"	131,970	291	46	113
VE6ARD	"	126,688	549	45	62
VE6BR	"	50,050	116	46	64
W8ILH/VE6		18,352	93	27	46
VE6AIK	28	18,944	292	14	18
VE6RP	21	118,657	596	26	51
VE6NW	"	105,750	458	29	61
VE6AGV	"	91,512	343	26	67
VE6AJD	"	48,480	308	20	40
VE6GN	14	224,128	706	38	98
VE6BB	"	206,629	669	38	89
VE6MC	"	107,932	334	36	85
VE6GB	"	98,828	283	36	88
VE6GQ	"	57,530	180	33	77
VE6AO	"	46,827	177	33	66
VE6AED	"	43,542	208	26	56
VE6AQZ	"	5,460	52	11	24
VE7AZG	28	29,657	281	22	25
K7LPZ/VE7	21	39,096	303	22	32
VE7CE	"	16,796	122	19	33
VE7SV	14	516,132	1301	39	123
VE7BDJ	3.8	13,653	162	16	25
VE8OK	A	161,063	311	69	104
VE8RX	14	458,055	1235	39	106
Greenland					
OX5BL	14	253,330	1134	31	67
OX3AB	"	43,641	238	22	46
Guadeloupe Is.					
FG7XX	A	320,544	631	78	134
Guantanamo Bay					
KG4DS	A	543,753	1319	63	126

Guatemala					
TG9US	28	736	17	6	10
TG9GF	21	258,916	1169	28	70
TG9UZ	14	220,010	1060	24	74
Jamaica					
6Y5AH	14	87,198	352	)23	68
Mexico					
XE1AZ	A	180,960	498	51	105
XE1UA	14	57,270	318	27	56
Nicaragua					
YN1MG	A	62,752	542	42	64
Panama					
HP1JC	A	132,510	532	26	79
Puerto Rico					
WA8ZZZ/KP4	A	74,752	574	30	34
KP4DBR	21	238,770	1212	25	65
KP4YT	"	18,942	108	22	43
KP4AST	14	619,714	1760	36	116
KP4CL	"	459,420	1587	35	95

Mozambique					
CR7IZ	A	95,592	242	62	106
CR7IK	28	48,790	198	28	57
CR7FR	14	51,660	184	36	69
Rhodesia					
ZE1CY	A	1,107,890	1350	89	177
ZE1JE	21	80,465	295	31	64
ZE2JE	14	101,200	362	29	59
Rwanda					
9X5LM	A	79,727	239	41	82
South Africa					
ZS5XA	A	1,542,368	1678	103	211
ZS1DC	"	241,500	418	72	138
ZS6ACK	28	196,300	667	30	70
ZS6DW	7	1,144	20	12	14
South West Africa					
ZS3S	A	274,920	566	59	115
Tanzania					
5H3KJ	A	1,500,525	1502	111	240
5H3LV	14	72,750	270	30	67



The boys at St. Joseph's Prep R.C. station K3CLA. With the exception of one operator all were under 15 years old. They enjoyed the contest but did not like the idea of spending 48 hours in school.

St. Kitts					
VP2KF	14	11,046	102	11	31
St. Pierre					
FP8AP	A	22,428	254	19	23
Salvador					
YS1XEE	A	849,420	1549	79	163
Virgin Islands					
KV4FZ	A	4,180,500	3725	136	364
AFRICA					
Angola					
CR6LV	A	1,679,600	1732	110	230
CR6IK	14	742,755	1542	38	131
Cameroun					
TJ1AK	14	54,004	217	31	61
Cape Verde Is.					
CR4BC	14	252,906	684	31	91
Gabon					
TR8DG	A	72,760	243	36	71
Kenya					
5Z4LW	28	193,560	554	34	86
Madeira Is.					
DJ6QT/CT3	A	914,977	1174	71	192
Morocco					
CN8HD	A	1,240,744	1677	74	174
CN8BB	"	36,112	259	27	47
CN8DW	14	223,973	766	29	68
Upper Volta					
XT2AA	A	289,338	548	59	107
ASIA					
Afghanistan					
YA1HD	A	85,412	216	59	104
Hong Kong					
VS6DR	A	1,913,680	2239	119	261
India					
VUØDK	A	1,665,660	1735	103	242
Iran					
EP2BQ	A	1,759,110	1626	104	278
Israel					
4Z4HF	A	1,110,793	1339	83	198
4X4HM	"	22,568	137	16	40
4X4JU	28	570,836	1522	34	99
4X4VF	14	59,520	258	21	59
Japan					
JA1AEA	A	1,584,093	1769	110	203
JA3USA	A	604,125	933	90	135
JA1NDO	"	290,658	525	71	122
JA1DFQ	"	164,576	406	65	83
JA2ACC	"	145,590	250	79	132
JA9BE	"	132,030	319	65	97
JA2PH	"	102,245	303	54	67

JA6CNL	"	100,810	228	66	104
JA7BSK	"	99,450	386	36	54
JA7CDV	"	89,310	289	55	75
JA1FJB	"	60,696	206	50	58
JA2HNP	"	59,902	169	50	72
JA6FFV	"	56,244	170	54	75
JA1ALX	"	46,863	150	57	70
JA2VY	"	34,529	169	36	37
JH1MTR	"	25,116	113	41	50
JA4FM	"	23,674	101	39	50
JA5DDF	"	19,536	109	37	37
JA8FBM	"	11,950	87	25	25
JA7HYS	"	10,112	61	30	34
JA3FPK	"	4,280	45	21	19
JA4YCU	"	4,120	45	20	20
JA6CRA	"	1,920	31	18	14
JA3AVO	"	247	7	7	6
JH1AJI	28	366,850	1085	34	81
JA8CKC	28	251,490	851	32	69
JA1LZR	"	208,182	744	32	70
JA7GDW	"	53,808	327	23	34
JA4ERX	"	50,384	258	26	41
JA5PQ	"	38,472	238	23	33
JH1EIG	"	33,418	192	22	40
JA7UZ	"	30,628	272	16	22
JA1WWY	"	21,670	147	21	34
JH1CJU	"	17,370	142	18	27
JA3CF	"	16,685	129	20	27
JA6BXX	"	9,044	85	16	22
JA8BZ	"	7,644	101	12	14
JA4FM	"	7,267	66	20	23
JA6BIF	"	1,872	30	13	11
JA1RJW	21	379,136	1197	37	91
JA7UJ	21	262,884	786	36	78
JA3COX	"	216,256	675	35	74
JA1JXU	"	214,303	757	33	64
JA2EQR	"	122,738	653	32	62
JA2KKX	"	96,232	369	33	59
JA8DNZ	"	75,032	315	27	56
JH1GNL	"	57,128	268	31	43
JA8BHV	"	54,510	237	26	53
JH1ARJ	"	52,632	273	26	42
JA1QIP	"	36,478	209	24	37
JA2PYX	"	12,978	76	28	35
JA2MVU	"	9,464	64	19	33
JA6KAV	"	8,976	70	21	27
JA7GOO	"	7,344	83	14	20
JH1AHU	"	6,800	60	16	24
JH1REV	"	4,386	48	12	22
JAØCYO	"	3,456	50	10	14
JA2YCL	"	204	7	6	6
JA4JTS	"	110	6	5	6
JA1OCA	14	103,912	305	37	87
JA3ERG	"	97,647	300	38	83
JA9AG	"	84,072	250	35	89
JA4AQR/5	"	2,975	37	16	19
JA8BWE	"	1,200	20	10	14
JA8GR	"	308	10	7	7
JA2BAY	7	16,271	114	23	30
JA2EKX	"	9,261	76	21	28
JA1IST	"	1,342	28	10	12
KA7CW	AA	454,923	827	79	110
Korea					
HL9VQ	A	111,625	368	53	72
Laos					
XW8CR	28	42,427	256	22	55
XW8CN	14	38,520	236	27	45
Lebanon					
OD5BZ	A	924,300	1204	72	188
OD5BA	"	334,910	525	46	168
OD5EP	28	19,110	182	8	27
OD5FA	21	261,595	829	33	80
Ryukyu Is.					
KR6RL	14	190,442	685	36	86
KR6FT	"	11,925	127	21	32
Saudi Arabia					
7Z3AB	A	122,502	408	35	67
Thailand					
HS1CB	A	84,255	307	61	76
Turkey					
TA2SC	14	88,218	386	22	65
U.S.S.R.					
Asiatic					
UA9FU	A	400,892	691	65	147
UA9KPW	"	127,674	410	44	79
UW9DZ	"	55,556	244	25	61
UA9MP	"	3,220	61	13	24

See page 102 for New Reader Service

TOP U.S.A. SCORES

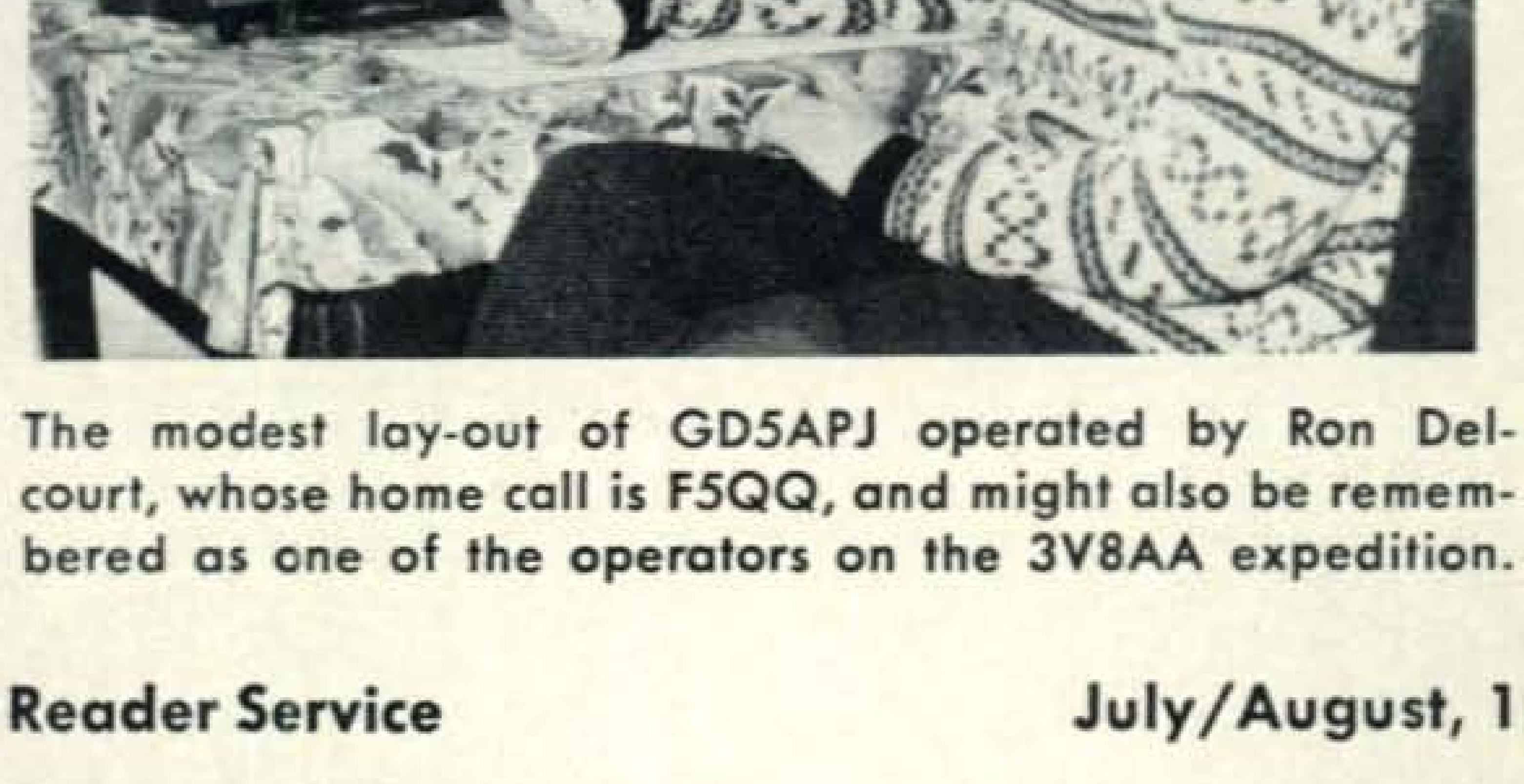
Single Operator

All Band	K1KTH	1,523,820
28 mc	K3HPG	276,080
21 mc	W4YHD	285,390
14 mc	WA3GUL	180,082
7 mc	W2DXL	52,008
3.8 mc	K3UZE	19,229
1.8 mc	K1BPW	299

Multi-Operator

Single Trans.	W4AXE	2,929,552
Multi Trans.	WA2ZAA	6,743,880

UW9CR	28	52,560	253	19	53
UA9CBK	"	1,349	33	6	13
UA9AB	21	132,462	468	35	78
UA9TT	"	125,892	593	25	53
UA9WJ	"	69,003	257	17	72
UA9DN	14	699,105	1478	39	126
UAØBP	28	307,945	1096	33	88
UAØTO	"	68,400	365	22	50
UAØABV	"	23,630	360	16	26
UAØLEH	"	18,615	129	18	33
UAØSU	21	70,380	525	21	48
UVØEX	"	8,976	326	8	14
UWØIE	14	154,500	595	36	67
UWØIN	"	136,188	451	37	71
UAØDG	"	68,026	361	33	53
UAØYE	"	46,800	257	28	44
Armenia					
UG6KAA	14	147,945	522	32	73
UG6JJ	"	2,059	40	12	17
Azerbaijan					
UD6BD	A	261,482	505	48	130
UD6BN	14	15,911	110	14	29
Georgia					
UF6KPA	14	53,048	249	21	55
Kazakh					
UL7AQA	28	129,120	617	29	67
UL7LA	14	18,198	140	16	38
Kirghiz					
UM8FM	14	16,677	118	15	36
Tadjik					
UJ8AAT	28	15,500	118	15	35
UJ8ABR	"	3,200	45	10	22
UJ8AAC	"	3,132	41	9	18
Turkoman					
UH8BO	A	54,282	189	37	72
Uzbek					
UI8LDD	28	23,373	175	18	35
UI8CD	21	257,148	954	33	75
EUROPE					
Aland Island					
OHØAM	A	1,241,995	1340	119	326
OHØNI	"	262,088	623	71	181
Andorra					
C31CQ	A	746,382	1278	81	192
Austria					
OE1JHA	14	52,716	256	30	62
OE1WO	3.8	12,322	159	13	48
Azores					
CT2AT	3.8	51,129	438	14	43
Balearic Islands					
EA6BN	A	888	33	8	16
EA6AR	21	5,024	123	10	22
EA6BM	14	57	9	3	8
Belgium					
ON5GQ	A	528,360	683	97	199
ON4XG	"	425,040	687	74	166
ON5AZ	28	86,751	403	27	54
ON8CG	21	60,800	291	29	66
ON5MG	14	71,364	261	32	82
ON4LJ	"	30,171	210	26	63
ON4QJ	3.8	10,328	99	14	40
Bulgaria					
LZ2EE	A	1,230	35	8	22
LZ1DV	14	109,750	509	33	92
Channel Is. (Jersey)					
GC3XOJ	A	37,366	164	39	80
Czechoslovakia					
OK1PG	A	211,357	503	76	165
OK1ADM	"	184,728	310	90	168
OK1GO	"	62,800	263	44	113
OK2QR	"	19,344	138	25	37
OK3EA	"	14,130	113	25	65
OK1AHZ	28	20,640	130	22	38
OK2BEN	"	6,810	79	15	15
OK2PAX	21	8,925	112	11	24
OK1ACT	"	81	5	4	5
OK1APJ	14	107,321	549	30	77
OK2DB	"	93,720	455	32	88
OK1BEG	"	53,658	271	29	70
OK1GT	"	48,244	177	35	89
OK3ALE	7	532	24	5	14
OK2XA	3.8	2,320	76	5	24
OK1WN	"	1,159	63	3	16
OK1MP	1.8	190	19	2	8
Denmark					
OZ1LO	A	1,825,600	1751	119	281
OZ5JT	"	152,872	361	69	125
OZ4IA	"	89,745	202	61	132
OZ5JR	"	45,719	245	39	92
OZ7DX	"	45,296	120	54	98
OZ3PO	"	19,360	86	37	51
OZ3Q	"	13,356	69	36	48
OZ1CZ	"	4,032	44	22	34
OZ3SK	28	448,500	1239	34	96
OZ8EA	21	16,764	116	23	43
OZ7TF	14	100,296	474	35	91
OZ3Y	"	50,232	276	36	68
OZ4H	"	6,696	71	27	35
England					
G3RRJ	A	859,747	1205	80	183
G3XYP	"	853,523	1031	94	247
G3XYB	"	229,672	576	53	99
G3YBH	"	91,800	311	49	104
G2AJB	"	75,818	288	49	118
G3WOU	"	9,280	89	23	41
G2BOZ	28	217,504	707	30	82
G3WJN	"	178,669	628	31	70
G3KMA	"	96,672	342	35	79
G3HCT	21	832,016	2124	37	112
G3LZQ	14	210,295	653	37	100
G3NSY	"	27,412	238	22	55
G3NLY	7	62,880	409	19	61
G5HZ	"	11,856	115	13	39
G3IGW	3.8	21,775	274	15	52
Faeroes Islands					
OY9LV	A	7,260	102	11	33
Finland					
OH2XF	A	315,900	543	80	180
OH2BAM	"	26,967	271	29	72
OH2FB	"	19,680	126	31	65
OH1UR	"	10,922	82	27	59
OH5NB	"	5,980	63	24	41
OH3XZ	28	134,583	498	32	81
OH1VA	"	85,437	357	32	67
OH2BHU	"	35,721	216	25	56
OH3TY	"	34,944	161	28	63
OH2BR	"	18,600	83	30	70
OH5TN	21	287,585	981	34	79
OH8NV	"	44,874	336	17	37
OH2BCV	"	40,128	301	20	56
OH6AF	"	12,208	112	19	37
OH2VB	"	10,336	75	17	51
OH2BAD	"	2,432	28	13	19
OH2HC	14	416,205	1257	38	97
OH2CP	"	101,296	675	28	76
OH5VT	"	61,920	316	33	63
OH6AA	"	39,442	280	23	59
OH2VZ	"	1,952	43	11	21
OH2BHZ	"	1,276	40	7	15
OH3VV	7	55,680	395	25	71
OH1PS/2	3.8	7,840	137	12	37
France					
F2SI	A	1,246,014	1695	90	189
F3EA	"	731,645	1232	72	143
F2JE	"	243,166	678	47	107
F9GL	"	231,504	442	73	135
F9RM	"	139,356	324	68	128
F8TQ	"	90,780	242	55	123
F9KP	"	60,060	283	41	91
F9EW	"	32,470	162	33	52
F6AGB	"	17,792	132	27	37
F9GO	"	17,394	97	30	48
F3AT	"	8,745	61	26	29
F5YJ	"	7,208	63	25	43
F8DP	"	1,785	32	12	20
F5RD	"	1,302	32	9	22
F5HO	21	3,686	55	11	27
F2OQ	14	49,050	335	26	64
Germany					
DJ4PT	A	2,017,169	1872	117	274
DJ8RR	A	1,765,288	1630	110	296
DL3XO	A	1,657,750	1646	97	278
DK2BI	"	965,120	1130	90	230
DL6WE	"	635,216	1090	65	167
DL8BS	"	529,542	753	82	197
DJ8FC	"	450,560	679	77	179
DJ2TK	"	437,742	559	90	203
DJ6TK	"	323,840	542	77	179
DL2JO	"	313,690	555	78	176
DJ8UV	"	273,006	482	74	187
DJ1MC	"	269,855	631	55	100
DJ2VZ	"	250,749	442	70	181
SJ2GG	"	207,427	405	59	114
DJ9IA	"	201,804	414	76	175
DL8PC	"	189,987	357	73	176
DL7PR	"	179,712	450	70	138
DJ1XC	"	164,502	292	79	168
DLØER	"	152,235	309	59	140
DL7BQ	"	92,672	273	62	119
DJ2UU	"	85,042	228	60	142
DJ8OT	"	55,692	219	39	78
DL9EY	"	52,095	258	38	77
DL8DC	"	51,666	197	44	65
DL7FP	"	36,452	163	40	88
DJ4IZA	"	35,190	144	42	73
DL8MY	"	30,008	159	28	60
DL1KN	"	21,645	119	34	31
DK1YK	"	7,519	60	29	44
DL1KS	"	7,504	51	21	35
DL8AJ	"	2,448	37	10	14
DL8AM	"	1,643	21	14	17
DL6EN	28	400,288	1237	34	78
DL7AA	"	299,824	936	34	78
DL7HU	"	264,720	771	33	87
DJ3YV	"	201,345	750	32	61
DJ3OC	"	187,680	653	33	69
DJ5JH	"	66,088	279	29	59
DL9VS	"	96,000	434	29	51
DJ6GW	"	31,773	230	21	30
DK1AQ	"	19,964	132	25	37
DJ9ZB	"	6,704	95	16	26
DJ7LP	21	213,444	574	37	95
DL8NU	14	717,558	1497	38	139
DJ2BW	14	597,681	1209	39	140
DJ7VY	"	175,346	612	38	108
DL2RR	"	86,884	413	27	89
DJ1WT	"	14,528	146	19	45
DJ2YA	3.8	40,448	382	16	63
DL1CF	1.8	468	39	2	10
DL4JW	21	130,368	509	27	69
DL5GY	14	11,193	94	17	24
DM2BTO	A	35,250	154	47	94
DM2BWD	"	13,376	134	19	69
DM2AYK	21	11,220	100	16	35
DM2BNI	14	29,484	223	23	58
DM6SAK	7	975	37	5	20
Hungary					
HA5CQ	A	184,212	483	67	137
HA3MB	"	25,908	154	31	71
HA7LF	14	116,844	557	25	82
HA5BY	"	73,704	421	32	79
HA5AM	"	68,400	272	34	86
HA5FQ	"	34,224	196	27	66
HA5FE	"	12,064	153	15	43
HA5DG	"	11,732	113	16	52
HA5DU	"	3,002	58	12	26
Iceland					
TF2WLW	A	178,517	649	45	96
TF3MA	"	167,280	457	61	144
TF3SF	28	374	18	5	12
TF2WLS	21	117,218	682	20	66
TF2WLN	14	160,484	617	27	79
TF3OJ	"	114,592	651	26	70
Isle of Man					
GD3AIM	28	59,680	296	27	53
GD5APJ	14	178,090	1008	29	81
Italy					
I1BAF	A	1,972,316	1901	109	270
I1FLD	A	1,962,492	2039	108	258
I1MOL	"	1,006,761	1548	82	169
I1YRK	28	113,740	477	31	63
I1SGZ	"	6,808	71	18	28
I1ZSQ	21	174,800	712	30	70
I1NAL	"	73,500	311	30	70
I1PLN	"	45,471	356	20	49
I1REK	"	15,730	160	19	46
I1TTL	14	34,845	200	29	76
I1RGA	"	17,940	114	21	48
I1ZGA	"	11,712	61	8	24
I1NU	7	34,036	331	17	50
I1BER	"	15,022	173	14	44



The modest lay-out of GD5APJ operated by Ron Delcourt, whose home call is F5QQ, and might also be remembered as one of the operators on the 3V8AA expedition.

Luxembourg
LX1BW A 509,640 1202 71 84

Netherlands
PAØXPQ A 456,170 626 94 196
PAØSNG " 126,896 365 52 154
PAØUC " 91,931 270 53 108
PAØJR " 7,276 97 20 48
PAØJPC " 3,075 60 10 31
PAØINA 28 57,000 210 34 66
PAØMIR/A 22,385 166 17 38
PAØEEM 14 33,162 935 39 127
PAØHSJ " 106,920 376 35 85
PAØFM 7 18,849 242 16 45

Northern Ireland
GI3YDO 14 9,620 107 15 37

Norway
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2,512,695 2425 110 271
LA8HN " 627,888 915 90 219
LG5LG " 164,096 497 50 114
LA8OM " 48,760 275 34 58
LA8RI " 47,190 173 47 74
LA7XM " 34,580 201 27 68
LA5QK " 30,500 164 36 86
LA4R " 21,648 193 15 33
LA8M " 10,428 84 25 41
LA6XI " 8,722 86 18 44
LA9ZF " 3,248 63 9 19
LA9WK " 513 13 9 10
LA4ZB 28 27,434 170 19 39
LA6OI " 9,313 53 26 41
LA3XG " 3,360 53 13 22
LA1FF 21 1,261 35 6 7
LA6U 7 3,913 66 14 29

Poland
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3Z8AWP " 46,374 259 37 94
3Z2BMM " 5,550 76 14 36
3Z6AAT 28 86,580 349 39 59
3Z9BZM 21 5,472 98 11 25
3Z3AMZ 14 19,710 168 22 51
3Z5SIP " 15,000 105 20 55
3Z7AWA " 8,071 167 13 34
3Z5CJU " 3,914 88 10 28
3Z9PT 3.8 5,166 125 8 33

Portugal
CT1BH A 1,283,337 1508 94 225
CT1MB " 4,575 45 22 39
CT1WA 14 146,256 461 34 98
CT1QN " 84,487 385 29 68
CT1WB " 76,908 358 31 85
CT1GD 7 5,265 122 8 31

Romania
YO9VI A 468,872 1032 68 183
YO2BB " 250,320 678 60 150
YO2AFB " 55,806 273 42 89
YO4KCA 14 368 19 5 11
YO6ALD 28 352 18 7 9

Scotland
GM3BCL A 404,096 745 64 160
GM3VTB 3.8 10,584 199 10 39
GM3YCB 1.8 1,080 90 2 10

Spain
EA2IK A 5,220 76 12 33
EA4LH 28 183,344 594 30 82
EA3SA " 81,530 495 23 39
EA1IY " 27,390 200 23 60
EA3IH 21 8,976 135 15 36
EA2HW 14 10,716 142 15 42

Svalbard Is. (Bear)
JW1CI A 287,592 857 56 128

Sweden
SM5CEU A
1,767,507 1846 107 250
SM5AD A
1,186,500 1248 106 269
SM3BIZ " 813,858 1077 90 213
SM5DJZ " 731,880 1136 89 196
SM7CCU/6 "
391,761 711 76 161
SM3EP " 162,565 368 65 140
SM3AF "141,050 448 43 112
SM3CXS " 81,320 181 66 130
SM0BDS " 73,084 271 61 100
SM2CAA " 38,586 206 37 72
SMØFT " 32,732 233 29 69
SM7TQ " 28,783 118 41 66

The operating crew of YU1BCD, winner of the multi-single division for Yugoslavia. L. to R. front: YU1QBC and Vlada; rear: YU1PCF and YU3EY.

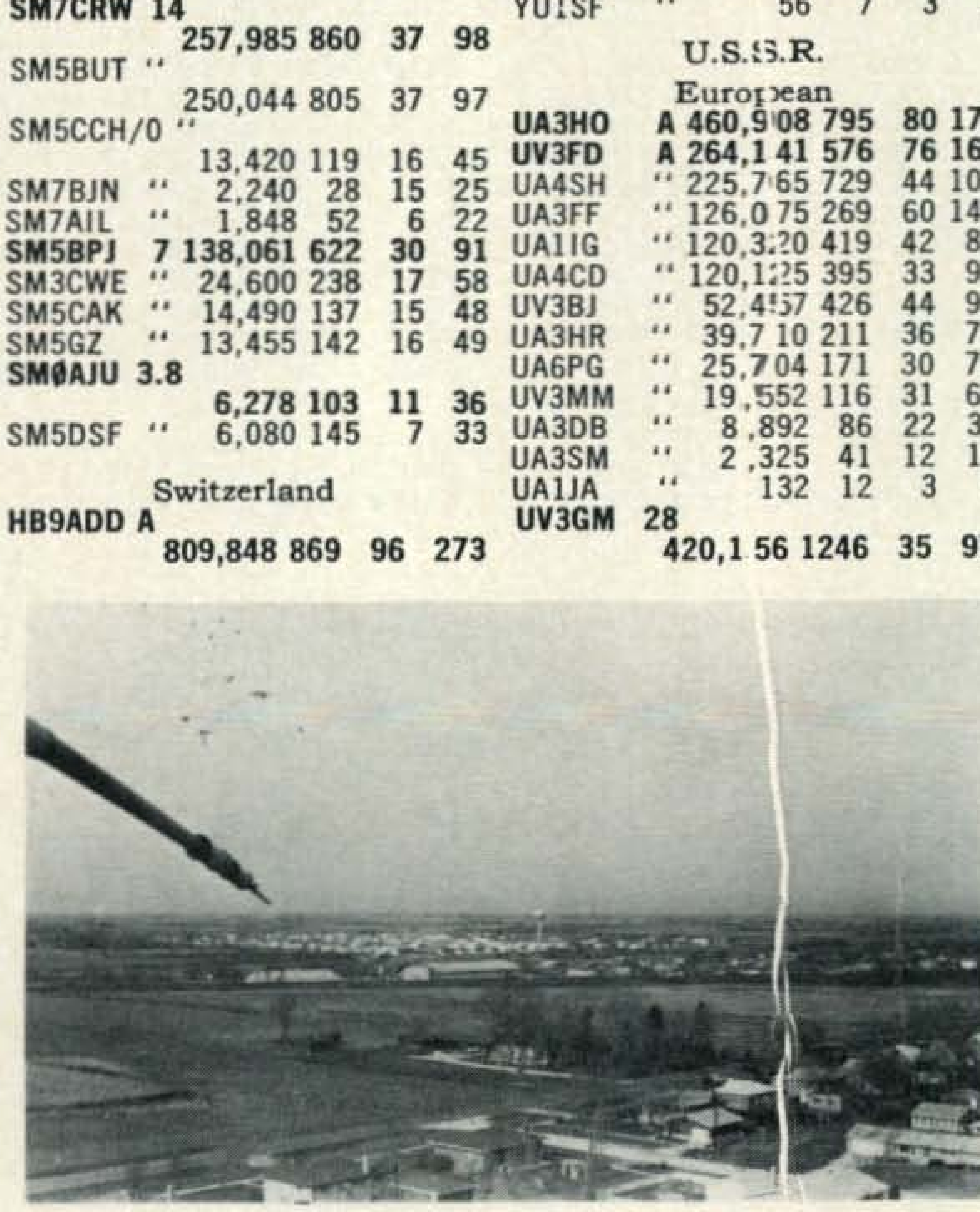
SM6ADW " 19,200 144 25 35
SM7TV " 12,692 129 19 57
SM6CKU " 6,344 36 28 33
SMØKV " 4,608 58 15 21
SM5AGU " 2,331 43 15 22
SM5UH " 272 10 8 9
SM6AEK 28
424,974 1102 35 102
SM4ARQ " 259,666 774 33 88
SK5AS " 144,861 465 34 75
SM4CMG " 113,288 428 30 68
SM5BOE " 67,712 304 30 62
SM2COR " 6,018 52 19 32
SMØCXM " 612 12 10 8
SM5API 21
389,046 1270 32 86
SM7CSN "
209,109 707 34 95
SM3DSP "
164,160 683 28 68
SM6BLT " 31,027 246 23 48
SM7ABL " 19,684 105 25 51
SM7CRW 14
257,985 860 37 98
SM5BUT "
250,044 805 37 97
SM5CCH/0 "
13,420 119 16 45
SM7BJN " 2,240 28 15 25
SM7AIL " 1,848 52 6 22
SM5BPJ 7 138,061 622 30 91
SM3CWE " 24,600 238 17 58
SM5CAK " 14,490 137 15 48
SM5GZ " 13,455 142 16 49
SMØAJU 3.8
6,278 103 11 36
SM5DSF " 6,080 145 7 33

Switzerland
HB9ADD A
809,848 869 96 273
HB9UD " 83,798 239 51 92
HB9ZY 21
406,830 1023 36 106
HB9AEB " 94,200 367 28 72
HB9DX " 23,074 119 25 58

Wales
GW3NWV A
723,840 1044 75 185
GW3POD " 174,472 480 61 132
GW3NNF 28
240,870 915 28 65

Yugoslavia
YU3OV A
809,775 1135 87 218
YU2CB/X " 168,960 500 63 129
YU3DQ " 103,350 282 64 131
YU1NWH 28 15,400 193 14 26
YU1SJ 3,388 66 11 17
YU3TXT 21 64,741 341 28 73
YU1NYE 14 9,342 108 16 38
YU4VXW " 1,053 20 9 18
YU1SF " 56 7 3 5

U.S.S.R.
European
UA3HO A 460,908 795 80 172
UV3FD A 264,141 576 76 167
UA4SH " 225,765 729 44 101
UA3FF " 126,075 269 60 145
UA1IG " 120,320 419 42 86
UA4CD " 120,125 395 33 92
UV3BJ " 52,457 426 44 96
UA3HR " 39,710 211 36 74
UA6PG " 25,704 171 30 78
UV3MM " 19,552 116 31 63
UA3DB " 8,892 86 22 30
UA3SM " 2,325 41 12 19
UA1JA " 132 12 3 8
UV3GM 28
420,156 1246 35 97



We see many photos looking up at beams and towers but here's one looking from the top down. It was taken from the "crow's nest" at the 120 ft. level of W9EXE's tower.

UA3AVV 28
285,890 1095 32
UA3OG " 184,047 888 29
UW4NH " 114,816 485 28
UW3UG " 67,067 355 28
UA3KQB " 58,350 394 24
UA3BB " 33,433 208 23
UA1AAT " 25,365 273 23
UA4CO " 13,482 142 18
UV3ACI " 11,718 139 17
UA4LT " 10,088 116 18
UA4DA " 9,450 77 18
UA3MNT " 7,761 128 11
UA1DZ 21
399,455 1314 33
UA6KOD " 236,130 969 32
UA4RO " 197,496 784 32
UW1BM " 117,528 758 24
UA4CZ " 100,555 510 28
UV3TE " 86,890 487 26
UW3IN " 83,517 439 32
UA6BL " 59,314 314 32
UW3NE " 4,650 67 12
UW3IP " 3,502 53 12
UW6LC 14 162,150 575 37
UW4IK " 115,940 432 32
UW3EH " 108,750 413 35
UA3HH " 94,640 400 33
UW3HY " 59,300 339 29
UA1LE " 29,304 179 28
UA3RG " 20,554 131 28
UA1MU " 8,892 153 13
UA4QQ " 3,999 55 14
UA1WT " 2,244 40 13
UA1KMD " 694 33 6
UA1WJ 3.8 1,512 74 4
UW3DH " 1,104 47 4

Estonia
UR2AR A
1,500,852 1673 93 2
UR2ED 28 17,629 165 22
UR2CW 14 226,736 706 38 1
UR2AD 7 21,056 285 15
UR2DL " 1,342 52 5
UR2EK 3.8 7,038 140 9

Latvia
UQ2DV A 24,374 180 19
UQ2GV 21 2,310 51 8
UQ2IL 14 5,148 94 11
UQ2MU " 3,570 105 7
UQ2NU 3.8 3,120 104 5

Lithuania
UP2NV A
1,539,030 1714 101 2
UP2PA 14 105,512 470 31
UP2LR " 53,594 290 40
UP2CV " 44,820 377 22
UP2CL " 16,520 231 16

Moldavia
UO5BGD 28 58,910 382 27
UO5BWG " 17,600 131 22
UO5BWZ " 350 16 5

Ukraine
UB5KIW A
1,019,904 1359 96 2
UT5DA " 41,837 304 30
UT5HT " 35,900 145 28
UT5FN " 23,901 184 32
UT5AM 28 66,612 338 29
UY5HI " 63,262 381 25
UB5EM " 25,460 216 20
UB5BLB " 8,096 130 12
UY5HG " 2,800 47 12
UB5KAS 21 53,200 302 29
UB5LV " 40,120 250 23
UB5FG " 20,376 125 22
UB5UN 14 291,288 930 39 1
UT5OZ " 172,074 779 34
UB5CI " 81,250 356 33
UB5KCX " 17,066 187 15
UT5GM " 13,375 87 27
UB5SR " 6,720 73 17

White Russia
UC2XW 14 3,230 79 10

OCEANIA

Australia
VK2WD A 38,790 153 29
VK2APK 14
447,262 1030 36 1
VK2BNK " 12,544 72 23

See page 102 for New Reader Service

VK3XB A 12,586 83 30 28
VK3SM 21 12,985 94 21 28
VK4FH A 329,760 691 65 115
VK4DO 14 28,575 143 27 48
VK4NS " 4,512 48 16 16
VK6RU A 1,774,808 1895 105 223

Christmas Is.
VK9XI A 89,053 283 51 58

Fiji Islands
VR2CC A 16,128 91 27 36

Guam
KG6AQY 28 435,528 1558 31 61

Hawaii
KH6GLU A 1,859,130 2146 109 206
KH6IJ A 1,711,708 2593 93 143
KH6GRG " 111,072 428 43 46
KH6BZF 21 81,732 560 19 30
KH6AA " 41,783 307 21 26
W9WKU/KH6 2,484 38 11 12

Lord Howe Is.
VK2BKM/2 A 896,736 1336 80 161

New Zealand
ZL1AGO A 457,504 830 80 112
ZM1TZ " 72,891 225 45 72
ZL1IL 21 57,892 241 24 58

New Guinea
VK9KS A 110,691 311 54 93

Papua
VK9RY A 43,660 286 22 37

Philippines
DU1FH A 1,329,410 1647 98 165
DU1FP 14 27,885 179 23 32

Samoa (American)
WØVRN/KS6 A 229,628 600 60 79

SOUTH AMERICA

Argentina
LU5AQ A 133,630 301 59 102
LU9DM " 99,600 480 38 62
LU3DGX 28 141,603 630 24 53
LU3FAN 14 102,235 312 34 81

Bolivia
CP1GN A 466,244 736 83 146
CP5FB " 147,186 436 39 78
CP1HW 28 80,972 432 21 41
CP5AK 21 41,640 265 21 39

Brazil
PY2EAD A 105,228 327 45 66
PY2GE A 103,174 237 58 100
PY5ATL " 68,068 173 57 86
PY3APH " 51,194 137 58 85
PY1DBE " 45,990 158 40 65
PY1DEF " 30,800 149 28 52
PY1MHB " 21,483 105 28 49
PY2YC " 19,136 85 38 54
PY1BAR " 17,716 83 34 52
PY1HT " 2,952 34 17 24
PY2DSO 28 98,301 361 30 63
PY5EG 21 346,090 1005 34 88
PY2CYK " 289,089 755 36 93
PY1CHP " 79,560 419 23 42
PY2EIR " 20,844 142 20 34
PY2ETK " 11,790 97 18 27
PY4OD 14 919,068 1723 39 135
PY7APS " 423,900 1057 37 98
PY3BXW " 71,144 1490 39 129
PY2CBP " 3,440 32 16 24
PY6OE " 3,122 77 7 7
PY2BZD " 1,331 32 17 22
PY4AP 7 13,338 91 16 41
PY2DL " 1,484 26 11 17
PY2EWL " 840 20 9 15
PY2CQ 3.8 800 22 10 15

Chile
CE5FQ 28 78,913 380 21 52
CE3UH " 6,104 78 12 16
CE3OE 21 177,786 785 28 55

Colombia
HK4DF A 615,264 989 61 147
HK5AZA " 25,944 100 35 59
HK4AZX 14 8,832 70 15 33

Ecuador
HC1TH A 2,183,024 2233 95 239

Paraguay
ZP5GS A 37,323 167 32 57

Peru
OA4PF 28 209,880 703 29 77

Suriname
PZ1BI A 156,950 632 31 55
PZ2CU " 127,361 461 31 66

Trinidad
9Y4AA A 4,318,925 3056 130 355
9Y4DS " 49,980 200 29 56
9Y4LO 14 66,230 313 20 54

Uruguay
CW0AA 21 1,068,552 2377 36 117
CX1JM " 192,454 807 28 58

Venezuela
4M7AV A 299,762 711 49 93
YV5BPG " 129,360 240 64 132
YV1YC " 45,816 170 28 64
YV5DDY " 18,460 94 26 45
YV5AKP 21 284,471 600 33 88
YV2IF 14 191,949 597 27 82
VE2DHF/YV1 " 190,988 493 32 101
YV1EJ " 66,123 304 23 70

MULTI-OPERATOR
Single Transmitter
NORTH AMERICA

U.S.A.
W1BGD/2 1,169,311 1002 115 292
K2BQO 477,883 555 94 199
W3WPG 589,034 655 86 225
W3GRF 567,948 703 88 194
W3NZ 457,080 555 89 204
W3SS 400,445 510 83 200
WA3FXJ 386,784 498 83 188
W3TV 220,190 403 61 133
K3CLA 114,996 287 49 99
W4AXE 2,929,552 1835 144 410
K4LK 596,000 703 85 213
WA4QPL 170,046 311 67 134
W4HOS 154,050 233 91 146
K4ORQ 64,125 183 43 82
W5RER 1,432,368 1249 124 282
W5TKB 887,340 913 103 242
WA5VPZ 366,980 541 72 164
K5FIQ 60,652 177 42 76
WA6UFW 762,729 850 114 205
WB6WIT 663,646 785 104 194
K6AUC 412,536 609 92 150
K6ILG 369,820 617 90 130
W6DOD 352,260 551 94 134
W6BIP 291,486 390 76 126
W6NJU 233,310 410 69 141
K8MMM 1,210,756 1161 108 250
W8IPA 498,690 634 81 189
W8MEL 465,480 599 89 181
WB8BLA 324,374 487 78 168
K8SMC 246,750 422 74 136
WB8BEG 204,020 364 64 138
WA8WGJ 4,469 44 15 26
W9LKJ 1,459,860 1167 125 310
K9KDI 1,335,978 1131 117 297
W9ARV 776,740 779 107 248
K9CUY 677,115 660 112 257
K9LYA 134,846 245 51 140
WØHP 818,777 766 115 252
WAØMLE 543,224 661 95 201
WAØNLP 228,660 372 76 146
WAØCJU 7,072 48 23 29

British Virgin Is.
VP2VP 2,019,314 2370 97 252

Canada
VO2AP 521,595 1106 63 138
VE2UN 1,330,064 1336 123 265
VE3HPH 1,014,843 1092 109 254
VE4AA 691,541 1050 91 190
VE6ADX 1,232,874 1761 97 192
VE6AUT 294,708 762 55 109

Canal Zone
KZ5NG 726,308 1844 65 122

French Sint Maarten
FG7TI/FS7 2,331,277 2644 113 276

Mexico
XE1WS 2,308,666 2726 112 274

AFRICA

South Africa
ZS5OA 500,611 899 41 120

ASIA

Iran
EP2DA 869,940 1157 78 192

Japan
JA3YBF 191,000 643 54 71
JAØYAW 53,544 268 25 44
KA9MF 1,110,600 1897 68 132

Korea
HM1BB 727,848 1367 73 125

EUROPE

Austria
OE4SZW 847,540 1126 90 220

Belgium
ON4UN 5,117,716 3339 149 408

Bulgaria
LZ2KKZ 1,130,285 1952 74 191
LZ1KSA 66,675 353 34 93

Czechoslovakia
OK2KOS 16,185 152 21 62

Denmark
OZ9CR 37,152 285 29 57
OZ4HAM 8,211 118 14 37

England
G3SSO 2,330,781 2080 115 296

This was PZ1DB's first crack at a contest. Now that they have experienced the excitement of competition I'm sure that Dave, PZ1DB (standing), John, PZ1DD and Bill, PZ1CY will be back for more.

G3WYX 2,287,090 2320 102 263
G3TXF 1,534,390 1657 96 274
G5YC 1,404,656 1573 101 246
G3KMI 846,351 1610 83 166
G3VUM 462,234 756 74 172
G3FVA/A 404,584 767 68 138
G3EEO 76,245 417 34 81

Finland
OH2AM 5,091,228 3232 132 428
OH4RH 703,395 1009 91 228
OH3MK 575,553 909 89 232
OH2MQ/3 328,918 712 61 153

France
F5OJ 517,066 937 66 143
F5OL 243,867 644 56 113

Germany
DLØWR 3,623,616 3037 119 347
DLØWW 2,745,384 2367 117 321
DLØWN 2,677,496 2557 115 271
DK3FZ 1,435,798 1621 96 226
DL7NB 1,338,780 1720 95 223
DL6UN 1,189,984 1330 91 237
DLØRCA 1,143,605 1351 100 231
DLØJR 1,020,510 1150 99 246
DL8CM 807,801 1080 90 203
DK2OG/p 734,139 1025 92 199
DJ4ZR 728,190 1057 78 183
DLØKL 628,958 960 93 160
DL8FR 617,838 977 80 187
DL8HA 402,849 1031 50 103
DLØII 187,798 459 70 163
DMØDDR 6,726 67 21 17
DL4QF 1,951,328 1724 118 304
DL4RM 1,022,698 1362 97 217
DL2ZN 972,420 1304 84 201

Hungary
HA5KDQ 271,472 674 64 124
HA9KOL 202,880 768 35 125
HA5KBP 42,723 237 33 68

Italy
I1DFE 458,126 1073 52 105
I1GAW 81,172 398 29 62

Netherlands
PAØHBO 2,109,631 2041 118 303
PI1PT 99,006 304 51 123

Norway
LA1H 1,228,702 1534 101 236
LA2T 134,017 461 47 122

Poland
3ZØPZJ 57,540 533 23 82
3Z5PWK 53,766 343 27 76

Scotland
GM5AME 719,104 1178 77 179
GM3YRK 192,993 512 64 157

Sweden
SK6AW 1,619,566 1707 109 264
SK3BP 934,740 1331 99 225
SKØTM 916,734 1421 84 189
SM5AZU 364,532 620 82 195

Switzerland
HB9AGC 674,584 1252 60 152

Wales
GW6GW 116,602 494 35 138

Yugoslavia
YU1BCD 1,613,328 1695 107 259
YU3EY 1,567,052 1725 99 248

U.S.S.R.
Club Stations
Asiatic
UA9KAX 3,673,969 2378 131 402
UW9KDL 164,012 493 40 91
UA9KCE 25,610 145 20 45

Georgia
UF6KPE 114,684 362 26 88

Estonia
UR2KBQ 16,632 234 20 43

European
UA3KAO 919,632 1211 113 279
UA3KND 744,436 1032 93 215
UA4KHW 363,050 652 84 181
UA3KAG 107,712 577 28 71
UA4KED 94,050 362 45 105
UA4KWP 10,738 127 18 14

Kaliningrad
UA2KBD 107,300 418 43 105

[Continued on page 93]

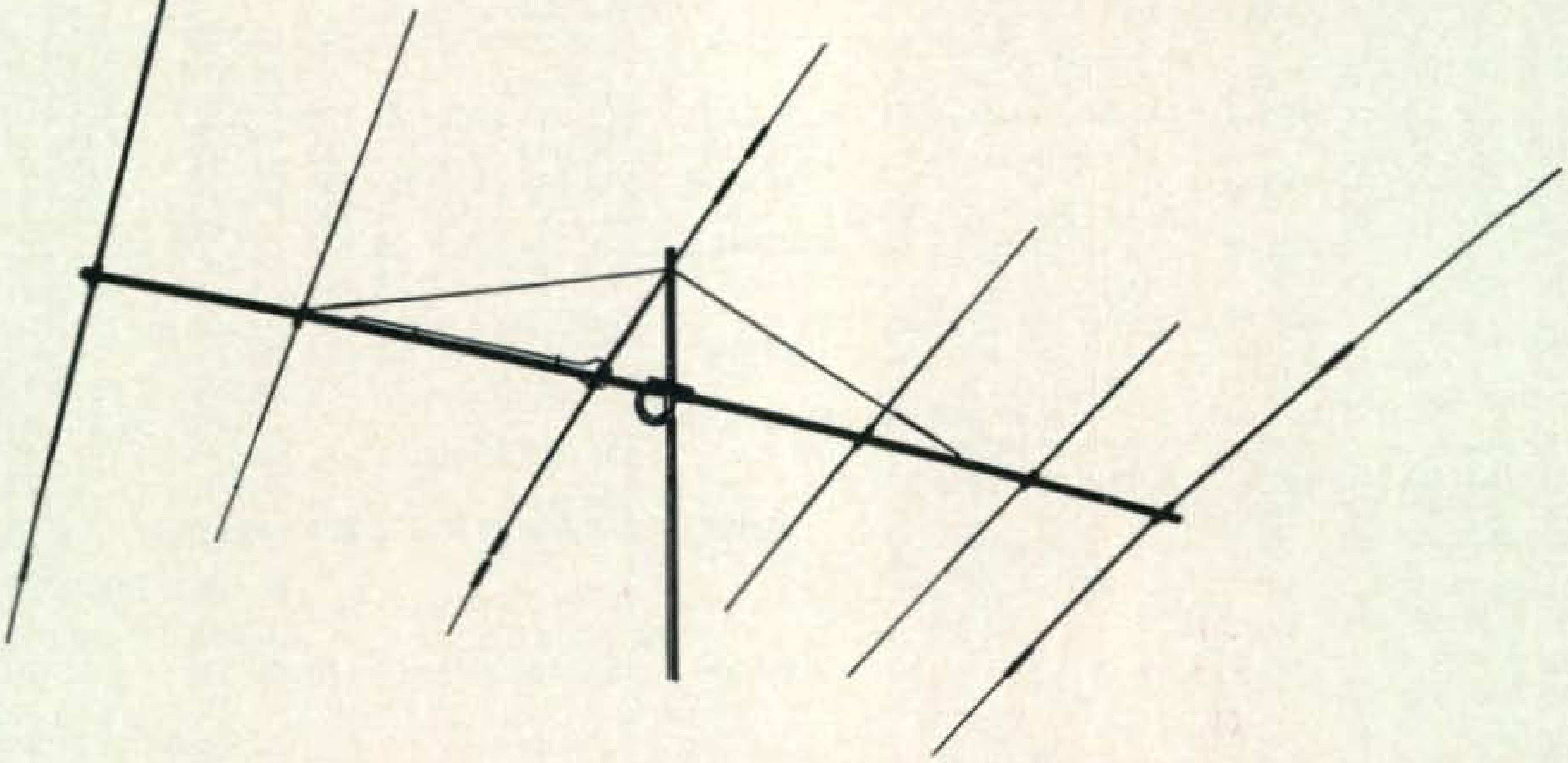
The voice of

HY-GAIN'S

THUNDERBIRD

10-15-20

is heard around the world



Here's why Thunderbirds outperform all other tri-banders:

- **Thunderbird's "Hy-Q" traps** provide separate traps for each band. "Hy-Q" traps are electronically tuned at the factory to perform better at any frequency in the band—either phone or CW. **And** you can tune the antenna, using charts supplied in the manual, to **substantially** outperform any other antennas made.
- **Thunderbird's superior construction** includes a new, cast aluminum, tilt-head universal boom-to-mast bracket that accommodates masts from 1¼" x 2½". Allows easy tilting for installation, maintenance and tuning and provides mast feed-thru for beam stacking.

  Taper swaged, slotted tubing on all elements allows easy adjustment and readjustment. Taper swaged to permit larger diameter tubing where it counts! And less wind loading. Full circumference compression clamps are mechanically and electrically superior to self-tapping metal screws.
- **Thunderbird's exclusive Beta Match** achieves balanced input, optimum matching on all 3 bands and provides DC ground to eliminate precipitation static.
- Up to 9.5 db forward gain.
- 25 db front-to-back ratio.
- SWR less than 1.5 to 1 on all bands.
- 24-foot boom... none longer in the industry.
- Extra heavy gauge, machine formed, element to boom brackets, with plastic sleeves used only for insulation. Bracket design allows full mechanical support.
- Interlaced, optimum spaced elements for higher gain and better pattern control.
- 3 active elements on 20 and 15 meters. 4 active elements on 10 meters.

New 6-Element Super Thunderbird
Model 389
Suggested retail price, **$179.95**

Improved 3-Element Thunderbird
Model 388
Suggested retail price, **$144.95**

Fabulous 3-Element Thunderbird, Jr.
Model 221
Suggested retail price, **$99.95**

Popular 2-Element Thunderbird
Model 390
Suggested retail price, **$99.95**

Buy one today at your favorite Hy-Gain distributor!

HY-GAIN ELECTRONICS CORPORATION
P.O. Box 5407-FG, Lincoln, Nebraska 68505

See page 102 for New Reader Service

CQ Reviews: The Hallicrafters SX-122A Receiver

BY WILFRED M. SCHERER,* W2AEF

MOST of the radio-amateur equipment produced these days is geared for amateur-band-only operation, both in respect to transceivers or individual receiver and transmitter combinations. As far as receiving goes in the latter case, a high-quality general-coverage receiver still can serve well as the normal station receiver. Both here and with a transceiver-equipped station, it can provide other useful service as well. At any rate, it will add to the flexibility of the station setup, enabling reception of many different type signals in the .54-34 mc range, such as WWV and CHU (for time signals and frequency calibration), the 160-meter amateur band, the marine band, commercial ship-to-shore communications, press and weather reports (excellent for code practice or just plain amusement), standard a.m. or short-wave broadcasts, Apollo tracking stations, 20 mc satellites, etc.

A receiver of this type also will be useful as a tunable-i.f. receiver with v.h.f. converters, offering complete v.h.f. band coverage without necessitating switching in additional crystals at the converters.

Another helpful function for such a set is as an aid in conjunction with servicing the more complex amateur gear now in vogue, one application of which would be the checking of equipment oscillators that operate at frequencies outside of the amateur bands.

Furthermore, the addition of a good general-coverage job can provide reliable standby or back-up service in the event the normal station receiver becomes disabled, besides which it can be put to good use for split-frequency operation with transceivers or for monitoring additional signals.

The SX-122A

An updated general-coverage receiver is the Hallicrafters SX-122A which is a dual-conversion job that includes important features necessary for today's advanced requirements.

Continuous coverage is provided over a 540-1600 kc and a 1.75-34 mc range with a high order of frequency stability. Calibrated bandspread is furnished for the 80-10 meter amateur bands and for the Citizen's band.

Three degrees of selectivity may be had. These are 0.5, 2.5 and 5 kc. Separate envelope and product detectors allow optimum reception for a.m., c.w., RTTY or s.s.b. Either upper- or lower-sideband operation may be selected for s.s.b.

An automatic noise limiter and an S-meter are included, while a 100 kc plug-in crystal calibrator is available as an optional accessory. Other features will be found in the following description.

Details

The setup for the SX-122A is shown at fig. 1. The dual-conversion scheme employs a 1st i.f. of 1650 kc, which ensures good image rejection, and a 2nd i.f. of 50 kc providing a high degree of selectivity and sideband selection.

The first conversion is made in conjunction with a tunable heterodyning oscillator that functions 1650 kc above the desired-signal frequency. A tuned plate-feedback or "tickler" type of circuit is used, with cathode in-

The Hallicrafters SX-122A General Coverage Receiver.

*Technical Director, *CQ*.

See page 102 for New Reader Service

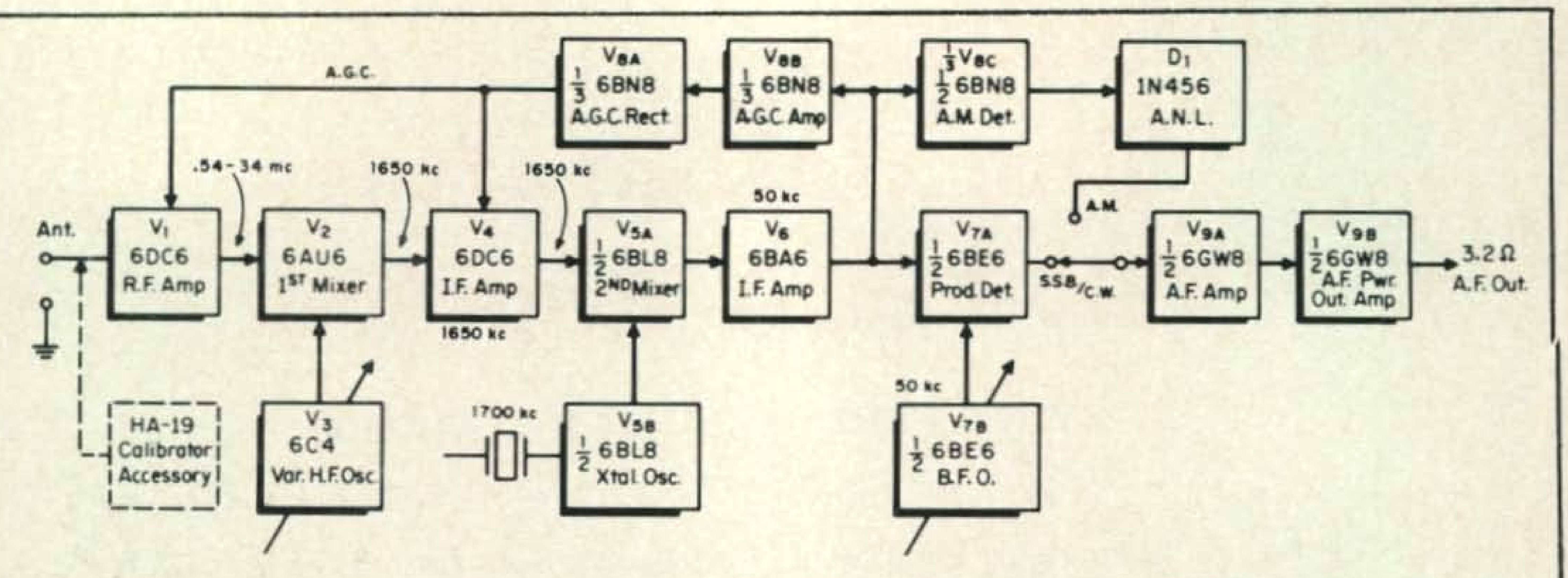


Fig. 1—Block diagram for the SX-122A. Details are given in the text.

jection to the 1st mixer obtained from the untuned grid winding at the oscillator inductors. Excellent frequency stability here is ensured through the use of ceramic coil forms, ceramic trimmers (not compression types), extensive use of temperature-compensating capacitors, plus voltage regulation and exceptionally rugged mechanical construction.

The overall stability is further enhanced by the use of a crystal-controlled second-conversion oscillator which is cathode-coupled to the 2nd mixer. The b.f.o. is a tunable self-excited one, but since it operates at a very low frequency, stability does not become a problem, especially since high-quality components are used.

High-*Q* r.f. circuits at the input amplifier and the 1st mixer contribute to good image rejection. The circuit constants also are such that provide relatively more uniform gain than usual over the whole range of the receiver. The r.f. circuits are gang-tuned with those of the h.f. oscillator. An "antenna trimmer" is included to compensate for variations in the reflected impedance from various antennas.

Double-tuned input and output circuits are employed at the 1650 kc amplifier. The 50 kc i.f. system, with the adjustable selectivity, is the same as that used in the Hallicrafters SX-115 and SX-117 amateur-band s.s.b. receivers. It is described at fig. 2.

The product detector and the b.f.o. are combined in a 6BE6 pentagrid converter using conventional circuitry for self-excitation. The b.f.o. is permeability-tuned by a core that is adjustable with a panel control whose setting for c.w. or for l.s.b. and u.s.b. operation are identified.

The envelope detector for a.m. is one diode section of a 6BN8. The triode portion of this tube functions as an untuned i.f. amplifier ahead of the a.g.c. rectifier which is the other diode in the 6BN8. The a.g.c. voltage is applied to the r.f. stage and the 1st i.f. amplifier. A fast-release time is used for a.m. When the receiver function switch is set to SSB/CW, a .47 mf capacitor with a 100K series resistor is automatically added to the a.g.c. line to provide a slow-release time.

The S-meter is located in the cathode return of the 1650 kc i.f. amplifier and thus responds to the changes in the cathode current according to the variations of the a.g.c. voltage with changing signal levels. A potentiometer across the a.g.c. line to this stage enables the degree of control voltage to be adjusted so that a 50 μv r.f.-input signal will read S-9 on the meter.

The noise limiter is a series-gate type and functions only for a.m. signals. The a.f. section of the set consists of the triode portion of a 6GW8 for the 1st a.f. stage, with the pentode half used for the a.f. power stage which has a 3.2-ohm output for a loudspeaker or headphones.

Receiver muting is accomplished by the insertion of a 330K resistor in series with the cathode return for the r.f. amplifier and the 50 kc stage. For receive, this resistor is shorted out and the cathodes are returned directly to ground through a 10K potentiometer that serves as an r.f. gain control. Receiver muting via a transmitter requires normally-closed contacts (for receive) on the transmitter relay.

Besides being applied to the h.f. oscillator, a regulated potential of 150 volts also is used at the screen of the 1st mixer and for the

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product detector/b.f.o. A 5Y3 vacuum tube is used as a full-wave rectifier in the power supply, a rather surprising aspect when silicon-diode rectifiers seem to be the rule these days.

Construction

The receiver is built on a heavy-gauge chassis with the panel well braced to the chassis with sturdy end brackets, making the whole setup extremely resistant to warping or twisting. This is augmented by installation in a rugged wrap-around type cabinet. Ventilation is provided by perforations at the top and bottom.

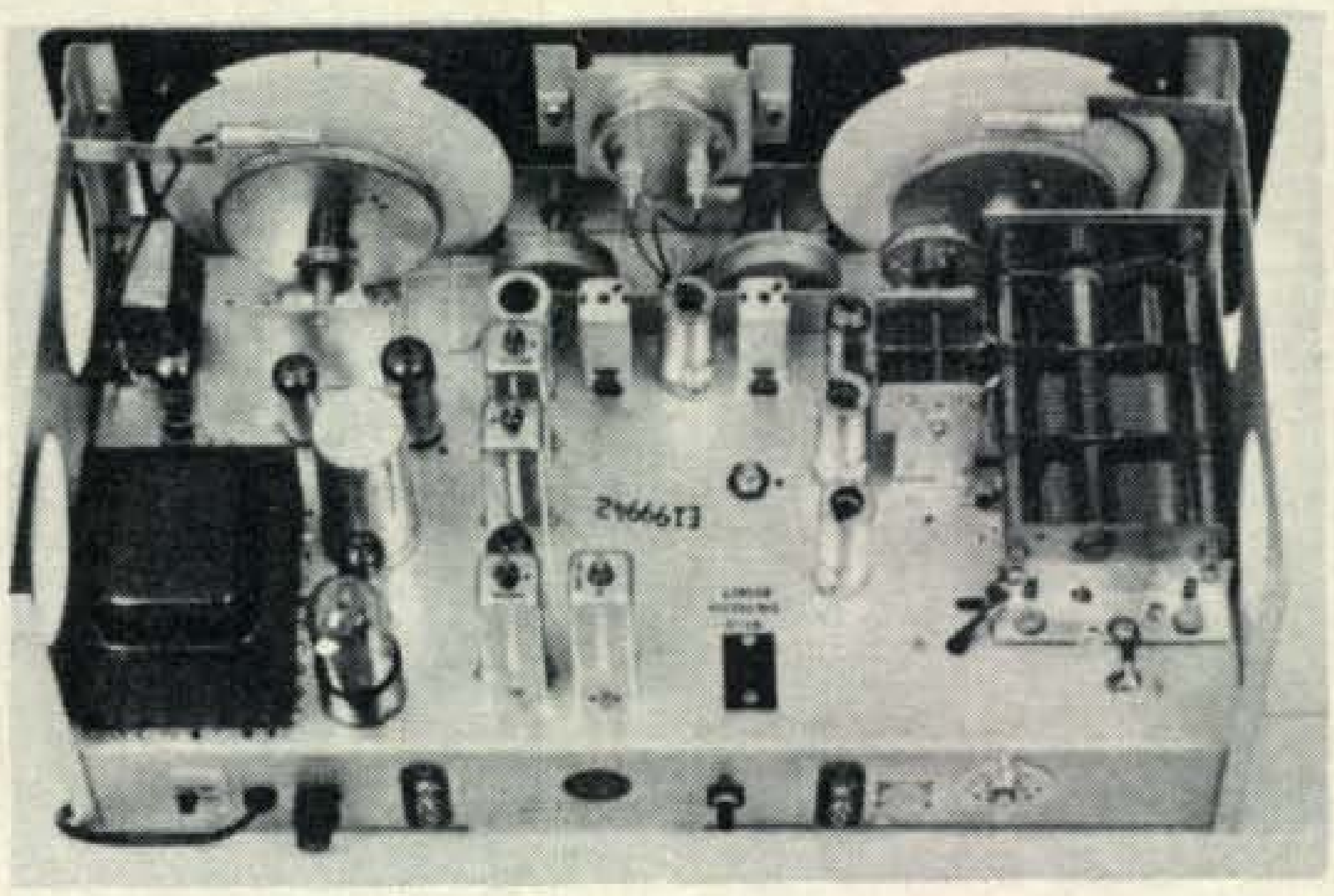
Complete shielding between the oscillator, mixer and r.f. stage circuits provides excellent isolation that eliminates interaction between oscillators, maintains stability and improves image or other unwanted- signal rejection.

An interesting wrinkle is that a collar on the metal shaft for the bandswitch holds a cup washer against the shield where the shaft passes between the r.f. stage and mixer sections. This provides a wiper action that grounds the shaft at this point and thus avoids unwanted coupling through the shaft between the two stages, that might otherwise introduce r.f. feedback and a consequential deterioration in the signal-to-noise ratio. Self-oscillation in the r.f. stage also is prevented by resistor-suppressors at the tube grid and plate.

A husky 3-gang variable capacitor is used for the main tuning. It is operated by a flywheel control with a string drive that rotates a large wheel the shaft of which is coupled to the capacitor through a split-gear setup. The overall drive ratio is 20:1. Also installed on this shaft is the main frequency dial that has five calibrated scales, one for each of the four frequency bands, plus a logging scale. The frequency bands are: .54-1.6 mc, 1.75-4.9 mc, 4.8-12.6 mc and 12.5-34 mc.

Since an antenna trimmer is provided for the r.f. stage, only a 2-gang capacitor is needed for the bandspread-tuning (at mixer and oscillator). This capacitor also is operated by a flywheel control and string drive with an overall ratio of 14:1. The bandspread dial is calibrated for each amateur band at about 1/8″-spaced increments of 5 kc for the 80, 40 and 20 meter bands, 25 kc for 15 and 50 kc for 10.

As is customary, the main-tuning dial has points indicated on it at which it must be set for the various amateur bands for correlation



Top view of the SX-122A as seen from the rear. Note the sturdy end brackets bracing the panel.

with the bandspread-dial calabrations. The shortwave-broadcast bands are indicated by double-width lines along the scales, as are the amateur bands (and CB) on the band-spread dial.

A large size S-meter is incorporated on the set. The phone jack is on the panel, use of which automatically cuts off the speaker. A socket for the calibrator accessory is located internally on top of the chassis.

Other connections are made at the rear apron where screw-type terminals are provided for standby or muting control, loudspeaker and balanced- or unbalanced-antenna inputs of 50-600 ohms. Mounting holes also are provided for customer-installation of an SO-239 type coax connector. The S-meter-zero control and a fuse holder also are at the rear.

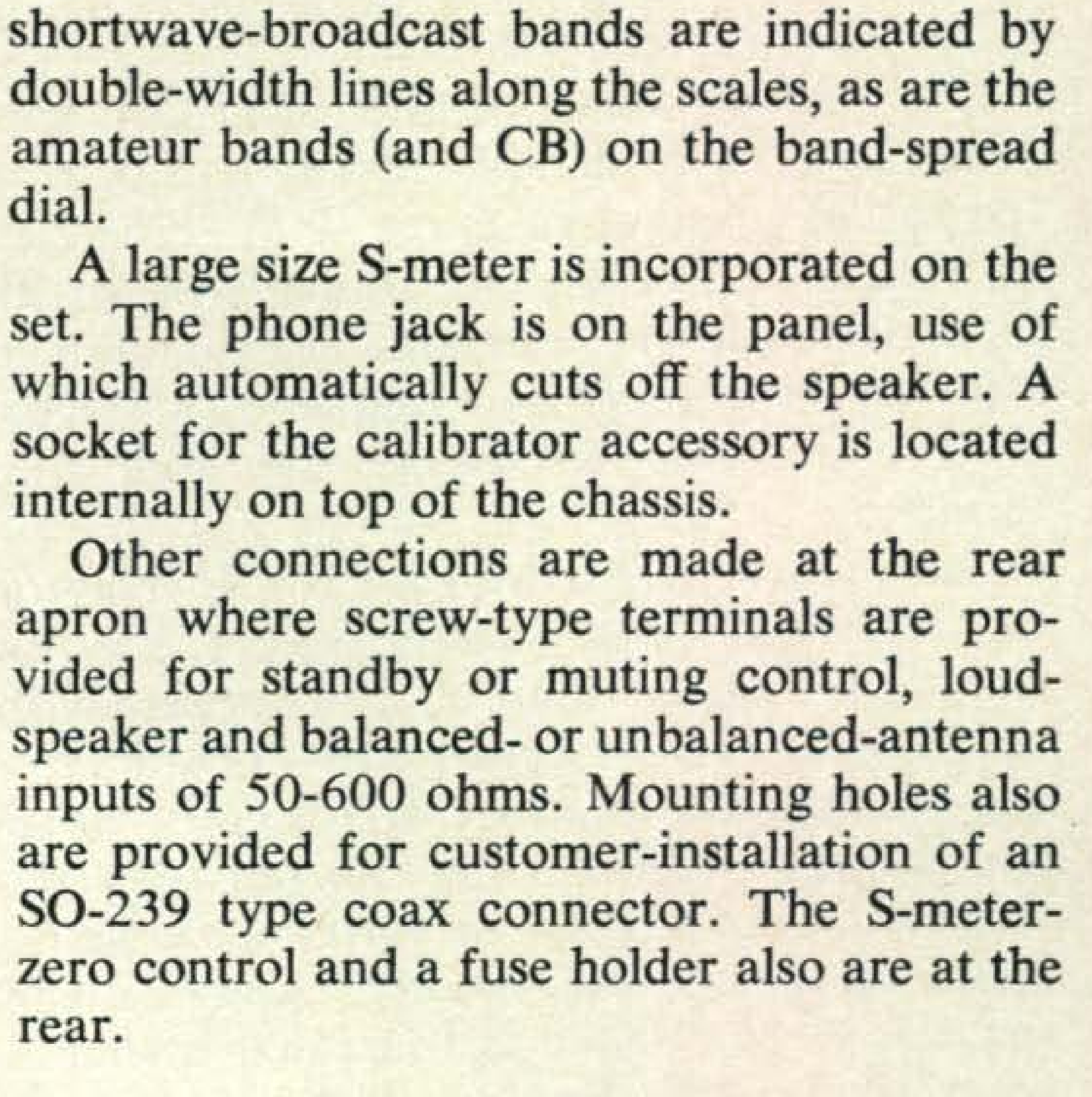


Fig. 2—The 50 kc i.f. setup for the SX-122A. Due to the individually shielded inductors, signal transfer occurs only through capacitance and resistance. *R* varies the Q of the tuned circuits and C varies the coupling. By increasing *R* and decreasing C, the selectivity is made broader Conversely, decreasing *R* and increasing C sharpens the selectivity. The three degrees of selectivity are obtained by switching in the necessary values of *R* and C by the selectivity control.

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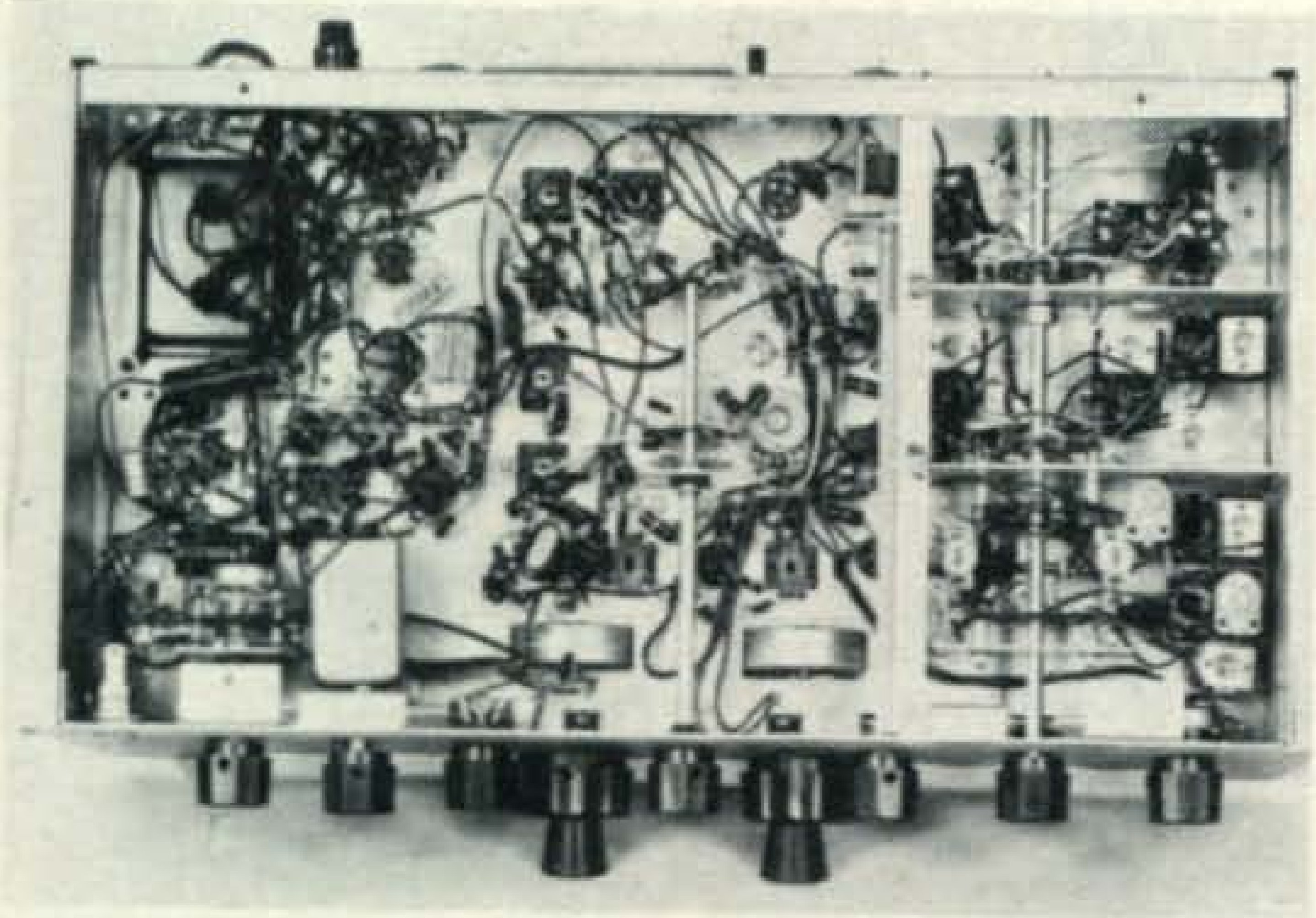


Bottom view of the SX-122A. The r.f. front end and h.f. oscillator sections are within the shielded compartments at the right.

Performance

The performance of the SX-122A was found to be considerably better than that of the usual general-coverage type receivers we've known in the past. This relates particularly to sensitivity, uniformity of gain, image rejection, selectivity and frequency stability.

Measurements produced the following results;

SENSITIVITY (for 10 db S+N/N): 1 μv or less with a.m. on all bands, except 2 μv on standard-broadcast band; 0.2 μv or less with c.w. and s.s.b. BAND-END-TO-END GAIN: average within 8 db. BAND-TO-BAND GAIN (amateur bands): within 8 db referred to 7 mc (sensitivity not affected by variations in gain). IMAGE REJECTION: 62, 60, 52, 51 and 42 db on the 3.5, 7, 14, 21 and 28 mc amateur bands respectively. I.F. SIGNAL REJECTION (1650 kc): 60, 70, 75, 70 and 65 db on the above respective bands. SELECTIVITY: 0.5, 2.5 or 5 kc at 6 db points (selectable). UNWANTED-SIDEBAND SUPPRESSION: 35 db at 1 kc. S-METER: Average reading of S-9 with 50 μv input signal on amateur bands. A.G.C. CHARACTERISTIC: 10 db a.f. output change with r.f.-input change of 80 db (1-10,000 μv), fast release on a.m., slow release of approximately 1 second on s.s.b. and c.w.

FREQUENCY STABILITY: Differed somewhat depending on band and band-end. The average drift during a 5-10 minute warmup ranged from 1-2 kc at the low frequency end of the bands to 3-4 kc at the high end. After warmup, drift on the amateur bands held to within 100-500 c.p.s. per hour, As a matter of fact, we were able to listen to s.s.b. signals over long periods with hardly any more retuning required than with many of the current amateur-band gear designed for s.s.b. work. With ±10% line-voltage variations, a change of ±100-500 c.p.s. was experienced, but this was a slow change as the temperature of the tube-heaters varied accordingly. Under mechanical stress, more severe than normally would be encountered during operation, no serious effects on the frequency stability were observed.

The dial calibrations were found to be quite accurate within the limitations imposed by the spacing of the incremental points.

Operationally, the a.f. quality of the set was excellent both on a.m. and s.s.b., with good a.g.c. action on the latter for pleasant listening without pumping or dynamic a.g.c. distortion. Unwanted-sideband suppression with the 2.5 kc selectivity was adequate as was the 0.5 kc position for c.w., although the signal does not seem to peak up as sharply as with some of the crystal c.w. filters. The noise limiter worked well in the a.m. mode and was more effective when a signal was present than without it.

A beneficial feature, we've vainly advocated for years in respect to receivers of this type, would have been a dial lock on the main-tuning control to prevent one's inadvertently knocking the dial off the desired bandset position during amateur-band or other operation. This can be most annoying particularly when you're in the midst of a QSO. Perhaps one day some manufacturer will take heed.

The receiver operates from either a 115 or a 230 v.a.c. source 50/60 c.p.s. with a power consumption of 85 watts. A switch, with a lock, on the rear sets up either type of operation. The size of the receiver is 8″ × 18¾″ × 9⅞″ (H.W.D.) and it weighs 28¾ lbs.

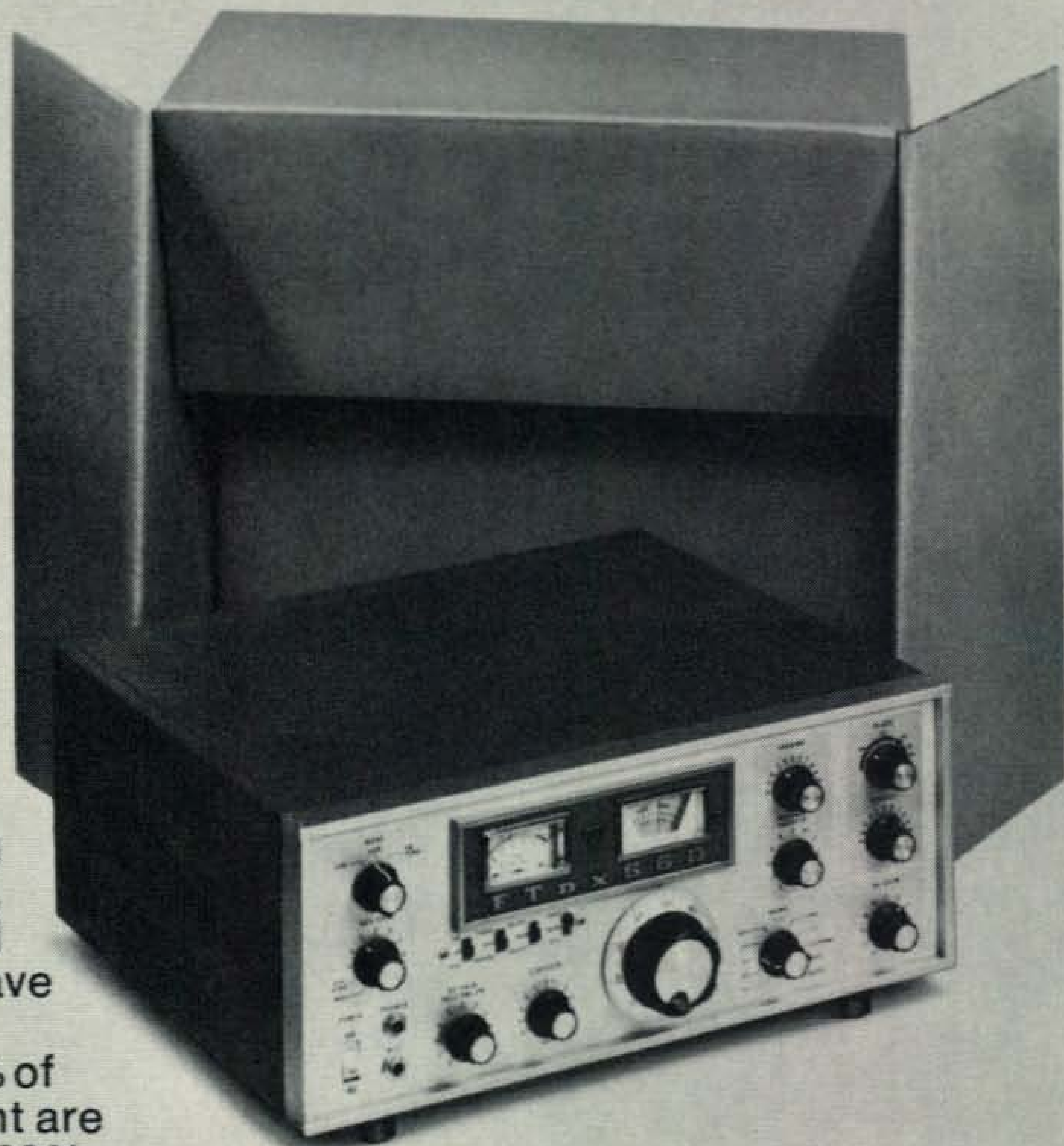
The SX-122A General-Coverage Receiver is priced at $395.00. The HA-19 100 kc Crystal Calibrator Accessory is $29.95. The manufacturer is The Hallicrafters Co., 4401 W. Fifth Avenue, Chicago, Illinois 60624.

—W2AEF

See page 102 for New Reader Service

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

At $450, it's a steal.



Considering all the FTdx 560 offers, you might think its $450 price tag was for a kit. But it isn't.

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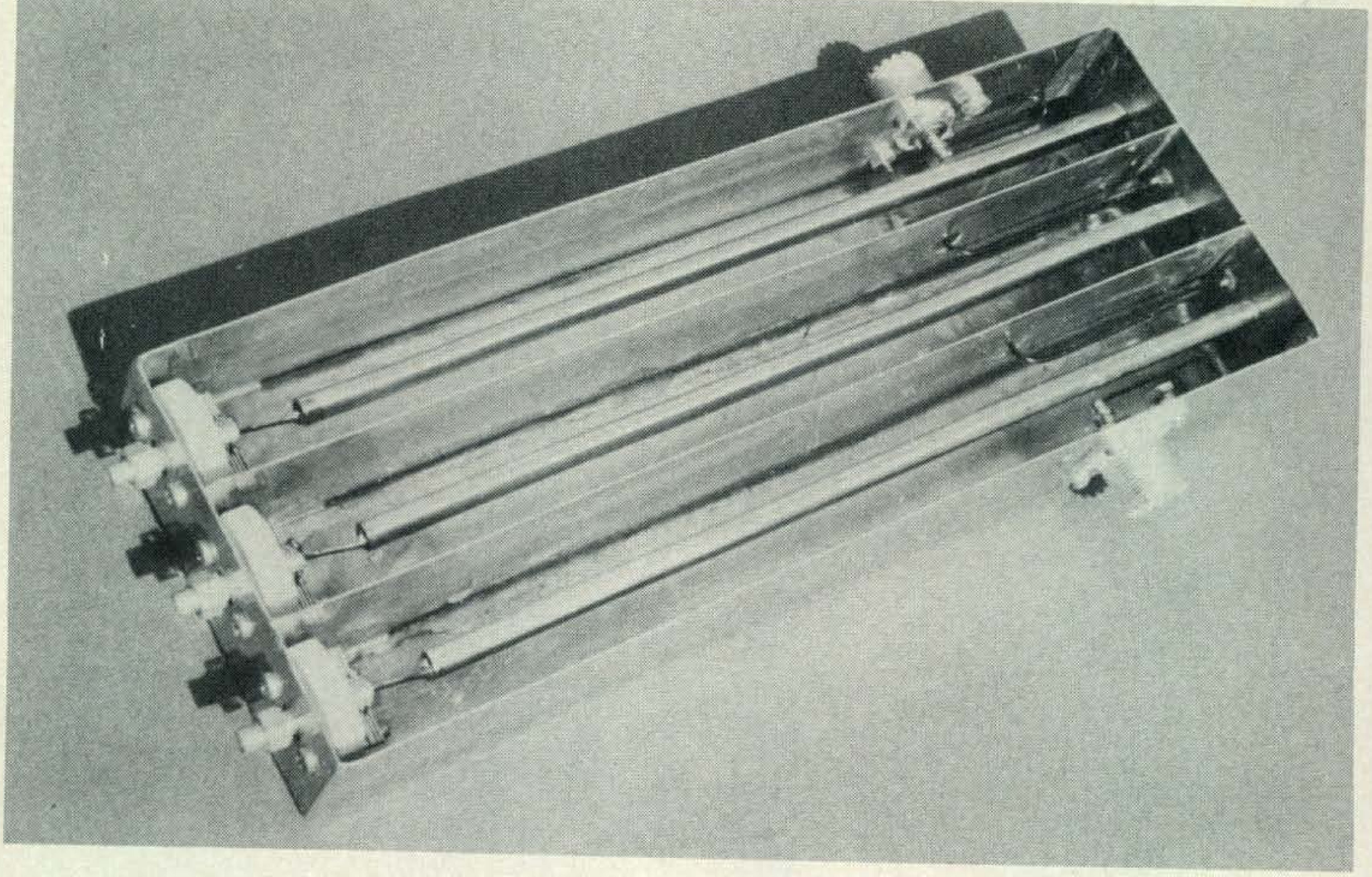

A TWO METER CAVITY FILTER

BY JOHN W. CORR,* W6QLB

To begin with, this article is written for those who operate in two meter nets or monitor a two meter channel for long hours and desire something as close to a clear channel as possible. It has a particular message for stations bothered by images or fundamental overload from nearby transmitters in the 150-160 mc high band such as police, fire, public safety, taxi, local government, *etc*. It also describes a sort of "blessed relief" for two meter operators who periodically get blasted from their chairs by unwanted images from commercial airlines passing overhead.

The truth of the matter is that this cavity-type receiving filter is not new. We first saw it in a RTTY publication, credited to W2FI and W2QBR of Nassau County Civil Defense. It is currently described in The New RTTY Handbook.

*Radio Officer, CD Area D, Reg. 1, Calif., 1295 Scott Ave., Pomona, Calif. 91767.

[1]Kretzman, Byron H., *"The New RTTY Handbook,"* The *CQ* Technical Series 1962, Cowan Publishing Corp., N.Y.C., pp. 172-174.

Materials

The filter is best made of flashing copper. This material is fairly expensive (the quantity required cost us under $5.00) so we started to get smart, right away, and substitute "bright tin" or "dairy tin" which *should* have worked well. We will never know, I suppose, because the heat of soldering caused it to warp beyond recognition.

Drilling

With a pathetic amount of relief at the sight of a well-built enclosure, our next step was to carefully measure, mark, and drill all of the necessary holes. The diagram, fig. 1, pretty well shows where these are. You will want to adapt them a bit to fit your own parts. It is quite important that you remember to drill passage holes in the partitions to accomodate the coupling links. These holes are not critical in size but, for the record, ours were a quarter of an inch in diameter.

Soldering

Seam filling and partition mounting come

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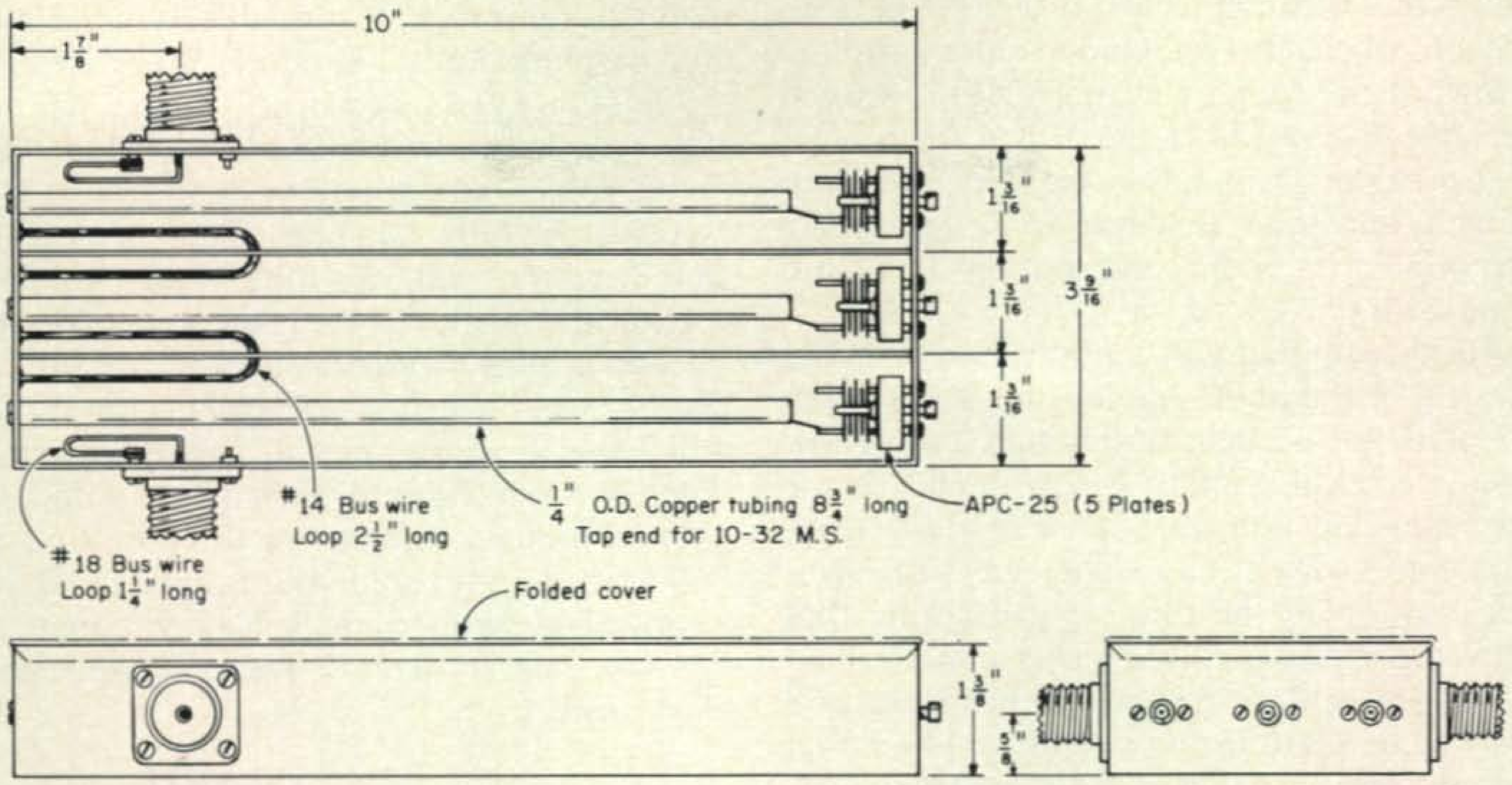

Fig. 1—Top, side and end views of the two meter cavity r.f. filter as seen in the New RTTY Handbook[1].

next in the assembly process. It was in this soldering task that the next major pitfall was encountered. I have, for years, used a very large one-hundred watt soldering iron for everything from transistors to chicken de-beaking (I *know* what they say!) so I just naturally plugged it in and got set for the task. Well, frankly, I have never seen the heat go out of that spade-tip so fast in all of its life as I did when it was applied to a sheet-copper box. It had never occurred to me that a good conductor of electricity might also be a good conductor of heat. With a sigh of submission, I unplugged the old iron and called our C.D. Communications officer who owns a gas torch. I also borrowed an old leather glove from the garden supplies in our garage because it was evident that the box was going to get hot. The torch proved to be a good solution and a fairly easy one, too. After first cleaning the oil and corrosion from the copper with that magic powder (used on kitchen pans of the same metal) I found that it was possible to seam-solder with a fairly small flame. It does pay to "tack-solder" every inch or so first, when placing the two partitions.

Coupling Links

One item not shown in the drawing is the method used to mount the coupling link wires. Here is where you can get into the design process. If you space the wire loop away from the partition and close to the center post (copper tube) you will achieve a broader bandpass with less insertion loss than you will get by moving the loop closer to the partition and further from the center post. We made a happy guess and spaced the loop wire about an eighth of an inch from the post which resulted in an insertion loss equal to one meter calibration mark on a Gonset III Communicator (not too serious). When the filter was peaked at 147 mc, the attenuation was down about three scale divisions on a signal at 145.5 mc of the same intensity. This is a receiving filter. We tried to transmit through it and there was no arcing at 4 watts but no QSO either. It is just fine for receiving, though.

Once you have selected your spacing, drill a tiny hole on each side of each partition to receive the loop "legs". These holes should provide a "friction fit" for the #14 or #16 wire used. Insert the links, balance them by eye to run through the center of their passage holes, and solder the "legs" inside and out. (Use the smallest torch flame.) Then, gently bend each loop upward until it is again centered in its partition passage hole and you will be all set.

The input and output links, being different, deserve a word too. We maintained the eighth inch spacing on these, also. One side of the loop goes to the center of the coax connector and the other comes back to a point halfway between the connector's mounting screws, bends, and is secured by one of the screws and some solder. In practice, you will have to mount the coax connector so that the beveled side of its center-conductor solder terminal is toward the loop. The loop wire is spaced the same distance from the post as the tip-end of this solder terminal so the wire goes into the side and then bends down for soldering purposes. The input and output links are made with #18 wire.

Another tip that you cannot glean from the drawing or the photograph is that each of the five-plate APC-25 capacitors much somehow make electrical contact with the end of the box. You will note that most of these trimmers come with a long solder lug formed as an extension of the three-legged spring that holds the rotor in place. This can be bent around the ceramic, nipped off just right, and easily soldered to the square metal block that contains one of the threaded mounting holes. This does not interfere with the mounting function but does ground the rotor when the trimmer is mounted. Be careful not to upset the rotor spring function while bending the lug. Use the soldering iron for this job because the torch (which you will be fond of by this time) creates enough heat to crack the ceramic. The stator of each capacitor is then electrically connected to the center post by a piece of #16 wire. This makes the center post quite firm and rigid so position it well first. The other end of the center post, of course, is affixed to the copper box by a 10-32 machine bolt. You will find that regular quarter-inch copper tubing can be tapped with 10-32 machine threads. It may need a very slight crimp.

Finishing Touches

Once you have all the parts carefully in place, ready to seal up, borrow a good lump of modeling clay from some child. Spread this evenly inside the metal cover to make a coating about as thin as the copper itself. Then place the lid on the box and press down. When removed, you will find that the partitions have left clear imprints in the clay that can be used as guides for center-punching small holes (1/16") every two inches along each line. These holes will permit spot-soldering of the cover to the partition edges, once the box is closed up. Remove the clay, of course (give it back to the child), and drill your holes. Take the whole project back to the kitchen and clean it up with that magic powder (you will find that it pays to buy your wife a new can of the stuff ahead of time) and rince it with good hot water. Flux from the solder is not going to hurt anything, but you can remove it if you wish by using alcohol or methyl-ethyl-keystone *(outdoors and no smoking)* and a stiff brush. Do not use acid flux just because this is sheet metal work. Rosin solder is best here as in all radio work.

Once the filter has been cleaned up inside and dried out well, it is time to take your last look at the insides, close it up, and solder the lid down with caution not to get the box so hot that your previous soldering is upset. You will have to move very fast with the torch. The cover will want to warp a little with heat, so hold it down with two or three well-placed "C" clamps. Spot soldering is enough. If you seam-solder around the edge, you may get the box hot enough to melt all your good work inside.

Adjustment And Use

Adjustment of the filter requires that it be coupled to a receiver and a good strong signal source. Wih the capacitor plates fully meshed you probably will not hear anything. Resonance will occur when they are about half open and is quite sharp. The three sections can be peaked on the same signal or can be stagger-tuned to cover about 500 kc fairly well. Since the filter has its greatest use in situations like Civil Defense and AREC, the peak-tuning may be more desirable as it will minimize insertion loss. We operate two RACES channels, using Gonset Communicators less than 1.5 mc apart on two meters. There had always been some cross-talk before and a fairly rough case of fundamental overload as well. The filter, applied to one of the sets, reduced this effect greatly. One on each set should clean things up. Odd effects from Police and Fire radios in the same building have disappeared and we are no longer bothered by being under the main approach leg to an airport. If you want to use this type of filter to help with duplex operation you should seek the maximum channel separation possible and consider cross-polarizing the sending and receiving antennas. The filter is good but will not perform miracles unless you help it a bit. By the way, it is a bi-lateral device. It doesn't matter which side is the input or the output. Though most people prefer to keep the filter near their receiver, its bi-lateral qualities may come in handy if you wish to mount it out near a duplex antenna. We already have plans for one that has a fourth section, full of pre-amplifiers that can be placed at the antenna end of a long transmission line. Good luck on yours. ■

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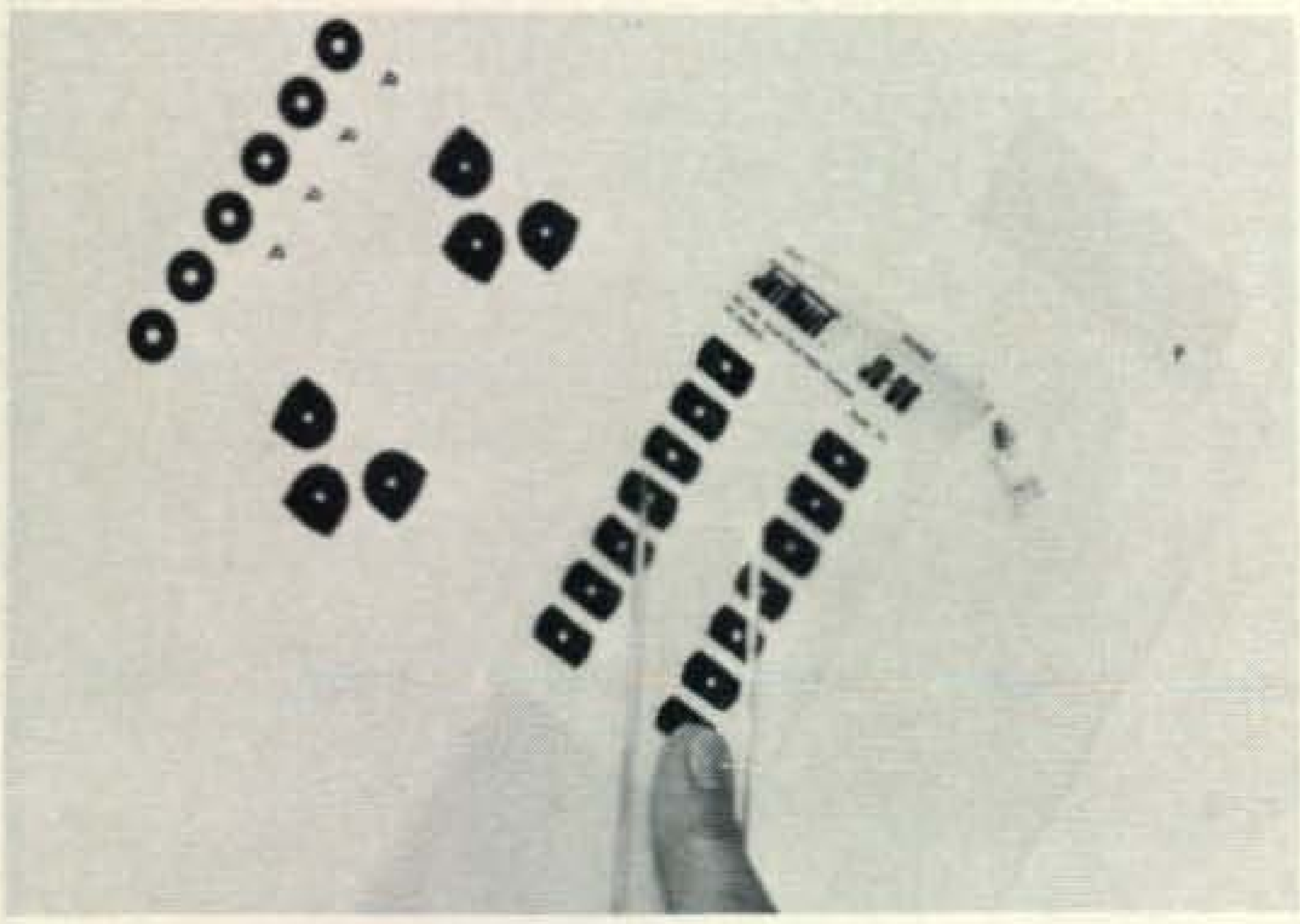
New Amateur Products

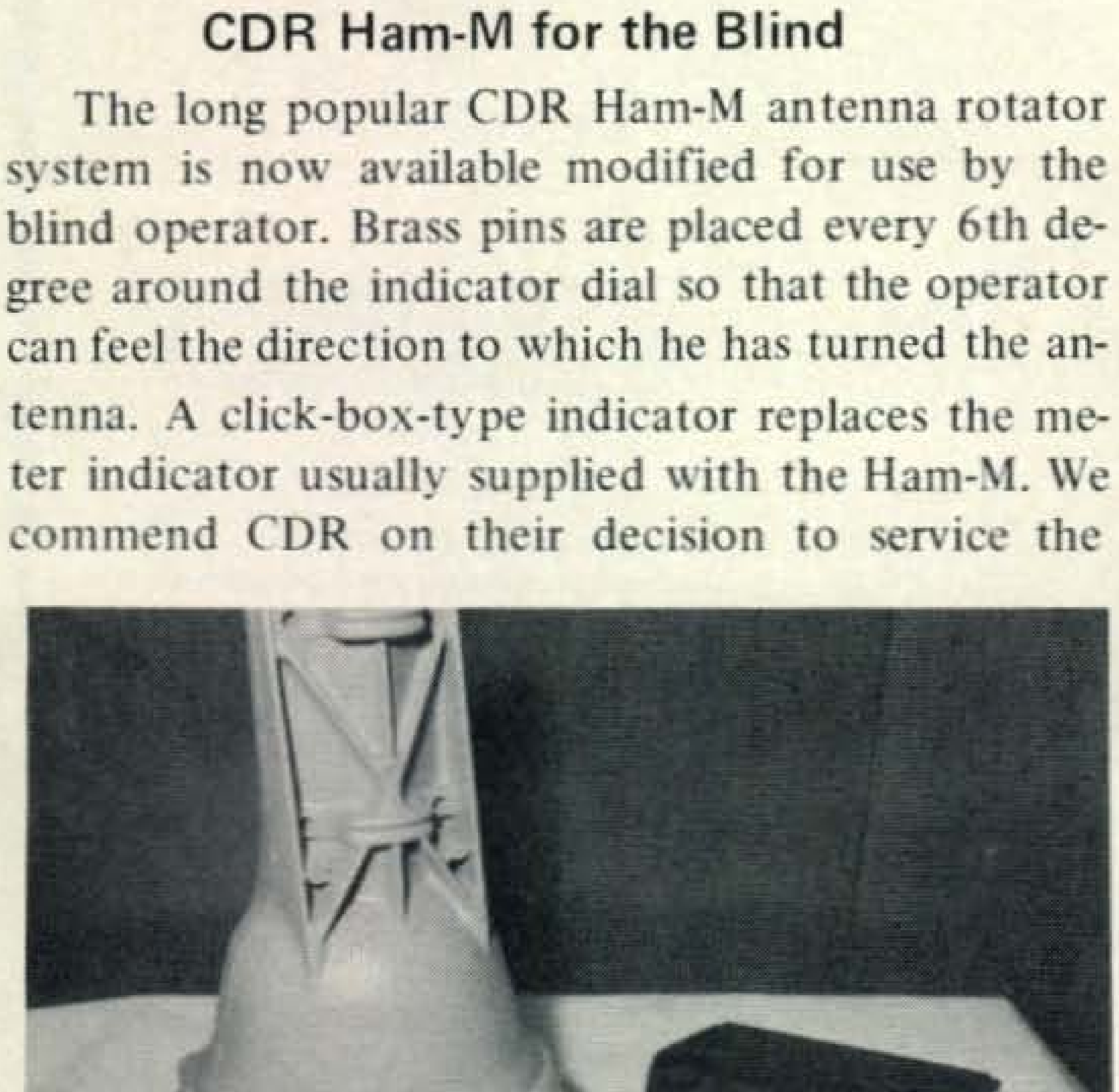
Datak JotDraft PC System

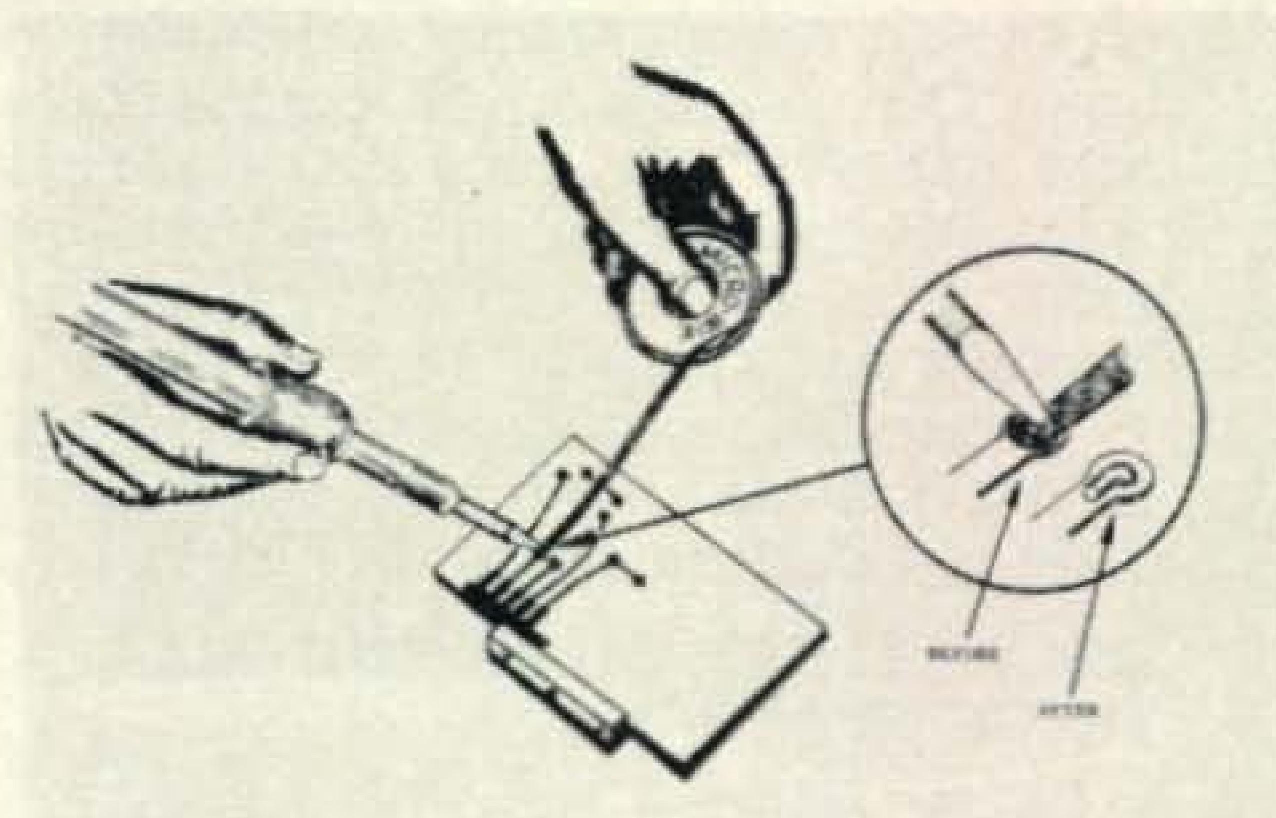
Using the new Datak JotDraft transfer patterns, printed circuit board layout is even faster and easier than ever. The patterns, available in 1x, 2x, and 4x PC pad clusters for IC's and transistors, TO, DO, and resister outlines, donuts, 1/2 size logic symbols and PC edge connector patterns, are simply positioned and transferred by rubbing with a ball point pen or burnishing tool. The transfers are suitable for either preparing oversize artwork for later reduction or for preparing direct, same-size artwork on photosensitive laminate boards. A free JotDraft sample and data sheet is available from The Datak Corporation, 85 Highland Ave., Passaic, N. J. or by circling A on the Reader Service Coupon on page 102.



CDR Ham-M for the Blind

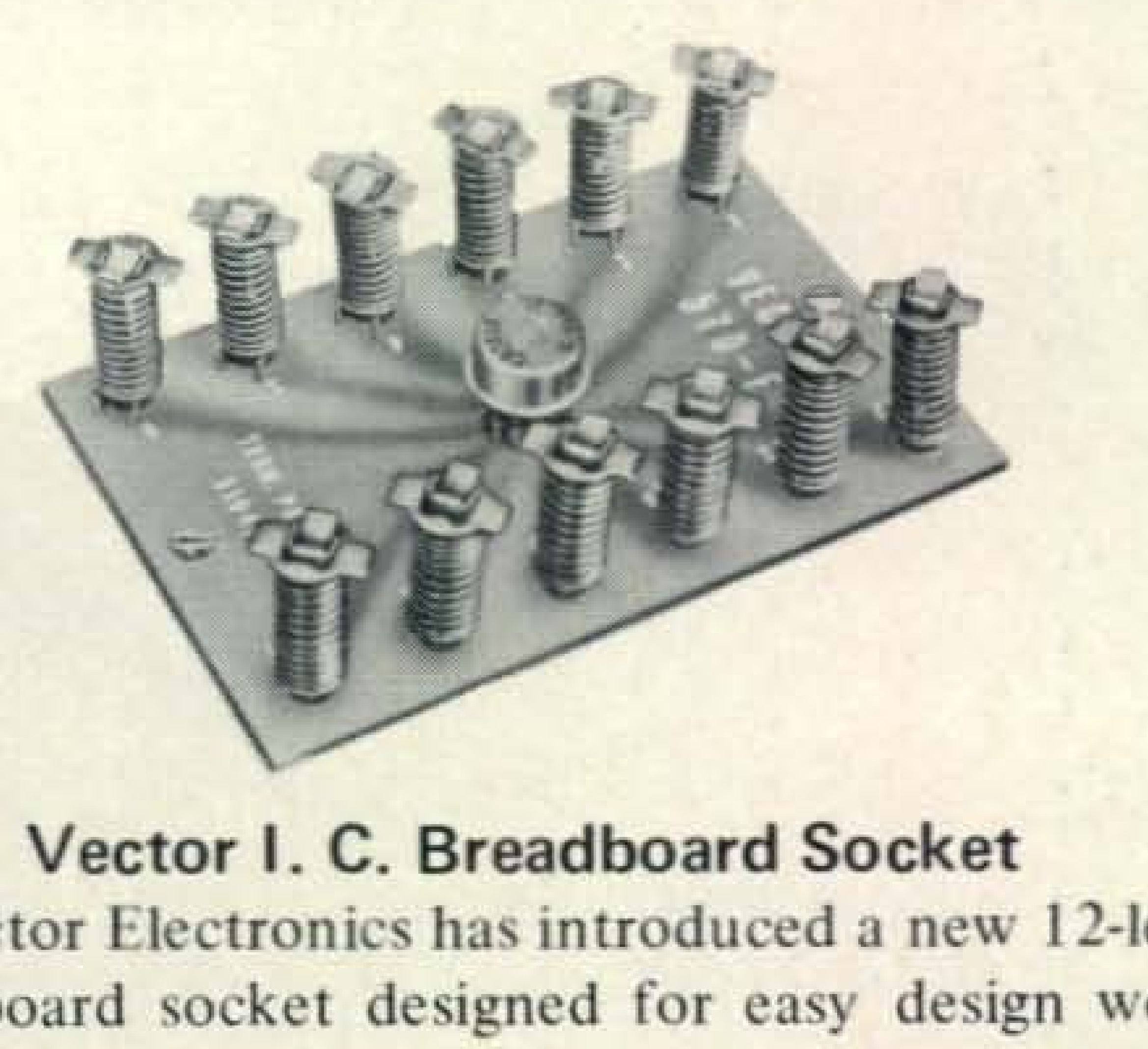
The long popular CDR Ham-M antenna rotator system is now available modified for use by the blind operator. Brass pins are placed every 6th degree around the indicator dial so that the operator can feel the direction to which he has turned the antenna. A click-box-type indicator replaces the meter indicator usually supplied with the Ham-M. We commend CDR on their decision to service the blind amateur market, despite the limited number of potential sales. Perhaps other amateur equipment suppliers will now follow their lead. For further information on this new rotator, circle B on the Reader Service coupon on page 102.





"Solder Blotter" Solder Remover

Easy Electronics has introduced a new product for quick removal of solder from soldered joints in either point-to-point or printed circuit wiring. Called "Solder Blotter," the material uses a wicking action to draw molten solder out of a joint for either salvage or resoldering. Two sizes are available: Bonus-Wik for large connections (10 feet for $1.80) and Micro-Wik for smaller, delicate work (20 feet for $3.50). The material is available from Easy Electronics Co., P. O. Box M-33, Fremont, Calif. 94537.



Vector I. C. Breadboard Socket

Vector Electronics has introduced a new 12-lead breadboard socket designed for easy design work with the TO-5 case I.C.'s. The glass-epoxy base measures 2 3/8" x 1 5/8" and contains a 12-pin IC socket wired to two rows of solderless Spring-clip terminals. Up to four solderless connections can be made to each terminal. The breadboard socket is designed also to plug into pre-punched terminal board with 3/32" holes such as type AA-pattern Vectorboard, by means of two pins mounted on the bottom. Designated the 570F, it is priced at $3.95 each from Vector Electronics Co., Inc., 12460 Gladstone Ave., Sylmar, Calif. 91342 or from the firm's distributors.

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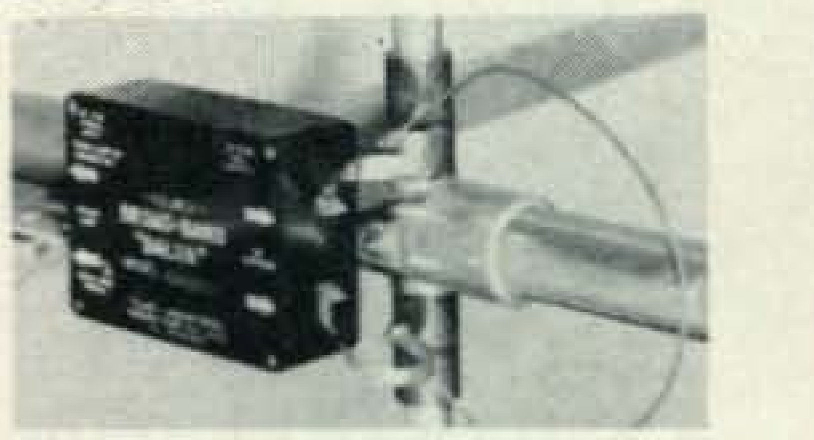

TRAP

Some thoughts from Mike Ercolino, P.E. — W2BDS, Telrex Chief Engineer . . .

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See page 102 for New Reader Service

DX

BY JOHN A. ATTAWAY,* K4IIF

"Unblemish'd let me live or die unknown;
Oh, grant an honest fame, or grant me none!"
—ALEXANDER POPE

THIS month we honor a new member to DX-dom's most prestigious group, the DX Hall of Fame. This man is probably the least publicized major DX figure in the United States. Although he played a prominent role in the organization and operation of seven major DXpeditions during the past 12 years, his name is relatively unknown except among the people most knowledgeable in DX affairs.

His initial effort was the first DXpedition in history to Navassa Island, the KC4AF operation, in March, 1958 when he was W8-DJN. What a way to begin! Also in this group effort were Don Chesser, W4KVX, then DX Editor of *CQ;* Jake Schott, W8FGX, now police chief of Cincinnati, Ohio; and other members of the Ohio Valley Radio Association.

Navassa was pretty hard to top, but for an encore he made an important contribution as an operator on the first DXpedition to Malpelo in March, 1961, when he, W6HAW, W9EVI, and WØNWX were guests of the Liga Columbiana Radio Aficionados. In 1962 he conceived and organized two DX-peditions by the Florida DX Club gang to Bajo Nuevo (HKØAB) and Serrana Bank (KS4BF).

For three years this man rested from first-hand participation in DXpeditions, but came out of retirement in 1965 to make a major contribution to the organization, procurement of gear, and actual operation of the first DX-pedition to San Felix Island, CEØXA. In more recent time he has figured as an organizer and operator for the second HKØTU expedition to Malpelo in 1969, and the Ernie Hendry DXpedition to Navassa, also in 1969. Informed DXers know by now that this could be more than H. Dale Strieter, W4DQS, DX Hall of Fame.

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

DX Hall of Fame

GUS M. BROWNING, W4BPD
Nov. 1, 1967

JOHN M. CUMMINGS, W2CTN
March 23, 1968

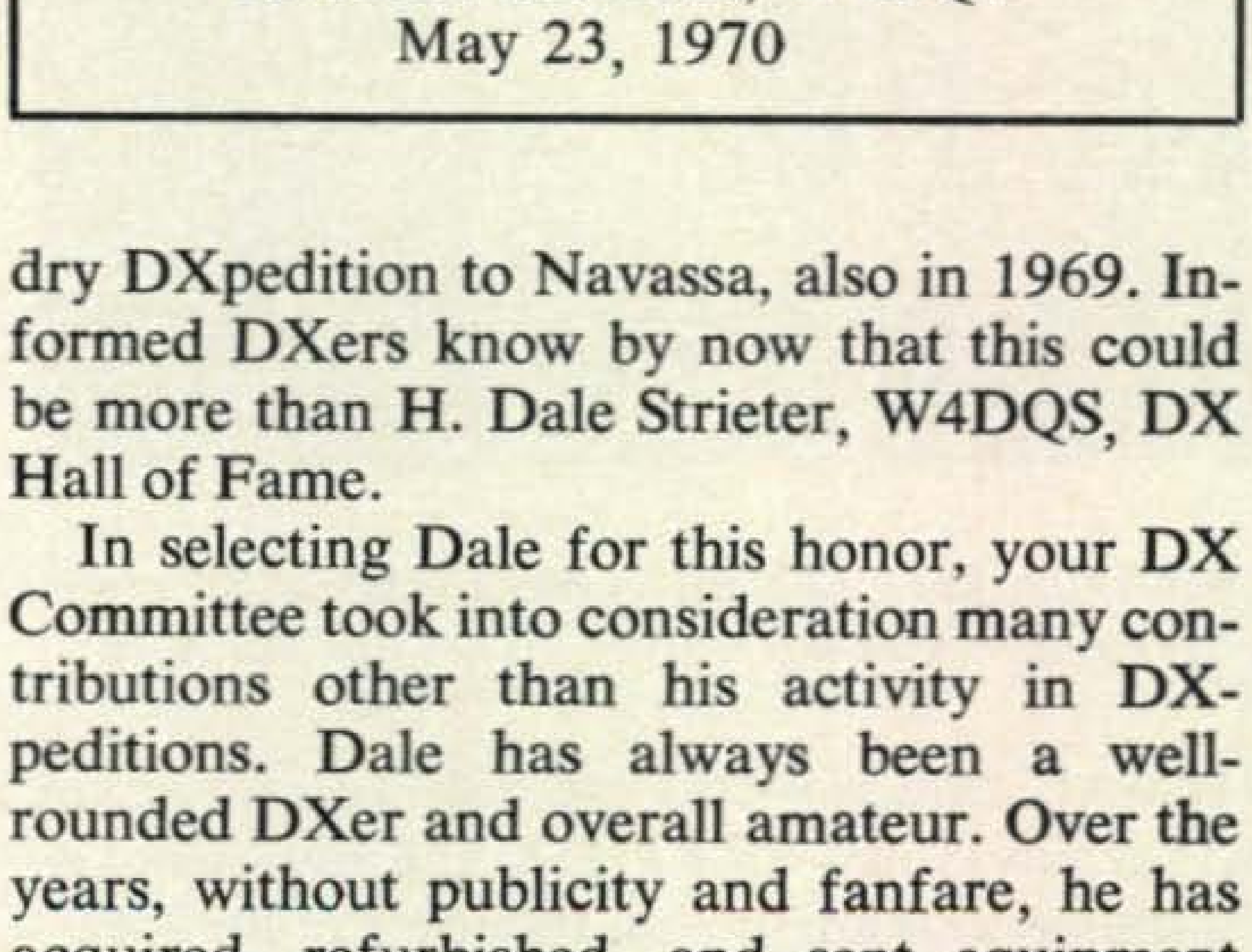
STEWART S. PERRY, W1BB
August 16, 1968

RICHARD C. SPENCELEY, KV4AA
March 1, 1969

DANNY WEIL, VP2VB
Sept. 15, 1969

H. DALE STRIETER, W4DQS
May 23, 1970

In selecting Dale for this honor, your DX Committee took into consideration many contributions other than his activity in DX-peditions. Dale has always been a well-rounded DXer and overall amateur. Over the years, without publicity and fanfare, he has acquired, refurbished, and sent equipment into South America and Africa to help get new hams on the air. He served as QSL Manager for the 1961 HKØTU operation, and for ZD8J, HK1QQ, CEØXA, TJ1QQ,



Installation of Danny Weil, VP2VB, into the DX Hall of Fame at the West Gulf DX Club dinner on Monday, April 6, 1970. Left to right: Don Busick, K5AAD, West Gulf member of the CQ DX Committee; Danny himself; and Hal Sears, W5NC (ex-K5JLQ) a member of *Yasme* board during the "Danny days." *(Photo by WA5LES).*

See page 102 for New Reader Service

Hal Whitaker, CT3AS. Photo by Edna Brannen, WA4EPM, during her recent visit to Madeira.

HK∅AB, and KS4BF. He has been a section winner in many ARRL DX and Sweepstakes Contests, and finished in the top five nationally in the c.w. division on several occasions. Dale is a past president of the Florida DX Club, a member of the All Operator's Club and First Class Operator's Club, and is currently Director of the Southeastern Division of ARRL. Congratulations Dale!

The WAZ Program

S.S.B. WAZ

779........DL8RH	784........K9KXA
780........WA7GHK	785........YV1KZ
781........W6NTQ	786........VE3LZ
782........W8JFD	787........ZS9L
783........W∅PAH	

C.W.—Phone WAZ

2889........HA5FE	2900........WA9JDT
2890........ZL2QM	2901........K4ELK
2891........JH7LPF	2902........WA9UET
2892........JA6HKC	2903........W3ZUH
2893........W7DVQ	2904........WA3IUV
2894........DJ3YU	2905........K4OLQ
2895........DJ7DS	2906........JA4SZ
2896........DK3CT	2907........HB9UP
2897........DL8SC	2908........OZ5KU
2898........W2MLO	2909........K∅PMZ
2899........K2AAC	2910........SP1BHX

Phone WAZ

441........YV1PP

De Extra

If you told some of your casual acquaintances that you were a DXer how would they react? Would they think it was your fraternity, or maybe that you were confessing to a mental illness or a social disease? Would they start avoiding you? They might know what you meant, but I bet 98% wouldn't. Two years ago a couple of senior citizens strolled by my house and silently contemplated the stacked 40 meter beam and tribander at 60 feet in the backyard. Finally breaking the silence one remarked "why does anybody in *this* neighborhood think they need a TV antenna *that* big." If you mentioned in a conversation that you had stacked beams at your house they would probably think you were bragging about your wife's figure. However, that's beside the point.

The point is that amateur radio in general and DXers in particular have fallen pretty far behind in educating the public. Every time you read of an injunction against somebody's tower or of an amateur being sued for some ridiculous sum of money because of TVI it drives that simple truth home. Unfortunately, since we DXers and Contesters usually have the tallest towers and highest power in a particular area its all too likelyy to be one of our soul brothers who's catching the static.

I had an eye-opener recently when taking a taxi to the airport of a large northwestern city. I asked the cabby what he thought of ham radio. His answer was that "hams were sorta radio pi'neers in the 20's and 30's that spear-minted with shortwave and helped out the Red Cross during 'mergencies." He went on to say that "hams weren't around anymore. People like that repaired TV sets." Well brother it may come to that if we don't get busy.

What can you do? Plenty! First of all, never miss an opportunity to volunteer your station for public service. Mobile units can frequently be useful in crowd management and at many types of outdoor functions requiring communication between groups at separated locations. Use your imagination. On the spot talk-power is welcome in all kind of instances, some nobody has even thought of yet. Demonstration stations set up to relay messages and originate traffic at fairs, expositions, and large shopping centers get much favorable attention.

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There is no finer use for your station than supplying communications for families of service men overseas, particularly those in southeast Asia. This can be done through MARS and through established nets. A note to ARRL should get you a listing of many other opportunities to help out J.Q. Public.

Service clubs are always seeking a fresh program and good presentations on amateur radio are very welcome. Over the years I've talked to Sertoma, Kiwanis, and Rotary clubs in at least 3 different cities, and have always been well received. All it takes is a dipole, a transceiver, and a little gab. A pre-arranged sked with a TG9, YV5, HK3, or KP4 is usually easy to arrange and a big hit. Encourage high school science teachers to become hams and set up stations in their schools. This is a very effective way to propagate the hobby.

No matter how you decide to proceed, don't be bashful about publicity. That's the name of the game! Write up your own press release if you have to. Type it double-spaced and your local paper will welcome it. They can't have a reporter everywhere all the time, and they need interesting items.

It's nice to sit back in the evening and admire the wall full of rare QSL cards and fancy certificates. Remember though, if we don't carry our weight, contemplating those cards and certificates may one day be the only activity still left for us.

DX Editor Away

If you mailed in your cards for WAZ during the month of June and they haven't been returned please stay cool. K4IIF was in Europe for most of the month and has a tremendous backlog of applications to process and letters to write. He hopes to have everything back to normal by mid-July.

Amateur Radio in India

Information for this article was sent to *CQ* by Mr. G. V. Sulu, VU2GV, well known Indian radio historian and chief promoter of amateur radio in India.

"Amateur Radio got it's start in India right at the very beginning of Wireless itself. The late Sir J. C. Bose, who investigated the quasi-optical properties of very short electromagnetic waves during the interval 1890-1900, is considered to be the first ham of India. Bose was elected a Fellow of the Royal Society for his work on the response of plants to electric waves.

"No records of early conventional ham

CQ S.S.B. HONOR ROLL

W9ILW	320	ZS6LW	308	K2DX	297	K9LUI	273
W2TP	318	G8KS	307	W8BT	297	W6PTS	272
WA2RAU	318	W2ZX	30[illegible]	K8IKB	296	W6RKP	272
WA2IZS	317	VE3ACD	30[illegible]	W8EVZ	29[illegible]	W8BVF	272
I1AMU	317	W4OM	304	K8ONV	29[illegible]	G3N G	270
W2RGV	316	W4SSU	304	F2MO	292	K9PPX	270
DL9OH	316	PAØHBO	303	W2FXN	29[illegible]	K4GXO	271
W3NKM	316	W6YMV	303	K1IXG	288	G3WW	269
K6LGF	316	KØUKN	303	SM6CAS	286	W9QLD	269
KP4CL	316	OK1ADM	302	W2LV	28[illegible]	G2BVN	265
VK3AHO	315	W2BXA	30[illegible]	W6EUF	28[illegible]	W2FXE	264
W4QCW	315	W4IC	30[illegible]	K8RTW	28[illegible]	HP1JC	263
W6EL	315	W6NJU	30[illegible]	K9EXY	284	W2MJ	261
K6YRA	315	VE2WY	302	W3KT	28[illegible]	W8ILC	255
WØBW	315	G3AWZ	30[illegible]	W6UOU	280	CT1PK	254
W4OPM	314	G3DO	301	W3EWD	279	W6BAF	254
WA8AJI	314	G6TA	301	W4RLS	27[illegible]	K6CAZ	254
TI2HP	314	WA2EOQ	301	K4OEI	27[illegible]	PAØSNG	252
W4NJF	313	W3DJZ	301	DL3RK	27[illegible]	VE6TP	251
W5KUC	311	G3HDA	300	DL1IN	276	W1AOL	250
G3FKM	310	K1SHN	300	K4HYL	276		
SM5SB	310	W9JT	300	W7DLR	276		
XE1NE	308	5Z4ERR	298	PZ1AX	274		

To remain on the Honor Roll, a station must update his country total at least annually.

activities are available. However, we know that by 1923 a handful of VU hams were working DX stations in Australia and South Africa. By 1924 there were about 30 hams with a couple of small clubs, and by 1925 VU hams were communicating with all parts of the world.

"In 1924 when the Madras Presidency Radio Club transmitted programs through its station 2GR it was the beginning of broadcasting in India. In those days hams could broadcast music and other type programs as well. Club stations 2FV and 2BZ of Bombay and Calcutta followed Madras within a year.

Two top DXers pose on Tristan de Cunha. On the left is Andy, VE1ASJ/HP9FC/HO9FC/ZD9-BP. On the right Ray, ZD9BP. Andy asks that QSLs for his calls be sent to P.O. Box 51, Saint John, N.B., Canada.

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At a recent party given in honor of Susi, HB9-AOE/4, when she was in New York. Standing: George, ex-YO2BO, Seichi, JA2ENU, Tony, W2-QL, Mamoru, JA1ANE, Alan, K2EEK. Sitting: Harvey, WA2GBF, Serge ex-YO3LM, Susi, HB9-AOE/W4, Steve, WA2DHF, ex-GM5AHS. George is forming a group to welcome foreign amateurs when they get to New York. If you want to take part, you can reach him at: 34-24 76th street, Jackson Heights, N.Y. 1372.

They broadcasted in the medium waves with 40-100 watts power. In 1925 the Radio Club of Bengal in Calcutta brought out the first monthly ham magazine entitled *Radio*. It was edited by G. Briggs, 2CZ, and included the Callbook.

"In 1927, the Indian Broadcasting Company was formed and took over commercial broadcasting. Consequently Indian hams were prohibited from broadcasting and the power of their transmitters was restricted to 10 watts. To protect he inerests of Indian amateurs during these difficult years the Indian Radio Society was formed in Bombay in 1929. It had about 100 members all over the country and published a monthly entitled *IRS Circular*. It also operated India's first QSL Bureau for 2 years, after which it was discontinued due to lack of interest in the part of the members. When World War II broke out in 1939 all ham activity was suspended.

"When licenses were reissued after the war, there were about 40 hams. In 1948 VU2BU collected a band of enthusiasts at the School of Signals in Mhow and formed the Amateur Radio Club of India (ARCI). ARCI was responsible for bringing in more hams, particularly from the Defense Services. It ran regular contests, issued certificates, and organized an SWL League and a QSL Bureau. However, in 1952 when VU2BU was transfered the ARCI came to a standstill. Three years later VU2-HM took over the work, shifted the club to Delhi, and registered it as a Society—the present Amateur Radio Society of India (ARSI).

"By the close of 1968 there were about 480 amateurs in India including 14 ladies—with four OM-YL teams. There are now about a dozen ham organizations big and small, but no ham organization is recognized so far by the government of India. For all official purposes, however, the ARSI, RESI (Radio & Electronics Society of India, Bombay) and BARC (Bangalore Amateur Radio Club) are regarded as the principal amateur organizations in India—a de facto recognition, though not de jure!

"The present ham activity in India is largely the result of World War II surplus equipment. The shortage of foreign exchange doesn't permit imports, and the very limited demand doesn't permit local manufacture. Receivers like the AR-88, HRO, Super-Pro, SX-28, and BC-348s are still going strong. Transmitters are assembled with surplus components, with power limited to 150 watts. We have no 160 Meter band and only 10 kc on 80 Meters. The 40 and 20 Meter bands have a lot of VU activity, but only a few get on 15 and 10 Meters. The 6 Meter band has been withdrawn and only 3 or 4 amateurs have any equipment for 2 meters. There is no VU activity above 2 Meters.

"Out of the roughly 500 hams we have today, only about 150 are active with about 40 of them on s.s.b. using homebrew gear. Due to their simplicity, long-wire and wyndom antennas are popular though a few use dipoles fed with surplus coax. There are about 25 cubical quads. Only a handfull of hams have measuring or test equipment with the exception of multipliers. Some have the BC 221 frequency meter, but it is a luxury for most. Two enthusiasts, VU6VU and VU-2BB, have amateur TV licenses but haven't

The S.S.B. DX Award Program

100 Countries	630........W4CRW
625........K8RRQ	631........W4IN
626........WA6JKO	632........KH6BB
627........WØIKD	633........VE2DJR
628........DL1EC	**300 Countries**
629........DL1EG	52........VE2WY

Complete rules and an application blank for the *CQ* S.S.B. DX Awards may be obtained by sending a self-addressed, stamped envelope to WA6GLD, 5031 Arroway Ave., Covina, Calif. 91723.

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taken it up seriously as of this date. VU2KV is the only RTTY operator, and so far there isn't any space communication—not even reception."

Next month—Amateur Radio in Czechoslovakia.

Preliminary Report from Aves Island
de YV5BPG/YV∅BPG

The following letter was written by Pedro on May 5, 1970:

"Dear John,

"We are writing this at the San Juan airport during a stopover from Guadeloupe to Caracas.

"Our Aves Island operation started late because of many unexpected problems, like for example the seizure of the Air France plane which was supposed to carry most of the gang from Caracas to Guadeloupe. If that wasn't bad enough we ended up with a skipper who didn't know the first thing about navigation, and who lied to us about a few things like the true speed of his boat. As a consequence we had the unusual experience of guiding the ship via YV∅AI/MM, with the help of a Venezuelan merchant ship skipper who gave us the necessary calculations by ham radio to enable us to find the island. Late but safe we landed at Aves and operated until Sunday noon, at which time we had to shut down in order to make it back to Guadeloupe on the slow boat.

"Fortunately we had no technical trouble of major importance except some difficulty with our keyer and a certain degree of cross interference on some bands, as we were unable to separate the transmitters as much as would have been desirable.

"As of this moment it is only 12 hours after our landing on Guadeloupe after a sleepless week. Therefore we haven't yet evaluated our logs to determine the effectiveness of the expedition. We do know that several stations, including ON4UN, HK3WO, XE1KS, W2-PV, W3AZD, W3SS, and others, told us that they worked us on 5 bands. Incidentally, we maintained a *strict* policy of no schedules, no QSO Managers, and no listening for friends.

"Please accept this as an advanced report, and we'll send a complete story with pictures, including an English transcription of the greeting to all amateurs from the President of Venezuela which was transmitted on 14195 kc.

"Unfortunately the trip was much more expensive than we had calculated. However, we have covered the bills with considerable sacrifice. Because of this contributions sent with QSL cards will be gratefully accepted. YV5BPJ is clearing house for contributions. The callsigns and QSL routings are as follows.

YV∅AI—Via W2GHK (operators were YV5's BPJ, BBU, BPG, & EL.

The WPX Program

S.S.B. WPX

499........OE5KML
500........CT1LN
501........W9GHO
502........G3UKH
503........W5HUM
504........WA∅EMS
505........W6QFU
506........VE4AE
507........CE3OE
508........WB2RLK
509........DJ5OI

C.W. WPX

1018........WA6JVD
1019........OK3JW
1020........YO3AC
1021........WA9OQE
1022........JA1GTF
1023........OZ2NU
1024........W7VSE
1025........HB9AKJ
1026........W∅YVA/4
1027........W6ANN
1028........JA4SZ

Mixed WPX

231........YU1BKL
232........W∅BE
233........WA∅EMS

Phone WPX

190........CT1LN
191........W9JJV
192........WA4MMO
193........K1DRN

WPNX

18........WN8EUN

VPX

21 (c.w.)........JA2-1762

WPX Endorsements

S.S.B.: K2POA—650, W4DQD—450, W8-GWM—450, YV1KS—450, OZ2NU—400, WA∅EMS—350, YV1KZ—350, WB2RLK—350, W∅YDB—350, W4WSF—350, DL1EG—300, W2WNW—300, K1KNQ—300, and WA-9SUJ—250.

C.W.: ON4QX—700, K2AAC—550, K∅JPL—450, OK3JW—450, JA1GTF—450, W6ANN—350, YU1NOL—350, and WA6JVD—350.

Mixed: W8ROC—700, CT1LN—600, WA∅-CPX—550, W4WSF—500, YU1BKL—450, W∅BE—450, and WA∅EMS—450.

Phone: CT1LN—550 and W4WSF—400.

80 Meters: OK3CEG and YO5BQ.

40 Meters: OK3CEG and YO3AC.

20 Meters: WA∅EMS and WA6JVD.

15 Meters: K4IEX.

10 Meters: OK2DB.

Africa: W8LY.

Asia: W8LY.

Europe: WA∅EMS, K2OLG, W8LY, OK3JW, W4WSF, and OZ2NU.

Oceania: W8ROC and W8LY.

South America: W8ROC.

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Here is Antonio Gomez Sobrino, HI3AGS, one of our recent WPX winners. Antonio is now chasing WAZ and can be found around 14200 after 2330 GMT on weekdays. On weekends he frequents 21250 beginning at 1800 GMT. The gear includes an HT-37, 2-B and TA-33.

VY∅PP–To YVIPP (Leslie)
YV∅LA–c/o YV1LA (Janusz)
YV∅BPG–Via YV5BPG (Pedro)
The other boys, that is our boss, Armando, YV5BPJ, YV5BBU, Jorge, and YV5EL, Migue, did not activate their YV∅ calls.

"Never before has a DX Editor got the report before the operators had a chance to sleep *in a bed*.

73 es DX,
Pedro, YV5BPG;
Jorge, YV5BBU;
Armando, YV5BPJ"

QRP'er John Thompson, W1BIH/PJ9JT operating from Curacao with his Ten-Tec, 5-watt transceiver. John QSO'd 300 stations in 32 countries on 20 and 40 meter c.w. These included VU via the long path, 6 VK/ZL's and 4X4. Sure the PJ9 call helped, but *5 watts!!* That's A-OK.

QSL Information

AX9MM–Via K4MQG
AX9WD–To W2CTN
C3ICR–c/o WB2NXL
CR3KD–Via W2CTN
DM6AO–To DM2ATD
EA8GZ–c/o VE7BWG
EL2AT–Via W4NJF, 1416 Rutland Dr., Virginia Beach, Va. 23454
EL8RL–To DL7FT
FB8WW–c/o F5QE
FB8XX–Via F2MO
FB8ZZ–To F8US
FL8SR–P.O. Box 25, Djibouti, French Somaliland.
FM7AA–c/o FM7WN
HC8GS–Via HK3WO
HK1BQR/HK4–To Scott's QSL Service, 1510 Lynnview, Houston, Tx. 77055
HK∅AI–c/o W9WHM
HS4ABS–Via W7FNY
JW3XK–To LA6RL
JY1–c/o King Hussein, P.O. Box 1055, Amman, Jordan
KZ5NR–Via WA9PZU, 5711 W. Brooklyn Pl., Milwaukee, Wis. 53216
M1B–To WA2HUP
MP4DAO–c/o W2CTN
MP4QBK–Via K4MQC
MP4TCE–To E. R. Chilvers, 1 Grove Rd., Lydney, Glos., England
OJ∅MI–c/o OH2ER
OY5NS–Via K1QLT
PJ8AA–To W2BBK
PJ8WW–c/o W9IGW
ST2SA–Via WA5REU
TA1HY–To W5QPX
TA1SY–c/o W5QPX
TA3HD–Via K3PZU, 900 W. Nolcrest Dr., Silver Spring, Md., 20903
TJ1AW–To K4ZCP
VP2AA–co VE3ACD
VP8FL, VP8JH, VP8JQ, VP8JI, VP8JG, VP8-JW, VP8KO, & VP8KN–Via E. R. Chilvers, 1 Grove Rd., Lydney, Glos., England
VR1L–To W6NJU, 7164 Rock Ridge Terrace, Canoga Park, Calif.
VR2CC–c/o VE6AKV
XW8CS–Via W3DBT
YA1OLK–To VU2OLK
YV∅AI–c/o W2GHK
ZC4CV–Via G3VCV
ZD8RC–To W4SFA
ZD9BM–c/o GB2SM
ZM3PO/C–Via ZL2AFZ
ZS3YK–To P.O. Box 25, Keetmanshopp, Southwest Africa
5A1TV (1965-68)–D. L. Hutchison, W7WQR, P.O. Box 542, Shafter, Ca. 93263
5R8AR–c/o WB4GQH
5T5BG–Via P.O. Box 538, Nouakchott, Mauretania
5VZDB–To W4SPX
5Z4KL–c/o VE3DLC
7Q7JO–Via K5QHS
9M6HM–To K6ZIF
9N1RA–P.O. Box 81, Katmandu, Nepal
9Q5DG–c/o W6KTE
9Q5WS–Via W1BPM
9X5AA–To W1YRC

73, John, K4IIF

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Propagation

BY GEORGE JACOBS,* W3ASK

BOTH 15 and 20 meters are expected to share honors for optimum DX propagation conditions during July and August.

Good-to-excellent world-wide openings are forecast for 15 meters throughout the daylight hours, and to many areas throughout the early evening hours as well. Peak DX propagation conditions are expected during the late afternoon and early evening hours, with excellent openings forecast in almost all dirctions.

Twenty meters is expected to remain open to one area of the world or another, around-the-clock. Although DX openings should be possible at almost any hour, optimum conditions are forecast during the early evening, the hours of darkness and the sunrise period.

Some fairly good 10 meter DX openings are expected during July and August, but mainly on north-south paths and to tropical regions, during the afternoon hours.

Despite seasonally high static levels some fairly good 40 meter DX openings are forecast to many areas of the world during the hours of darkness and the sunrise period. High static levels are expected to result in a seasonal decline in DX propagation conditions on 80 meters, although some openings are forecast during the hours of darkness. Not many DX openings are expected on 160 meters during July, because of seasonally high levels of static and solar absorption.

Check last month's column for a comprehensive band-by-band DX propagation forecast for July and August.

Short-Skip

This month's column contains Short-Skip Propagation Charts for the period July 15—September 15, 1970. Optimum short-skip conditions on most bands are expected during July and early August, mainly as a result of a seasonal peak in sporadic-E propagation.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for July 1 through Aug. 31, 1970

	Forecast Rating & Quality			
Days	(2)	(1)	(4)	(3)
Above Normal: July 1, 16, 18-19, 28-29. Aug. 13, 15-16, 25-26.	B	B-C	A	A-B
Normal: July 2-3, 6-10, 12, 14-15, 17, 20-22, 25-27, 30-31. Aug. 3-7, 9, 11-12, 14, 17-19, 23-24, 27-28, 30-31.	C	D	A-B	B
Below Normal: July 4-5, 11, 13, 23-24. Aug. 1-2, 8, 10, 20, 22, 29.	D	E	B-C	C-D
Disturbed: July none. Aug. 21.	E	E	C-D	D-E

HOW TO USE THESE CHARTS

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

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

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

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

3—With the forecast rating noted above, start with the numbers in parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

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

6—These Propagation Charts are vaild through Sept. 30, 1970. These Charts are prepared from basic propagation, data published monthly by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

During the daylight hours considerable short-skip openings are forecast for 10 and 15 meters over distances ranging between approximately 500 and 1300 miles, with some double-hop openings out to 2300 miles. Frequent short-skip openings ranging between 250 and 2300 miles should be possible on 20 meters, almost around-the-clock. Optimum short-skip conditions on 10, 15 and 20 meters can be expected during the late morning hours and again during the late afternoon and early evening hours.

Good daytime short-skip openings are predicted for 40 meters between distances of approximately 100 and 600 miles, excellent nighttime openings between 250 and 2300 miles. Good 80 meter openings should be possible up to distances of about 300 miles during the daylight hours, with the range extending up to 2300 miles during the hours of darkness. While no 160 meter short-skip openings are expected during the daylight hours, some openings are forecast during the hours of darkness for distances up to 1300 miles. When static levels are low, 160 meter nighttime openings may extend out to approximately 2300 miles.

V.h.f. Ionospheric Openings

Sporadic-E ionization generally reaches its annual peak during July and early August. openings, over distances between approximately 900 to 1300 miles, with some openings extending out to as much as 2300 miles. Optimum times for 6 meter short-skip openings are a few hours before noon and again during the early evening hours, although openings can take place at any time of the day or night. During many 6 meter sporadic-E type openings, signal levels may be exceptionally strong.

Be sure to check the 2 meter band during intense 6 meter short-skip openings, since 2 meters may occasionally open as well. Generally, 2 meter short-skip openings take place between distances of approximately 1000 and 1300 miles.

There is a fairly good chance for some meteor-type v.h.f. ionospheric openings during the last week of July, when the *Delta Aquarids* shower is scheduled to take place. This shower should reach its maximum intensity during the evening hours of July 29, with a predicted meteor count of between 20 to 30 an hour.

The *Perseids*, a major meteor shower, is expected to take place from August 9-14, with maximum intensity occurring during the nighttime hours of August 12-13. Other meteor showers are expected on August 1, 3, 5 and 18.

Trans-Equatorial (TE) propagation reaches a minimum during July, and few if any such openings are expected. It might be worthwhile, however, to check, on 6 meters between 8 P.M. and midnight, for the occasional opening that might occur between the *southern* half of the USA and Latin America. TE openings should begin to increase by late August.

Some v.h.f. short-skip openings resulting from auroral ionization should be possible during July and August. Check the "Last Minute Forecast" appearing at the beginning of this column for periods that are predicted to be disturbed or below normal; since these are the dates that auroral v.h.f. openings are most likely to occur.

Sunspot Cycle

The Swiss Federal Solar Observatory reports a monthly mean sunspot number of 109 for April, 1970. This results in a smoothed sunspot number of 105, centered on October, 1969.

A smoothed sunspot number of 94 is forecast for July, 1970, with a level of 93 expected for August.

CQ Short-Skip Propagation Chart
July 15—September 15, 1970
Local Standard Time At Path Mid-Point

(24-Hour Time System)

Distance From Transmitter (Miles)

Band (Meters)	*750-1300*	*50-250*	*250-750*	*1300-2300*
10	*Nil*	07-09 (0-1)* 09-13 (0-2)* 13-17 (0-1)* 17-21 (0-2)* 21-23 (0-1)*	07-09 (1)* 09-13 (2-3)* 13-17 (1-2)* 17-21 (2-3)* 21-07 (1)*	07-09 (1-0)* 09-13 (3-1)* 13-17 (2-1)* 17-21 (3-1)* 21-07 (1-0)*
15	*Nil*	07-09 (0-2)* 09-13 (0-3)* 13-17 (0-2)* 17-19 (0-3)* 19-21 (0-2)* 21-07 (0-1)*	07-09 (2)* 09-13 (3)* 13-17 (2)* 17-19 (3)* 19-21 (2)* 21-23 (1-2)* 23-07 (1)*	07-09 (2) 09-13 (3) 13-17 (2-3) 17-19 (3-4) 19-21 (2-3) 21-23 (2) 23-07 (1)*
20	09-00 (0-1)*	06-09 (0-2)* 09-15 (1-4)* 15-20 (1-3)* 20-00 (1-2)* 00-06 (0-1)*	06-09 (2-4) 09-15 (4) 15-20 (3-4) 20-00 (2-4)* 00-02 (1-3)* 02-06 (1-2)*	06-09 (4) 09-16 (4-3) 16-00 (4) 00-02 (3) 02-06 (2)
40	07-11 (2-4) 11-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (0-2)* 06-07 (1-2)	07-09 (2-4)* 09-11 (4-3) 11-16 (4-2) 16-18 (4-3) 18-20 (4) 20-22 (3-4) 22-04 (2-4) 04-07 (2-3)	07-09 (4-2) 09-11 (3-1) 11-16 (2-1) 16-17 (3-1) 17-18 (3-2) 18-20 (4-3) 20-04 (4) 04-05 (3-4) 05-07 (3)	07-17 (1-0) 17-18 (2-1) 18-20 (3-2) 20-05 (4) 05-06 (3-2) 06-07 (3-1)
80	06-10 (4) 10-18 (4-3) 18-00 (4) 00-06 (3-4)	07-09 (4-1) 09-10 (4-0) 10-16 (3-0) 16-18 (3-1) 18-19 (4-2) 19-21 (4-3) 21-06 (4) 06-07 (4-2)	06-07 (2-1) 07-09 (1-0) 09-16 (0) 16-18 (1-0) 18-19 (2-1) 19-20 (3-1) 20-21 (3-2) 21-04 (4) 04-06 (4-3)	07-18 (0) 18-19 (1-0) 19-20 (1) 20-21 (2) 21-03 (4-3) 03-04 (4-2) 04-05 (3-2) 05-06 (3-1) 06-07 (1)
160	17-18 (1-0) 18-19 (1) 19-21 (3-2) 21-23 (4-3) 23-05 (4) 05-07 (3-2) 07-08 (1) 08-09 (1-0)	18-19 (1-0) 19-20 (2-0) 20-21 (2-1) 21-23 (3-2) 23-03 (4-2) 03-05 (4-3) 05-07 (2-1) 07-08 (0-1)	20-21 (1) 21-00 (2-1) 00-03 (2) 03-05 (3-2) 05-06 (1) 06-07 (1-0)	20-22 (1-0) 22-00 (1) 00-05 (2-1) 05-06 (1-0)

*Predominantly Sporadic-E Openings

[*Continued on page 95*]

See page 102 for New Reader Service

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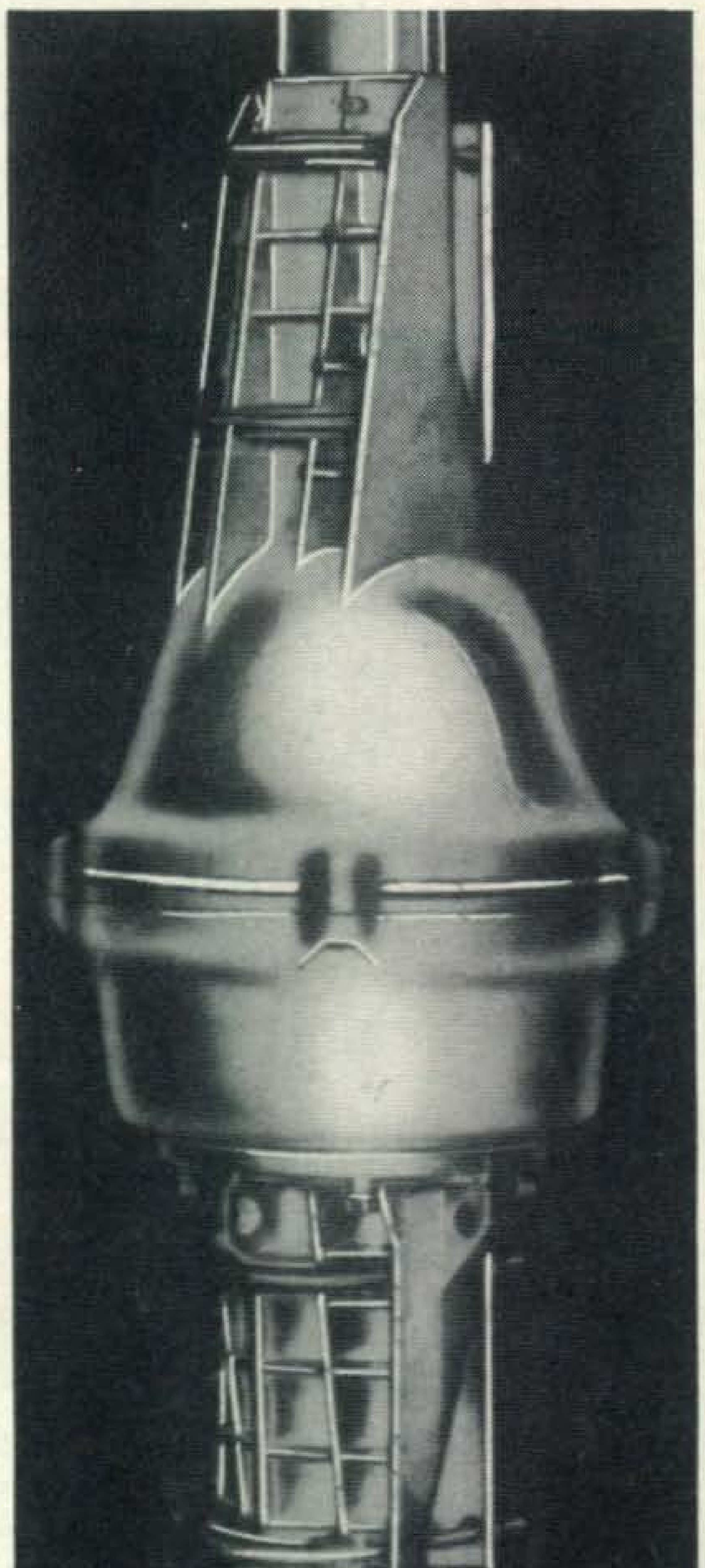

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The new Cygnet line is our latest development, and promises to become tremendously popular. Being self-contained with AC and DC power supply and loudspeaker, it is designed for easy portability, ideal for vacation or business trips, field day, or mobile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

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

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

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1200 watts, P.E.P. input, 10 through 80 meters. Has self-contained AC power supply, and same cabinet size as Cygnet Transceivers. Utilizing a grounded grid, super cathode drive circuit with four 6LQ6's, both efficiency and linearity are exceptionally high. Plugs directly into Model 270. May be easily adapted to the 260 and other transceivers. **$295**

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See page 102 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

July	4-5	Venezuela Contest
July	18-19	Colombia Contest
July	18-19	Bermuda C.W. Contest
July	18-19	Ontario QSO Party
July	25-26	County Hunters C.W. Party
Aug.	1-2	Romanian Contest
Aug.	1-2	Maryland/DC QSO Party
Aug.	1-2	Illinois QSO Party
Aug.	1-3	W2 Land QSO Party
Aug.	8-9	DARC WAE C.W. Contest
Aug.	8-9	Ohio QSO Party
Aug.	15-16	New Jersey QSO Party
Aug.	22-23	All Asian C.W. Contest
Sept.	12-13	DARC WAE Phone Contest
Sept.	23-25	YL "Howdy Days"
Oct.	3-4	VK/ZL/Oceania DX Phone
Oct.	10-11	VK/ZL/Oceania DX C.W.
Oct.	10-11	RSGB 28 mc Phone Contest
Oct.	16-18	RTTY "Plaque Sweepstakes"
Oct.	17-18	Boy Scouts Jamboree
Oct.	21-22	YL C.W. Anniv. Party
Oct.	**24-25**	**CQ WW DX Phone Contest**
Oct.	24-25	RSGB 7 mc C.W. Contest
Nov.	4-5	YL Phone Anniv. Party
Nov.	7-8	RSGB 7 mc Phone Contest
Nov.	8	Czechoslovakia Contest
Nov.	**28-29**	**CQ WW DX C.W. Contest**

Ontario QSO Party

Starts: 1700 GMT Saturday, July 18
Ends: 2400 GMT Sunday, July 19

This is the second QSO Party sponsored by the Radio Society of Ontario.

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

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

Scoring: For Ont., 1 point for each QSO, multiplied by the number of ARRL sections and foreign countries worked.

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

Frequencies: 3560, 3685, 3855, 3909, 7030, 7240, 7290, 14040, 14140, 14255, 14290, 21050, 21300, 28100, 28600, 50.25, 50.36, 144-144.5, 145.8.

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

Mailing deadline is August 31st to: Contest Chairman, Radio Society of Ontario, P.O. Box 334, Toronto 550, Ontario, Canada. Include a s.a.s.e. if copy of results are desired.

*14 Sherwood Road, Stamford, Conn. 06905.

County Hunters C.W. Contest

Starts: 0000 GMT Saturday, July 25
Ends: 2400 GMT Sunday, July 26

This party is being sponsored by the CW County Hunters Net, operation by mobiles and portables in less active counties is encouraged. Stations may be worked on each band and again if it has moved to another county.

Exchange: QSO nr., RST and state or province and county.

Scoring: Multiply total number of QSOs by the number of counties worked. Mobiles calculate their score on the basis of total contacts within a state.

Frequencies: 3575, 7055, 14070, 21070, 28070.

Awards: Three categoriees: 1. Highest scoring fixed or fixed portable in each state, Canadian province and country. 2. Highest portable in each state operating from a county which is not his normal point of operation. 3. Highest mobile in each state operating from 3 or more counties with a minimum of 25 QSOs per county. (A min. of 100 points are required for 1 and 2)

All entries with 100 or more QSOs must include a check sheet of counties worked.

Logs must show category, date/time in GMT, station worked, exchange, band, location and claimed score.

Mailing deadline is Sept. 1st to: CW County Hunters Net, Att: Jim Hoffman, K1ZFQ, 42 Gresham Street, Milford, Conn. 06460. Include s.a.s.e. if results are desired.

Maryland/D.C. SO Party

Starts: 2200 GMT Saturday, August 1
Ends: 2200 GMT Sunday, August 2

The 5th MD/DC QSO Party is again sponsored by the Maydale ARC. A station may be contacted on each band and mode. Separate logs must be submitted for c.w. and phone.

Exchange: QSO nr., RS/RST and QTH. County for Md./DC stations, ARRL section or country for others. (Baltimore and Wash. DC count as separate counties.)

Scoring: Two points for each completed QSO. Md./DC use ARRL sections and countries worked for their multiplier. Out-of-state stations use Maryland counties. (max. of 25)

Frequencies: C.W.–3575, 7075, 14075, 210-75. Phone–3850, 3950, 7275, 14275, 21325. Novices–3735, 7175, 21110. Tech.–50.175, 145.175.

Awards: Certificates to the top scorers in each ARRL section and country, both on c.w. and phone, additional awards where returns warrant.

Logs: Should show date/time in GMT, QSO nr. station worked, RS/RST sent and received, and QTH. A summary sheet with name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed is also requested.

Mailing deadline is Sept. 1st to: Carl E. Andersen, K3JYZ, 14601 Claude Lane, Silver Spring, Md. 20904. Include s.a.s.e. if copy of results are desired.

Romanian Contest

Starts: 1801 GMT Saturday, August 1
Ends: 2400 GMT Sunday, August 2

It's the world working the YOs in this one, all bands 3.5 thru 28 mc, on c.w., a.m. and s.s.b. Cross band and cross mode operation is not allowed.

Exchange: Signal report plus a 3 figure QSO number starting with 001, regardless of band or mode.

Points: Each completed QSO 2 points.

Multiplier: A multiplier of 1 for each YO county worked on each band and mode. There are 40 counties and c.w., a.m., and s.s.b. count as separate modes. The YOs will indicate their county with two letters. (*ie.* 569023/SJ)

Final Score: Total QSO points from all bands × the multiplier from each band and mode.

Logs: Use a separate sheet for each band, fill in multiplier only first time it is worked, and include a summary sheet showing the scoring, other important information, and a signed declaration that all rules and regulations have been observed.

Awards: Certificates to the leading scorers in each country and each classification. Single and multi-operator, both single and all bands. The over-all world champion wins a Crystal Cup.

Contest contacts may be applied to the many YO awards. A list will be sent on request.

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

DARC WAE Contest

C.W.–Aug. 8-9 **Phone**–Sept. 12-13
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

Rules for the 16th WAE contest sponsored by the DARC are same as last year with one exception, the multi-operator multi-transmitter classification has been eliminated from this year's contest.

Everything else remains the same: Use all bands 3.5 thru 28 mc, RS/RST plus QSO nr. exchange, multiplier from WAE country list and a compulsory 12 hour rest period that can be taken in up to 3 periods.

The QTC feature is still a big feature of the contest and awards are made in three divisions, power input up to 200 watts, over 200 and newcomers licensed less than one year.

Contest contacts can be used for WAE certificate endorsements provided the log of the requested station is also received, and the request is made within one year.

Complete rules which are quite lengthy and in details can be found in the July 1969 CALENDAR. Official copy as well as log forms can be obtained by sending a s.a.s.e. directly to me, W1WY or to DARC address below.

Mailing deadline is Sept. 15th for C.W. and Oct. 15th for Phone. The new address is WAEDC Contest Committee, P.O. Box 262, D-8950 Kaufbeuren, West Germany.

WAE Country List

CT1, CT2, DL/DJ/DK/DM, EA, EA6, EI, F, FC, G, GC, GD, GI, GM, GM Shetlands, GW, HA, HB, 4U1ITU, HB∅, HV, I, IS, IT, LA, Bear Is., JX, JW, LX, LZ, M1/9A, OE, OH, OH∅, OK, ON, OY, OZ, PA/PI, PX, SM/SL, SP, SV, SV Crete, SV Rhodes, TA Europe, TF, UA/UV/UW 1-6, UB/UT/UY, UC, UN, UO, UP, UQ, UR, UA Franz Josef Land, YO, YU, ZA, ZB2, 3A, 9H.

Illinois QSO Party

Starts: 1600 GMT Saturday, August 1
Ends: 2200 GMT Sunday, August 2

The 8th annual Illinois QSO Party is again sponsored by the Radio Amateur Megacycle Society. The same station may be worked and counted for QSO points on each band and mode.

Exchange: QSO nr., RS/RST and QTH. County for Illinois; state, province or country for others. (Ill. may work in-state stations)

Scoring: One point per QSO. Ill. stations multiply total by number of states, VE provinces and countries worked. Others use Ill. counties for their multiplier. (max. of 102) USA, Canada, Hawaii and Alaska count as countries, KH6 and KL7 also count as states. (Each group of 8 contacts with the same county earns a bonus multiplier of 1)

Frequencies: 3560, 3735, 3900, 7060, 7175, 7260, 14060, 14275, 21060, 21110, 21360, 28060, 28660 and 145.2 mc.

Awards: Certificates to the top stations in each state, VE province and country, provided at least two entries are received from that region. In Illinois, single and multi-op stations compete separately with 1st, 2nd and 3rd winners.

A summary sheet showing scoring and other pertinent information is requested.

Mailing deadline is Sept. 1st to: Radio Ama-

See page 102 for New Reader Service

teur Megacycle Society, K9CJU, 3620 N. Oleander Ave., Chicago, Ill. 60634. Enclose usual s.a.s.e. if results are desired.

W2 Land QSO Party

Starts: 0001 GMT Saturday, August 1
Ends: 0400 GMT Monday, August 3

Here's a new one for you, sponsored by the Moorestown Society of Amateur Radio. Mobile and portable operation is encouraged, and those planning such operation are asked to contact WB2UVB for a list of rare New Jersey and New York counties.

Exchange: QSO nr., RS/RST and QTH. County and state for W2's; county and state or province for US/VE; and country for DX.

Scoring: For W2's–Total QSOs × states/provinces × countries × continents worked.

US/VE/DX–QSOs × W2 counties (max. 83) × W2 states. (max. of 2)

After you have totaled above score, you can add the following bonus points. If you work 20 counties add 50 bonus points, 40 counties add 100 points, 60 counties add 200 points, 80 counties add 300 points, and all 83 counties, 500 bonus points.

Frequencies: c.w.–3575, 7060, 14075, 210-90, 28090. Phone–3943, 7260, 14340, 21360, 28620. v.h.f.–50.3, 145.3, 221.4.

Awards: 1st, 2nd and 3rd place awards in each state, VE province, country and New Jersey and New York counties. Special awards to Novice and Tech. class stations.

Include a summary sheet with your entry with all contest data and state class of your license, also s.a.s.e. for results.

Mailing deadline is Oct. 1st to: Gene Bond Jr. WB2UVB, 15 East Camden Ave., Moorestown, New Jersey 08057.

New Jersey QSO Party

Two Periods:
1900-0600 GMT Sat./Sun. Aug. 15-16
1200-2300 GMT Sunday, August 16

This is the 11th party sponsored by the Englewood A.R.A. Phone and c.w. are considered part of same contest and the same station may be worked on each band and mode.

Exchange: QSO nr., RS/RST and QTH. County for N.J., and ARRL section or country for all others.

Scoring: *For N.J.*–US/VE contacts count 1 point, DX 3 points; multiply total by ARRL sections worked. (max. of 74) N.J. may work in-state stations for QSO and multiplier credit. *Out-of-state*–Multiply number of N.J. contacts by N.J. counties worked. (max. of 21)

Frequencies: 1810, 3555, 3740, 3930, 7060, 7275, 14075, 14280, 21100, 21375, 28800. Also 50-50.5 and 144-146. Phone activity suggested on even hours.

Awards: Certificates to top scorer in each N.J. county, ARRL section and country, 2nd place awards if four or more logs received from that section.

Logs: Indicate multiplier *only* first time it is worked, and also include a summary sheet with the scoring and other information.

Stations planning full activity, especially portables, are requested to advise EARA so that coverage of all counties may be planned.

Logs must be in the hands of Englewood ARA, 303 Tenafly Road, Englewood, N.J. 07631 no later than Sept. 12th. Include s.a.s.e. if results are desired.

1969 All Asian Contest Results

U.S.A.

All Band

K4BLD/6	**21800**
W3MSK	**18202**
WA6IVN	**18090**
W3GM	14796
WB6OLR	10530
K1ZND/Ø	9610
W5WZQ	7560
W4KVX	6810
W4BAI	6475
WB6QJD	6315
WA8AJZ	6248
WA1FHU	6240
K2BQR	6162
W8HN	5597
K6MG	2805
W1TW	2310
K7WWR	2035
WA5VSL	2032
W1QV	1812
W6JPH	1736
W3CRE	1584
W4JK	1428
KØEKR	1428
W6GEB	1330
K7VPF/7	984
WØAUB	585
W3NB	520
W9WCE	295
W2CVW	240
W6GBY	230
WØBMM	492
W6CLM	415
K5MHG/6	204
WA2FQG	192
W9QWM	180
W8BQV	168
K1WJB	150
WA6NHD	140
W6CLP	135
W9UKT	132
WB6YIZ	126
W5OJZ	120
W4UF	120
W3QOR	65
W3CBF	60
W6GJV	48

28 mc

W6ISQ	**316**
W5QNQ	3

21 mc

K6AHV	**5814**
K6NA	3816
K6OZL	1600
K4CFB	1424
W1DTY	1260
K6HPZ	1008
W3AIZ	836
W4OEL	660
K8NMG	372
WA0WOW	183
WA5RTB	100
W4UDS/0	96
WA3JBN	84
K6TWE	70
W3LMZ	64
WA8TYF	48
K9TQR	56
W8PCS	35
K9UCR	30

14 mc

W6AFI	**4640**
K6EIV	**4592**
K2KUR	**4522**
W1YYM	2800
W3AFM	2642
W1GYE	2295
W2AIW	2288
W1HRJ	2054
WB4DJT	1582
W1PYM	1260
K6IH	1152
W2LWI	968
W8VKK	620
W4KO	520
WA3HRV	414
WØLPO	355
OH3UQ/W6	220
W5WMU	216
W1GSN	189
K6EVR	184
K4IEX	129
W6TZD	120
W8RVD	76
W8HXZ	66
W1FBY	66
KØARS	34
K6FO	26
W6KYA	22
WAØPRS	14

7 mc

W6ZGM	**34**

All Asian DX Contest

Starts: 1000 GMT Saturday, August 22
Ends: 1600 GMT Sunday, August 23

This is the 11th annual contest sponsored by the JARL. This year multi-operator stations are permitted, awards by call areas will be given in the United States, and prefixes will be the multiplier.

The exchange will be between Asian countries and the rest of the world, on all bands 1.8 thru 28 mc, on c.w. only.

Classifications: Single operator, single band and all band; multi-operator, single transmitter, all band only.

Exchange: For OM's, five figures, RST plus your age. For YL's RST plus 00.

Scoring: One point per QSO. Asians use non-Asian countries worked for their multiplier. (ARRL DXCC list) Non-Asian count each *prefix* of Asian countries as their multiplier. (*CQ* WPX list) Note: JD1, the Ogasawara Is. (Bonin & Volcano) are considered in Asia, and Minamitorishima (Marcus) is in Oceania.

Final Score: For Asians, sum of contact points on each band multiplied by the Country multiplier on each band. For non-Asians, sum of contact points on each band multiplied by Prefix multiplier on each band.

Awards: To the highest scoring stations as follows: Single operator, all band–Certificate and plaque with medal in each continent. And 1st, 2nd and 3rd place certificates in each country. *New,* 1st place in each area of the United States.

Single operator, single band–Certificate and medal in each continent. And 1st place in each country on each band.

Multi-Operator, all band only–Certificate and plaque with medal in each continent. And 1st place in each country.

Logs: Keep all times in GMT, fill in country or prefix column *only* first time it is worked and use a separate sheet for each band. A summary sheet is also a must, showing the scoring and other necessary information, and a signed declaration that all rules and regulations have been observed.

Things to remember, non-Asian stations will use prefixes of Asian countries for their multiplier. Multi-operator stations are to strictly observe the single transmitter defination, contacts on different bands at the same time are prohibited. (Club stations come in this catagory) Each operator will give his age in the contest exchange when he is operating. Contacts with KA stations not permitted.

Disqualification: Violation of the regulations of amateur radio in the country of the contestant, or the rules of the contest, or unsportsmanlike conduct, or taking credit for incorrect QSOs or multipliers, or duplicate contacts in excess of 2% of the total made, will be deemed cause for disqualification. The All Asian DX Contest Committee decision shall be final in all disputes.

Logs must be *received* no later than Nov. 30th 1970 and go to: J.A.R.L. Contest Committee, Central Post Office Box 377, Tokyo, Japan. Include 1 IRC with your log for copy of the results.

Editor's Notes

Sorry the Phone Results did not make last month's issue as I had planned. These things seem to be getting more involved each year, or maybe I'm slowing down.

How about all those crazy prefixes that showed up in our WPX SSB contest this year. It's going to be a job in itself figuring out where they all came from.

You will note that the JARL finally got around to honoring our suggestion that awards for the USA should be made by call areas. Now let's prove that it was justified by flooding them with

[*Continued on page 94*]

See page 102 for New Reader Service

AMATEUR ELECTRONIC SUPPLY

is the Best Place to purchase your new SWAN gear for the following reasons-

SWAN 260 Cygnet 80-10m AC/DC ($50 Bonus)	$435.00
SWAN 270 Deluxe Cygnet ($50 Bonus)	525.00
SWAN 350C 80-10m Transceiver. ($50 Bonus)	420.00
SWAN 500CX 80-10m – Deluxe ($50 Bonus)	565.00
SWAN 250C 6m Transceiver ($50 Bonus)	450.00
NS-1 6m Noise Silencer	36.00
TV-2B (Specify 14 or 50mc if) ($30 Bonus)	350.00
CYGNET 1200W Linear ($25 Bonus)	295.00
Mark II 80-10m Linear – w/tubes ($50 Bonus)	395.00
Mark 6B 6m Linear – w/tubes ($50 Bonus)	395.00
Power Supply for Mark II & 6B	265.00
117XC AC Supply w/spkr. in cabinet	105.00
14-117 12v DC Supply w/Cable	130.00
510X MARS Oscillator - less crystals	55.00
508 Full Coverage VFO	145.00
210 6 Meter VFO	120.00
VX-II Plug-in VOX	35.00
100kc Calibrator for 350	19.50
100kc Calibrator kit for 350C only	19.50
500kc Calibrator kit for 250 or 250C	19.50
FP-1 Phone Patch	48.00
AF-800 Audio Filter	28.00
14C 12v DC Module/cable	$ 65.00
14CP As above, but Positive Ground	75.00
117X Basic 117v AC Supply ONLY	65.00
230X Basic 230v AC Supply ONLY	75.00
117 or 230vac Line Cord (specify)	8.00
8' Cable w/plug (Supply t o Transceiver)	6.00
230XC 230v AC Supply, speaker, cabinet	115.00
14-230 12v DC Supply w/230v Basic	140.00
Universal Mobile Mounting kit	12.00
SS-16 Custom Crystal Lattice Filter	95.00
SWAN HORNET TRI-BAND BEAMS (2kw P.E.P.)	
TB-2 2 Element (standard)	$ 99.00
TB-3 3 Element (standard)	119.00
TB-3H 3 Element (Heavy Duty)	139.00
TB-4H 4 Element (Heavy Duty)	169.00
1040 10-40m Trap Vertical	59.95
"MODEL 35" SINGLE BAND MOBILE ANTENNAS	
5' top section with kwik-on	$ 11.95
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See page 102 for New Reader Service

See page 102 for New Reader Service

VHF TODAY

BY ALLEN KATZ,* K2UYH

FOUR years ago we considered ourself especially lucky to be able to pick up a 4CX1000A at a local club auction for 25 dollars. On numerous occasions since then, we have seen 4CX1000A's along with other high performance tube's for sale at similar savings. The local surplus dealer has even had a few in stock. Construction articles utilizing these tubes have also appeared.[1,2] Yet there are still very few of these tubes in use on the v.h.f. bands.

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

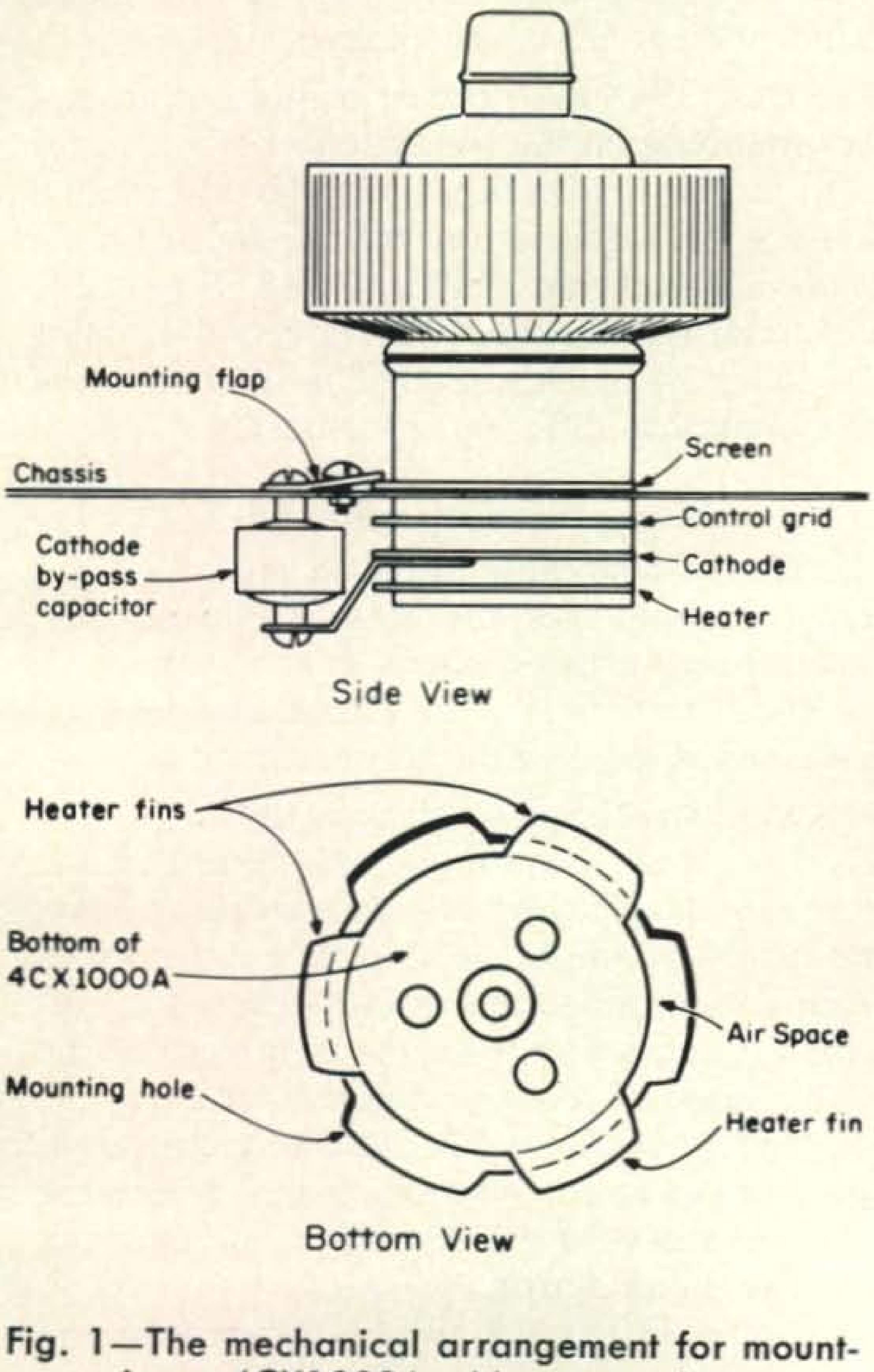


Fig. 1—The mechanical arrangement for mounting a 4CX1000A without a socket.

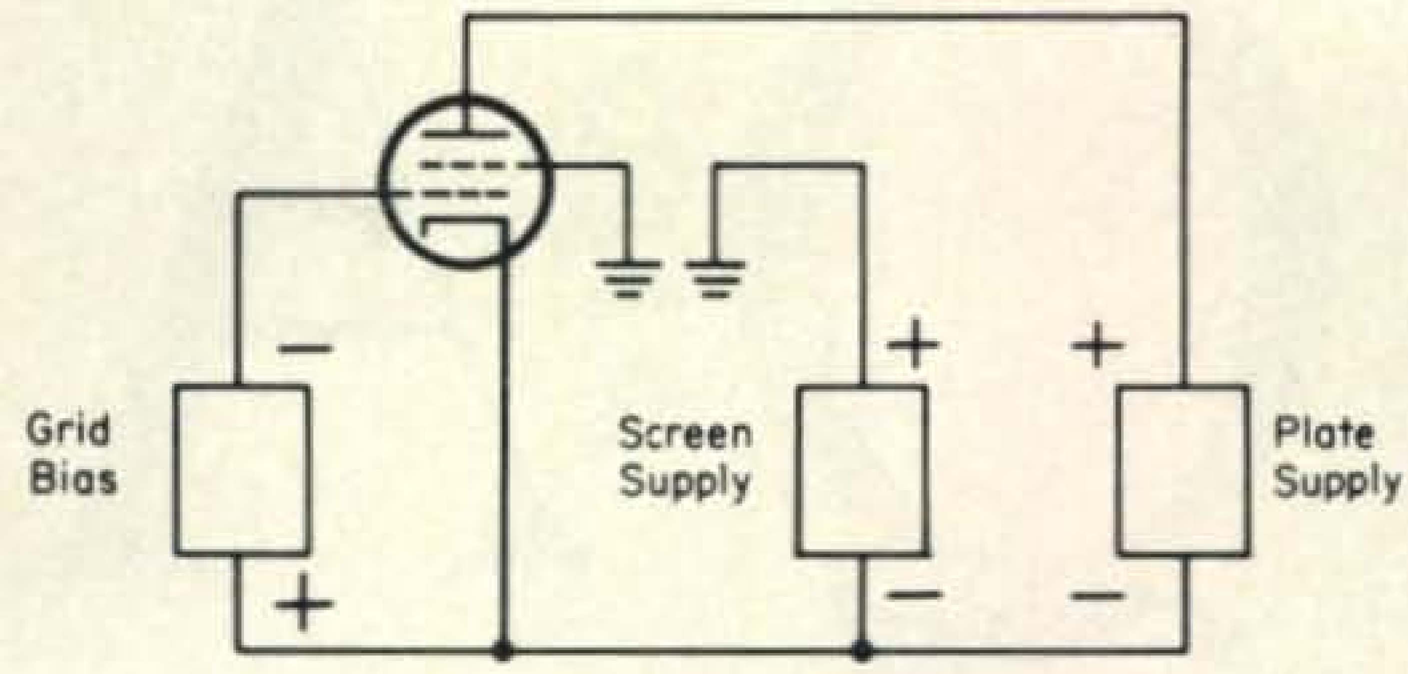


Fig. 2—The connection of d.c. supply voltages when the screen is grounded. Note: the negative side of the plate supply is isolated from ground.

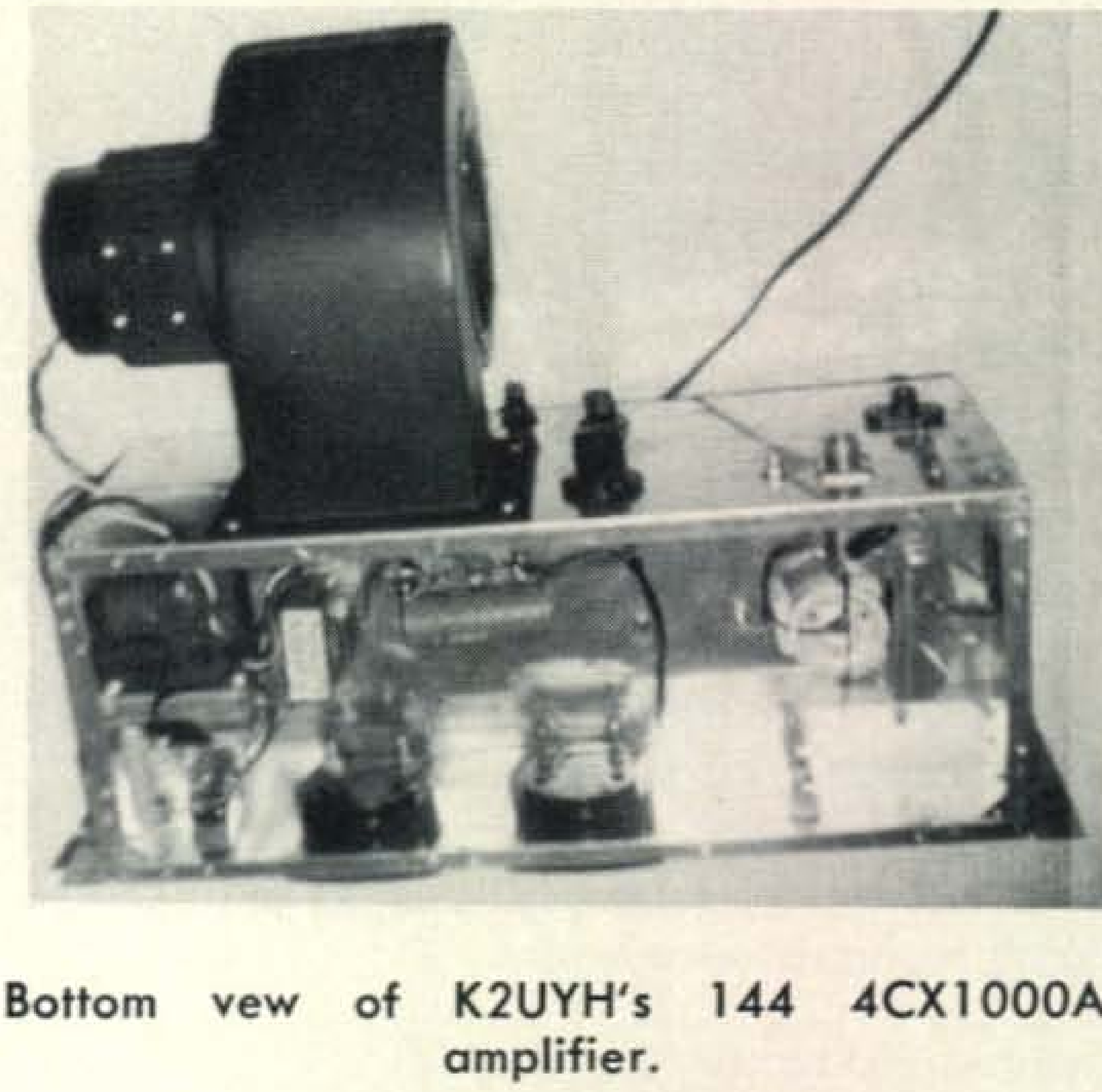
One of the major problems in getting one of these big tubes in operation is the lack or almost total absence of sockets for them. In the case of the 4CX1000A, a new socket costs more than I would care to pay for the tube alone. However there is no reason why you need a new socket or any socket at all to get a 4CX1000A on the air.

If a hole slightly larger than the outline of the 4CX1000A's bottom periphery is cut in the amplifier chassis (see figure 1), the tube can be mechanically mounted by placing it through this hole, twisting it 60 degrees (such that the screen fins overlap the chassis), and bolting the three screen fins directly to the

[1]Barber, W6GQK; Orr, W6SAI; Rinaudo, W6-KEV; Sutherland, W6UOV, "Modern Circuit Design for VHF Transmitters Part II," *CQ* p. 40, Dec. 1965.

[2]Crowell, W7GVL, "An All Band 4CX1000A Super Cathode Driven Amplifier," *CQ*, p. 16, April, 1970.

[*Continued on page 88*]



Bottom vew of K2UYH's 144 4CX1000A amplifier.

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

Oscillator Pulling With R-100A Receiver

QUESTION: I wish to modify my R-100A receiver with the product detector and a.g.c. described in *CQ*, June 1969. However, the h.f. oscillator pulls badly, with a frequency shift of up to 1 kc when the r.f. gain or the antenna trimmer is operated while Band B is used on 80 meters. It seems stable with Band C on 40. With the advent of a.g.c. this might present a problem with the resulting changing voltages. How may this be corrected?

ANSWER: Oscillator pulling in the R-100A with changes in the setting of receiver controls is a "built-in" situation often experienced with other receivers that utilize a variable h.f. or front-end oscillator, especially with a 1st i.f. of 455 kc.

The frequency variations can be minimized by setting the antenna trimmer slightly on the low-frequency side of resonance (or signal peak), except on Band D where it should be at the high-frequency side. (on bands A, B & C the oscillator is on the h.f. side of the signal, on Band D it is the low side –in the case of other receivers where the oscillator position may be otherwise, the trimmer should be set on the side of antenna-resonance opposite that at which the oscillator operates).

What happens when the antenna trimmer is on the other side of resonance (or toward oscillator frequency) is that the r.f. stage circuit is then tuned nearer the h.f. oscillator frequency which then tends to pull the oscillator. Why the effect is more pronounced on the 80-meter band is that there is less tuning capacitance at this end of Band B, making the oscillator more susceptable to pulling by nearby resonant circuits.

*Technical Director, *CQ*.

This also should correct the problem with different r.f.-gain settings; however, in other receivers where voltage regulation is not provided, particularly on the oscillator, such an expedient may be needed.

Power Loss in Antenna Coupler

QUESTION: Using my Drake MN-4 antenna-matching coupler I find about an 11 per-cent loss through it. Is this standard for matching networks or is there something particular about the MN-4?

ANSWER: An 11 per-cent power loss (0.5 db) is about normal with most any antenna couplers or this type. This in itself is relatively insignificant as far as signal level goes, in addition to which other advantages may be gained with the coupler, such as allowing more power to be actually transferred, than otherwise possible in certain cases without it. Another possible benefit is the reduction of harmonic transfer to the antenna.

Linear Amplifier With 4-125A's

QUESTION: Have you any data on a circuit for a linear amplifier using two or more 4-125A tubes in parallel? I am looking for an amplifier that will cover the 80-10 meter bands with at least 1 kw p.e.p.

ANSWER: We have no past or present articles or other data on the construction of such gear with the particular tubes. On the other hand, some good information will be found in the *Radio Handbook* (Editors and Engineers, Ltd.), the 16th Edition. This covers data using 4-125A's, 4-250A's, etc. The 17th Edition also some has different information.

Chirp With Apache TX-1

QESTION: I just came upon an Apache TX-1 which I wanted for c.w. It works beautifully, but at times it has a chirp. It is not there all the time, but mostly on 20 meters. Do you have any dope on how to correct this?

ANSWER: In respect to chirp with the Apache TX-1, as described above, assuming that the time-sequence keying system is working okay, the difficulty might be due to r.f. feedback from V^3, the stage that follows the v.f.o. and which functions on the same frequency as the v.f.o. Suggest you try slightly detuning the "15-meter" inductor BK. This inductor actually is tuned to the 40-meter band, where the v.f.o. operates for 40, 20 and 15, so feedback from here could affect the v.f.o.

Make sure the VR tube is okay Also the neon bulb in the time-sequence keying sys-

See page 102 for New Reader Service

tem. Make sure other related components are okay (those mentioned in the first paragraph on page 5 of the manual).

Source for DPZ Antennas and Others

Although it apparently is no longer in production, the DPZ antenna suggested for portable operation in the May Column may be obtained from Antennas, Inc. Bob Quenstedt of Antennas, Inc. has informed us that they have located a number of these antennas which will be available from them.

Antennas, Inc. also carries one of the most comprehensive inventories of antenna systems and related components available anywheres. A large catalogue is available for $2.00, refundable with first order. In addition, their long-experienced staff can provide sound technical advice in this field.

The address is: Antennas, Inc., 512 McDonald Road, Leavenworth, Kansas 66048.

More On W5CJV-Special Quad

In respect to the W5CJV-Special Quad described by W5ZUS in the Q & A Column for March, no dimension was given for the boom length. Cal, W5ZUS, has been flooded with inquiries about this omission which should have stated the boom length as exactly 8 feet.

Super-Pro Modifications

QESTION: Can you refer me to articles on modifying the old World War II Hammarlund BC-1004C military receiver?

ANSWER: We've received quite a few inquiries about modifications to the BC-1004C, BC-799, SP-400, et al, Super-Pro receivers. 14 pages related thereto will be found in the Surplus Conversion Handbook which may be obtained from *CQ's* Circulation Dept. for $3.00. Some of the data given therein also will be found in *CQ*, February 1957, page 24 "Worthwhile Improvements for that Old Receiver". Another article, not repeated in the Handbook, is "Souping Up The Super Pro", published in *CQ*, December 1957, page 30. Xerox copies of the above articles are available for $1.00 each.

Swan 500-C With Johnson Thunderbolt

QUESTION: I have a Swan 500-C transceiver which works perfectly. I have now aquired a Johnson Thunderbolt amplifier that requires only 20 watts drive to push it to 2000 watts p.e.p. The Johnson people advised use of a T-pad attenuator between the two units, since the Swan 500-C runs at about 300 watts p.e.p.

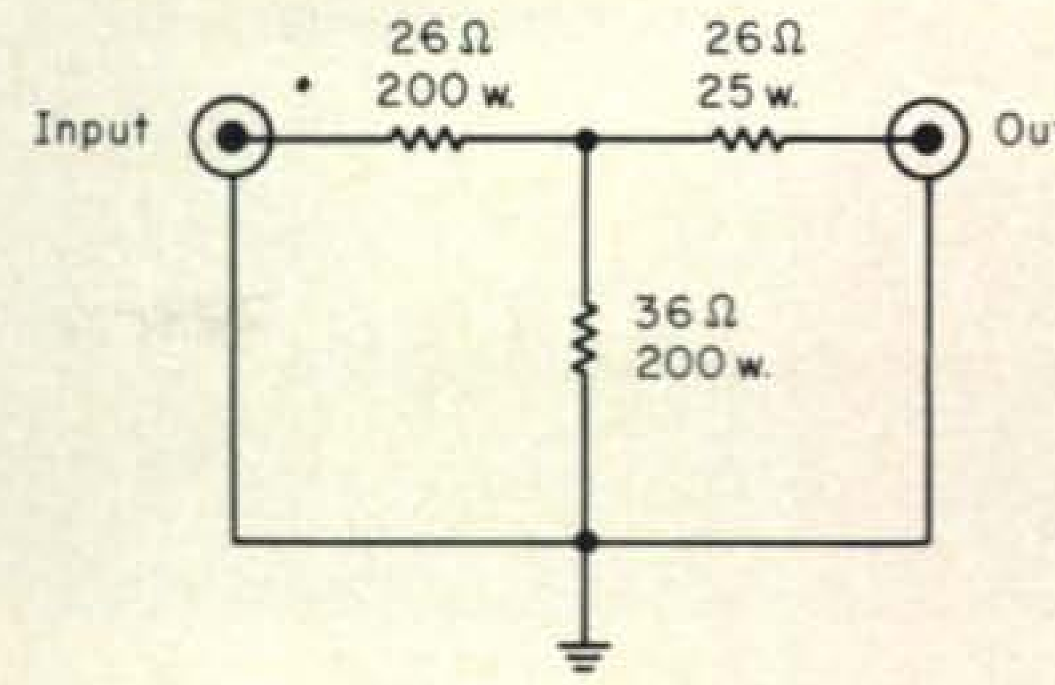


Fig. 1—Circuit and constants for 10 db T-pad for use between Swan 500-C and Johnson Thunderbolt.

output. I should apppreciate data on the required pad and information on all the other needed connections between the exciter and amplifier, including relays, etc.

ANSWER: A number of other inquiries in a similar vein have been received of late. The following data in reply to the particular situation above may be used as a pattern for other cases.

The power ratio between 300 and 20 watts is 15:1, indicating the need for a 11.75 db pad; however, for all practical purposes a 10 db pad should do, allowing some leeway also. Circuit and constants for such a pad are given at fig. 1. Space does not allow constructional details to be given here. They may be found

[*Continued on page 94*]

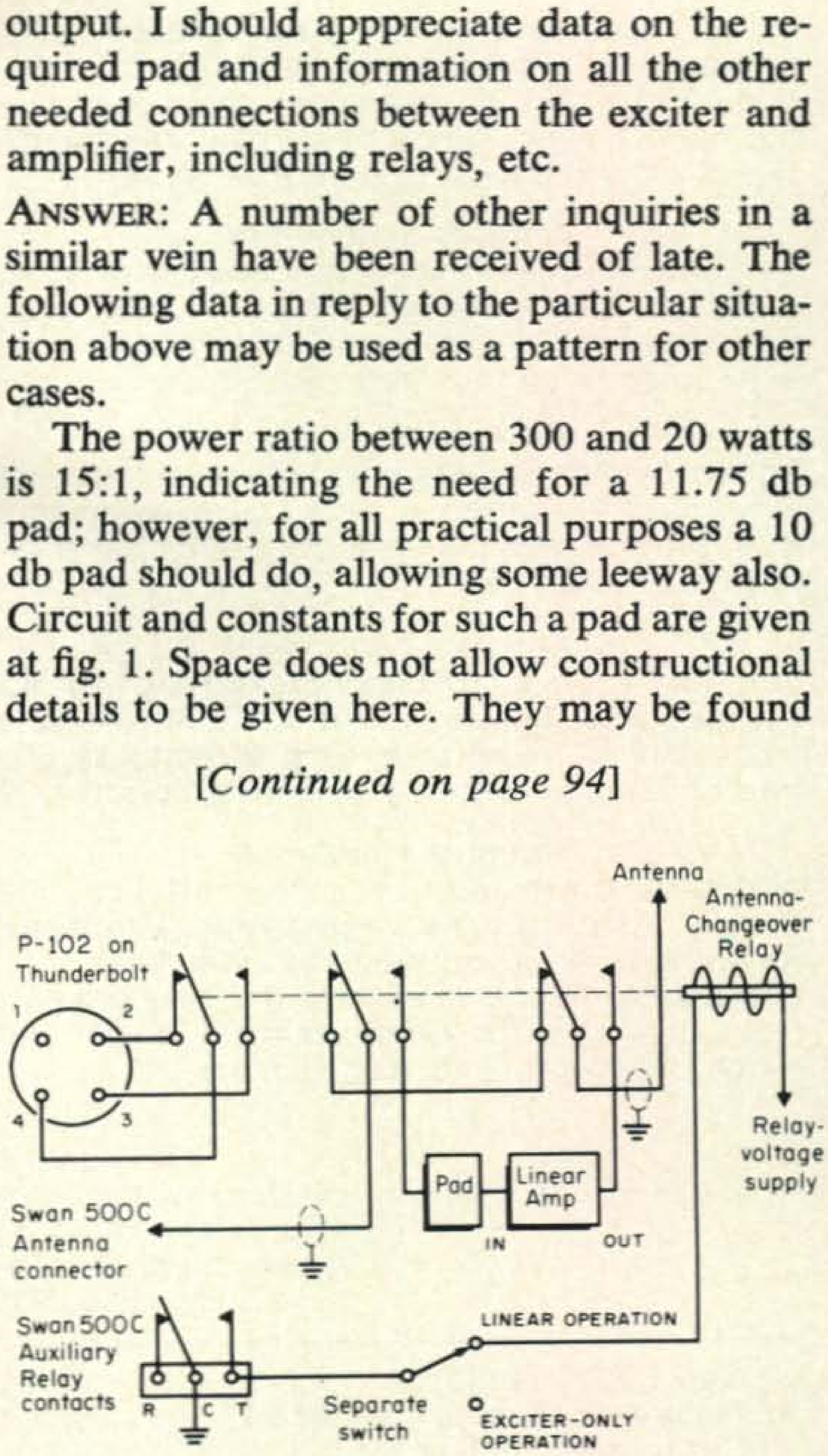


Fig. 2—Circuitry for use with Swan 500-C and Johnson Thunderbolt. A like setup may be used with other gear, except the bias switching at P-102 most likely will not be needed. Relay contacts for P-102 may be auxiliary ones on antenna relay or on a separate relay operated in parallel with antenna-relay coil. Antenna relay may be 6, 12 or 115 v.a.c.-operated job. A 12 v.d.c. relay also may be used, obtaining power from Swan 500-C +12 v.d.c. at power-supply terminal 6.

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

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

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Edited by Art Seidman, a 160 page mass of antenna information directed at answering a multitude of questions surrounding the mysterious antenna. $4.00

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

OSCILLOSCOPES are handy things to have around the shack. They can be used to monitor your modulation for instance, avoiding distortion and splatter and other technical unpleasantries that tend to cause unhappiness on the bands and with the Federal Communication Commission. They can be used to watch radio-teletype, with a neat little cross pattern that indicates a properly-tuned frequency-shift signal is being received. There are several other applications, of which one of the most useful is the comparison of different frequencies as they weave those interesting patterns observed by M. Lissajous.

Even non-amateurs can find uses for a 'scope. If you have no other purpose you can hook up the audio output of your receiver to the deflection plates and create a "dancing waters" image that will at least impress the uninitiated visitor with its approximation of Mission Control in your shack.

One acquaintance of mine has converted a 21 inch color monitor to a rudimentary oscilloscope which he has attached to a receiver tuned to a local rock music station. The resulting explosion of color is technically meaningless, but it is certainly psychedelic.

Now there are all sorts of 'scopes in surplus, ranging up to recent Tektronix units with dual-trace amplifiers, triggered inputs, wide-band response, delay lines, and other high-cost options. On the other hand there are a great number of surplus black boxes with cathode-ray-tubes poking out of them, a few controls, and no indication whatsoever as to what they may be good for. The latter are generally priced rather under the Tektronix units, by a factor of about 20:1. If one could make use of the cheaper set, why spend the money on the sophisticated one?

Why indeed? For common Amateur use virtually any 'scope that will display a pattern is a helpful addition to the shack.

The key thing to remember is that the basic oscilloscope consists of a cathode ray tube, a flyback oscillator that controls the trace on the CRT, a power supply for filament and B+ voltages, and for the high voltage CRT anode, and, usually, amplifiers for the horizontal and vertical deflection plates to make even small signal voltages readable on the tube.

Accordingly, in most surplus 'scopes you will find the basic circuits plus some extraneous material, depending on the purpose of that design. Radar sets and various military indicators contain a basic oscilloscope which can be converted to amateur use reasonably easily, such as the indicator used with a World War II IFF set (Identification, Friend or Foe) known as BC-929. The thing to do with the BC-929 is to remove the extra IFF junk, starting with the motor-driven switch which provides indication of the bearing of an incoming signal, something not of immense use in the ham shack. (There are two ranges, 50 mile and 10 mile, if you are expecting hostile aircraft)

Unfortunately the BC-929, and other cheap surplus units were designed for use in aircraft, and have power transformers wound for 400 cycle a.c. power. At that frequency there needs to be less iron in the transformer core, therefore less weight for the plane to lug aloft. The lack of a stiff iron core means that if attached to a 60 c.p.s. power source the transformers will rapidly go up in rather unpleasant-smelling smoke and bubble out considerable tar and other substances. Not recommended.

If your particular unit is designed for 400 c.p.s. *only*, the transformer will have to be replaced with a similar 60 c.p.s. version. But don't be hasty about tearing out the transformer. Some sets have power supplies usable on 60 c.p.s. Aside from the weight, a 60 cycle transformer will work just fine at higher frequencies, and in some units, the manufacturers used the cheaper 60 c.p.s. item. In fact, if you can stand the smoke, it might be worth risking the useless 400 c.p.s. transformer on 60 c.p.s. just to see if it might carry the load. I have a very fine Airborne Instrument Labs audio oscillator that operates beautifully when plugged in on commercial power. Most won't, but with proper precautions, it might be worth a try.

Assuming the smoke-test is a failure, it will be necessary to install 60-c.p.s. versions of the power transformers. In the BC-929 the power transformer may be replaced by a 2400v., 4 ma scope transformer, Chicago or Jefferson

*5716 N. King's Hgwy., Alexandria, Vir. 22303.

D-161913 or equal, and a 2.5 and 6.3 v. filament transformer *with high voltage insulation*, such as the Chicago D-161916. The 250 volt B+ and 6.3 volt filament power for the amplifiers would be supplied from a third transformer, or possibly one could find a single oscilloscope transformer that could handle the whole thing.

One caution: be sure to use insulated INTENSITY and FOCUSING controls, remembering that they may have up to 3,000 volts on them. It would be best to mount them on an insulated subchassis and use insulated couplings between the potentiometer and the outer knob.

There have been a couple of specialized conversions of the BC-929, though none before as an ordinary general-purpose oscilloscope. W9JFX, writing in *QST* in August, 1957 proposed it as a modulation monitor, without a horizontal amplifier. He showed an r.f. input with inductive coupling to a transmitter and provisions for tuning the 'scope to the incoming signal.

Writing in the November, 1957 *CQ*, W2-ZGU describes a more flexible conversion, through without schematics, for the BC-929. He added a few ideas for calibrating the set to read voltages, and offered considerable on CRT theory that might make interesting reading. ■

VHF [*from page 83*]

chassis by means on three small flaps. The space remaining between the wall of the hole and the tube will allow forced air to pass and direct it up toward the external anode.

Connecting the screen directly to the chassis, as described above, eliminates the need for a screen bypass capacitor, and actually yields superior performance since we want to keep the screen as close to r.f. ground potential as possible. This procedure does, however, necessitate that the negative plate supply voltage be isolated from ground. D.c. screen and plate voltage can be applied to the amplifier as shown in figure 2. The cathode must be also by-passed to ground. The cathode by-pass capacitor is non-regenenative and thus not critical. In the 4CX1000A two meter amplifier shown in the photograph we use two large TV type doorknob capacitors connected in parallel for this purpose. The tops of these capacitors are connected to a copper flashing clamp which presses on two of the tubes three cathode fins.

Connection to the heater and grid fins can

See page 102 for New Reader Service

be made by means of small clips or you may carefully solder directly to these terminals as we have done.

We have used a 4CX1000A mounted as described here on 144 mc for several years without incident and are now planning a second 4CX1000A amplifier for 220 mc using a similar arrangement. I am sure with a little ingenuity similar techniques could be applied to other tubes for which sockets are unavailable.

73, Allen Katz–K2UYH

Letters [*from page 9*]

operate as she was a dependent).

KA operation is authorized as Auxiliary Military Radio Stations (AMRS) by the US Forces, Japan. JA operators are forbidden by their FCC equivalent to contact KA stations as they are not recognized as amateur, but military. In the past there was a bit of hostility by the JARL to KA operation, and I think there might still be some. (How would you like a bunch of foreigners operating in your country by their dictation?)

Like George, I would like to see full fledged reciprocal operating with Japan. I do believe forces are at work on this and that in the near future JA's will be signing /W and W, K WA and WB's will be signing /JA.

Dirk Johnson, WB6AGZ/KH6
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ontest Results [*from page 55*]

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Q2KDZ	307,395	597	73	180
Q2KAX	280,060	751	68	152
	Lithuania			
P200	1,334,639	1464	105	248
P2KPI	361,522	816	66	151
P2KTU	319,336	926	75	148
	Ukraine			
5KTH	1,112,945	1692	85	220
5KAW	34,768	212	34	72
5KWX	11,592	220	13	33

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6DC	699,396	1422	73	94

SOUTH AMERICA

	Ecuador			
1RF	1,500,000	2146	73	167
	Netherlands Antilles			
1AA	3,345,042	2824	112	290
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3GM	2,763,950	1761	141	389
UYC	2,237,625	1688	144	315
CG	2,018,506	1498	127	352
6ISA	2,003,157	1595	137	302
3GN	1,779,460	1378	124	337
B6HGU	1,679,616	1352	130	302
8UDJ	1,621,820	1364	118	297
4BVD/6	1,592,032	1341	134	282
ICC	1,473,531	3382	71	130
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W6UUI	1,103,376	1082	118	244
W8NGO	695,198	747	101	221
W7OHR	506,664	661	98	181
W4KXV	447,304	630	78	175
VE8NWT	375,964	904	69	124
WA3ATP	282,964	422	67	169
WIUOP/1	175,990	335	53	132
W3EQA	115,075	248	53	116

AFRICA

ZS5JY	3,979,346	3126	127	307
ET3USA	1,172,762	1382	93	196

ASIA

XW8CS	1,806,847	2032	109	250
VS6AL	1,001,098	1532	95	227

EUROPE

OH5SM	11,593,925	6771	153	526
OH1AA	6,470,325	4519	144	435
DL4UU	3,932,250	3268	126	364
DL0MU	3,016,668	2690	120	284
4U1ITU	2,731,990	3223	100	259

SOUTH AMERICA

PJ0DX	17,613,400	9270	156	488
4M1A	12,993,600	7357	146	454
LU3FA	1,911,000	1826	108	256
OA1BT	1,223,661	1606	87	180

Our thanks to the following stations who submitted their logs for checking purposes. CP4DD, DJ0TA, DM2CHM, DM3XUE, HA5FA, JA4DZ, K0HIL/5, LA1ZI, LA4DM, LA7RB, LA9HC, OEL-999, OH1TM, OH1XO/W9, OH2BAC, OH3KX, OH4RN, OH5OD, OH8OW, OK1BY, OZ8T, PY1CWV, SK6CF, SM4CGM, SM5AQB, SM7ASN, SP6ZAI, SP8-1079, UA3-127204, UA3-15710, UA4RL, UA4WF, UA0GF, UA0KCA, UA0NH, UB5-07325, UB5WE, UQ2-03715, UW9KDF, VE1OM, VE3CEA, VE3SH, VE5KK, VE7BB, W1STW, W2UJ, W2WZ, W3MDJ, W4NZR, WB4OKY, W5FRM, W6FKZ, WA0EPG, YO9APJ, ZE3JJ.

Multi-Operator Multi Transmitter Station Operators

L4UU: DJ1KG, DJ9CN, DL2NO, DL3BA, DL4CM, DL4FB, L4HY, DL4WS, DL5BA, DL5GT, DL5HW. **DL0MU:**, DJ1FC, J9TQ, DK1QV, DK3BJ. **ET3USA:** W3DNA, W4SYX, WA3RL, WB8EPM. **K4CG:** K1PKQ, K1TKS, K3WUW, K4PQL, 9OPF, W3JPT, WA0IYX, WB4FDT, WB4FQR, WB4GTS. **4BVD/6** & K2RBT, K6VVA,W6PNV, WA6TQK, WB6GFJ, /B6QDC. **K6UYC** & K6YNB, VE2AKQ, VE2LO,W6CCP, W6P, W6IXK, W6OSU, W6PBI, W6WWQ, WA6FIT, WA6ZZK, /B6PKA. **K8UDJ** & K1ZND, K7NHV, K8BGZ, WA8LWK. **U3FA:** LU1FBR, LU2FAO, LU5FEH, LU6FZ, LU8FAO, LU8P, LU8FV. **OA1BT** & OA1A, OA1AG, OA1BT, OA1CP, OA1E, A1I, OA1Q, OA1T,OA1U, OA4ACP. **OH1AA:** OH1LM, OM1K, OH1NM, OM1PI,OH1RG, OH1SS, OH1SY, OH1VR, H1YW, OH2KZ, OH3NB. **OH5SM** & OH2BC, OH2BCP, H2BO, OH2BX, OH2MK, OH2SB, OH2WI, OH3QA, OH5Q, OH5NW, OH5SE, OH5SM, OH5TM, OH5TS, OH5UQ, H5VY. **PJ0DX:** K1ANV, K3EST, K3NPV, K4AQQ, PJ2CC, /3AZD, W3MSK, W3ZKH, W4BVV. **VE8NWT:** VE8BB, VEBY, E8HH, Ted. **VS6AL** & VS6AA, VS6BF. **W1UOP/1** & K1UDP, /1DIL, W1ORV, W1UMC, W1ZW. **W3EQA** & WA3DRC. /**3GM** & K4WUY, W3BUR, W3JSX, W3KV, W3LTU, W3NOH, /A3KEY. **W3GN** & K3JYZ, VE2MW, WA3GUI, WA3GVP, /A3HRV, WA3IYS, WA3JXJ, WA3LRS. **W3MWC** & K3JLI, 3JLK. **W3WJD** & K3BNS, K3HTZ, W3BGN, W3YIK, WA2LV, WA3FFR. **W4KXV** & W4YZC, WB4ODN. **W6ISA:** K6SDR, 6VZA, W5CWQ, W6ITY, WAECZR, WB6OLR, WB6OYU, /B6YGK. **W6UUI:** W6BXL, W6DQX, W6JPH, W6KMP, W6FF, WA6HNS. **W6VSS** & K6EVR, K6MQG, K6QPN, K6SEN, /6ICJ, W6QY, W6UED, W6VPH, WA6OHJ. **W7OHR:** W7NXH, 7RAJ, VE2DGL, WA7BVM. **W7RM** & W5QQQ/7, W7YGN. /**8NGO** & K8EHD, W8ONA, W8ROF. **WA2ZAA:** K1ZVU, K2GT, K2GL, K2KUR, K2TXC, K2UYG, W1GYE, W2GLM, /2HH, W2IWC, W2SKE, WB2SQN. **WA3ATP** & WA3EPB. /**B6HGU** & WB6NWK, WB6YNI. **XW8CS** & HS3AL, HS3DR, XW8CR, XW8CW, XW8DA. **ZF1CC:** W4DGY, W4ZRZ, WB4MKU. **ZS5JY** & ZS5DC, ZS5EY, ZS5JM, ZS5KI, ZS5QU. **4M1A:** WB4MDO, YV1BI, YV1KZ, YV1LA, YV1OB, YV1PP, YV1SA, YV1TF, YV1WH, YV1WX, YV1WY, YV5ANE, YV5ANF, YV5BPJ. **4U1ITU:** F8RU, HB9AW, HB9XL.

Multi-Operator Single Transmitter Station Operators

CW3BH & CX1AAC, CX1BBV, CX4CR, CX9BT. **DJ4ZR** & DJ9IE. **DK2OG/P** & DL1HC, DL1ID. **DK3FZ** & DJ0ND, DL3LU, DL8RL, DL8RM. **DL2ZN:** DL5ZB,DL5ZD, DL5ZH, DL5XD, DL5YP. **DL4QF:** DL4QQ, DL4QP, DL5QC, DL5QO,, DL7AV. **DL4RM:** DL4ER, DL8RH, DK1BN. **DL6UN** & DJ1BV, DJ3GD, DJ3OI, DJ8EQ, DK1UK, DK2PB, DK3PK, DK3SF. **DL7NB** & DJ6QX, DL7LV. **DL8CM** & DL8CH. **DL8FR** & DL8DL, DL8FQ. **DL8HA** & DK1MG. **DL0II:** DJ2YE, DJ4TJ, DL5PC. **DL0JR:** DL7HN, DL7OD, DL7ON, DL7OR. **DL0KL:** Club. **DL0RCA:** DJ1GX, DJ1IP, DJ1SX, DJ6AR, DK3UO. **DL0WN:** DL1AO, DJ3GY, DJ7IK, DJ0JX, DK3DS. **DL0WR:** DJ4AX, DJ8SW, DJ9YI. **DL0WW:** DJ3GR, DJ4OQ, DJ4XN, DJ6DU, DJ6NT, DJ9CE, DK1AN, DL2UU, DL3ZA, DL6NK, DL6OE, DL8WE, DL8XI. **DM0DDR:** Club.**EP2DA** & EP2BI, WA5VKJ, W8RBI. **F5OJ:** F2QQ, F5ZK, F5ZW, F0RA. **F5OL:** Club. **FG7TI/FS7:** PJ7JC, VE3EUU, W9ZRX. **G3EEO:** Club. **G3FVA/A:** G3FNM, G3SMM, G3SVW, G3VIW, G3WFT, G3XDS, G3YKJ, G3YTZ. **G3KMI:** G3TDL, G3VRW, G3WXC, G3WZH, G3WZS, G3XBX, G3XJM, G5AOZ, G8BQA, G8COK, GC3XZC. **G3SSO:** G2HDU, G3FXA, G3PEO, G3SNN, G8BNJ, G8KG. **G3TXF** & G3SXW. **G3VUM:** G3VNV, G3XIR, G3YLE, G8CQD, GI3VDB, GM3YOK. **G3WYX** & G3HTA, G3RUV, G3RUX, G3TJW. **G5YC:** G3SEP, G3UML, G3VXB, G3WSB, G3WTS, G3XVM, G5AIY, G8BAH. **GM3YRK** & GM3SSB. **GM5AME** & GM5AMS, GM5AOR. **GW6GW:** W3TKZ, GW3WVG, GWXNI. **HA5KBP:** Club. **HA5KDQ:** HA5FM, HA5HO. **HA9KOL:** Club. **HB9AGC** & HB9AFZ, HB9AJM, HB9ALM, HB9ZE. **HC1RF** & HC1SG. **HM1BB** & HL9UU. **I1DFE:** K2QFI, K7YUC, WA3MIV, WA3MPR. **I1GAW** & I1RGU. **JA3YBF:** JA3EBT, JA3FGJ, JA3KGF, JA3OLO, JA4DFJ, JA0CDC. **JA0YAW:** High School. **K2BQO** & K2UYC. **K3CLA:** WB2VMD, WA3CUI, WA3JGN. **K4LK** & WA4UFW, WB4EYX, WB4IAE, WB4IAG, WB4IAK. **K4ORQ** & WA4IVL. **K5FIQ:** K4FTY, WA5ICD. **K6AUC** & K6HIH. **K6ILG** & K6AUC, K6HEM, K6HIH. **K8MMM** & K8EUR, K8TVD, WA8LEO, WA8VCY, WA8ZKL. **K8SMC** & WA8QOY, WB8BJI. **K9CUY** & K9ECE, WARQY. **K9KDI** & K9LTN. **K9LYA** & WA9BNX, WA9ZOI, WB9AMH. **KA9MF:** KA9EE, KA9JS, KA9RC, KA9PP, KA9ZZ. **KH6SP:** K5LTH, KH6GKV, WA6KZH, WA7LFD, WA8IAP. **KX6DC:** KX6DR, WB2SXF. **KZ5NG:** KZ5BCN, KZ5KD, KZ5KN, KZ5NW. **LA1H:** LA8UL, LA9OI. **LA2T:** LA1EI, LA1EK, LA3PK, LA3VK, LA7VK, LA9AL. **LZ1KSA:** Club. **LZ2KKZ:** Club. **OE4SZW** & OE4WBW, OE7UU. **OH2AM:** OH2BBM, OH2BBR, OH2BQ, OH2BS, OH2QV. **OH2MQ/3:** 2 Oprs. **OH3MK** & OH3WW, OH3YI. **OH4RH** & OH4RF. **OK2KOS:** Club: **ON4UN** & DK1FW, G3XVY. **OZ4HAM:** Club. **OZ9CR:** 2 Oprs. **PA0HBO** & PA0HOR, PA-1555. **PI1PT:** 5 Oprs. **PJ1AA:** PJ2ARI, PJ2CA, PJ2CB, PJ2CR, PJ2CU, PJ2HT, PJ2VD, PJ9VR. **PZ1DB** & PZ1CY, PZ1DD. **SK3BP:** SM3BUS, SM3DNI, SM3EVG. **SK6AW:** SM6CJK, SM6CKS, SM6CKV, SM6CVE, SM6EJI. **SK0TM:** SM0AXN, SM0DZL, SM0EGE, SM0EIE, SM5FC. **SM5AZU** & SM5BGM, SM0ATN, SM0MC. **UA2KBD:** UA2AEI, UA2WJ, UA2-12546. **UA3KAO:** UV3CC, UV3CO, UW3BO, UW6BK. **UA4KED:** UA4-KED: UA4-14829,UA4-14833, UA4-14834.**UA9KAX:** UA9BB, UA9BE, UV9AK, UV9DP, UW9AF, UW9BC, UW9BY, UA9-1656.**UP2KPI:** UP2KBC, UP2MAD, UP2MC, UP2OE, UP2OQ, UP2PX, UP2QA. **UP2OO** & UP2CY, UP2KNP, UP2NK, UP2OX. **UQ2KAA:** UQ2AO, UQ2ON, UQ2PN, UQ2-0371. **UR2KBQ:** UR2-083-700, UR2-083-701. **VE2UN:** VE1JN, VE2DCW, VE2DFO, WA2UPC. **VE3HPH:** VE3BAP, VE3CEZ, VE3CRG, VE3CX, VE3GIY, VE3LX, VE3ZN. **VE4AA:** VE4AE, VE4AS. **VP2VP:** VE3ACD, VE3GMT, VP2VI. **W1BGD/2** & K2DXV. **VE6AKV**, VE6ALS, VE6AWF, VE6AWV. **VO2AP** & VE1ST/VO2. VE6XJ, Ross. **VE6AUT** & VE6AA, VE6ABZ, VE6AI, VE6AID, VE4TJ, VE4ZX. **VE6ADX** & VE6AEY, VE6HN, VE6SB, VE6TL, VE4BJ, VE4IM, VE4MP, VE4RP, VE4SA, VE4SD, VE4SK, K2JWM. **W3GRF** & W3IAQ, W4RVE. **W3NZ** & K3YOV. **W3SS** & W3EAN, W3LRO, WA3JLT, WA3LRN. **W3TV** & W3AOH, W3VW, W3UHN. **W3WPG** & K3WJV. **W4AXE** & K4YBE, WA4EEX, WA4GVQ, WA4PXP, WA4ZGI. **W4HOS** & W4FRO. **W5RER** & W3JXS. **W5TKB** & W QT, W5KTR, W4OBS, WA5SGD. **W6BIP** & WA6DJI. **W6DOL** & W6KG. **W6NJU** & K6YRA. **W8IPA** & WA8PJA. **W8MEL** & W8HDB, WA8DCH. **W9ARV** & W9DY, K9WEH. **W9LKJ** & W9AQW, W9ICE. **W0HP** & W0PAN, W0YCR. **WA3FXJ:** 6 Opers. **WA4QPL:** WB4EQQ, K4TJO. **WA5VPZ** & W5CCP, WA5TSJ, WA5VCQ. **WA6UFK** & WA6IQM. **WA8WGJ** & WB8BZK. **WA0CJU:** K0UYN, WA0MVO, WA0PMM. **WA0MLE** & K0DDA, WA0HVR. **WA0NLP:** 10 Opers. **WB6WIT** & W6LEX, WA6BWG, WA6PNN, WB6PNN, WB6VFJ, WB6VZI, WB6ZIN. **WB8BEG** & WB8AEO, WB8AGV, WB8BUP. **WB8BLA** & WB8CLX. **XE1WS** & XE1KS, XE1GGW, VE1MN. **YU1BCD:** YU1PCF, YU1QBC. **YU3EY** & YU3EJ, YU3TGR. **ZS5OA** & ZS5OB. **3Z5PWK:** Club. **3Z0PZJ:** 3Z1BTF 3Z1CQN, SP1DKV.

See page 102 for New Reader Service

Contest Results *[from page 49]*

Many stations commented on the lack of activity from the boys "down under." This is something we have not been able to solve, and personally I cannot understand. With the large assortment of awards for Australia many are going unclaimed because of this lack of activity.

The YL's bless them, were in there bucking the competition. A few I ran across were Paula, WA1ANR who suggests that General frequencies restrictions be removed during a contest. (Now wouldn't that be nice.) Ethel, VE6RP, Irmgard YV1YC, and the ole reliables Molly, ZE1JE; Alicia KP4CL and Carola of the OH5SM crew.

And a final paragraph that I would rather not have to write. We found it necessary to disqualify the multi-operator score of WA3-GJU. The rules under Par. XIII are very specific.

Once again we extend our thanks to several overseas contest managers who co-ordinated the logs of their respective clubs. Among the most prominate being Werner Stiehm, DJ8-SW; Klaus Voight, DM2ATL; Milos Prostecky, OK1MP and Wojciech Klosoh, 3Z9PT.

This year's Committee include, besides yours truly, the old reliables Fred Capossela, W2IWC; Bob Entwistle, W1MDO; Andy Malashuk, W1GYE; and our new member Bernie Welch, ex-DL4FS and now WA2LLK.

73 for this one, Frank, W1WY

Q & A *[from page 85]*

in the past *CQ* articles listed on page 89 for the Q & A Column in *CQ*, Feb. 1970. These articles also include data for other degrees of attenuation.

Relay requirements and other connections are given at fig. 2. These also will serve as the basis for other applications.

73, Bill, W2AEF

Contest Calendar *[from page 80]*

entries from the USA.

And Oh! Yes, many thanks for all those cards and letters, complementary and otherwise, regarding the photo that headed this column in the April issue. Especially the one from the little ole lady who wanted to make a sked on the high end of 10, where it's nice and quiet. I found it necessary to go back to my own smiling photo, Marcello would not agree to a reciprocal agreement and use my photo in his movie releases.

73 for now, Frank, W1WY

See page 102 for New Reader Service

Announcements [from page *10*]

Angola, Indiana. Activities will begin at 8 a.m. Sunday, Aug. 2, 1970. For entertainment there will be boating, fishing, swimming, camping facilities, and excellent picnic grounds. The picnic will also feature a free flea market and big prizes. More information can be obtained by contacting FWRA, Box 6022, Fort Wayne, Indiana 46806.

Levelland, Texas

The Northwest Texas Emergency Net and Levelland Communications Club is sponsoring a Ham & CB Swapfest & Picnic, Sunday, August 9th, 1970. This is an event for the entire family. Bring your own picnic basket. Registration begins at 9 A.M. Lunch at 1300. Mobile talk-in frequency is the net frequency, 3950 kc, and channel 11 for CBers.

Marshalltown, Iowa

The Iowa 75 meter phone net's annual picnic will be held on August 16, 1970, at the Riverview Park in Marshalltown. Festivities will begin around noon with the frequency of 3970 being monitored.

Wilmington, Delaware

The Amateur Radio Club of Delaware in a joint effort are planning for the 1970 Delaware Hamfest, which will take place at Wilmington, Delaware, on August 16, 1970 (rain date Aug. 23rd). For exact location and further details contact Roger Cole, W3DKX, 345 East Roosevelt Ave., New Castle, Delaware 19720.

Danville, Illinois

The Danville Hamfest, sponsored by the Vermilion County Amateur Radio Association, Inc., will be held at Douglas Park, on August 30, 1970.

Youngstown, Ohio

The Mahoning Valley Amateur Radio Association will sponsor a hamfest Sunday, August 2, 1970, at Lions Park in New Bedford, Pennsylvania. Location is 9 miles East of Youngstown, Ohio off US 422 and 1/2 mile North of US 422– signs will be posted on US 422. There will be door prizes and a flea market. Call in frequencies are 146.94 and 146.34 to 146.76 to Repeater W 8 I O O . For further information, write Frank Dodd, K8UYF, 323 Bedford Road, Lowellville, Ohio 44436.

Huntsville, Alabama

The North Alabama Hamfest Association is holding their hamfest on August 15th and 16th at The Mall in Huntsville, Alabama. For complete details contact James A. Brashear, WB4-EKJ at P. O. Box 423, Huntsville, Alabama 35804.

Propagation [*from page 74*]

HAWAII

Openings Given In Hawaiian Standard Time†

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

ALASKA

Openings Given In GMT‡

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

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT or Z Time. For example, when it is Noon in Honolulu, it is 17 or 5 P.M. in NYC, EST.

‡To convert to Local Standard Time in Alaska, *subtract* 8 hours in the Pacific Standard Time Zone; 9 hours in the Yukon Zone and 10 hours in the Alaskan Standard Time Zone, from the GMT times shown in the Chart. GMT is 5 hours *ahead* of EST; 6 hours *ahead* of CST; 7 hours *ahead* of MST and 8 hours *ahead* of PST. For example, when it is 18 GMT it is 13 or 1 P.M. EST in NYC.

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

See page 102 for New Reader Service

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00**. No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.**

FOR SALE: GT-550 Galaxy transceiver with all station accessories. System is practically new-I/M less than 8 hours operation. Accessories include AC-400 ac power supply, SC-550 speaker console, RV-550 remote vfo, PR-550 phone patch, VX-35C vox unit, CAL-25 25-kHz crystal calibrator, and F-3 300-Hz CW filter. List price for this package comes to $915. Special summer-cleaning price, $700. All units have original warranty cards. W1DTY, Box 25, Rindge, N. H. 03461. (603) 899-5483.

WANTED: Schematic and/or operating manual for Weston V.O.M. Model 772 type 1, or photostats of same. W. McPherson, 3820 S. Military Highway, Chesapeake, Va. 23321.

TOROIDS: 88 mhy. 5 for $2.00. Postage paid. WA0PYW, W. H. Schler, 5345 N. Woodland, Kansas City, Mo. 64118.

RUBBER ADDRESS STAMPS: $2.00. Signature, $3.50. Free Catalog. Jackson's, Box 443F, Franklin Park, Illinois. 60131.

MAKE OFFER. NCL 2000; HQ-170; 20-A, BC458 VFO; AF-67, PMR8, with AC-DC supply; 6 meter 50D; R45/ARR7 receiver, broadcast to 42 mc. All in operating condition, with manuals. No shipping. Deliver nearby. W7IBR, 14412 N.E. 76th Street, Vancouver, Wash. 98662. Phone: (206) 892-9507.

SB-200 Kw Linear: $195.00. Ronald M. Nagata, (WGRQ2) 1330 Curtis Street, Berkeley, Calif. 94702. TELEPHONE: (415) 526-7345.

TWO-METER SOLID STATE Transceiver VHF transistors in rcvr 8 xmtr. Schematics (needs readjustment), LM freq. meter with power supply. W2OKO, 27 Somerset Place, Murray Hill, New Jersey. 07974.

SELL: Tektronix 541A Oscilloscope with type C-A plug-in, $750.00; Type D Hi-Gain D-C differentiated plug-in, new, $95.00; Type T test plug-in $35.00; 181 time-mark generator, $145.00; Gertsch FM-6, Frequency Meter, 20 Mc to 1000 Mc with 0.0001% accuracy (used by FCC for commercial station frequency measurement), $650.00. FOB. H. T. Cervantes, 34 Johnson Road, Binghampton, New York. 13905. (607) 724-5785.

FOR SALE: Heathkit Seneca VHF-1 $100, HQ170 Rcvr. $150 will split postage, both units look & operate like new. I am going SSB. Also have many items like tubes, meters, parts, etc. SASE brings list. W. Strand, 312 Kings Hwy. Swedesboro, N. J. 08085. WA2LMN.

WANTED: B & W FC-15 Filament choke. W7AOQ, 2723 VanGeisen, Richland, Wash. 99352.

SELL: Hammarlund HQ110 AC-VHF Receiver---- $225.00 or best offer. Mike Skinner, 707 Fairview, Galion, Ohio. 44833.

SCOTT'S QSL SERVICE: Cards forwarded anywhere, 3 cents. No U.S. to U.S. Free information on manager services, 1510 Lynnview, Houston, Texas. 77055.

OLD QST, Radio & Electronic magazines & books. Also Railroad & model railroad books & magazines. Send stamp for list to: A. T. Hennek, 308 West Ferndale Road, Wayzata, Minn. 55391.

SP-600, $300 or Trade for multi-band transceiver. HW-12, $80. Both excellent. K0RFX, 854 Skyline Junction City, Kansas. 66441.

See page 102 for New Reader Service

WANTED: Heath KW. Kompac amplifier in excellent working condition. Write your price to: W0KZZ, 1422 N. 12th St., Fargo, N. D. 58102.

HAMFESTERS 36th ANNUAL HAMFEST and picnic. Sunday, August 9, 1970, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago, Exhibits for OM's, XYL's. Famous swappers Row. Information and tickets. Tom Ondriska, WA9YZW, 6609 S. Kedvale, Chicago, Illinois. 60629.

MOVING TO APT: B.T.I. - TA33 - Ham-m, 60 ft. crank-up. Morris Cohen, 400 Brookhaven Road, Wallingford, Pennsylvania.

SELL: Eico 753 Triband transceiver with AC supply, latest modifications, mint condition. $150.00. W2KZ, 61 East Depew Avenue, Buffalo, New York. 14214.

FOR SALE: Marconi DT-45 2-meter FM mobile complete with cables, head, mike, crystals, 146.34-.94 & 146.46-.94. Marconi DT-65 2-meter FM mobile complete on 146.34-.94 & 146.94-.94. CN 144 Ameco converter with PS. Knight TR-108 2-meter AM xceiver. CDE model TR4A rotor. WA2HSB, 5 Addoms Street, Plattsburgh, N. Y. 12901.

COLLINS KWS-1 ser: 1296, 75A-4 ser: 2048 3 filters; 3.1, 2.1, 0.5, mc; speaker. in top condition, $1,250.00. On the air now. W2FXE, Short Hills, New Jersey. 07078. (201) 379-5553.

NOVICE CRYSTALS: 40—15M $1.38, 80M $1.83. Free flyer. Nat Stinnette Electronics, Umatilla, Florida. 32784.

FOR SALE: HQ180AC, $225.00. Knight T-150A, $75. Knight KG-635 WB Scope, New, Factory-wired, $150. Mercury 2000 Tube Tester, almost new, $90. FOB Hoshal, Box 191, Aberdeen, Maryland. 21001.

TOY TRAINS WANTED: I want to swap or buy those electric trains you no longer use; any age or condition. SWAP 75A2, SX42, HP400D, G50, more. Send full description, asking price and SASE. K4EIH, Box 1028, Springfield, Va. 22151.

1000 piv at 1.5 amp epoxy diodes includes disc bypass capacitors and bridging resistors. 10 for $3.95 or 100 for $30.00, postpaid U.S.A. East Coast Electronics, Dept. C, 123 St. Boniface Rd., Cheektowaga, New York. 14225.

CIRCUITS for 32 electronic projects, R. F., audio and gadgetry, complete plans $1.00. P. M. Electronics, Inc. Box 46204, Seattle, Wash. 98146. Dealer inquiries invited.

REI can train you for the First Class Radio Telephone License in only five (5) weeks. Approved for Veterans training. REI has schools in Sarasota, Florida; Glendale, California; Fredericksburg, Virginia; and Kansas City, Missouri. For free brochure write REI, 1336 Main St., Sarasota, Fla. 33577 or call (813) 955-6922.

RTTY Gear for sale. List issued monthly. 88 or 44 Mhy torroids, uncased, five for $2.50 postpaid. Elliott Buchanan and Associates, Inc., 1067 Mandana Blvd., Oakland, California. 94610.

WANTED: 1964 to '70 issues of RADIO ELECTRONICS Magazine. Will pay $1 per year and postage. Write: J. Wegner, P. O. Box 262, Glendale, California. 91209.

SELL: Collins 51J-4 Receiver with 1.4, 3.1, 6.0 kc Mechanical Filters, Gear Reduction Dial, Cabinet, Manual and plug in CE Sideband Slicer, $750; Also RD-92A/UX Facsimile Recorder with CV172/U Frequency Shift Converter, $150. Also Klein-Schmidt teletypewriter TT-4A/TG $80 Freight Collect Auguste Schwab, Jr., 560 Woodmere Blvd., Woodmere, L. I., New York. 11598.

TRADE OR SELL: Have 16mm Bell Howell 70-D Seven speed movie camera. WANT: Swan 140-W6BWQ, 6449 Graves Avenue, Van Nuys, California. 91406.

WILCOX 96A, 96C3, TBY4, ARC5, ARC4/233A, Ts170/ARNS, TS110, some Collins xformers. Rf coils, choke, tubes, 2c26, 2c43, 2k25, 3E29, 4F32, 717A, 3B24w, 117k7 GT, Ferrite Memory units, RCA. German Magnetic memory units. RCA plug-in boards trans IC. SASE to: Doug Craton, 5625 Balfrey Drive, West Palm Beach, Fla. 33406.

GET YOUR "FIRST!" Memorize, study: "1970 Tests-Answers" for FCC First and Second Class License. -plus- "Self-Study Ability Test." Proven. $5.00. Command, Box 26348-F, San Francisco, California. 94126.

WORLD RADIO's used gear has trial-terms-guarantee! Gonset 910A, $179.95; SR160, $149.95; Swan 350, $289.95; Swan 400/420, $299.95; HT40, $49.95; Apache, $99.95; DX60, $49.95; T4X, $319.95; HQ180 AC, $349.95; SP600JX(rack) $269.95; Galaxy R5 30, $649.95; 75A3, $209.95; Drake 2A, $149.95. Free "Blue-Book" list for more. 3415 W. Broadway, Council Bluffs, Iowa. 51501.

HAM RADIO COUNSELORS: Boys summer camp, June 24, Aug. 23. Minimum age 19. Write or call: Morgan Levy, RD 4, Waynesboro, Pa. 17268. TELEPHONE: (717) 794-2313.

EXCESS HAM EQUIPMENT SALE: No junk. SASE for list. W1KZQ, Baltic, Ct. 06330.

QSLS. Second to none. Same day service. Samples, 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah. 84015.

BUY, TRADE or SELL: used amateur band receivers. Steven Kullmer, Evergreen Hatchery, Dysart, Iowa. 52224.

MANUALS: TS-323/UR, SP-600JX, R-274/FRR, $5.50 each; R-390/URR, BC-639A, $6.50 each. Many others. List 20 cents. W3IHD, 4905 Roanne Drive, Washington, D.C. 20021.

SALE: Teletypes Model 15, $60; Model 19, $90; AN/FGC—IX audio converter, $25; Hornet TB-3B Tri-band beam, $40; Mosley A-92-S (2 mtr) Beam 110' twin lead, $15; ASAHI-PENTAX 35mm, Fl.8-55mm, fl.8-85mm with cases, $150; want Central Electronics 20A; WA4TNW. 29482.

CUSTOM CONSOLES For Amateur Radio Stations. Equipment may be updated by changing only front panel. Inquiries and orders now being accepted. Literature with pictures available. "ACE" Goodwin, W4WEU, 2510 Via Havarre, Merritt Island, Florida. 32952.

75A4 For Sale, Serial No. 2060, $325. with 3.1 kc filter, $345. with 3.1 and 6 kc filters, $385.00 with 0.5, 3.1, and 6 kc filters. K4IIF, Box 205, Winter Haven, Florida. 33880.

RCA SENIOR VOLTOHMYST WV-97A, AC/DC Probe. $22 cert. check. E. Stolz, WA6YQS, 3738 Robertson Avenue, Sacramento, Ca. 95821.

WANTED: Any 'Don Britton' Construction Plans adv. in POP ELECTRONICS. Swap, Too! Joe Wegner, P. O. Box 262, Glendale, Ca. 91209.

FOR SALE OR SWAP: Laboratory test equipment-Garage full: Hewlett Packard UHF Signal generators, $25 ea., Oscilloscope-storage type, 5" screen-similar to Tecktronix-$2.50., etc. Stereo equipment-casette recorder/playback units-car and home types. Cameras, etc. Send for list. Murray Marcus, 11 Eldridge St., E. Northport, New York. 11731.

WANTED: QST before 1920 and amateur radio-teletype publications. Orville Magoon, 1941 Oakdell Drive, Menlo Park, Calif. 94025.

POSTAL CHESS: American Postal Chess League Box 1022, Greeley, Colorado. 80631.

CINCY STAG HAMFEST: The 33rd Annual Stag Hamfest will be held September 27, 1970 at Stricker's Grove, Compton Road, Mt. Healthy, Cincinnati, Ohio. Door prizes each hour, raffle, lots of food, flea market, model aircraft flying. and contests. Identify Mr. Hamfest and win prize. $5.00 cost covers everything. For further info., contact John Bruning, W8DSR, 6307 Fairhurst Avenue, Cincinnati, Ohio. 45213.

BUILD: Transformers, inductors, coils yourself. Save to 80%. Plans - kits. Free estimates and information. Magnetic Circuits, Dept. A, 386 Deborah Ct., Upland, California. 91786.

NOVICES: Need help for general ticket? Complete recorded audio-visual theory instruction. Easy, no electronic background necessary. Write for free information. Amateur License, Box 6015, Norfolk, Virginia. 23508.

MAGAZINES: Sell CQ July 1966 thru March 1969 and October 1969 plus 7 extras. QST August 1964 plus March thru December 1967. 73 Magazine August 1966 thru March 1967. Short Wave Magazine (English SWM) November 1961 thru April 1966. DX Magazine (Don Chesser's) April 1959 thru February 1964. What am I offered? O'Brien, W2EQS, BETTER BUSINESS BUREAU, 2 Forest Avenue, Paramus, N. J. 07652. Telephone: (201) 845-4044.

See page 102 for New Reader Service

NEW JERSEY QSO PARTY: August 15-16! See Contest Calendar in July CQ for complete rules.

SELL: Swan Cygnet 260, $360. HQ200, $200. Both in mint condx. J. G. Swaney, 10403A 46th Number 105, Beltsville, Md. 20705. Phone: (301) 937-8130.

SELL: Hammarlund HQ170, Manual, asking $160; Hallicrafter HT37, Manual, asking $175.00; Hallicrafter HA1 Keyer with Chrome Vibro Paddle, asking $80.00. John Fearon, 3384 Peachtree Rd., N. E., Suite 705, Atlanta, Ga. 30326.

FOR SALE: Elements of Radio Comm. Morecraft 1929 Radiotelegraph and telephony. Duncan 1929 theory of Radio-Filgate 1929. Principles of Radio Comm. Morecroft 1929. Sell to highest bidder. Douglas, 2254 Pepper, Concord, Cal. 94520.

PITTSBURGH HAMFEST: Sunday, Aug. 2, 1970, noon till dusk. St. Clair Beach, formerly Paris Lake, Prizes Galore. Information available: Contact, WA-3KOS, 5073 Grove Road, Pittsburgh, Pa. 15236.

BARGAINS: Varied assortment ceramic standoffs, feed thrus, bees hive insulators. Free list Ken Maas, W9AZA, Burlington, Wisconsin. 53105.

REAL NICE Novice Station: Ranger I, HQ143, Receiver Preamp, All band dipole, Antenna relay, Low pass filter, mike, all manuals. $200. WB4BZE, Ramseur, North Carolina. 27316.

SELL: 75A4 Ser. No. 3058, $395. Hammarlund HX500 Xmitter CW, AM, SSB, FM, RTTY, $225. W6JBM, F. Kubias, 4655 Lamont, San Diego, California. 92109.

WANTED: Heath VF-1 VFO. Any condition bought. Steve Garson, 77 Luciani Road, Woodbridge, Conn. 06525. TEL: (203) 387-5109.

NCX-3 AC/DC Supplies. Hi-Gain mobile ant/3 coils. Mint Condition. $200.00 firm. R. Arnold, 90 Devon Road, Norwood, Mass. 02062.

HEATHKIT DX100, converted for SSB, with freq. spotting control; Heathkit SB10 Sideband adaptor; Central Electronics MM2 Multiphase analyzer; all original instruction books. On the air daily, until supplanted by higher power rig. Best offer over $140.00. W9PPH, 1104 Wade Street, Highland Pk., Illinois. 60035.

WANTED: RCA Carphone Cable connector, Cannon Number NK-R16-21-1-BEAN or Complete cable, MI-31218 for RCA CMC-20, also Geared knob for 75A4. K9ISI, 4549 North 38th Street, Milwaukee, Wisconsin. 53209.

TELETYPE, tape perforator w/keyboard (iron horse) $25.00. Goodman, 5826 South Western Avenue, Chicago, Illinois. 60636.

DRAKE R4A, $250, TR4 with AC & DC Supply, $550, Eico 717 Keyer, $45. All like new. I'll pay shipping in the United States. WA8ASV.

COMPLETE 2M STATION PKG, $45.00; Clean ARC-3 XMTR/RCVR w/plugs, parts/115 VAC P.S. varitune RCVR. conversion. Original IB schematics 60 FOB QTH/W2DXK, 6015 Weekslane, Flushing, New York. 11365.

88 Mh Uncased. Toroids 5/$1.50, 255A relays, $2.30, relay sockets 80 cents each, PP48. E. W. Evans, K4OEN, 220 Mimosa Lane, Paducah, Kentucky. 42001.

CLEANING Up The Shack Again! Send SASE for List! Jon Hart, WB2RTA, 26 William Street, Glens Falls, New York. 12801.

TRADE: $175 of radio/tv parts for any type minibike. Send photo. WN1MGV, Robert Indech, 7 Lewis Drive, Randolph, Massachusetts. 02368.

TRADE: Bird 2 Slug 1 3/4" round line section for HF TVHF Slugs. SELL: Motorola Base 3-meter panels, $15.00, 2.5 kw gen, less engine, $85. 5 kw 4 cyl, $450.00. R. M. Ellis, 1340 Elizabeth Street, Las Vegas, Nevada. 89109.

WANTED: Heath SB610 & SB620. Must be mint, with manuals and no modifications. R. Mendelson, W2OKO, 27 Somerset Place, Murray Hill, N. J. 079-74.

WANTED: Measurements 8 OR signal generator. Also, Boonton 160A Q-Meter. F. E. Rice, Glasgow, Kentucky. 42141.

SELL: Collins 30S1; 312B4 $130.00; CE 10B $45.00; Heath HO-13, $50.00; Wagner Xfmrs 3600-0-3600 at 1 amp 110/220 pri $30. All FOB. W0AIH, Rev. Bittner, Virginia, Minn. 55792.

MINIATURE LICENSE PLATE! Your call embossed in raised letters on 7" x 2 1/2" steel plate. $1.00 postpaid. Yale Packaging Co., Yale, Michigan. 48097.

SELL: Johnson Viking kilowatt desk model, $400. Original cost $1,595. Hallicrafter HT 32 (used to drive the kw.), $175. Both perfect condition with instruction manuals. Dehumidifier A-1 condx, $50. Cash and carry. Reason for selling - moved to new QTH. Also, 2 - 810s, $15 each; 4 - 872s, $5 each; 1 - 866, $2. QST Jan. '61 thru Aug. '68, $18; CQ Jan. '61 thru Dec. '69, $21. O'Brien, W2EQS, BETTER BUSINESS BUREAU, 2 Forest Avenue, Paramus, N. J. 07652. Telephone: (201) 845-4044.

SB-300 FOR SALE. Exc. condx., make offer. WA3NNB, Ken Coit, 13905 Bethpage Lane, Wheaton, Maryland. 20906. TEL: (301) 871-8503.

KW PLATE TRANSFORMER: 3000/2000 VCT. Weight: 26 lbs. $30 or best offer. Also 5 Capacitors, 150 MFO/330 VAC (600 VDC), $1.50 each. WA1JYU, 27 Blue Ribbon, Westport, Conn. 06880.

SELL: A.C. Variac, 110 v. input, 0-140v at 3 amp output. Brand new, Never used. Original box and data. Best offer. W2ASI, 15 Kensington Oval, New Rochelle, New York. 10805. (914) NE 3- 7077.

CLEANING SHACK: Write for list. K3DTL, Art Prutzman, 31 Maplewood, Dallas, Pa. 18612.

TRADE: QST, 1926, 1929, complete year, FOR: 1945 (complete year) CQ, or WILL BUY. W2IXT, 447 South Ocean Avenue, Patchogue, L. I., New York. 11772.

FOR SALE OR TRADE: BC654 with PE103, RCVR Pwr supply, & cables. BC221 Freq. Meter, Gates, Mc DE number 1. Audio Line Amp, with compression & Meter. 600 r in & out. W9KIQ, Rt. 2, Box 776, Collinsville, Ill. 62234.

MOVING TO APT. - BTI - TA33 - Ham-M 60 ft. crank-up. Morris Cohen, 400 Brookhaven Road, Wallingford, Pa.

HENRY 2KD-2 Desk type linear amplifier, with remote heavy duty solid state power supply. Mint condition. $550.00. Pick-up only. W2HC, Telephone: (516) 333-1079.

FOR SALE: SX-130 rcvr & speader in mint condition. Johnson Messenger 100 CB unit with xtals in mint condx. Best offer takes them. Bruce A. Rahn, WB9ANQ, 1511 East Main Street, Little Chute, Wisconsin. 54140.

WORKED SOUTH AMERICA CERTIFICATE: Work all 13 countries. Send $1 and confirmation to HC1TH, Box 583, Quito, Ecuador, S. America.

SHAWNEE AMATEUR RADIO ASSOCIATION (SARA), Hamfest, August 2, 1970. Herrin City Park, Herrin, Illinois. 62901.

SELL: SBE-34 with mobile mount and mike. $250.00. TA-36 tri-band beam with AR-22 rotor. $125.00. K3JYZ, 14601 Claude Lane, Silver Spring, Maryland. 20904.

FOR SALE: SB300 complete with Spkr., AM, CW, SSB filters, 2 & 6 converters, and SB401. Make an offer. WA1JYU, 27 Blue Ribbon, Westport, Connecticut. 06880.

WANTED: 64 through 70 issues of RADIO ELECTRONICS, POP ELECTRONICS. Will pay 10 cents each and postage. Write, Joe Wegner, P. O. Box 262, Glendale, California. 91209.

RCVR: BC-312, Xmtr, Globe Scout, VFO, Ant. relay, all for $95. W4ZSC, 2665 Hawthorne Dr., N.E., Atlanta, Ga. 30329.

WANTED: Pre 1923 old tubes like Marconi-Osram, DeForest Fleming Marconi Telefunken Welsh Moorehead Deitzen Margo, W9LGH, 610 Monroe Avenue, River Forest, Ill. 60305.

SB-300 FOR SALE. Exc. condx., make offer. WA3NNB, Ken Coit, 13905 Bethpage Lane, Wheaton, Maryland. 20906.

HYGAIN DB1015 & DB2040. SELL or TRADE for 312B4. Mint QST's, 1931 thru 1969 in binders. Best offer. WA5TYB, Box 19522, Dallas, Texas. 75219. (214) 369-3850.

WANTED IMMEDIATELY every amateur who has been licensed for forty years to join the Old Old Timers Club. Send QSL card for application to: Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, NE, Cedar Rapids, Iowa. 52402.

See page 102 for New Reader Service

WANTED: Early radio and wireless receivers, parts, tubes, catalogs, books, magazines and call books. Will trade early magazines or pay cash. Erv Rasmussen, W6YPM, 164 Lowell Street, Redwood city, California. 94062.

FOR SALE: Knight T-60 Transmitter, Factory-wired (A rare one) $50.00; 6 mtr Converters, techcraft CC-50, AMECO CB-6, $27.50 each; Transcon 10 mtr trans, VFO & Conv, $50.00. All FOB. R. Wendel, WB2YYX, 160-20 Grand Central Pkwy., Jamaica, L. I., New York. 11432.

LM FREQUENCY METER (Bendix) w/book, matching 117 AC supply. Both excellent condition. Cert. $40. E. Stolz, WA6YQS, 3738 Robertson Avenue, Sacramento, Calif. 95821.

FOR SALE: Electric Instructograph. 20 tapes: $25.00; Dow Key Coax Relay-(DK60-6) New, $15.00; First and Second Phone Course (Slide Rule) Both $20.00; Code Practice Osc. (AMECO), $10.00; Transistor Inter. Com, $10.00. Harold Hastings, WA6KXB, 13445 Hwy 80-SP 42, El Cajon, California. 92021.

BERKELEY Mod. 1556 1 MHZ events counter, w/ 1450 printer, $175. Also model 7150/7160 1 MHZ freq. counter. $175. W9TKR, 505 South Elmwood, Waukegan, Illinois. 60085.

FOR SALE: HQ-170A with clock, good condition, $225. DX-60B xmtr, mint condition, best offer, R-100A Rcvr (less original knobs) $50. John Wyncott, 1107 W. Main Street, N. Manchester, Indiana. 46962.

MASCO wireless nurse to AM radio $6. Gonset tuner 108-128 & 40-50 M. C., Aircraft & highway patrol respectively. Each cost $99, sell $25, FOB Richard M. Jacobs, 4941 Tracy, KCMO 64110.

FOR SALE HRO5 coils E, F, G, H, J, JA. HRO60 dial. Make offer for all or any part. Wells chapin, W8GI, 2775 Seminole Road, Ann Arbor, Michigan. 48104.

FOR SALE: Rack Cabinets, 22" x 22" x 76". Over 6 feet of 19" panel space! $30 each. HQ-145C, likenew $165. No shipping. W4JSC, Rt. 2, Box 952, Odessa, Fla. 33556. 813-920-5094.

WANT: Low power SSB transmitter with VOX, VFO and Power supply. Must have manuals. Send description and price to W9KIQ, Route 2, Box 776, Collinsville, Illinois. 62234.

NEW JERSEY QSO PARTY- August 15-16. See Contest Calendar in July CQ for complete rules.

WANTED: Paper for Model 14 RTTY Machine: misc. Test equipment. Marty Feeney, K1OYB, 38 Howard Street, Portland, Maine. 04101.

SELL OR SWAP: KWM-2 DC PS $75.00, X'tal Pack $110.00, Collins 180T-2 Ant. Sys. $200.00, WA6G22, 4133 Stonecutter Wy., N. Highlands, California. 95660.

6M Tunaverter-$20; DX-40- $45; VF-1—$12.40 MHZ Converter, Tapetone $20. Marty Feeney, K1OYB, 38 Howard St., Portland, Maine. 04101.

SALE: Omega T antenna noise bridge, $18.50, 15 meter Heliwhip antenna, $95.00. F. Strickhausen, WA0NLR, 715 Tyler, Number 36, Topeka, Kansas. 66603.

WANTED: Power transformer for Collins 310-B exciter. Collins part number 66200038-00. Robert Bristow, W0LNC, 818 South White Street, Kansas City, Mo. 64125.

FOR SALE OR TRADE: Heath Q-Meter and Heath Z-Bridge. WB6HQH, R. B. Martin, 1697 Galway Drive, San Jose, California. 95129.

FOR SALE: Henry 2K-D, $475. Squires-Sanders SS-1 R, SS-IV, SS-IS, $500. H-P 130-A 'scope, (need work), $95. TR-3 (Drake up-dated 11/69), MS-3, AC-3, Adcom 350-12, $400. Lafayette HA-410, whip, mike, $80. Galaxy 300, PSA-300, $195. Invader-2000, $200. James W. Craig, W1-FBG, 29 Sherburne Avenue, Portsmouth, New Hampshire. 03801.

DX-60 in A/1 condx. With 80 es 40m Novice X-tals and manual. $40. U pay shipping. WA3LPK, 2300 Louise Avenue, Balto., Md. 21214.

HRO 60 15 meter bandspread coil number AC wanted. Must be in reasonable or better condition. Will pay any reasonable price. Blake Tucker, 6112 Beachway Drive, Falls Church, Va. 22041.

WANT TO TRADE OR SELL: Have complete U.S. Divers, Scuba Gear. Will trade for SSB equipment, Have Royal Master double Hose Regulator, Tank, Audio Valve, Contour Back Pak, gauges, camera, full wet suit plus hood, boots, gloves, knife, May West, Weight belt and mold mask, etc. Write WA0KJO, 1433 Summit, Ames, Iowa. 60010.

FOR SALE: 2 and 3 acres, view property, ideal for ham or retirement, near Portland, Oregon. Write A. C. Perry, Box 192E, Rt. 1, Banks, Oregon. 97106.

DRAKE: R4B--MS4 with WWV, MARS-4025 all of 10 meters. Mint condition. $350.00. Ray Farwell, 370 N. E. 147th Terrace, North Miami, Florida. 33161. W4BJ.

SHACK CLEANOUT: Making room for baby. SASE for 3 page list of goodies and junque. WB4HLZ. 3479 Mark Twain St., Memphis. Tenn. 38127.

FOR SALE: 75A4 No. 5822, 0.5, 1.5, 2.1, spkr, $500. Squires-Sanders SS-1R, SS-IV, SS-IS, $500. Tektronix 514-D, $175. NCL-2000, $325. Galaxy 300, PSA-300, $195. Henry 2K-D, $475. Eldico SSB-100, spare 5894, $100. Model "B" Slicer, $25. Heath KL-1, KS-1, $265. James W. Craig, W1FBG, 29 Sherburne Avenue, Portsmouth, New Hampshire. 03801.

MAYBE I have the back copy of CQ or QST you need. Write for Prices. W3IND, 914 Claire Ave., Huntingdon Valley, Pennsylvania. 19006.

RTTY INFORMATION: For the amateur interested in RTTY. F. DeMotte, P. O. Box 6047, Daytona Beach, Florida. 32022.

APACHE XMTR FOR SALE: Novice or general, 75-180 watts, cw, phone, xtal, or VFO, sacrifice-$70. Will ship. Eugene Gascho, Pigeon, Mi. 48755.

TRANSFORMERS: What do you need? K3DTL, Art Prutzman, 31 Maplewood, Dallas, Pa. 18612.

COLLINS: Crystal pack, short 4 xtals, certified check or M.O., $175. WA6DKU/4, 4735 Brenthaven Road, Columbia, S. C. 29206.

SOS, May Day, Help! I need CQ-1945 complete year. W2IXT, 447 S. Ocean Ave., Patchogue, New York. 11772.

SELL: Drake R4B, Manual & Spkr, Newest model 8940sn. NC300 & spkr, HQ180 & spkr, 32vz. ME51 up3 kmc Freq-pwr meter. Best offers. W4AXL 2432 Savoy, Birmingham, Ala. 35226.

FOR SALE: HW-32A and ac/PS, Ranger I, 6N2, good condition, $60 each. You ship. Write P. O. Box 574, Carbondale, Illinois. 62901.

SALE OR TRADE: Heathkit SB-620 Spectrum analyzer. Mint. $90.00. WANT: Pair 6 meter lunchboxes or marine VHF. WA4HAO, 703 East Grace Street, Richmond, Va. 23219.

HELP! MUST SELL! RME DB-23 $15; SB-610 $55; HQ-180C, $160; AR-22 rotor cable, control box, $20. All perfect. WA9HMY, 1115 Olive, Lawrenceville, Illinois. 62439.

WANTED: Heath Kompact KW, with fixed and mobile supplies, for DX-peditions. Mike Swink, HT-IMG, c/o 8009 Beverly, Prairie Village, Kansas. 66208.

SELL OR TRADE: for 6 or 2 or FM equipment: Solar enlarger, Spiratone enlarging meter. Lentz WA1DND, Box 655, Durham, N. H. 03824.

HUSTLER WHIP Antenna-base, shaft, resonators for 15, 20, 40, 75. Cost $60. Sell $40. Hallicrafter 2 meter superhet receiver S102-$10. Krebs, W2ESY, 1739 E. Susquehanna, Allentown, Pennsylvania. 18103.

WANTED: 811A, 813 tubes, KW Balun. Have 4CX300A's & 3 E29's. E. H. Jeltrup, 27A Lincoln Place, Ossining, New York. 10562.

DOCTORS: M.D., D.D.S., D.O., D.V.M., O.D., PHD, etc. Send name, call, address, degrees indicating your major to: K4RTA, 105 Freshrun Dr., Hendersonville, Tenn. 37075, for listing in Worldwide Doctors' Directory.

WANTED: Clegg-66'er, must be in excellent condition. Have a Parks 2 meter conv.-$45.00 (IF-28-32 mc). Jim Gysan, 53 Lothrop Street, Beverly, Massachusetts. 01915.

MOSLEY: TA-31 Jr. Rotatable 20-15-10 meter dipole, $15. Plus Shipping. E. Stirratt, WA2HJM, 76 Woodridge Avenue, Cheektowaga, N. Y. 14225. Telephone: (716) 832-2827.

CQ ADVERTISING RATES

Each month our advertising department receives numerous requests from readers for advertising rates. We've decided that we can save everyone some time by listing those rates right here. The costs per ad will vary, depending upon the number of ads run during a twelve month period. Advertisers may earn a rate from *the time the first ad appears*, rather than being obligated to run on a calendar year basis.

	1 or 2 times	3-5 times	6-11 times	12 times
Full Page	$525.00	$470.00	$430.00	$385.00
1/2 Page	275.00	255.00	235.00	215.00
3/8 Page	220.00	205.00	195.00	180.00
1/4 Page	150.00	140.00	130.00	120.00
3/16 Page	106.00	101.00	97.00	93.00
1/8 Page	80.00	75.00	70.00	65.00
1/16 Page	40.00	38.00	35.00	33.00

Costs for second color are $75.00 per ad. Bleed charges are $50 per page, $35 per fraction. Ad copy should be submitted by the 15th of the second preceding month; i.e., April issue closes by February 15th. For additional information or assistance contact CQ advertising department.

HY-GAIN DB-62, 6/2 meter beam, instructions, excellent condition. Half price for quick sale. $20.00. W0RJZ, Box 466, Creston, Iowa. 50801.

AMPEX: Two Channel Professional tape recorder model 602. Will accept 7" reels. Now in Samsonite Case; suitable for custom console mounting. Best offer. 314 So. Western Ave., Springfield, Ohio. 45506.

WANTED: Issues of QST, 1922 and before, to complete file. Pay ur price. SELL: Two brand new 304-TL's, $35.00. W9CO, 604 Wyatt, Lincoln, Illinois. 62656.

SUPERIOR TV-50-A RF, AF, TV Gen. $30.00. Lafayette 174 VTVM $20.00 FOB 1924 Sheridan Avenue, Sp. 4, Escondido, Calif. 92025.

PORTABLE FIELD DAY RIG-See CQ, June, 1968. This is the actual one built by W6BLZ, $40.00. Knight P-2 SWR Bridge, $8.00, 2-new, unused, 12 element 2 meter beams with stacking harness, $45.00. Much more. Stamp for list. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022.

FOR SALE: Hammarlund Hq170 AC VHF, $250. Hq160, $160.00. Like new. R. J. Windisch, Rt. 2, Box 20, Eagle River, Wisconsin. 54521.

F.M. EQUIPMENT- Motorola 80-D 150 mc w/ cont. $60. T44-450 mc $30; Lampkin 105-B Freq. Meter, 1-500 mc $150. W. J. Davis, 4434 Josie Avenue, Lakewood, Calif. 90713.

WANTED: DeForest panel units and Atwater Kent breadboard receivers and units. 25000 Volt AC Transmitter Condenser. Glen Angle, K0TAM, Clear Lake, South Dakota. 57226.

NOVICES: Heath DX. Gets you on the air cheap. Best offer. WA2AUB, 220 Pinebrook Blvd., New Rochelle, New York. 10804. (914) 235-4940.

FOR SALE: Waters Dummy Load-Wattmeter Model 334. Firm $70. RME 23 Preselector, $18. 4-811A practically new, $3.00 each. Walter Camuso, W1ESN, 31 Seward Road, Stoneham, Massachusetts. 02180.

FOR SALE: Polar relays, 12 total, all or any part, $5.00 each. Goodman, 5826 S. Western Avenue, Chicago, Illinois. 60636.

SELL: Swan 260 Cygnet. Excellent condition, $360. J. G. Swaney, 10403A 46th Avenue, Apt. 105, Beltsville, Md. 20705.

W2AU QUAD below cost. $35.00; Brand new in sealed carton. Pick up only. WA2EBS, R. Formica, 1300 Greenbriar Lane, North Bellmore, New more, New York. 11710.

WANTED: Copies of ANY 'Don Britton' construction plans or courses adv. in POP ELECTRONICS. Joe Wegner, Jr., P. O. Box 262, Glendale, California. 91209.

THE BEDFAST CLUB thanks all donors of stamps, Callbooks & Handbooks. More please. Everyone. A. Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England.

COLLINS 75-S3 in perfect condx. $450. Homebrew Auto-keyer with pwr supply & speaker. $13.50. Hla Oung, Ex XZ2AD, 115 Sudden Street, Watsonville, California. 95076.

GONSET Comm IV: 2 mtrs. Works AM or FM by turning one switch. Excellent condition. Late model. $175.00. Postpaid. Charles Simmons, Box 552, Plattsburgh, New York. 12901.

WANTED: Chess players interested in forming chess by mail group. A. M. Fox, Box 895, Greeley, Colorado, 80631.

FOR SALE: Clegg Zeus $300. Intercepter, $300. All bander $75. Equipment in top condition. Will consider trade. Ed Wagner, 6307 East Gate Rd., Monona, Wisconsin. 53716.

FOR SALE: SX-130 rcvr & spreader in mint condition. Johnson Messenger 100 CB unit with xtals in mint condx. Best offer takes them. Bruce A. Rahn, WB9ANQ, 1511 East Main St., Little Chute, Wisconsin. 54140.

FOR SALE: WRL 6 meter Transceiver, $15.00. Johnson Variable Inductor number 226-3, 13 sun inductance, $12.50. John Sypek, 311 Montgomery Street, Chicopee Falls, Mass. 01020.

See page 102 for New Reader Service

FOR SALE: Model 26 Teletype Printer, Keyboard, cover. Table in excellent condition, $50.00, FOB. W6DOU, 3154 Stony Point Road, Santa Rosa, California. 95401.

SELL: Millin 90932 Monitor Oscilloscope. Mint condition and guaranteed flawless performance. $70. Also digital clock with 10 minute timer, $20. Call 445-8066, or write: Rick Scielzo, 19 Longview Drive, Waldwick, N. J. 07463.

SELL: DX100, $60 or trade on HT46 or Similar SSB Xmitter. Pollock, Ironia, N. J. 07845.

CLEAN-UP: Transformers, transistors, tubes, sub assemblies. Low priced. Dime for list. Doug Pongrance, 316 Donnell Road, Lower Burrell, Pa. 15068.

SELL: TR-4, RV-3, and AC-3, like new, with cartons, $450.00. W9FRU, R. V. Blaney, 127 Westlawn Drive, RR 4, Decatur, Ind. 46733.

HAMMARLUND HQ110C, an oldie but goody. $100 or best offer. Jim Hadlock, K7JRE, 604 S.W. 144th, Seattle, Washington. 98166.

JOHNSON THUNDERBOLT Linear, 2000 pep, xlnt. condx. $250.00. You pay freight, Dr. B. W. Dukett, 2523 Durwood Road, Little Rock, Arkansas. 72207.

CANADIANS: Complete amateur equipment service by fully-equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta, Canada.

FOR SALE: Lafayette HA-35A, w/12v Power EMC 208 Tube Tester, $20.00; Precision E-200C Sig. Gen., $75.00. All FOB. R. Wendel, 160-20 Grand Central Pkwy., Jamaica, N. Y. 11432.

WANTED: Model 28 teletype complete or parts to build up my station. Ed Wagner, 6307 East Gate Road, Monona, Wisconsin. 53716.

WANTED: Postage stamps. My 10 year old collects stamps. All gifts would be appreciated. A. M. Fox, Box 895, Greeley, Colorado. 80631.

WANTED: News articles or clippings showing beneficial activities of ham radio. I xerox, return original to you. WA1GFJ. 160 Elm, North Haven, Connecticut. 06473.

WANT DAVCO DT-20 Transmitter. State serial number and condition and any accessories. W7BIF, 107 Wyoming Street, Boulder City, Nev. 89005.

FOR SALE: SBE-34, $235.00; Collins 75S3B, $450.00; Heath SB200, $225.00. Mint; make offer. WA3HMQ. (717) 761-1107.

LICENSING COURSES. The LERC Amateur Radio Club regularly conducts free classes which are open to all LA area people. Write to: 2814 Empire Avenue, Burbank, California. 91504.

MOVING To Detroit in December. Will rent or buy 3-4 bedroom house. Antenna possibilities strong factor. K0HIL15, 15-B Albrook, Big Spring, Texas. 79720.

COLLINS CRYSTAL PACK, $110.00; SONY TC-530, $225.00; HA-14, $100.00; DC PS for KWM-2, $80.00. WA6GZZ. TEL: (916) 331-2185.

SWAN 500c with 117xc, VOX, and remote VFO (No. 508, new). EICO 717 Electronic Keyer, Drake W4 Wattmeter, new. You pay shipping. No reasonable offer refused. F. Colella, 105-18 131st Street, Richmond Hill, N. Y. ac 212 MI 1-2559.

WANTED: For collection Hayley Mills Records, movie soundtrack. Any condition. WA5FAO, Chan Smith, Box 534, Osceola, Ark. 72370.

COLLINS 75S3 in perfect condx. $450. Homebrew Auto-keyer with pwr supply & speaker, $13.50. Hla Oung Ex XZ2AD, 115 Sudden St., Watsonville, California. 95076.

SELL OR TRADE: SR-150 xcvr with AC power supply in mint condition for Wireless gear, Old radios, tubes, parts, magazines, etc. circa before 1929. J. Vanicek, 3313 So. Lowe Avenue, Chicago, Illinois. 60616.

SELL: 1200 v 1 amp Xfmr, $10; CE 10B, $47; HQ-110, $90; Mint HQ-170C, $155. All FOB. WANT: 200 cycle filter for 75S3B. Rev. Bittner, W0AIH, 814 4th Street So., Virginia, Minn. 55792.

HALLICRAFTERS: SX-111, $75; Ranger 1, $50; VF-1, $15; Gonset Super 6, $20; K6CS, 805-495-7883, Dlvr LA area.

PERFECT CONDITION HT37 for sale, $150.00 or best offer. W2TXV, Phone: (516) 676-4477.

SBE-33 with Linear. Excellent condition, $350, or best offer. Will ship. Ken Schroeder, P. O. Box 56, Kearney, Nebraska. 68847.

HQ180AC, $325.00. Ronald M. Nagata, 1330 Curtis Street, Berkeley, Calif. 94702. (415) 526-7345.

PLATE TRANSFORMER: Thordarson 25P83. Primary 115/230, 60 CPS. Secondary 1800 CT, tapped at 1470 CT at 250 MA. New, $7.95. Weight 14 lbs. Please include postage. FREE CATALOG. R. W. Electronics, Inc., 4005 W. Belmont Ave., Chicago, Illinois. 60641.

WANTED: Early handbook, catalogues, call books, wireless books as well as early Radio receivers and parts. Erv Rasmussen, W6YPM, 164 Lowell Street--Redwood City, California. 94062.

DRAKE TV-1000-LP Low Pass Filter, $14. Cesco Model CM-522 SWR Bridge, $25. Jay Sewell, W5DWN, 2714 Pecan Drive, Temple, Texas. 76501.

TRADE: Pair 813 tubes, new for Rotor & Control. Need not be new. OR: Give me a cash offer. Tom Fitzpatrick, KP4DJI, P. O. Box 219, APO New York. 09845.

W5TIA/4 - Bulloch County in Georgia QSO party. QSL to W4DQD, Box 2067, GSC Br., Statesboro, Ga. 30458.

HENRY 2KD-2 desk type linear amplifier, with remote heavy duty solid state power supply. Mint condition. $550.00. Pickup only. W2HC, Tel: 516 333-1079.

NOW'S THE TIME to join The Old Old Timers Club. Licensed for 40 years qualifies for this club. Send QSL for application to Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, NE, Cedar Rapids, Iowa. 52402.

WANTED: Old Crosley X or XJ battery radio and 1924, 1925 or 1926 list of U. S. broadcast stations. W7KE, 1109 S 2, Hamilton, Mt. 59840.

ALL RADIO AMATEURS are invited to check in-to the Southwestern Conn. AREC Net on Monday nights at 0100Z. The net frequency is 21.410 mhz. Howard Hecht. WA1LWD.

SELL: SSB 201 Linear. Excellent, $155.00. Or swap for SX146 RCVR. WA2CKM, 1816 Park-Avenue, Bronx, N. Y.

CLEGG 22'er: Excellent condition with 25 crystals, $150.00. WA8VFK, 314 So. Western Ave., Springfield, Ohio. 45506.

WANTED: Pr. RK-65/5 D23 Triode tubes. Send condition and price to: Jack. K6SNM, 3941 Broadway, San Diego, California. 92102.

FOR SALE: HT-41 Linear all bands Killowatt Amplifier, $145.00, plus postage. Excellent condition. Also, have lots old QST and CQ and 73 Magazines at 20 cents each. Send list of what you want. K1JAR, L. M. Covey, 238 Jenness Street, Lynn, Mass. 01904.

FOR SALE: COD DX40 DX60 HT40 BC221 $60. HW32 EICO753 HQ100 SX100 DX100 $100. BC348 TBS50 $75. GLOBE 90 $30. F. Shain, Box 8352, Savannah, Ga. 31402.

WANTED: Power cable for BC-669. W4YOK.

PANEL METERS: 3 1/2" ROUND 0-200 ma dc; 2 11/16" ROUND 0-150v ac $2.50 plus shipping. List available. Ken Maas, Burlington, Wis. 53105.

TRADE: Collins 30L-1 Linear Amplifier for 75S-1, 75S-2, 75S-3, etc. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Mass. 01056.

WANTED: QST's before 1923. SELL: Concord Tape Recorder, like new, 7" Reels, 3-3/4 & 7-1/2 i.p.s. Cost new-$189.95 for $75. W9CO, Box 37, Lincoln, Ill. 62656.

FOR SALE: Dynakit stereo Preamp, $40.00. Viking 6N2 converter 14 mhz IF $39.00. Electro Voice 926 Xtal mike $12.00. W8IIT, Jenny Lane, Dayton, Ohio. 45459.

144 MHZ C.W. Meteor Skeds Wanted with Idaho, Oregon and Washington. Write Bob Berk, W0NXF, 5218 Prescott, Lincoln, Nebraska. 68506.

GUNS WANTED: Have amateur radio equipment to trade, including SSB station. H. Uthoff, Box 351, Kimball, Nebraska. 69145.

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READER SERVICE

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See page 102 for New Reader Service

A 50 uamp ***VOM*** *at less than the price of the meter alone!*

Only $11.95 post paid to U.S. and Canada.

A most essential ham tool is the common **VOM.** Necessary to all routine maintenance and even to the creative engineer - most **VOM's** suffer with limitation or high price. Here is the best unit of its kind we have ever seen and at such a low price that many industries are ordering by the dozen. Just because it is inexpensive doesn't make it shoddy for, in fact, this M500 is precisely built, has a mirror scale to help eliminate parrallex and uses precision deposited carbon resistors made to better than 1%.

Hams require the 5000 volt DC range and competition even at substantial increases in price do not give this range. Audio buffs will find the 0-40 db scale invaluable. Consider this meter sensitivity - on the low current scale 50 microamperes will fully deflect the needle; just the thing when you want to balance discriminators in FM sets.

Midscale resistance range is 60 ohms so the wide 2 ¾" scale permits accurate measurement all the way up to 12 meghoms. Dimensionally the illustration is about full scale 5 5/8" x 3 5/8" x 1 3/4" thick inclusive of rubber feet. Exquisitely crafted with a superb switch and of idiot proof design, the M500 is furnished with batteries and test leads at only $11.00 over the counter or $11.95 postpaid. Tell your boss about this beauty – order today.

HERBERT W. GORDON COMPANY

HELPING HAMS TO HELP THEMSELVES

Woodchuck Hill Road — *Harvard, Mass. 01451*

PHONE: 617 456 3548

See page 102 for New Reader Service

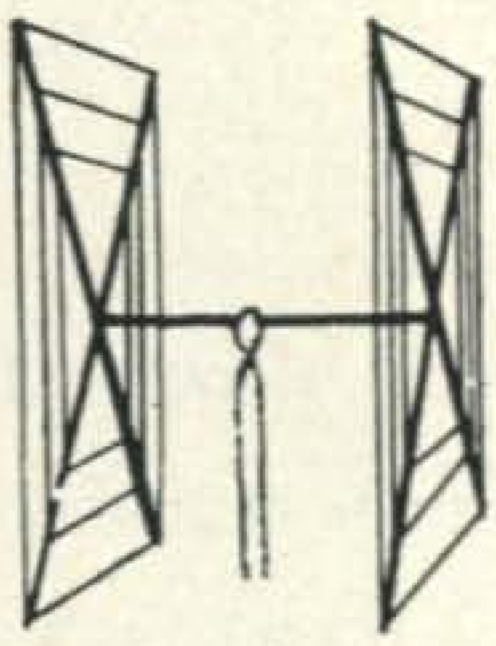
AHA! YOU THOUGHT GOTHAM

made run-of-the-mill ordinary antennas. No, no, no. Our materials are the best, and our design superior. WA1JFG won the New England Round-Up championship with our 3-element 15meter beam by a margin of 5,982 points!

QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3

CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



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

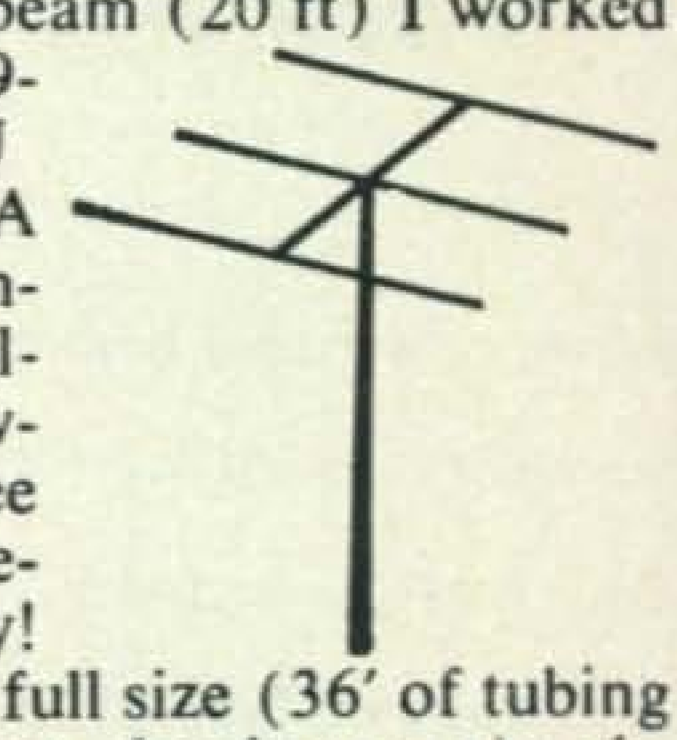
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
TEN METER CUBICAL QUAD	25.00

(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.

2 EL 20	$21	4 EL 10	20
3 EL 20	27	7 EL 10	34*
4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*		
5 EL 15	30*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts! *FLASH!* Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

GOTHAM
1805 Purdy, Dept. CQ,
Miami Beach, Fla. 33139

"HOW TO ORDER: Send money order (bank, store, or United States) in full. We ship immediately by REA Express, charges collect. DEALERS WRITE."

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Take power tubes, for example.

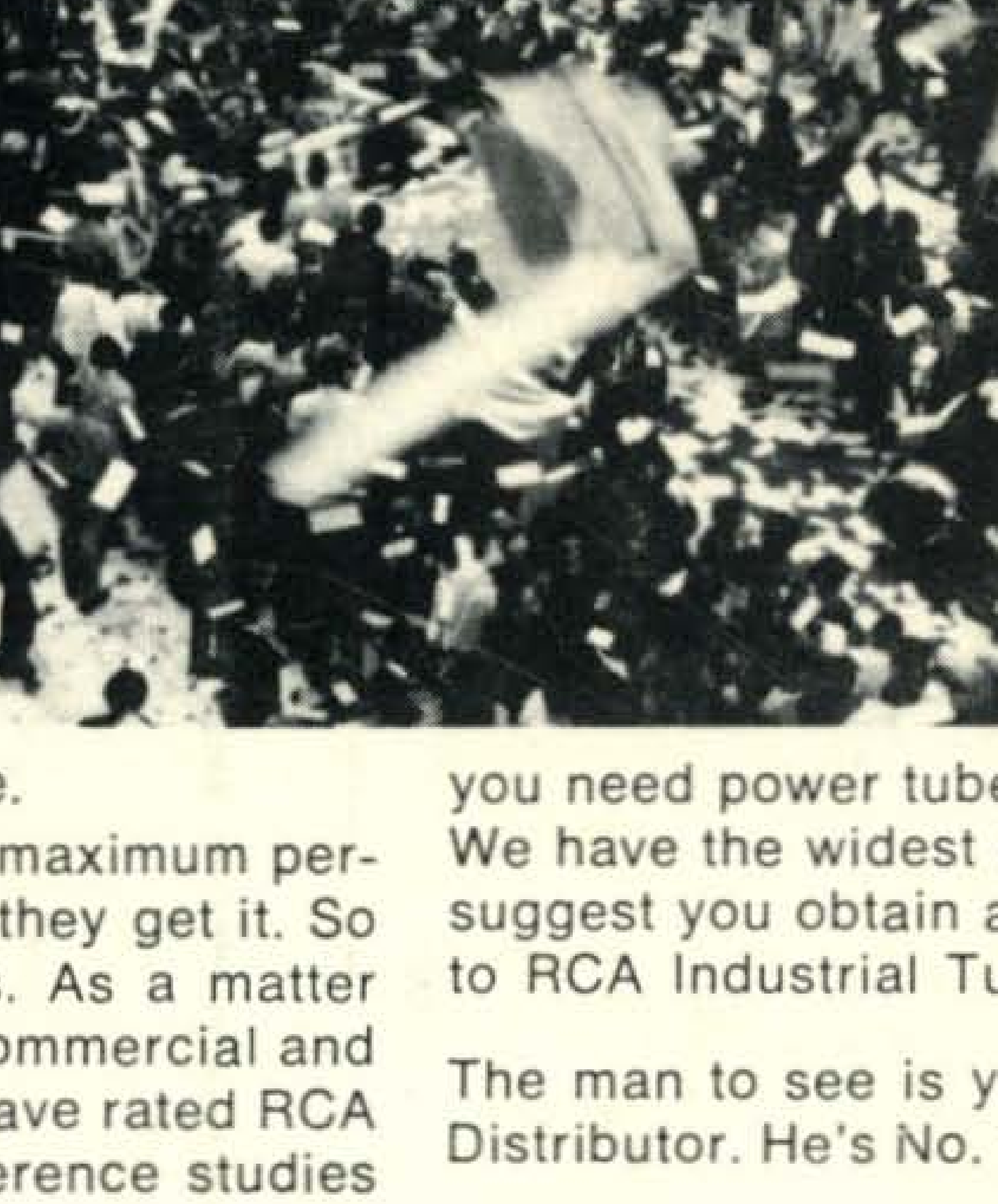
RCA amateur tube fans expect maximum performance year after year. And they get it. So do our professional customers. As a matter of fact, designers of amateur, commercial and military electronic equipment have rated RCA first in power tube brand preference studies year after year.*

So take a tip from the professionals. When you need power tubes, insist on No. 1—RCA. We have the widest choice. And the best. We suggest you obtain a copy of the 1970 Guide to RCA Industrial Tubes, TPG 200E.

The man to see is your RCA Industrial Tube Distributor. He's No. 1, too.

RCA | Electronic Components | Harrison, N. J. 07029

*Brand preference studies conducted by leading Electronic Publications.



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