

September 1969



BUILD A COMPLETE 6 METER STATION
AN AUTOMATIC TRANSISTOR CHECKER
CIRCULATOR COUPLED PARAMP
INTEGRATED CIRCUIT ELECTRONIC KEYS

CQ Reviews



**The Heathkit
SB-500 Transverter**

The Radio Amateur's Journal

The Complete VHF Ham Uses



Heathkit® SB-110A & SB-500

VHF Is Where The Action Is These Days ... Moonbounce, long-haul DX, more efficient antenna designs ... and a whole lot less QRM. And whether you're a serious VHF'er or an 80 through 10 man just starting to discover 6 and 2, Heath has the gear you need to go first class ... the SB-110A — the 6 meter SSB /CW Trans-

ceiver that puts thousands of hams on 6 ... and the SB-500 — the new 2 meter Transverter that gives more sideband and CW capability on 2. Check the features and specs below ... and be convinced that when you go to the high bands, go with the SB gear from the Hams at Heath.

- SB-110A covers 50 to 52 MHz with crystals supplied ... total coverage 49.5 to 54 MHz • Same Heath Linear Master Oscillator as used in SB-101 for exact frequency control • Switch selection of Upper Sideband /Lower Sideband / CW • 180 watts PEP SSB input — 150 watts CW input • Features same high quality crystal lattice filter as used in Heath SB-101 • Operates PTT or VOX • Separate offset CW carrier crystal for pure, clean CW note • Automatic Level Control helps prevent overdriving and distortion • Automatic Noise Limiter • Built-in 100 kHz calibrator • Built-in Antenna Switching • One kHz dial calibrations — bandspread equal to ten feet per megahertz • Three oscillator modes aid CW, cross-mode or split frequency — LMO-controlled transmit and receive, crystal-controlled transmit and receive and crystal-controlled transmit with variable-tuning receive • Fast, easy assembly
- Kit SB-110A, 6 M Transceiver, 23 lbs. \$299.00*
 HP-23A, AC Power Supply, 19 lbs. \$51.95*

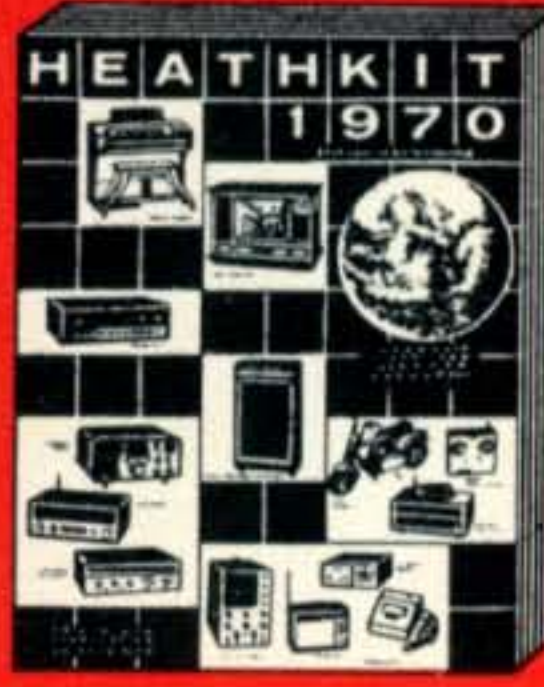
- SB-500 covers complete 2 meter amateur band when used with SB-110A having a full complement of crystals • Tunes 144 to 146 MHz when used with SB-101, SB-301 / SB-401 combination and HW-100 • 140 watts PEP input • 50 watts output for a really big signal on "two" • Highly sensitive receiver — 0.2 uV for 10 dB S+N/N for solid copy QSO's • Fast, easy, exact tuning • Uses a pair of inexpensive 6146's in AB₁ configuration in the final • Driving unit supplies final plate voltage ... all other operating voltages come from built-in, very stable supply — no extra outboard supply to buy • Supplies ALC voltage to driver to prevent flat-topping • Reliable, relay-controlled T/R switching • No cable changing necessary to go from lower band gear to 2-meters — internal relays do it all by just turning the SB-500 on • Built-in meter monitors plate current or relative power • Built-in 1 MHz crystal calibrator • SB-Series styling
- Kit SB-500, 2 M Transverter, 19 lbs. \$179.95*
 Kit SB-600, Station Speaker, 6 lbs. \$19.95*

PARTIAL SB-110A SPECIFICATIONS — RECEIVER SECTION: Sensitivity: 0.1 uv for 10 dB signal-plus-noise to noise ratio. Selectivity: 2.1 kHz @ 6 dB down, 5 kHz max. @ 60 dB down. Image rejection: 50 dB or better. IF rejection: 50 dB or better. Audio output power: 1 watt. AGC characteristics: Audio output level varies less than 12 dB for 50 dB change of input signal level (0.5 uv to 150 uv). **TRANSMITTER SECTION:** DC power input: SSB, 180 watts PEP; CW, 150 watts. RF power output: SSB, 100 watts PEP. CW, 90 watts (50 ohm non-reactive load). Output impedance: 50 ohm nominal with not more than 2:1 SWR. Carrier suppression: 55 dB down from rated output. Unwanted sideband suppression: 55 dB down from rated output @ 1000 Hz & higher. Distortion products: 30 dB down from rated PEP output. Hum & noise: 40 dB or better below rated carrier. Keying characteristics: VOX operated from keyed tone using grid-block keying. **GENERAL:** Frequency coverage: 49.5 to 54.0 MHz in 500 kHz segments (50.0 to 52.0 MHz with crystals supplied). Frequency selection: Built-in LMO or crystal control. Frequency stability: Less than 100 Hz drift per hour after 20 minutes warmup under normal ambient conditions. Less than 100 Hz drift for ±10% supply voltage variations. Dial Accuracy: Electrical, within 400 Hz on all band segments, after calibration at nearest 100 kHz point. Visual, within 200 Hz. Dial backlash: No more than 50 Hz. Calibration: Every 100 kHz. Power requirements: High voltage, +700 v. DC @ 250 ma. with 1% max. ripple. Low voltage, +250 v. DC @ 100 ma with .05% max. ripple. Bias voltage, -115v. DC @ 10 ma with .5% max. ripple. Filament voltage, 12.6 v. AC/DC @ 4.355 amps. Dimensions: 14⁷/₈" W x 6⁵/₈" H x 13³/₈" D.

SB-500 SPECIFICATIONS — RECEIVER — Sensitivity: 0.2 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. Spurious Response: All are below 0.1 microvolt equivalent signal input, except at 145.390 MHz (50 MHz IF only). Antenna Input Impedance: 50 ohm unbalanced. **TRANSMITTER — DC Power Input:** 140 watts PEP. Power Output: 50 watts (50% duty cycle). Output Impedance: 50 ohm with less than 2:1 SWR. **GENERAL — Frequency Range:** Any 2 MHz Segment between 144 and 148 MHz into 50 MHz or 28 MHz tuned IF. Mode of Operation: SSB or CW only. Power Requirements: (1) 120/240 VAC, 50/60 Hz at 82 watts (internal). (2) 700 to 800 VDC at 200 mA (from driving unit). Fuse: 3/4 ampere slow-blow for 120 VAC (formerly 3AG); 1/2 ampere slow-blow for 240 VAC. Front Panel Controls: Meter-calibrate switch, final tuning, off-on (function) switch, preselector, final loading, driver tuning. Chassis Controls: Relative power adjust & bias adjust. Rear Apron Connectors: RF output, ALC, linear relay, relay, drive, power plug, low f receiver, low f antenna, fuseholder. Tube Complement: 6CB6 transmitter mixer, 6CB6 crystal calibrator, 6DS4 receiver RF amplifier, 6DS4 receiver mixer, 12GN7 transmitter RF amplifier, (2) 6146 final amplifiers, (types 6146A or 6146B may be directly substituted), 7059 heterodyne oscillator-amplifier, 8156 RF driver, OA2 voltage regulator. Diode Complement: 5 silicon diodes, 750 mA, 500 PIV; 3 in power supply, 2 in ALC. 1 Germanium diode, 1N191; REL PWR. Cabinet Dimensions: 12¹/₄" wide x 6⁵/₈" high x 13" deep. Overall Dimensions: 12¹/₄" wide x 7-15/16" high x 14" deep including knobs and feet. Net weight: 14¹/₂ pounds.



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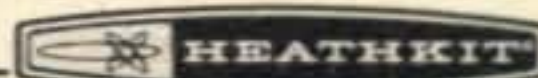
- **Marine Electronics** ... For safety and pleasure; radio-telephones, direction finders, depth sounders, weather monitors, and accessories.

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The Radio Amateur's Journal

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Technical Editor
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Technical Director
JOAN WEILBACHER
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Contest Calendar
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Propagation
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GORDON ELIOT WHITE
Surplus Sidelights
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VHF Today

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

CQ—(Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, \$6.00; two years, \$11.00; three years, \$15.00. Entire contents copyrighted 1969 by Cowan Publishing Corp. CQ does not assume responsibility for unsolicited manuscripts. Please allow six weeks for change of address. Printed in the United States of America.

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

the famous HORNET ANTENNAS

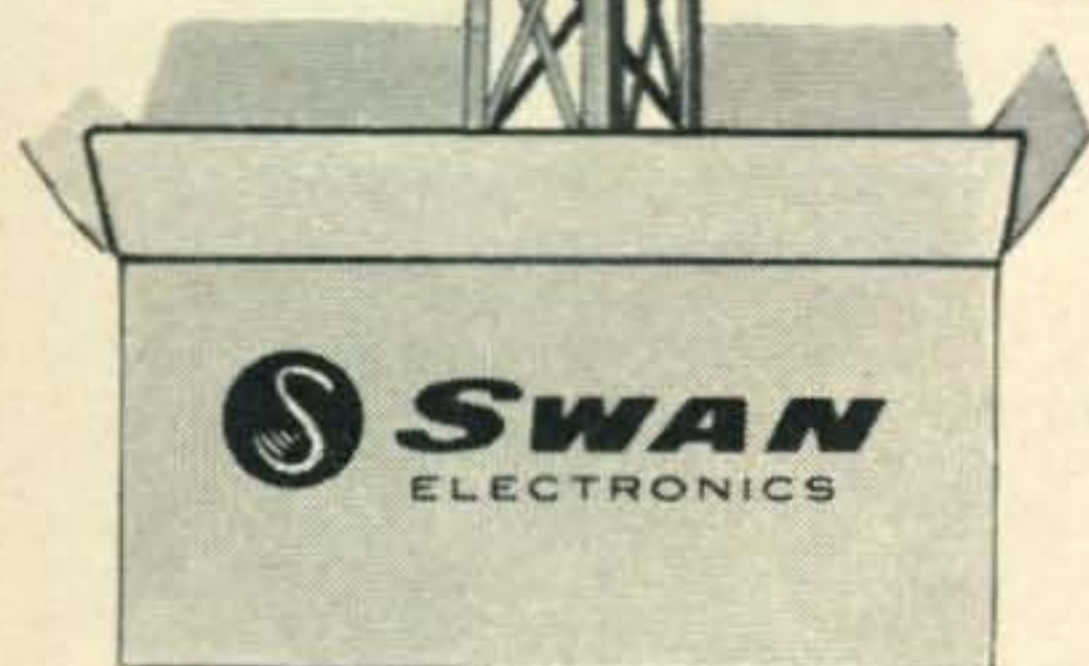
are now made by **SWAN**

For a number of years Hornet Antenna Products of Duncan, Oklahoma has been manufacturing a line of high quality, high performance antennas for the amateur bands as well as for other services. These antennas have been designed and manufactured by Jack Guest, W5AJZ, president of the Hornet company. Probably the best known of his products is the famous Hornet Tribander, made in both 3 and 4 element models and making use of Jack's patented, extremely rugged and efficient frequency dividers, or "traps" as they are commonly called. The 4 element model TB-1000-4 will equal or exceed the power gain and front-to-back ratio of any other beam built on a 24 foot boom. The enthusiasm of thousands of Hornet owners proves this better than anything we can say.

This is why we are so pleased to announce that Swan is now manufacturing and marketing the Hornet line of amateur band antennas. Hornet Antenna Products in Duncan, Oklahoma will continue manufacturing and marketing their line of Citizen's Band Antennas. Our new Antenna Division is a 10,000 square foot addition to our Oceanside factory, and is now in production on the Swan-Hornet Tribanders. We will feature a complete line of antenna products for HF, VHF, and mobile. It's a double pleasure to also announce that Ray Hodges, W6AQP and Fred Schnell, W6OZF, who have been manufacturing a beautiful line of mobile antennas at their Los Angeles factory, including the 5 band Swantennas, have recently joined the Swan family, and will be in charge of antenna production.

Visit your Swan dealer soon, or write for further details.

Best DX es 73



SWAN

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in Amateur Radio*

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Herbert Hoover, Jr., W6ZH

1903-1969

WITH the death of Herbert Hoover Jr. on July 9, at age 66, the nation lost an outstanding citizen and amateur radio one of its keenest participants and supporters.

Herb Hoover's interest in radio dates back to his earliest years. Born in 1903, he followed the early development of radio with the avid enthusiasm that kids today follow exploits in space. By ten he mastered the Morse Code and by twelve he constructed his first wireless set and had his first QSO on the air. He was active as a radio amateur while attending Stanford University during the early 1920's. During summer vacations in Washington, D.C. where his father was then Secretary of Commerce, Herb fired up an amateur station on the grounds of the old National Bureau of Standards.

Upon graduation from Stanford in 1925, Herb began a career as an oil exploration and mining engineer. In 1928, after receiving his Masters Degree from Harvard, he returned to communications, and for several years pioneered the development of airline communication systems in this country. In 1934 he returned to oil and mining engineering, became outstandingly successful, and earned worldwide fame.

Although his father served as President of the United States (1928-1932), Herb shunned politics most of his life. In 1954, when asked by President Eisenhower, he accepted an appointment as Undersecretary of State. During a three year tenure in the number two position in the State Dept., Herb demonstrated his abilities as a diplomat and was instrumental in mending serious disputes in the volatile Middle East. While public office held no glamour for him, he felt it a matter of duty to serve his country when asked to by the President.

He displayed this same loyalty to amateur radio. He often stated that he owed much to amateur radio for providing the initial stimulant which launched him on his successful engineering career. In 1962 he became President of the American Radio Relay League and the International Amateur Radio Union, posts he held until 1966.

Herb brought an aura of dignity to amateur radio and he devoted long hours in attempting to uplift its status in this country and abroad. He is given major credit for the establishment of reciprocal licensing legislation between the United States and foreign countries, and he was very instrumental in getting the OSCAR amateur radio satellite program established.

Herb received honors and declarations from several countries for his engineering achievements and he belonged to a list of professional and civic organizations, but his favorites were those associated with amateur radio. He once said there were four things that made life worth living for him—the outdoors, far away places, mining engineering and amateur radio.

Tall, distinguished looking and always a gentleman, Herb had a generous, courteous and upright nature, with a great sense of responsibility in everything that he undertook. His values were loyalty, service and integrity, and he deeply appreciated human comradeship. He was, in fact, the epitome of amateur radio itself.

W6ZH's key is silent now, but he will long be remembered by his colleagues in the amateur radio fraternity, his country and the world. ■



The late Herb Hoover Jr., W6ZH, addressing a meeting of the Quarter Century Wireless Association.

OUR READERS SAY

Weather Warnings

Editor, CQ:

Your July issue contained a short but very interesting article on "Weather Warning" which points up an important field presently neglected. In the recent weather disasters in the midwest, one observer stated on TV that "there was no advance warning, and within ten seconds from the first raindrop, giant trees were falling."

The value of a good storm detector, equipped with moderate squelch, and constantly monitoring alongside the family radio in the kitchen, is self-evident.

Without meaning to detract from his very good article, I would like to gently chide W9-VCL. His typewriter probably has been changed over to the metric system a little too soon. A barometric pressure of 29.75 mm of mercury would be a pretty good vacuum, since it is roughly the equivalent to an altitude of 73,000 feet. A few minutes in that environment and you wouldn't need a storm detector.

For the benefit of readers who have run-of-the-mill barometers, I would guess that Irvin meant 29.75 inches of mercury.

James M. Bruning, K2BZ
North Arlington, N.J.

Editor, CQ:

In response to the July 1969 article, "Weather Warnings with the VHF Receivers," this is being written.

It is necessary to remove the noise silencers on the receivers to count static crashes. It is amazing how many amateurs didn't do this while attempting to listen for storms.

Irvin Schroeder, W9VCL
Sheboygan, Wisc.

Commercial or Home-Brew?

Editor, CQ:

In your February issue, Sylvia Margolis gives us her version of the GB2LO installation, sponsored by the Daily Mirror.

Let me say that, in this *particular* case, her decision to use commercially manufactured equipment, was correct. However, I take strong exception to her derogatory comments on home-brew gear. Quote, "No matter how efficient, how ingenious a homebrew rig might be, fuses blow, capacitors collapse, resistors burn out," unquote. Nonsense! My home brew rig, 6AU6 v.f.o., 6AG7 buffer, 807 doubler, 813 final, built in 1948 and in constant use for over 20 years, has needed no repairs, except normal replacement of tubes after long service—how, if you have 2000 v. on the plate, don't use a 2500 v. blocking condenser—use 5000 w.v.d.c. components. Air-conditioning also helps, especially in tropical climates. Mrs. Margolis appears to have acquired the impression that home-brew rigs are generally assembled out of the junk box. Again, "Only the builder himself could trace and remedy the fault." Frankly, I have a neat, professionally appearing, complete schematic of my transmitter, indicating

values of all components. "These things," she says, "happen in the best of (home-brew) installations." So they may, and so they do in commercially manufactured equipment—in which case she could obtain and *install* (?) a substitute rig within minutes. Surely—but then have we not descended into operation of a plug-in appliance?

Let me reiterate, in the case of GB2LO, hers was the correct decision, but I strongly feel it was unnecessary to express derision at home-built equipment—after all, we are amateurs—I have been a commercial communications man since 1927, and an "amateur" since 1939—I do not consider myself a die-hard nor am I ashamed to "wind my own coils," provided I have the know-how to do so. To use her own words, I remain "adamant" but am not "obstinate."

I am surprised you, as an Editor, permitted such slurs on hard-core amateurs, and I will be more surprised if you have enough "hard-core" to print this in your READER'S SAY Column.

A. R. Rowley, HP1BR
Panama 1, R. de P.

How kind of Mr. Rowley to write that he agrees with our decision on choice of equipment for an exhibition station.

If all amateurs had Mr. Rowley's constructional ability there would be no need for commercial equipment. But let's face the facts—the average piece of home-brew is to the greater extent the result of compromise. The finished product is a complex of (a) what was in his junk box; (b) what was scrounged from other junk boxes; (c) what was recognized as a good surplus buy; (d) what was bought in the normal way because it couldn't be got any other way.

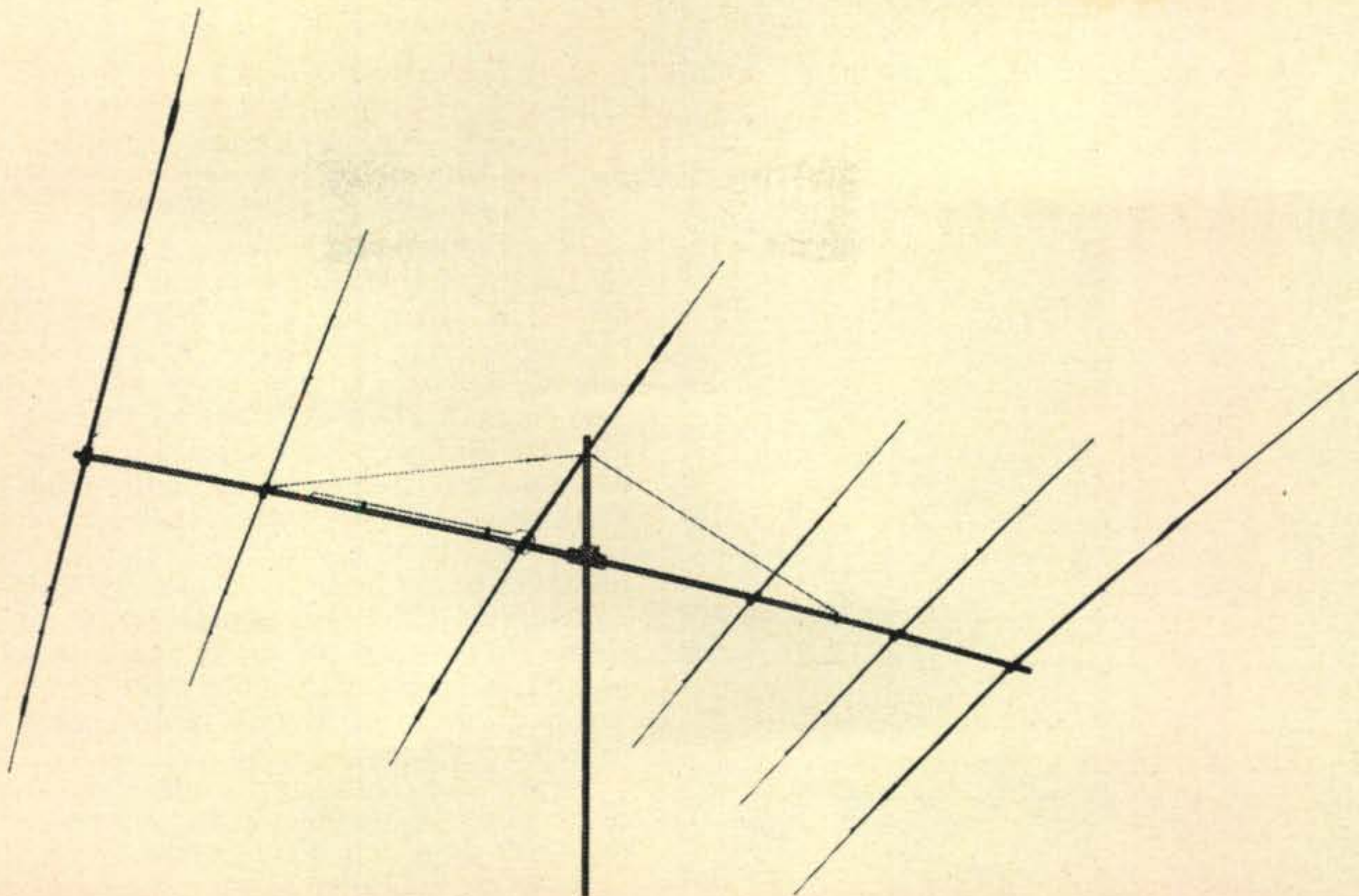
The resultant equipment could be (a) a piece of gear that is technically excellent and does what it was intended to do; (b) a good try that didn't quite make the grade; (c) ashes-to-ashes... back to the junk box.

Unless every component is new and repeatable from manufacturers' stock, a piece of home-brew is as ephemeral as a musician's improvisation. A failure (and even a Rolls Royce can get a puncture) may involve a major reconstruction, dependent on the resourcefulness of the exhibition operations. Hours could go by without activity. Considering what the GB2LO project was costing our hosts, the *Daily Mirror*, such a delay would be inexcusable.

So what is all the fuss about? GB2LO, like most exhibition stations was a demonstration of operating, not of electronics. In fact, hardly any of the thousands of visitors asked about the rig. All they wanted to know about what countries we could talk to.

Long live the amateur constructor. Some of my best friends don't have Collins, Drake or Hy Gain. So long as I can rely on replacement commercial rig from stock if and when a commercial fuse blows, capacitor collapses or resistor burns out in the exhibition stations I promote, I'll praise home-built gear—and *exploit* the commercial!

Sylvia Margolis



NOW! A SUPER THUNDERBIRD!

ALL NEW 6-ELEMENT SUPER THUNDERBIRD TH6DXX

The new Super Thunderbird TH6DXX offers the ultimate in tribander performance, with mechanical and electrical specifications unsurpassed for 10, 15 and 20 meters. This newest of Hy-Gain's amateur antennas is superb on DX and other long haul contacts, and gives peak performance on each band whether you're working phone or CW. Check the many features at right; you'll see why you should be using the new Super Thunderbird!

PLUS THESE OTHER GREAT THUNDERBIRDS

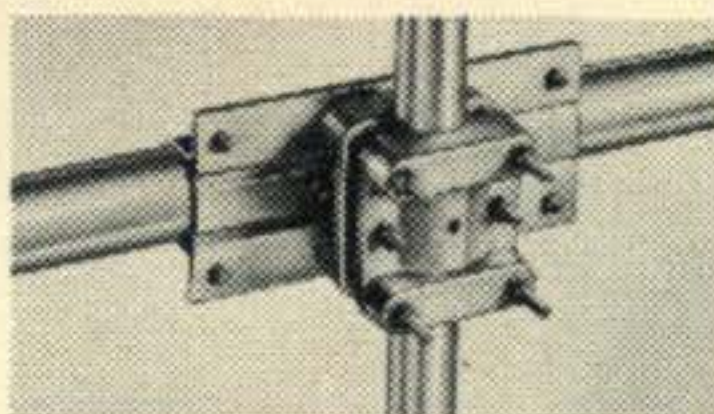
- New, improved 3-element Thunderbird—Model TH3MK3.
- Fabulous, 3-element Thunderbird Jr.—Model TH3JR.
- Popular 2-element Thunderbird—Model TH2MK3.

Buy one today at your favorite Hy-Gain distributor.

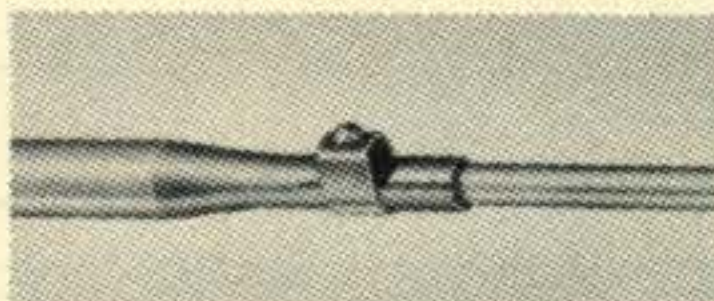
Hy-Gain Super



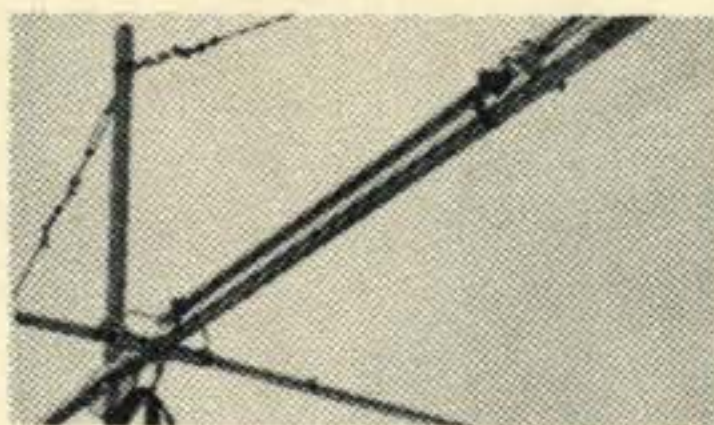
The most advanced antennas under the sun.



Tilt-head, universal boom-to-mast bracket—all new, cast aluminum bracket accommodates masts from 1¼" x 2½". Allows easy tilting for installation, maintenance and tuning, provides mast feed-thru for beam stacking.



Taper swaged, slotted tubing—new tubing on all elements allows easy adjustment and re-adjustment. Taper swaged to permit larger diameter tubing where it counts! And, less wind loading. Full circumference compression clamps are mech. and elec. superior to self-tapping sheet metal screws.



Hy-Gain Beta Match—Advanced design from company that invented the Beta Match, achieves balanced input, optimum matching on all 3 bands, and provides DC ground to eliminate precipitation static.

OUTSTANDING HY-GAIN FEATURES

- Tilt-head, universal boom-to-mast bracket (see details at left).
- Taper swaged, slotted tubing with full circumference compression clamps (see details at left).
- Hy-Gain's exclusive Beta Match (see details at left).
- New, improved "Hy-Q" traps... separate traps for each band.
- Up to 9.5 db forward gain.
- 25 db front-to-back ratio.
- SWR less than 1.5:1 on all bands.
- 24-foot boom...none longer in the industry.
- High-performance element spacing.
- Extra heavy gauge, machine formed element-to-boom brackets, with plastic sleeves used only for insulation. Bracket design allows full mechanical support.



Thunderbird

Hy-Gain Electronics Corporation
P.O. Box 868-2
Lincoln, Nebraska 68501 AC-9

Designed for



Application



90651

**The No. 90651
GRID DIP METER**

The No. 90651 MILLEN GRID DIP METER is compact and completely self contained. The AC power supply is of the "transformer" type. The drum dial has seven calibrated uniform length scales from 1.5 MC to 300 MC plus an arbitrary scale for use with the 4 additional inductors available to extend the range to 220 kc. Internal terminal strip permits battery operation for antenna measurement.

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MASSACHUSETTS**



DXing Courtesy?

Editor, *CQ*:

I'm sending my remittance for renewal of your fine mag and also a short note. I certainly hope you at least consider my complaint.

The complaints don't concern your mag at all, as I think *CQ* is much better than "the other mag." Hi! They do, however, concern perhaps the entire ham population, because they are in regards to Gus and his DX-pedition. One night very recently while Gus was on 20, the mob calling him occupied almost 100 kc of the band. I, for one, feel that is going quite a bit too far, don't you? After all, not everyone is chasing him from rock to rock, but must everyone be called on to suffer the end result—massive QRM! Maybe it showed the real spirit of DX'ing, but I'd rather think it was just a plain case of poor manners. The 20 meter band is quite tough enough without such a horrid mass of screaming fanatics to make it worse.

Please fellas, have some consideration for the rest of us who would much rather have a good ole QSO than call VQ9/A/BC any day. Show some of those clean operating habits and good sportsmanship we're supposed to have.

P. V. O'Donnel Jr., TF2WLS (WA2HNO)
NSGA Box 14
F.P.O. New York 09571

Announcements

New Kensington, Pa.

The Skyview Radio Society will hold their 7th annual Swap & Shop on Sunday, Sept. 7, 1969. There is no registration fee. Bring your equipment for sale or trade. Food and refreshments available. Bingo for the ladies and prizes. Mobile check-ins and directions on 29.0 and 50.4 mc. Follow direction signs from Camp Joan Junction Rt. 366 & 380 10 miles Northeast on Monroeville, Pa.

Augusta, Georgia

The 1969 Georgia Station Convention and Augusta Hamfest are being held jointly on September 13 and 14, 1969. Over 400 amateurs from Georgia and South Carolina are expected to attend. For complete details on this event contact Allan J. Barton, K4OHK, A.R.C. of Augusta, Inc., P.O. Box 3072, Augusta, Georgia 30904.

Rare County DXpedition

For the interested DX & "W" fraternity the North Jersey DX Association will operate their club station from the very rare WARREN county in New Jersey. They will operate under the callsign W2JT/2 on October 18 & 19, 1969. Continuous operation from 1600 GMT on Oct. 18, to 2000 GMT on Oct. 19th. Frequencies: c.w.

**Ted Henry
needed a
rugged linear
triode.
So
he came
to us.**

Two rugged Eimac 3-500Z high-mu triodes are featured in Henry Radio's new 2K-3 linear amplifier. Henry designed the amplifier around versatile Eimac power tubes because these popular triodes are ideal for grounded-grid operation at the 2 kW PEP SSB input level, and at the 1 kW

DC input level for CW, AM and RTTY. Users of this new Henry rig will enjoy a conservative plate dissipation rating of 1000 watts for year-in, year-out reliability under key-down service. Henry's choice should be your choice. For more information on the 3-500Z and on Eimac's line of power tubes for advanced transmitters, write Eimac Amateur Services Department or contact your nearest Varian/Eimac distributor.



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by Donald L. Stoner, W6TNS & Lester A. Earnshaw, ZL1AAX. Covers transistorized communications equipment for amateur applications. Provides simplified theory, plus practical construction projects for solid-state equipment. 180 pages. EE-044, only.....\$5.00

Amateur Radio Incentive Licensing Study Guide

by Robert M. Brown, K2ZSQ/W9HBF and Tom Kneitel, K2AES. Fully explains the new incentive licensing. Covers all the new FCC regulations and band allocations. Includes sample exams for Novice, Technician, Conditional, and General- Advanced- and Extra-Class licensing. 160 pages. EE-050, only.....\$2.75

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Uniontown, Pa.

The 20th annual Gabfest of the Uniontown Amateur Radio Club Inc., will be held on September 13, 1969 (Saturday afternoon and evening). It will be at the club grounds: turn off Route 51 at the sign just north of Uniontown and follow the signs. Registration costs \$2.00. Prizes and swap & shop.

Joliet, Illinois

The second "160 Meter Reunion" sponsored by the Chiburban Radio Mobileers will be held at the Joliet Beach Club on Rowell Avenue in Joliet, Illinois on Sunday, September 14, 1969. Food will be available on the grounds. Interested persons should contact Barry Boothe, W9UCW, Route 1, Minooka, Illinois 60447 (815-462-5893).

Dallas, Texas

The Texas Instruments Amateur Radio Club will sponsor a Ham-Swap-Fest on September 14, 1969 at the Texas Instruments Activity Center located on N. Central Expressway in Dallas. Over 1000 amateurs are expected to attend. Activities start at 9 A.M. and continue to 5 P.M. Prizes include a Swan 350C, TH-6 Tri-bander, and many more. Bring your swap gear. Register now for the pre-registration prize, \$2.00 per person. Contact John Zagrodnick, W5LWH, 3823 Antigua Drive, Dallas, Texas 75234.

Peoria, Illinois

The Peoria Area ARC will hold its 12th annual hamfest Sunday, September 21, 1969 at Exposition Gardens (same place as last year), located on the northwest edge of Peoria, Illinois. Food will be available. There will be plenty of free activities for the entire family. Advance registration \$1.50, at the gate \$2.00. For further details and advance registration write: L. Lytle, W9DHE, 419 W. Stonegate, Peoria, Illinois 61614.

Walla Walla, Washington

The Walla Walla Valley A.R.C. will hold its 23rd annual all family picnic and hamfest Sept. 21st at Jefferson Park in Walla Walla. Saturday evening, Sept. 20th will be openhouse at the W7DP homebrew hamshack. Quite a number of activities are planned including a meeting of the M.I.N.O.W. gals. Talk in frequencies are 3960, 29.6, and 146.760. For more information write to: W7DP, P.O. Box 321, Walla Walla, Washington 99362.

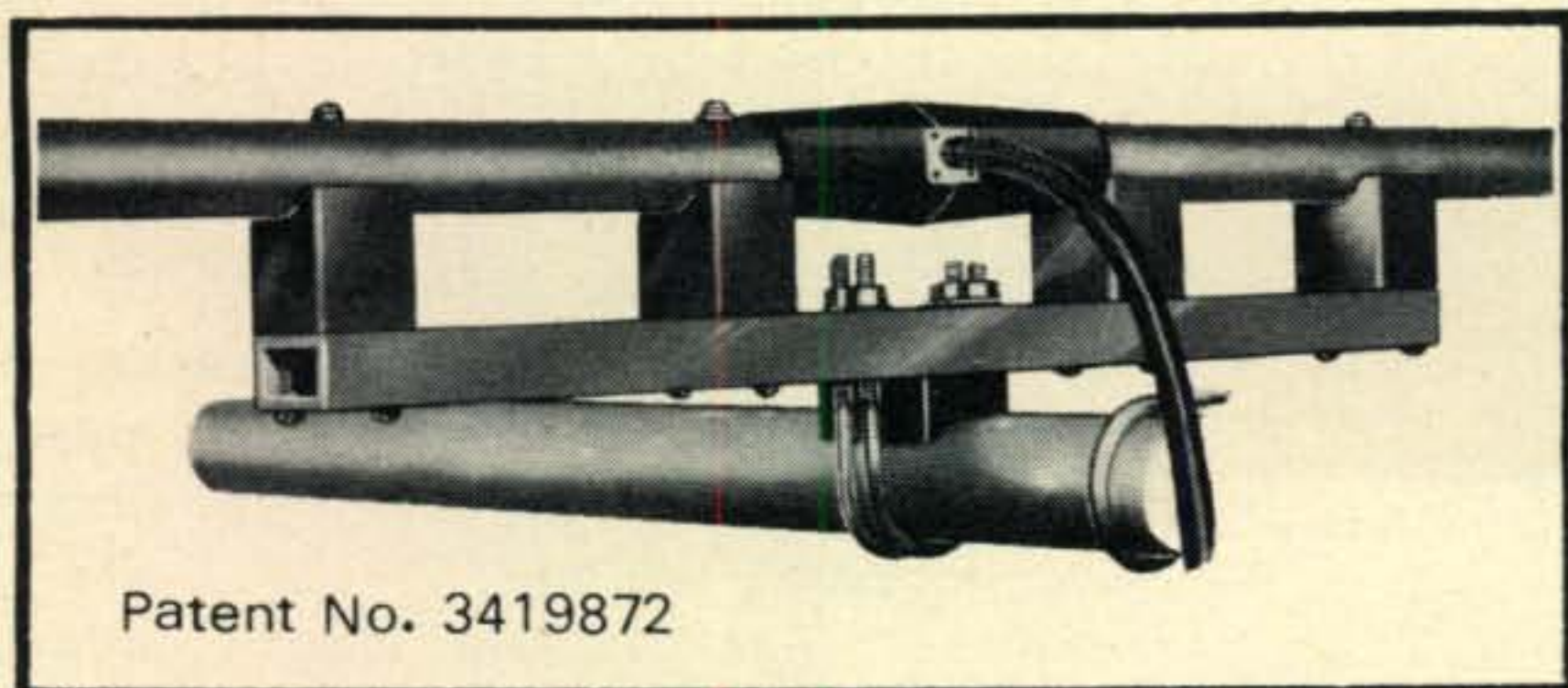
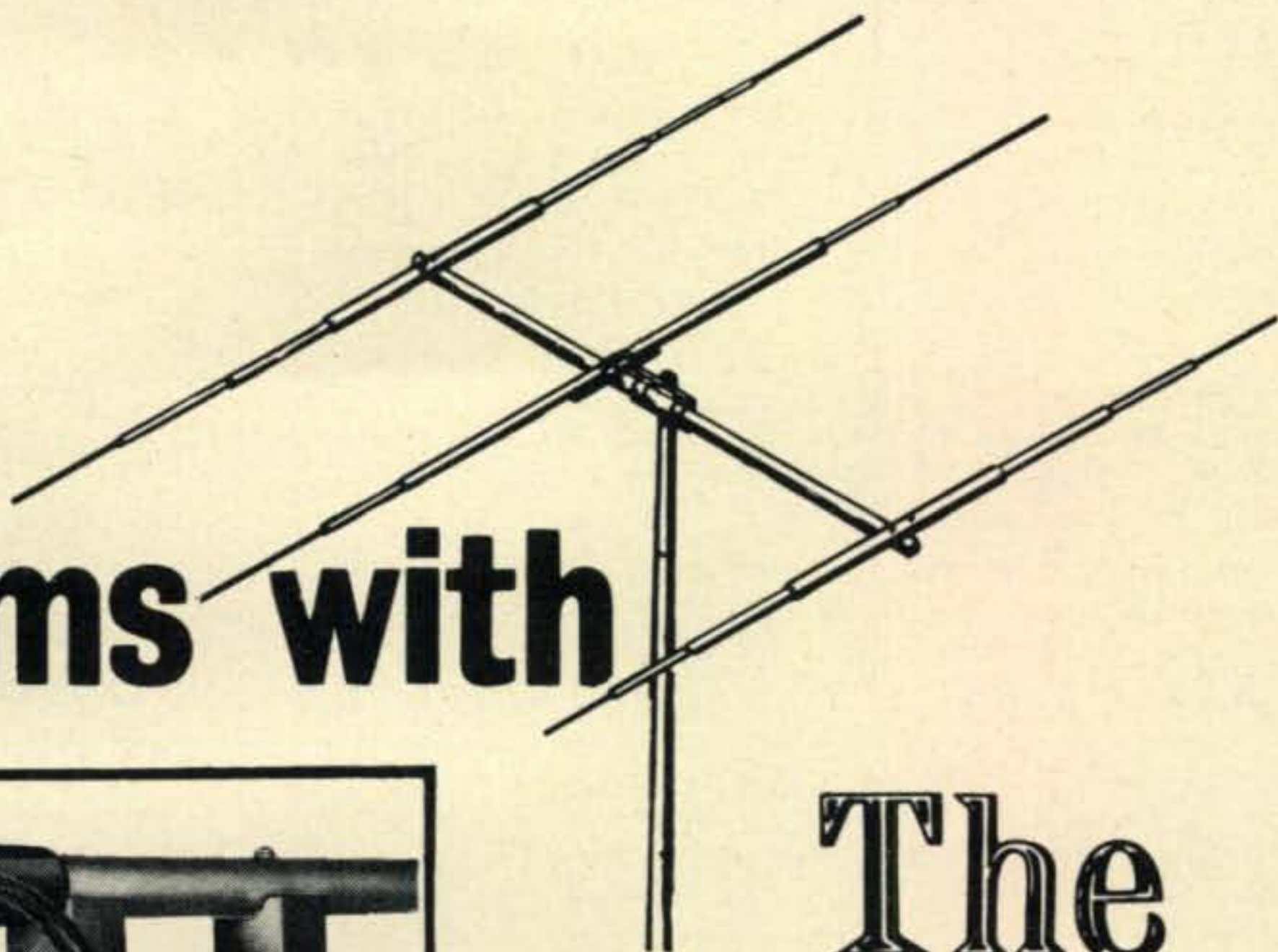
Boulder, Colorado

The Boulder Amateur Radio Club will hold its annual auction at the National Guard Armory, 470 N. Broadway, Boulder, Colorado on September 21, noon to 6:00 P.M. Further infor-

[Continued on page 98]

NEW! FROM MOSLEY

Two Single- Band Beams with



Patent No. 3419872

The Classic **FEED**

According to forecast, 1969 should be another great year for h. f. propagation conditions. Make the most of the DX openings on 10 and 15 meters with new Mosley single-band beams, the Classic 10 (Model CL-10) and the Classic 15 (Model CL-15). These beams offer the optimum spacing possible only on single-band arrays. But even more advantageous is their famous Classic Feed System (pat. no. 3419872) This "Balanced Capacitive Matching" provides maximum gain, increased bandwidth and more efficient performance because of its better electrical balance and weather proof design.

See these DX champions at your nearest Mosley dealer. For complete specifications and performance data, write factory direct for free brochure, Dept. 189.

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1969 YLRL Anniversary Party

Time: C.W.—Start, October 15, 1969, 1200 EST (1700 GMT). End, October 16, 1969, 1800 EST (2300 GMT).

Phone—Start, November 5, 1969, 1200 EST (1700 GMT). End, November 6, 1969, 1800 EST (2300 GMT).

Eligibility: All licensed YL and XYL operators throughout the world are invited to participate. YLRL members *only* are eligible for the Cup Awards. *Non-members* will receive certificates. *Only YLRL members* are eligible for the Corcoran Award. Contacts with OMs will not count.

Operation: All bands may be used. Cross band operation is not permitted. Only one contact with each station will be counted in each contest.

Procedure: Call, "CQ YL".

Exchange: Station worked, QSO number, RS/RST, ARRL Section or Country. Entries in log should show the time, band, date, transmitter and power.

Scoring: A. C.W. and Phone sections will be scored as separate contests. Submit *separate* logs for each contest.

B. IMPORTANT! NOTE CHANGE IN SCORING FROM PREVIOUS YEARS! All YLs located within an ARRL Section, score 1 (one) point for each QSO with another station located within an ARRL Section. Score 2 (two) points for each contact with a station not located in an ARRL Section, (ie; DX). DX YLs (by definition all stations not located within an ARRL Section) shall score 2 points for each contact with a station located in an ARRL Section. Score 1 point for each contact with another DX station.

Note: It is imperative that each YL know her Section. Do not use the name of the "country" if it is an ARRL Section. Hawaii, Puerto Rico, Virgin Islands, Alaska, etc. are not DX as they are in ARRL Sections. NOTE: Maritime Section includes New Brunswick, VE1; Nova Scotia, VE1, Prince Edward Island and Newfoundland, V01 & 2. (SECTION LISTS ARE AVAILABLE FROM THE VICE PRESIDENT. SEND S.A.S.E. TO RECEIVE ONE.)

Multiply number of contact points by total number of ARRL Sections or countries worked.

C. Contestants running no more than 150 watts d.c. input at any time, may multiply this score by 1.25 (low power multiplier). D. SSB contestants running 300 watts P.E.P., or less, at all times may use the low power multiplier.

Awards: Highest CW score—Gold Cup (YLRL Member only).

Highest Phone score—Gold Cup (YLRL Member only). Highest Phone and highest CW score in each district and country shall receive a certificate.

Highest **COMBINED** Phone and CW scores (YLRL Member) will receive the Corcoran award.

DX Awards: Given by Arlie Hager, W4HLF. Highest **Combined phone and CW scores**. From North and Central America, including Greater and Lesser Antilles—Cup DX YL from any other part of the world—CUP. PLEASE SEND LOGS AIRMAIL TO BE SURE OF QUALIFYING.

Logs: Copies of all logs must show claimed score, be signed by the operator, postmarked no later than Nov. 19, 1969, and received no later than Dec. 6, 1969, or they will be disqualified. Send copies of logs to: Ebba Kristpansson, VE5DZ, Box 71, Colonsay, Sask., Canada.

NO LOGS WILL BE RETURNED. BE SURE IT IS A COPY OF YOUR LOG THAT YOU SEND. CARBON COPIES WHICH ARE SMUDGED IN MAILING AND HANDLING AND BECOME UNREADABLE WILL BE DISQUALIFIED.



SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Since riting you last month about dee-x'ing the planets and how hard it going to be, Scratchi are in 1/c Hon. Blue Funk. You recalling my letter, I'm surely.

I figyuring out that there are four stars neer enough to having planets that amchoor can talk to in his lifetime, on acct. it taking radio singals so many yeers to getting to planets and back again.

Well, this are heck of a Hon. Note. What are we amchoors going to look forward to in dee-x anyhow? Four lousy planets — or maybe a few more if the stars Alpha Centauri, Sirius, Procyon and Altair having amchoors on more than one planet.

Of coursey, dee-x'ing the whole universe not being problem in we can finding a way to making radio waves go faster than lite. Scratchi putting on his Hon. Thinking Cap and thinking some, but it being waste of time.

We scientists not even knowing what lite is, so we having fat chance of figyuring out how to making radio waves go faster than lite. Anyhow, lite and radio waves are kinda similar, so it like trying to make lite go faster than lite!!

No indeedy, Scratchi not coming up with any ideas on that. Lite faster than lite. Hahh!! I thinking we have to waiting for some sooper-smart geenyus to coming up with answer to that.

So, Hon. Ed., is that the end of dee-x'ing? Is that the wall—a Hon. Dee-X Barrier—against which dee-x'ers of the future will everlastingly have to beat their head? The Dee-X Barrier, a magical number—186,000 miles per second—which limits forever the distance a dee-x'er can reach as he sends out his musical signal into the vast unknown reaches of space?

Limits him because he knows that if his signal is heard beyond the planets of Altair—even if he has managed a way to get them past—he can never benefit from this feat, because an answering signal would take so long to come back that the amchoor would be in amchoor's hevvin.

How to break this dee-x barrier? How to devise a way to heer a signal that takes so long in wending its weary way back that only the amchoor's children would be around to resevee it?

The children!! Of course! that, Hon. Ed., is when I getting this stewpendus idea! You don't have to get an answer! You can leeve the answer to posterity! Now an amchoor has a legacy he can leeve his children!

How obvious. How simple. How wonderful! And so easy. All an amchoor does is this. He keeps a log of all the extra-solar seek-yous he makes throughout his lifetime. Then, he makes this log a part of his Hon. Last Will and Testament and his inheritance.

Now, long after the amchoor has passed on to his just reward, his children, who are amchoors, can answer any of their Hon. Father's seek-yous.

Only one eensy-weensy problem. Children needing to have same call-letters as their Hon. Father. That's where you come in. You having to start lobbying with Hon. FCC so a father's call-letters can be passed on to his children.

Hon. Ed., the future of extra-solar dee-x is in your hands. You can be famous as the man who struck down the Hon. Dee-X Barrier!! Think of the honor. Your name will be on everyone lips. Hon. Huzzah, Huzzah for Hon. Ed., the breaker of the Dee-X Barrier!! Don't fail your fellow amchoors! The torch is in your hands and now is the time to strike.

Oh, I reelizing this will take a few bux, but I hoping you not so mundane as to letting this bother you—not when the future of extra-solar dee-x rests in your hands.

To helping out I'm enclosing a cupple 3-cent stamps as a contribyoushun. I sorry there's no gum on them, but with a little paste they sticking on a letter just fine.

On, on and upward, Hon. Ed!

Respectively yours,
Hashafisti Scratchi

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THE EVOLUTION OF A CIRCULATOR COUPLED PARAMP

BY J. T. CHAMBERS,* W6NLZ

Perhaps no piece of equipment has frustrated v.h.f. men as much as the paramp. Until recently, the key element to success has been priced beyond the amateur pocketbook. The "Circulator," now available, permits great simplification and improved performance.

THIS strange madness (paramp building) started with an article by Sam Harris, W1-FZJ, in *CQ* magazine, November 1958¹, followed by a series of articles in *QST* magazine, December 1958, by Ross Bateman, W4AO, and Walter Bain, W4LTU.² These, incidentally are very good articles and well worth going over and reviewing again. These pioneers pointed out that a device called a parametric amplifier was capable of almost noiseless v.h.f. amplification; then the mad rush was on. Let us give credit to Sam Harris as he was the first person known to get one of these things to work and receive useful signals on the air with it. In honor of Sam, a

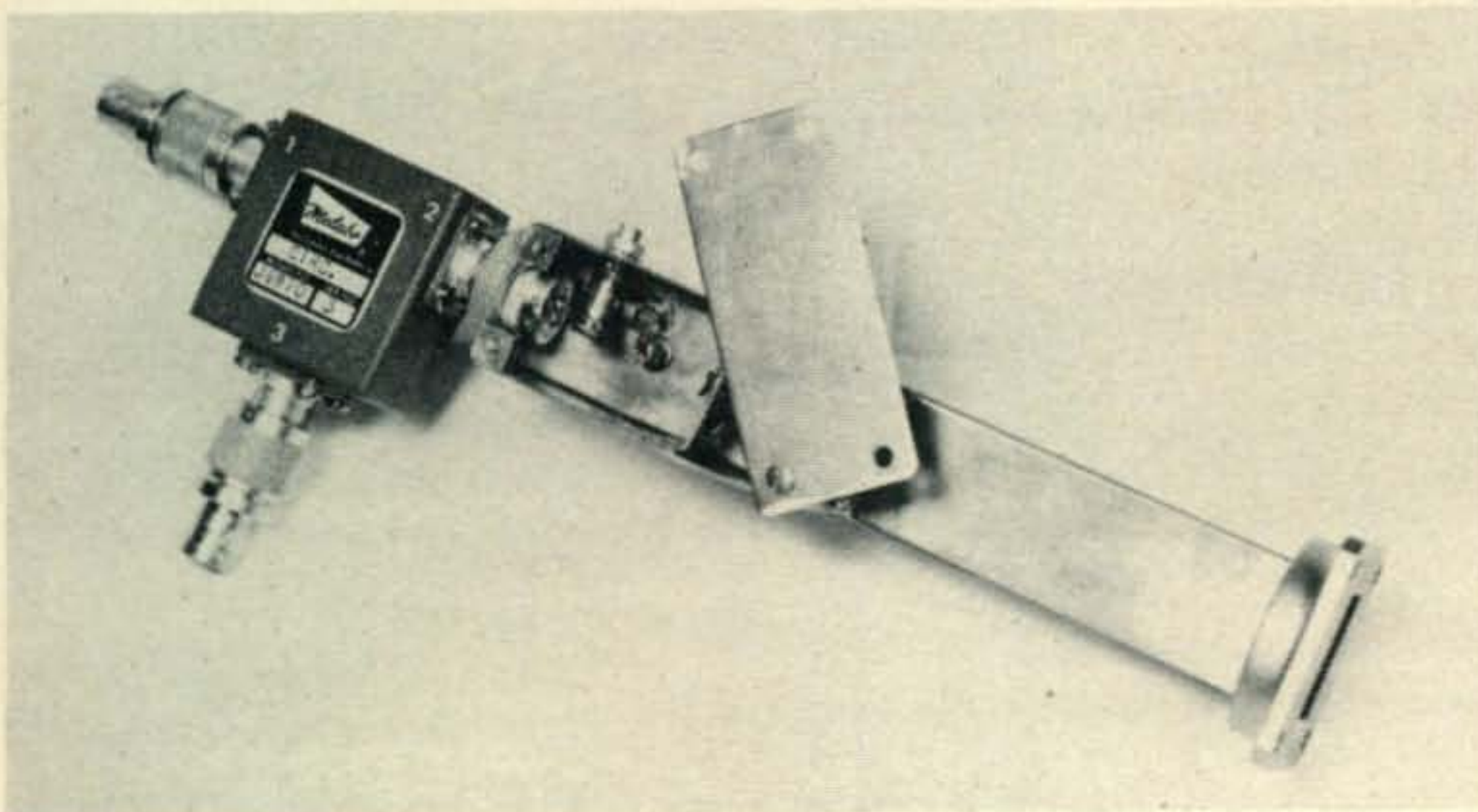
*Sr. Staff Engineer, TRW Systems, #1 Space Park, Redondo Beach, Calif.

¹Harris, F. S., "The Parametric Amplifier," *CQ*, November 1958, p. 74.

²Bateman, R. and Bain, W., "New Thresholds in V.H.F. and U.H.F.," *QST* December 1958, p. 30, January 1959, p. 11, February 1959, p. 28 and March 1959, p. 35.

specific variety of amplifier is named for him. It uses a tank circuit that is resonant both at the signal frequency and others, but necessarily the idler, and hopefully somewhere near resonance at the pump.

No matter how you slice it, these parametrics are difficult to adjust. At least the one I made seemed to require more than just plain luck to get working, but it did work, and it was more sensitive than anything I had ever heard on the 220 mc band. Bear in mind that at this time tubes were still in the 6BQ7, 6BK7 stage and these were considered real hot, just about the best obtainable, excluding the 416A which wasn't priced for ham pocketbooks. Transistors just weren't any good at all for v.h.f. and weren't given much chance of ever being good for much anyway. A 7 db noise figure at 432 was just about the end of the rope. A lot of Harris Type amplifiers were built but, like mine, they eventually went on the shelf; just too much trouble to tune, keep tuned and worst



View of the circulator mounted on the compartment which is secured to the X band waveguide shown in figs. 1 and 3. Note the impedance matching network that connects to the varactor diode. The pump oscillator is fed in on the right end as shown in fig. 2.

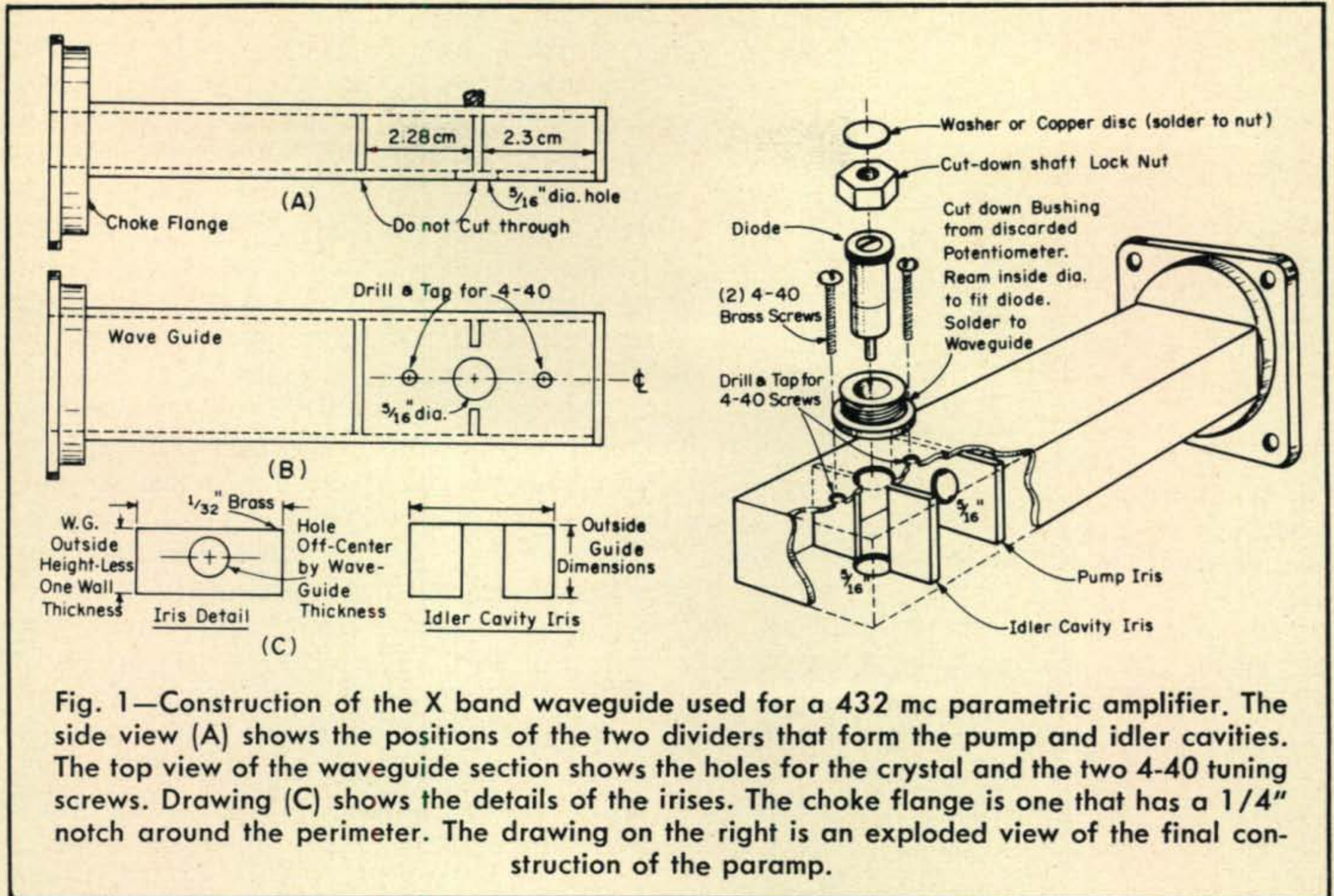


Fig. 1—Construction of the X band waveguide used for a 432 mc parametric amplifier. The side view (A) shows the positions of the two dividers that form the pump and idler cavities. The top view of the waveguide section shows the holes for the crystal and the two 4-40 tuning screws. Drawing (C) shows the details of the irises. The choke flange is one that has a 1/4" notch around the perimeter. The drawing on the right is an exploded view of the final construction of the paramp.

of all it was hard to tell just how well it was working.

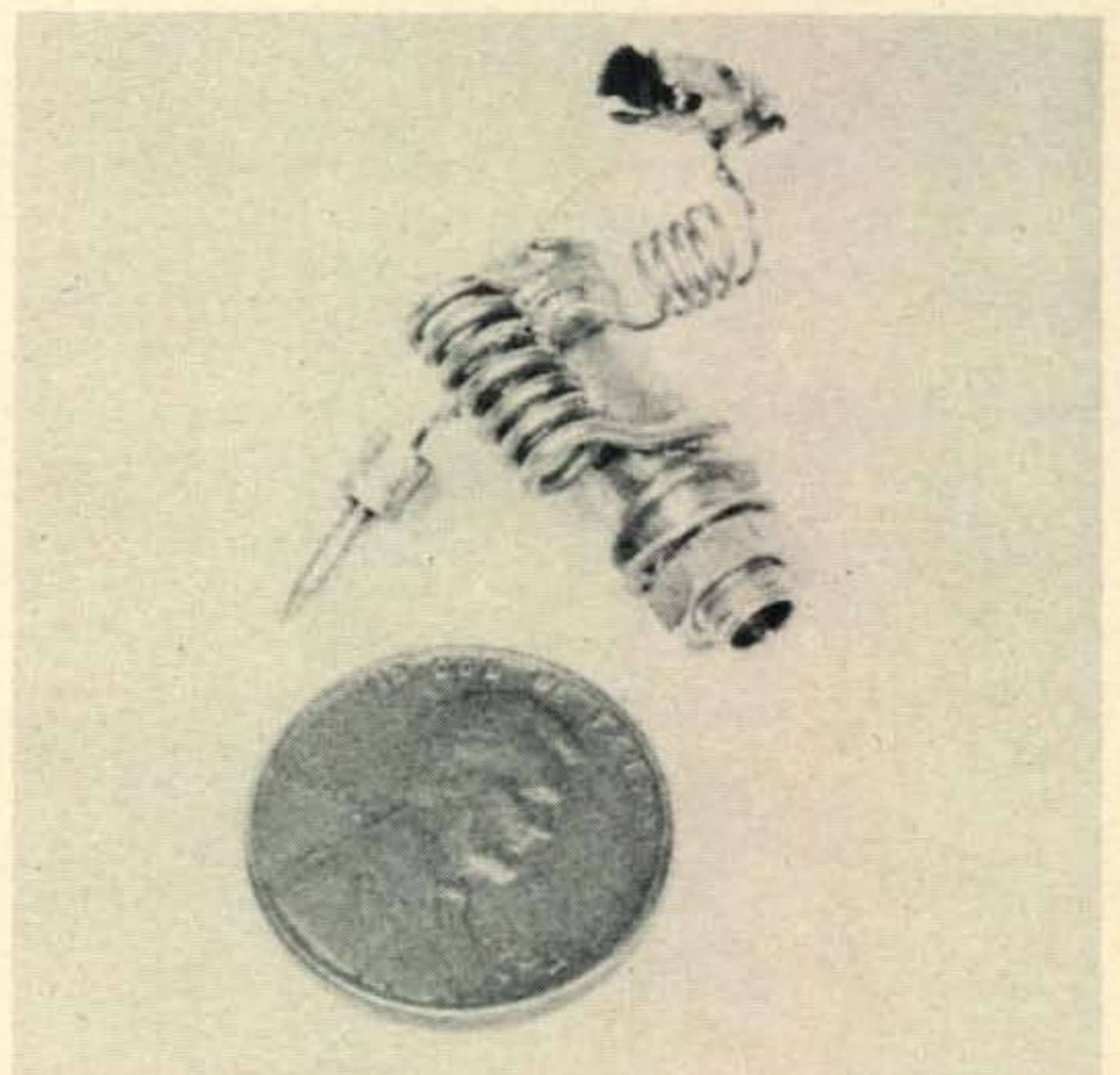
In a third article in the series by Bateman and Bain (*QST* February 1959),² a new and wonderful improvement was added—an idler circuit that could be separately tuned. More practical construction details were given by the same authors in *QST* of March, 1959. Here was a system that worked well enough that the basic design was elaborated on many times by others, particularly by Frank Jones, W6AJF.³ It was well covered in *VHF for the Radio Amateur*.⁴ This basic design is sound, but still tricky and the techniques as shown were limited to frequencies at or lower than 432 mc which is where the paramp really starts to show its worth. Also, as the months went by and tubes got better, the 417A became more common and the 6ES8 built for the TV trade was a marked improvement over the 6BQ7.

The transistor still didn't amount to anything, but don't throw brick bats at the Jones Amplifier: KH6UK used one to work W1-FZJ on 432 with the help of the moon. Incidentally, both the Harris and Jones ampli-

fier are a little hard to get the pump power into; a lot more power is required than is needed for later designs.

The next step was a big one. In the January 1961, *QST*, Troetschel and Heuer described a paramp for 1296 mc that was a real performer.⁵ A lot of these were built and many

⁵Troetschel, W., Heuer, H., "A Parametric Amplifier for 1296 Mc.," *QST*, January 1969, p. 13.



Close up view of the impedance matching network consisting of L_1 , C_1 and L_2 .

³Jones, F., "Experimental Parametric Amplifiers," *QST*, August 1959, p. 11.

⁴Jones, F., "VHF for the Radio Amateur," Cowan Publishing, Port Washington, N.Y., Cat. No. 115.

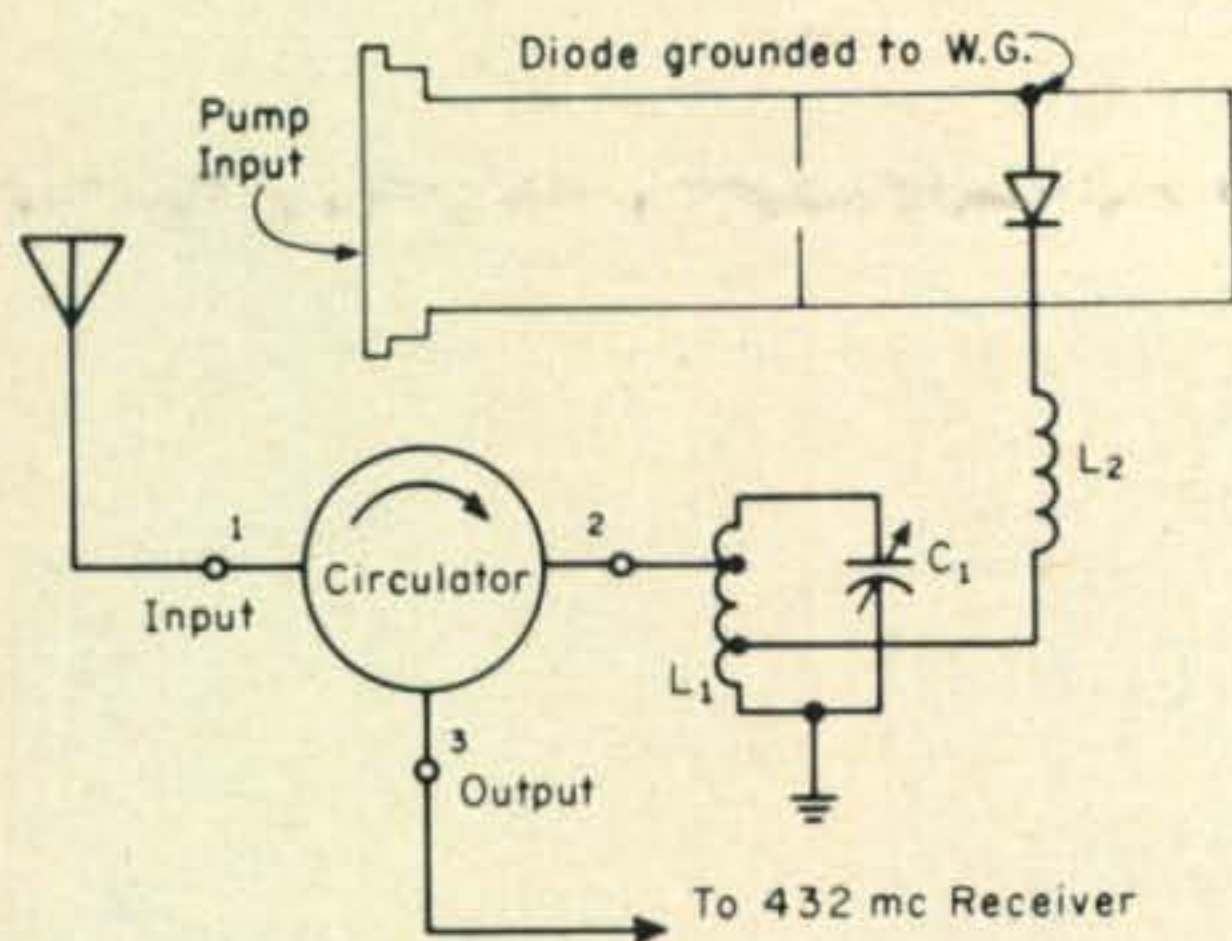


Fig. 2—Circuit arrangement of the circulator, impedance matching network, diode and pump input point for the 432 mc parametric amplifier.

are still in use; however, more were built and laid on the shelf as impossible. A few words are in order about that; the first time you try to tune one, unless you are lucky, you will be convinced that it cannot be done. However, I can assure you that after several dozen retunings it can be done in 10 minutes or less, but...I seriously believe you must have a few tools to do it. A signal generator with some form of attenuator is almost a must; also, the variable attenuator in the pump level control must work reasonably smoothly. The instructions in the article are correct, but it is still tricky to do. As an example, it is very easy to tune up on the image of the receiver—lots of noise, good gain, “obviously” its working—but it isn’t.

Let us add here that I had no luck at all trying to tune mine up until I got a ferrite isolator and inserted it in series with the pump signal. Really an isolator isn’t necessary at all, provided you use a well matched smoothly working pump attenuator, and I don’t use mine anymore. It is similar to the training wheels on a little boy’s bicycle; once you learn to ride the bicycle you no longer need the training wheels, but it sure simplifies the behavior of the bicycle until you can get the feel of it, and I can assure you that you do need a feel for it.

The Circulator

All through the above growth stages I kept trying to badger all of the experts I could corner on how to make a better paramp and the discussions always went the same way, “A paramp without a circulator? They won’t work; don’t waste your time; no good, impossible; a laboratory curiosity!”

The circulator is a non-reciprocal ferro-

magnetic network which, when properly terminated, has the properties of allowing energy to flow from port (terminal) 1 to port 2, and from port 2 to port 3 with very little loss, in this case 0.5 db. Conversely, the loss from port 3 to port 2, or port 2 to port 1 is very high, approximately 20 db. This characteristic provides roughly the isolation between input and output that is found in the pentode vacuum tube and can permit amplification without self-oscillation.

The “experts” sure were sold on this thing called a circulator, but circulators are relatively narrowband and the chances of finding one in surplus that happens to hit the ham-band are darn slim. A notice, however, in a magazine revealed that one of these elusive jewels was available from an outfit in the Bay Area for just under \$100.00. Therefore, I called a friend of mine who is a paramp expert and went through the usual discourse about whether or not a circulator would improve my paramp \$100.00 worth. Once again the story was very much the same, a circulator is the only way to go. My friend told me not to pay out the \$100.00 for the circulator, however, because he believed he just happened to have an old laboratory model that I could have. Oh boy, a circulator, and for free. But you don’t just plug the circulator into the Troetschel type amplifier and solve all of your ills; it wasn’t that easy. Yes, it improved and simplified the adjustment of the thing, but frankly, I was disappointed and thought how displeased I would have been had I paid out \$100.00 just for that. I wasn’t doing something right, so enter Paul Rumford, K6IMZ. Paul pointed out that when one has a circulator he doesn’t even need a signal tank of the high Q variety. All you have to do is to match the impedance of the circulator to the diode over the signal band and provide an idler and pump circuit. The following design at 432 mc was the result.

432 mc Paramp Construction

The pump cavity and the idler cavity assembly is a close relative of the Troetschel-Heuer⁵ system. It is made from standard $1/2" \times 1"$ waveguide. See fig. 1. The only change for 432 mc is the dimension of the idler cavity to 2.3 kmc. Another suggestion is the use of 4-40 screws for tuning; they give a “vernier” tuning. The pump oscillator should be adjusted to 9200 mc. This can be accomplished either with a wavemeter or

estimated as follows: If you use the 723 A/B tube, turn the tuning nut fully counter clockwise; next, rotate $3\frac{1}{4}$ turns clockwise. This almost puts the tuning bows together. (Not the best way to zero in on a frequency, but better than nothing.)

Impedance Matching

Sounds easy, doesn't it? Now, just what is the impedance of a varactor diode at the signal frequency? I submit that it varies between the multitude of various types available, and any construction article had better involve some form of impedance matching device like an auto transformer. Also, the diode is clearly capacitive below its self-resonant frequency. This capacitance is cancelled by resonating the diode at the operating frequency with a small inductor, 5 turns of #24 wound on a $\frac{1}{8}$ " drill, winding spaced to total inductor length of $\frac{3}{16}$ "; this is L_2 in fig. 2. It attaches to the diode with a clip obtained by crushing a ceramic octal tube socket and salvaging one of the pin receptacles. Our auto transformer, L_1 , consists of 7 turns of #20 wire wound around a $\frac{1}{8}$ " drill, the turns spread to a length of $\frac{3}{8}$ " shunted by a 0.5 to 5 mmf trimmer capacitor (C_1). By connecting the circulator to the fourth turn from the ground end we have the capability to step up or down to the diode impedance. This lead should be short, $\frac{1}{2}$ " or less. Now, how are you going to find the right tap? Fortunately, there aren't many turns and it isn't very critical, so start one turn from the bottom and slowly work your way toward the top. The diode impedance should be 10 to 15 ohms if it is a good paramp varactor. It will probably start working about turn 2 and be at its best about turn 3, but don't count on it. I measured a 1 db noise figure on turn 5 using an old MA460E. Incidentally, a good paramp varactor should have a junction capacitance of around 1.5 mmf for 432 mc, and about 0.5 to 1.0 mmf for the higher bands. The cutoff frequency should be about 80 gc or greater. The cutoff frequency is a figure of merit for varactor characterization. It is expressed as:

$$f_c = \frac{1}{2\pi R_{sc} C_{min}}$$

Tune Up Procedure

How about the tune-up procedure?

1. Connect the paramp to a signal generator at operating frequency to the terminal,

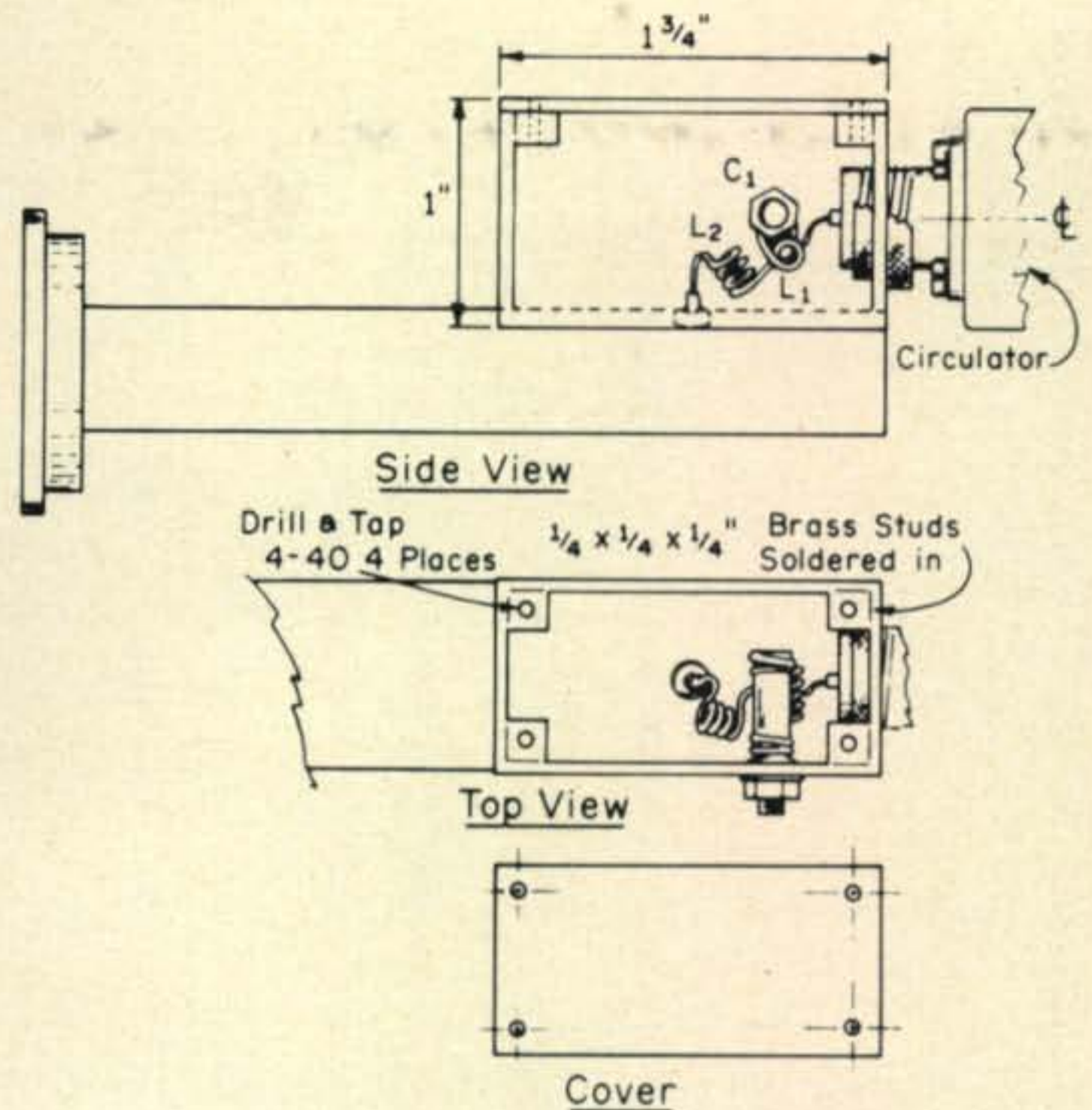


Fig. 3—Location, details and dimensions of the enclosure containing the impedance matching network and which mounts the circulator.

or in the proper terminology, port No. 1. Connect the output port No. 3 to your best 432 mc receiver.

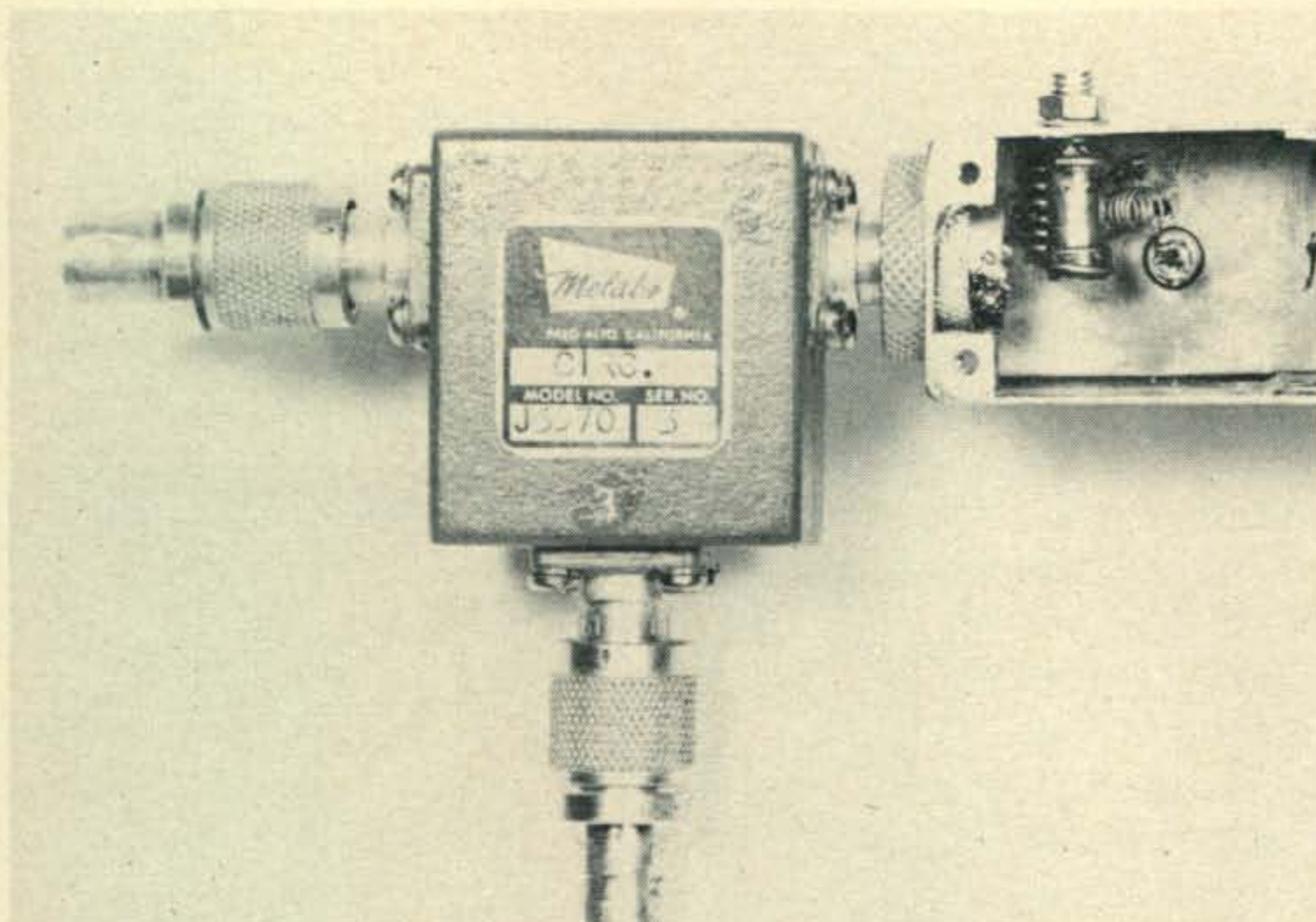
2. Run up signal generator output to about $A+10$ dbm. If you don't have a suitable signal generator, couple in your 5 watt 432 transmitter to the input port through 200 feet of RG 58/U cable.

3. Resonate the auto transformer L_1-C_1 by adjusting for maximum signal as detected with a wave meter or a Loop, 1N82 and a 1 ma meter.

4. Reduce output of signal generator to about S6 on the output indicator of the receiver. (This should take an added 600 feet of RG 58/U if a transmitter is used.) This should represent an input signal level of less than -30 dbm; otherwise, the amplifier will be saturated and the gain will appear much lower than it would be at low input levels.

5. Set the pump frequency to approximately 9200 mc and full pump power. For this one it may be necessary to borrow a wave meter. If none are available, in the 723A series Klystron, the bows should be adjusted so that they almost touch—about a $\frac{1}{32}$ " gap (as described earlier). Note that most any Klystron putting out 30 mw or so at the pump frequency is usable.

6. Use the loop, 1N82 and 1 mil meter again. Tune idler tank screw. The current meter mentioned above should kick up sharply in as many as three places.



Close up view of the circulator and the impedance matching network.

7. If you are in luck, during stage 5 or 6 the signal should be running through the paramp and should have shown some signs of life by an increase in amplitude. For the moment let us assume it did and rock whichever control brought up the signal back and forth and peak all variables; while doing this, the device will probably burst into oscillation, reduce the pump power just below the point of oscillation and repeak the controls, this should result in more oscillation and much more gain.

8. It is now time to optimize the diode resonator L_2 . It is adjusted by squeezing the turns with a pair of long nose pliers to shorten the inductor slightly or prying the turns slightly with a knife to decrease the inductance. One of these actions should have brought the amplifier back into oscillation. Note that the better the tuning of L_2 , the more easily or the less pump power it will take to oscillate. Try to optimize for minimum pump power, but don't worry too much about it, it really isn't very critical, nor is it a very high Q circuit.

9. Adjusting the tap is almost the same procedure as step 8, but instead of spreading the turns, change the tap to L_2 reaping C_1 as required for maximum signal.

10. Optimum performance should be obtained near minimum pump power; however. Advancing the pump power, of course, should run up the gain immensely till the point of oscillation. There is no need to run on the edge of oscillation, I measured a half power bandwidth of 500 kc and 36 db gain well inside the stable operating point. More gain should be obtained with the tap run up (away from ground) on L_1 . No more than about

20 db gain is needed and the noise figure improves toward the bottom end of the coil. This puts you to the final frog hair adjustment which should be made with a temperature limited noise diode or a superior instrument if you can borrow it. Making measurements in the vicinity of 1 db is a pain in the neck and I would suggest that unless you are very experimentally minded that the first 1 db measurement you get that you stop there. You are not going to do much better.

11. Now let us suppose nothing happens, no oscillation, no amplification. This puts me in the position of the government technical manual writer on complex electronic equipment, except you are in a worse position, since you really have no proof it ever did work. All I can suggest is verification of all the known fixed values, and make sure it is really ready to work. Assuming they are all there, try the tap high on the coil; if it will not oscillate than something is really bad like the klystron isn't putting out or at least not on the frequency you had hoped it was. (Did you measure it?) Is the varactor good? If you can get a kick in the close held milliammeter when tuning the idler, its got to be good. There isn't much point in carrying on any further here as it just almost can't help but work.

You may ask yourself why you should fiddle with a paramp when transistors are so good. Probably the best answer is that I don't believe, at least this month, that there is a transistor as good as this paramp regardless of the price, and the cheap ones, although good, end up being about 3 to 4 db worse. There is another factor of ruggedness to be considered; those small signal transistors are very unforgiving when it comes to mishandling, particularly from input signal overload. (I know.) Paramp varactors can take hundreds of milliwatts with no problem. But we must acknowledge that those three-legged

[Continued on page 90]

REMOTE ANTENNA TUNING

BY RONALD LUMACHI,* WB2CQM

NEWLY licensed amateurs and SWL's often underestimate the problems encountered when building and installing their first antenna system. For example, many will simply refer to the rather uncomplicated formula/frequency relationship, utilize a mathematical process, and finally arrive at the length of an antenna in feet and inches. Unfortunately, the radiating system seldom works properly. The antenna constructor tends to forget that the formula was designed originally as a guide or rough estimate of antenna length. The calculations do not consider, for example, the height of the array above ground, the proximity of large buildings, the effect of nearby trees or objects, or the general quality of the electrical ground system. Each one of these factors affects the formula which in turn alters the antenna length for the particular installation. In addition, the operating frequency determines the extent to which any of the variable factors will alter the antenna characteristics.

Antenna experimenters and builders, before permanently installing their systems will make measurements near ground level to insure maximum quality. When satisfied with the preliminary adjustments and the antenna raised to the operating height, they invariably find that the antenna does not resemble the system just tested. Several (or all) of the factors affecting the electrical characteristics are responsible for the change. The very tedious chore of lowering the antenna system, making calculated adjustments, and re-raising the unit is the only apparent solution to finally achieving worthwhile results. Perhaps remote tuning is a more sensible solution and easily achieved with a minimum of effort and cash outlay.

Tuner Construction

The basic components required to effectively construct a remote tuning device in-

*73 Bay 26 Street, Brooklyn, New York 11214.

cludes a low r.p.m. synchronous motor (1-2 r.p.m.), a variable capacitor (full 360 degrees rotation) and a dowel shaft to insulate the motor from the capacitor. These are shown in fig. 1. In all cases the capacitor is series installed in some portion of the antenna as will be illustrated shortly. Since the capacitor is used in a low voltage, high current installation, the spacing between the plates is not too critical. However, good sense suggests that the greater the input power to the final transmitter, the larger the required spacing between plates. Antennas for s.w.l. operation can use receiving type tuning capacitors.

It might be well to mention again that all capacitors must have a full 360 degrees rotation since the synchronous motors are not reversible and all capacitors must rotate smoothly without binding. Many capacitors have provisions for adjusting tension. Since the motor drives a gear train the motor will not rotate when power is removed therefore, adjust the shaft of the capacitor for minimum friction.

The capacitance value of the tuning unit is proportional to the frequency and whether it will be used in a matching stub or series installed in an antenna. For example, an 80 meter dipole installation requires at least 200-250 mmf capacitor in series with one

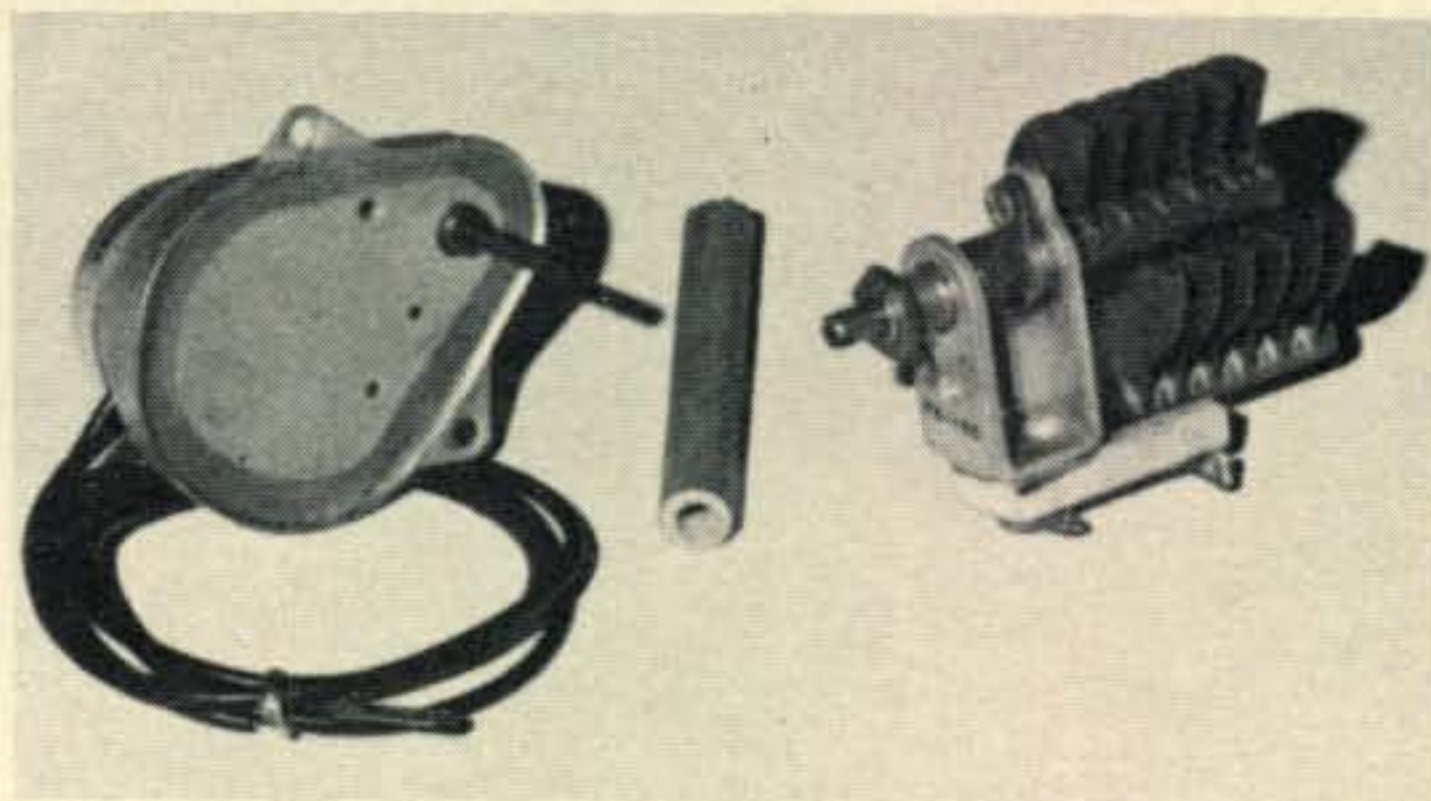


Fig. 1—The three basic components necessary for the remote antenna tuning device. The shaft of the tuning capacitor and the drive motor are of different diameters. Drill undersized holes and secure both ends with a suitable epoxy.

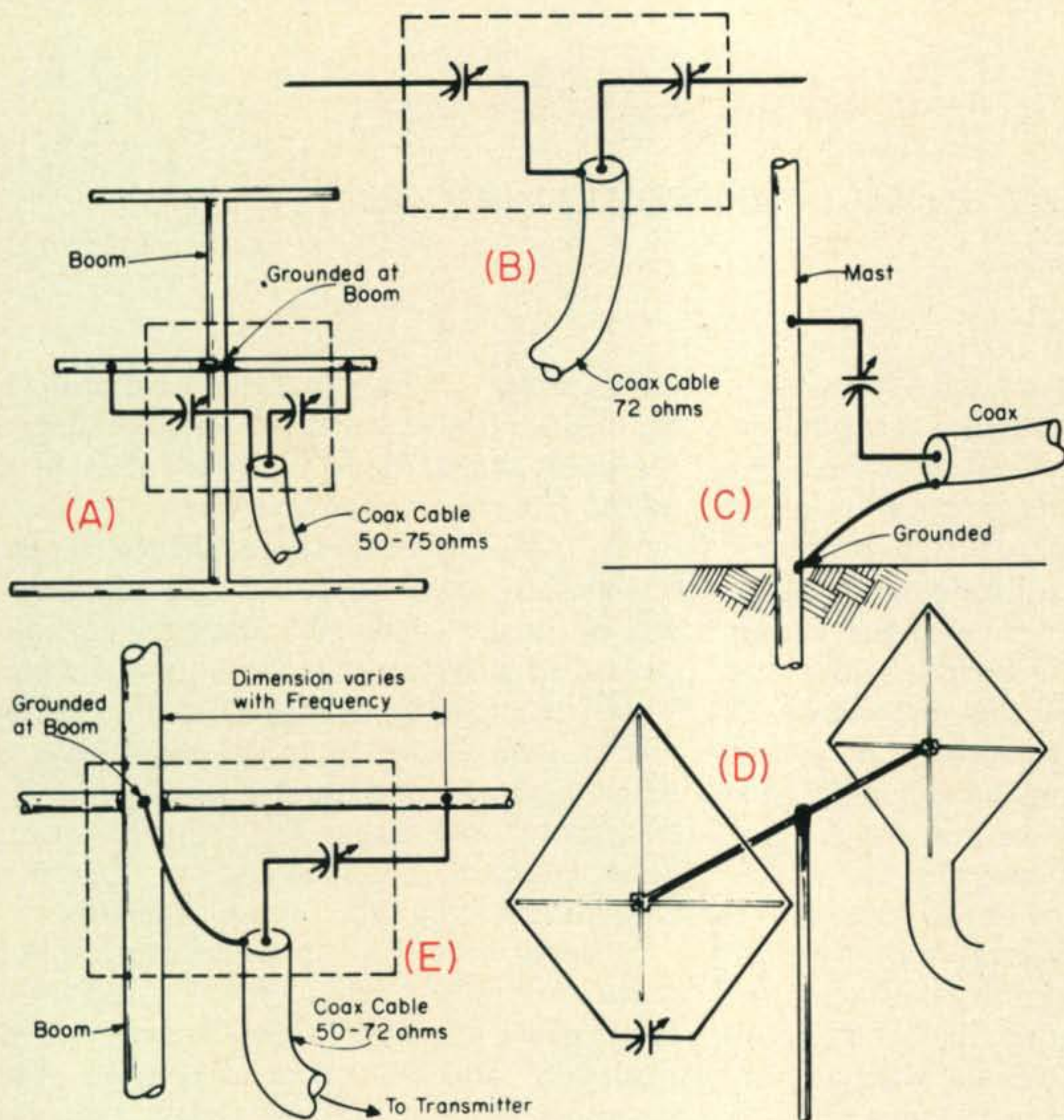
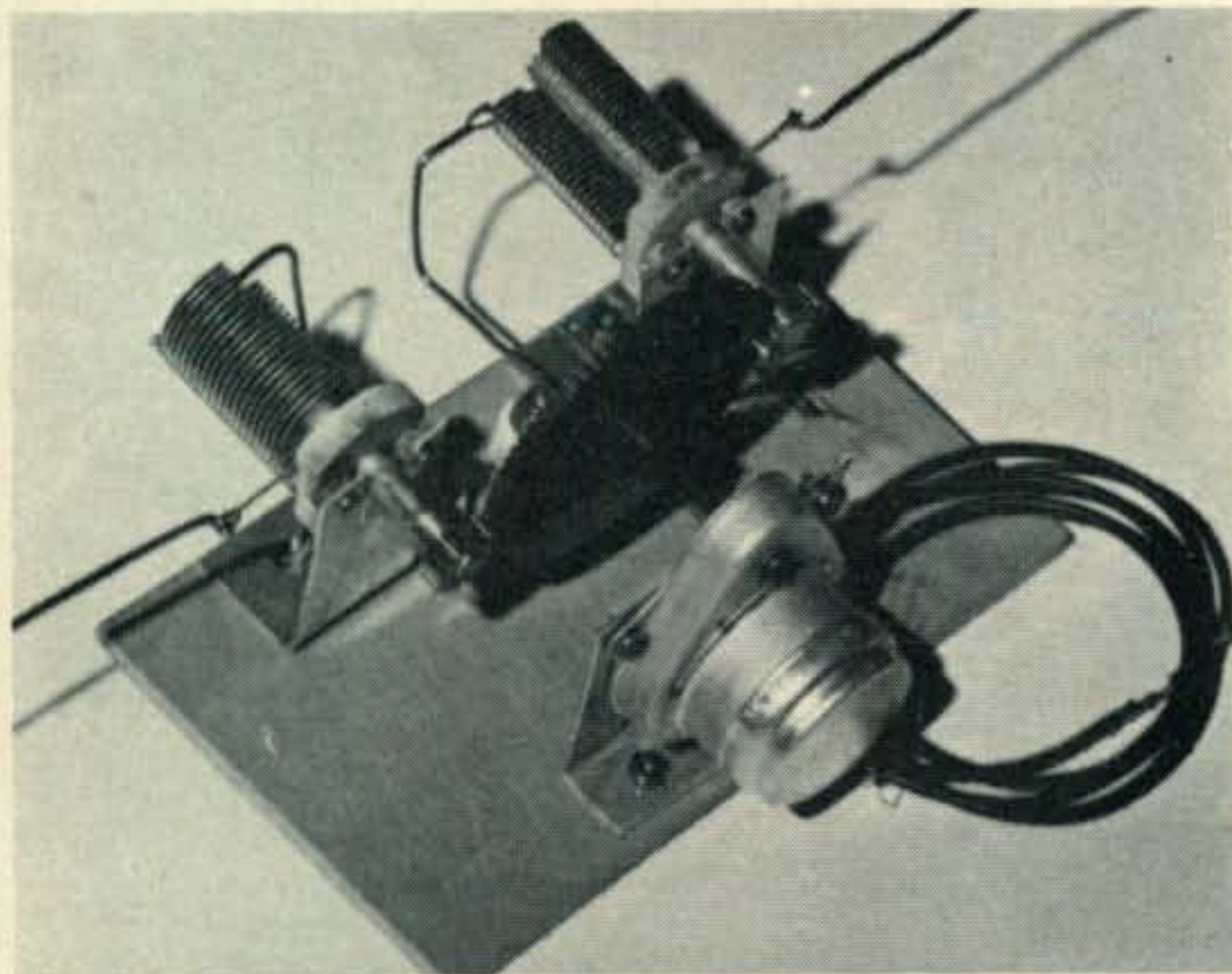


Fig. 2—Various methods of feeding and tuning antennas that are suitable for use with a remote motor control system.

leg of the antenna. The capacitor used for a tuning stub is always of a lesser value for the same 80 meters ranges from 35-70 mmf.

Protection

In all installations, the option of protecting the remote tuner is up to the individual builder. In all instances, however, the capacitor



The synchronous motor tandem couples two tuning capacitors for ganged tuning in the T match and dipole antennas illustrated in fig. 2.

must be insulated from all other components in the system and actually floating. Polystyrene (1/4") insulates well and provides a base support that is rigid and light. If this or other plastics are not available, plywood can do. Since the motor draws a minimum amount of current, bell wire, rotator cable, or other small gauge wire works well. Simply tape this wire to the outside of the coaxial cable. The alternating current flowing to the motor will not affect any antenna characteristics.

Once the remote tuner is built and installed and the antenna system cut for the approximate frequency, the remote tuning device can be put to work. It is especially effective when operating on various segments of the band. In this application, cut the antenna length to resonate on the lowest portion of the band. Decreased capacitance in the line will raise the frequency. The radio amateur can tune for a minimum s.w.r. and the s.w.l. can simply tune for maximum signal reception on the receiver's S meter.

Not only can the remote tuner be used to set the electrical length of the antenna as shown in fig. 2 (B) and (D) but it can be used to tune the matching system. In fig. 2 (A) the tandem capacitors tune out the inductance of the T match. In figs. 2 (C) and (E) the capacitors are used to tune the gamma match. ■

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RF-550,	3000/400 watt Wattmeter/Antenna Selector (Available after April 1)	\$ 69.00
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Australis-OSCAR

Telemetry Calibration Data and Reporting Instructions

BY GEORGE JACOBS,* W3ASK

The Australis-OSCAR satellite has undergone final environmental and functional tests, and is now ready for a launch which may occur as soon as this fall. Last month W3ASK, CQ's Space Communication Editor, described the satellite and this amateur radio space project in detail.¹ This month he discusses telemetry decoding and the special form that must be used to report satellite reception.

THE Australian-built radio amateur satellite, which will bear the name AUSTRALIS-OSCAR 5 when it successfully launched into space, has completed its environmental and functional tests.

With all systems in their normal operating mode, the satellite has been checked-out in a thermal vacuum chamber where both the temperature and pressure levels expected to be encountered in space were simulated. It has also successfully passed its RFI test; all harmonic and spurious radiation are within allowable limits and the satellite is not expected to cause any radio frequency interference.

All channels of the telemetry system have been calibrated under simulated flight conditions. Calibration curves have been prepared for voltage, current and temperature measurements, and are discussed later in this article.

Reporting Form Instructions

To enable rapid evaluation of telemetry, orbital and reception reports by computer techniques, all reports *must* be submitted in the same form. For this purpose, the special reporting form shown in figure 1 has been prepared, and its use is absolutely essential. Data reported in any other way cannot be handled by the computer, and may be of little value.

The following instructions should be followed in completing the AUSTRALIS-OSCAR 5 reporting form:

CALL (Columns 1-6): Insert call-sign of reporting station so that digit in call appears in column 3. For example, VE9AB would start with column 1 so that the 9 falls in column 3, but W3ASK would start with column 2 for the digit 3 to appear in column 3. 4X4ZZ would begin with column 1 so that the second digit in the call would fall in column 3, etc. If reporter has no call-sign, write ZZ1 in columns 1-3, followed by the reporters initials.

ORBIT NUMBER (Columns 7-9): Insert correct orbit number if known. Leave blank if unknown.

MONTH (Columns 10-11): Designate month by digits 1-12, with January being 1.



Bill Browning (right) G2AOX, AUSTRALIS-OSCAR regional director for Europe and Africa, proudly showing off his satellite receiving station to G4HQ.

*11307 Clara Street, Silver Spring, Md. 20902

AUSTRALIS - OSCAR 5

TELEMETRY CODING FORM

CALL						ORBIT NUMBER		MONTH	DAY	V.H.F. TRANSMITTER					H.F. TRANSMITTER					TELEMETRY																																		
		AOS				LOS		R S		AOS			LOS		R S		HI	CUR-RENT	VOLT-AGE	INT. TEMP.	SKIN TEMP.																																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46									

COMMENTS:

Fig. 1—Australis-OSCAR 5 Data Reporting Form.

DAY (Columns 12-13): Use digits 1-31 to designate the correct day of observation.

V.H.F. AOS (Columns 14-19): AOS stands for time of acquisition of signal. Digits 00-23 should be used to report the hour; 1 to 59 the minute and 1 to 59 the second that the v.h.f. signal is first heard on 144.050 mc.

V.H.F. LOS (Columns 20-23): LOS is the time of loss of signal. The time that the signal fades out should be recorded in the same manner as the AOS, except that the hour need not be given since this can be inferred from the AOS entry.

V.H.F. RS (Columns 24-25): R is observed signal readability and S is signal strength, reported in the standard radio amateur RS code, as follows:

Readability

- 1 Unreadable
- 2 Barely readable
- 3 Readable with considerable difficulty
- 4 Readable with practically no difficulty
- 5 Perfectly readable

Signal Strength

- 1 Faint signals, barely perceptible
- 2 Very weak signals
- 3 Weak signals
- 4 Fair signals
- 5 Fairly good signals
- 6 Good signals
- 7 Moderately strong signals
- 8 Strong signals
- 9 Extremely strong signals

A separate line entry should be made for each RS report, completing columns 1-13. The time of the report should be entered in columns 14-19.

A letter should be placed in column 20, consecutively for each observation, beginning with A. The same letter should be repeated in the comments space, with an explanation of the observation. For example, if it is a random report primarily for a QSL card, indicate "random report-QSL" in comments. If the report is a propagation report, indicate "propagation" in comments, as well as any other pertinent comments. If it is a report of TCA (time of closest approach, when the satellite's signal is strongest), indicate "TCA", etc.

H.F. AOS (Columns 26-31): Complete in same way as V.h.f. AOS, except reporting signal on 29.450 mc.

H.F. LOS (Columns 32-35): Complete in same way as V.h.f. LOS, except reporting signal on 29.450 mc.

H.F. RS (Columns 36-37): Complete in same way as V.h.f. RS, except report on 29.450 mc. signal.

HI (Column 38): If the keyer is operating normally insert the letter A in column 38, if not, insert the letter F for failure, and describe difficulty in comments space, or on reverse of form.

CURRENT (Columns 39-40): Battery current in milliamperes derived from telemetry calibration curve in fig. 2.

VOLTAGE (Columns 41-42): Battery voltage in volts derived from telemetry calibration curve in fig. 3.

INTERNAL TEMPERATURE (Columns 43-44): Temperature within the satellite in degrees C, derived from telemetry calibration curve in fig. 4.

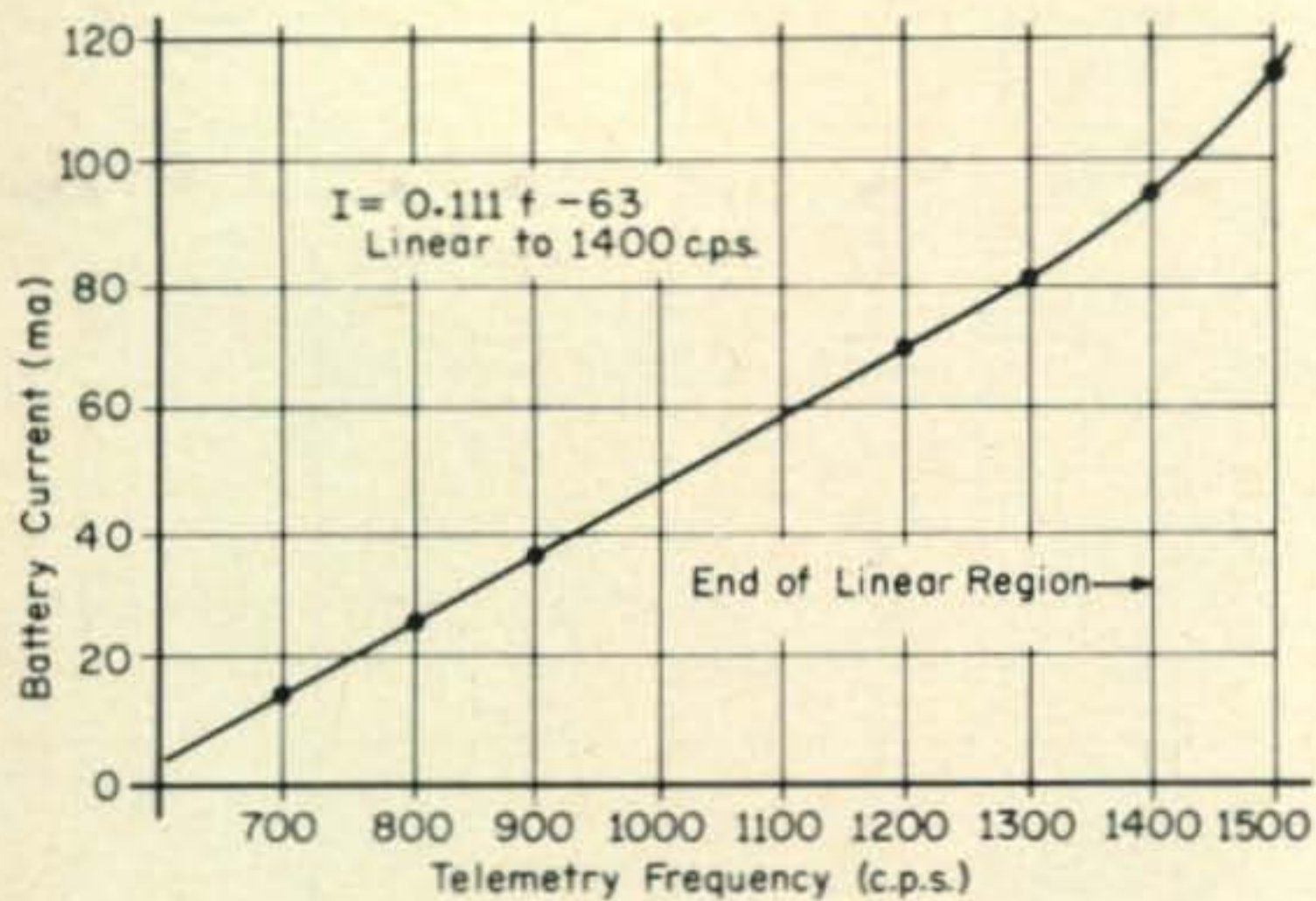


Fig. 2—Calibration curve, Telemetry channel 1.

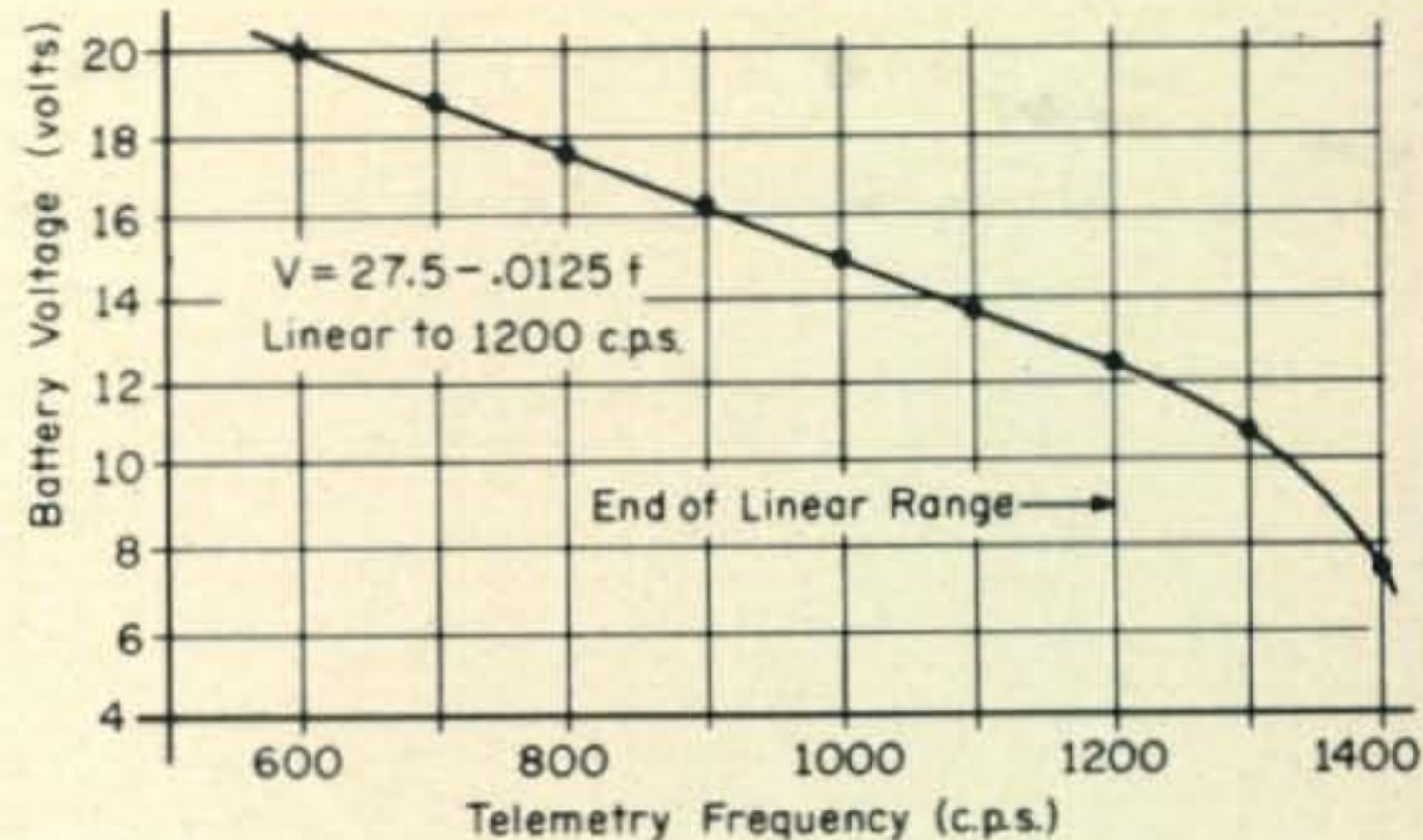


Fig. 3—Calibration curve, Telemetry channel 3.

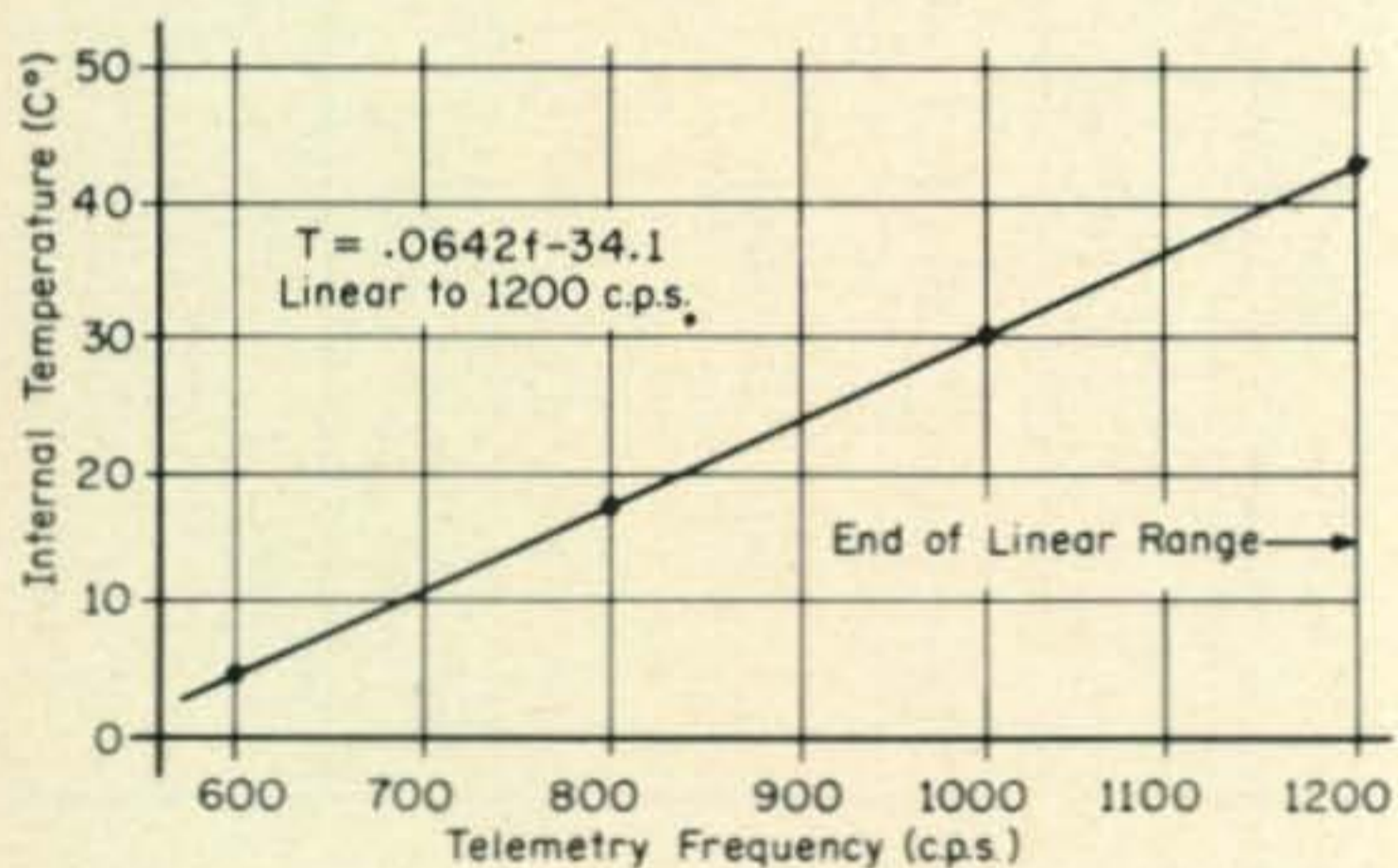


Fig. 4—Calibration curve, Telemetry channel 5.

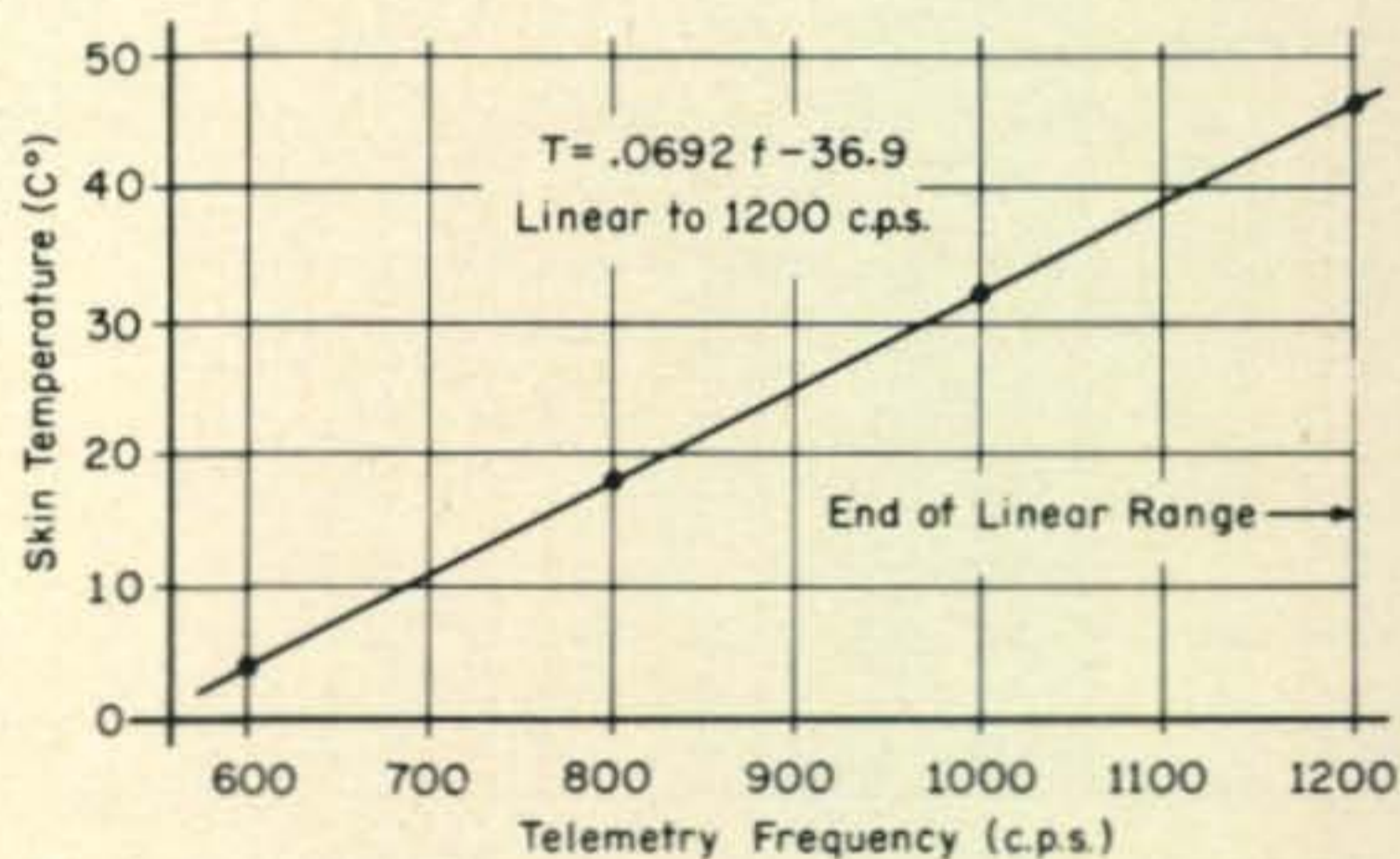


Fig. 5—Calibration curve, Telemetry channel 7.

SKIN TEMPERATURE (Columns 45-46): Temperature on satellite's surfaces in degrees C, derived from telemetry calibration curve in fig. 5.

ALL TIMES ENTERED ON REPORT FORM MUST BE IN GMT

To summarize, if the report is to be used for:

1. V.h.f. AOS and LOS, complete columns 1-23.
2. H.f. AOS and LOS, complete columns 1-13 and 26-35.
3. V.h.f. reception or propagation, complete columns 1-19 and 24-25. Place a letter in column 20 and explain observation in comments.
4. H.f. reception or propagation, complete columns 1-13, 26-31 and 36-37. Place a letter in column 32 and explain observation in comments.
5. Telemetry reports, complete columns 1-13 and 38-46. If observation made on h.f. also complete columns 26-31, if made on v.h.f. complete columns 14-19, to indicate approximate time telemetry reading was taken.

The above instructions should be followed in submitting report for the AUSTRALIS-OSCAR 5 satellite. If additional information is available which is not called for in the form, such as absolute signal strength readings, S-meter observations, Doppler shift reports, etc., the standard form should be completed as far as possible, and the additional data can be provided in the comments space, on the form's reverse side, or on a separate piece of paper

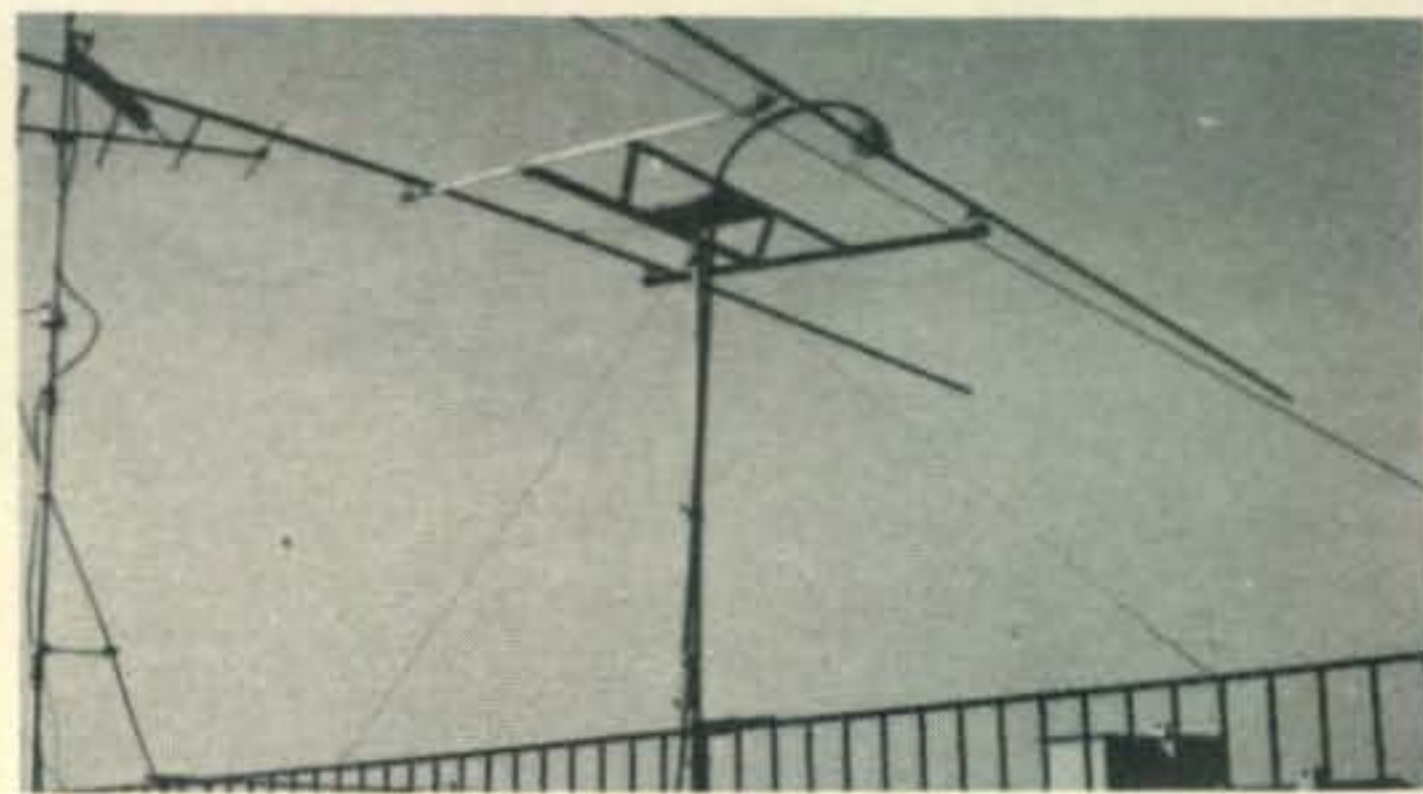
attached to the form.

When making propagation observations, remember that a valid negative report of reception is equally important as a positive one. If during an observation the satellite's signals are not heard, complete the form accordingly, but place zeroes in the R and S columns.

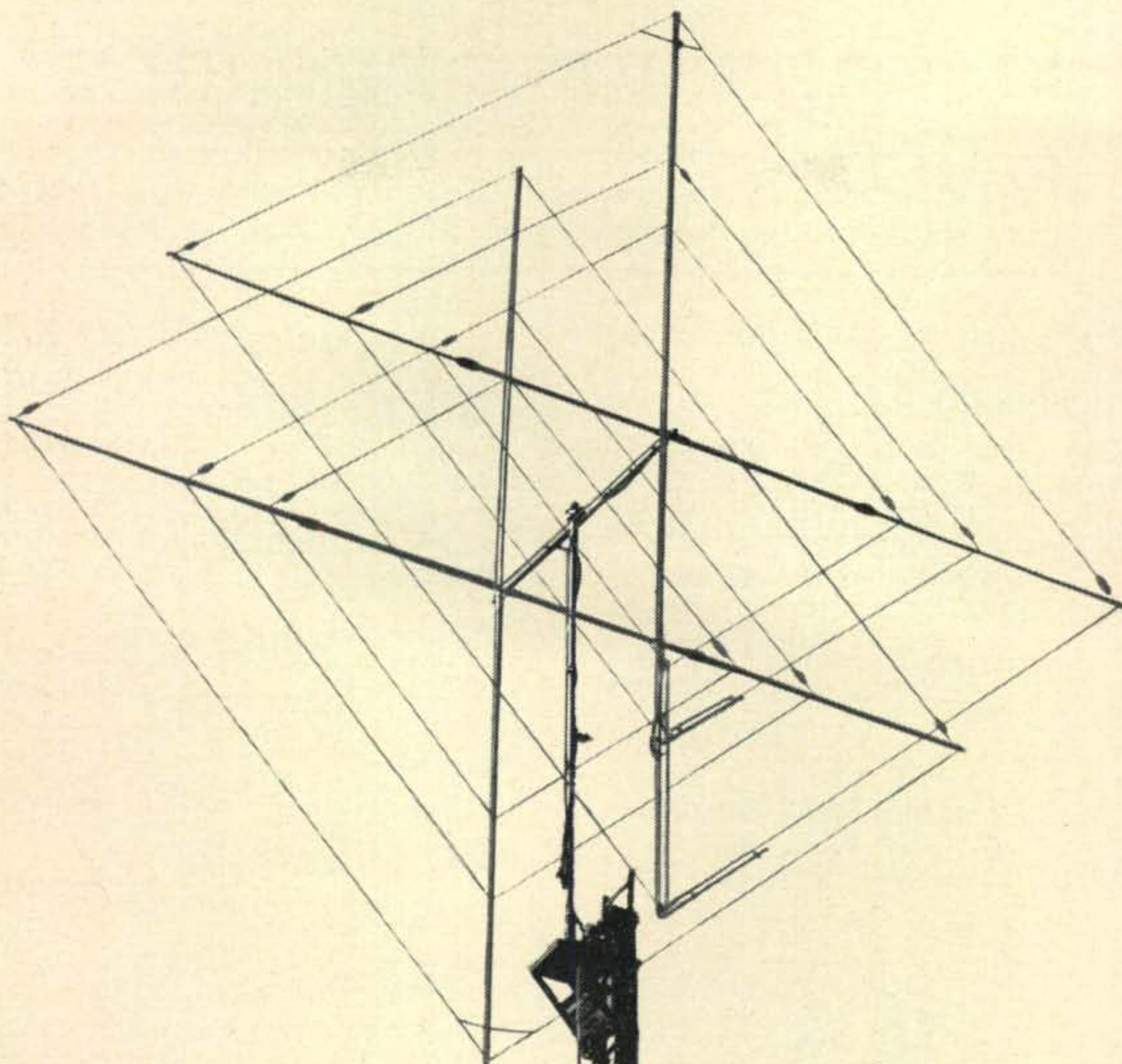
The following additional information should be provided with the *initial* report, but need not be repeated with later reports:

1. Name and full postal address, including ZIP number.

[Continued on page 86]



IIER's ten and two meter yagi arrays all tuned-up and ready to receive signals in Milan, Italy from the AUSTRALIS-OSCAR 5 satellite.



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Weight	42 lbs.
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Boom length	8'
Mast diameter	1¼" to 2½"
Wind survival	100 mph
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CQ World-Wide DX Contest

ALL-TIME PHONE RECORDS

In the records listed below, boldface listings denote world records. Number groups after calls are: year of operation, total score, contacts, contacts,

Single Operator / Single Band

WORLD RECORD HOLDERS

1.8 DL9KRA ('67)	486	57	2	7
3.5 YV5BTS ('66)	69,471	296	21	62
7.0 YV4UA ('68)	97,605	414	20	61
14 YV5BIG ('66)	840,252	1929	36	111
21 CX2CO ('68)	805,090	1912	37	106
28 YV1LA ('68)	664,560	1898	33	87

AFRICA

1.8 No Entrant				
3.5 No Entrant				
7.0 No Entrant				
14 CR6BX ('67)	698,640	1450	39	125
21 ZD8WZ ('66)	378,200	1076	31	91
28 EL2J ('68)	275,296	829	31	80

ASIA

1.8 No Entrant				
3.5 4X4AS ('64)	29,392	227	11	33
7.0 JA2BTV ('67)	46,620	196	29	55
14 HL9KH ('63)	318,960	826	37	107
21 4X4TP ('67)	375,354	1019	33	93
28 UF6CR ('68)	280,836	891	34	82

EUROPE

1.8 DL9KRA ('67)	486	57	2	7
3.5 ON4UN ('66)	61,523	616	19	58
7.0 SM4CMG ('68)	61,473	363	23	70
14 G5AAM ('67)	824,344	1634	39	144
21 PA0FM ('68)	613,816	1564	34	102
28 DL4PM ('68)	614,544	1858	34	84

NORTH AMERICA

1.8 VE3BS ('67)	400	51	2	2
3.5 W1FZJ/KP4 ('68)	50,410	297	18	35
7.0 K2GXI ('67)	60,204	254	27	60
14 VE3LZ ('68)	601,620	1274	40	145
21 VE3ACD ('68)	286,358	806	34	100
28 W2SKE ('68)	429,976	1030	34	108

OCEANIA

1.8 No Entrant				
3.5 KH6EPW ('66)	5,040	82	10	11
7.0 ZL1AGO ('68)	13,896	134	17	19
14 KX6BQ ('65)	449,306	1125	36	107
21 KH6BZF ('68)	290,628	1382	27	42
28 KH6GPQ ('68)	278,320	1695	30	50

SOUTH AMERICA

1.8 No Entrant				
3.5 YV5BTS ('66)	69,471	296	21	62
7.0 YV4UA ('68)	97,605	414	20	61
14 YV5BIG ('66)	840,252	1929	36	111
21 CX2CO ('68)	805,090	1912	37	106
28 YV1LA ('68)	664,560	1898	33	87

Single Operator / All Band

AF ZD8Z ('68)	4,184,680	3210	122	327	
AS JA1AEA ('68)	1,714,195	1983	101	200	
EU DJ6QT ('67)	2,270,224	1966	119	315	
NA W0VXO/KV4 ('68)		3,135,475	3372	119	286
O VK2ADY/9 ('69)	5,045,115	3310	153	384	
SA CX2CO ('65)	1,815,288	1849	106	238	

WORLD RECORD

Station	Band	Contacts	Zones	Countries
VK2ADY/9 (1967) 5,045,115	1.8	—	—	—
	3.5	29	15	20
	7.5	118	25	37
	14.0	949	38	110
	21.0	1084	38	104
	28.0	1130	37	113
Total		330	153	384

Multi-Operator / Single Trans.

AF CR6CA ('68)	2,481,248	2371	99	272
AS UA9AN ('68)	2,692,440	2023	126	360
EU DL0WR ('68)	3,048,903	2556	115	314
NA WA6ZQU ('67)	1,451,219	1264	126	275
O KG6AAY ('67)	1,525,396	1813	106	181
SA CX2CO ('66)	2,600,923	2413	114	263

WORLD RECORD

Station	Band	Contacts	Zones	Countries
DL0WR (1968) 3,048,903	1.8	—	—	—
	3.5	74	9	41
	7.0	95	12	42
	14.0	615	30	93
	21.0	1015	31	67
	28.0	757	33	71
Total		2556	115	315

Multi-Operator / Multi-Trans.

AF ZS5JY ('68)	3,458,007	2886	123	296
AS HSIMD ('68)	851,480	1298	110	210
EU OH2AM ('68)	10,074,120	5882	159	511
NA W3MSK ('68)	5,515,701	3094	159	470
O KX6AF ('58)	306,642	711	59	88
SA 4M5A ('67)	7,468,117	5033	134	393

WORLD RECORD

Station	Band	Contacts	Zones	Countries
OH2AM (1968) 10,074,120	1.8	34	2	4
	3.5	315	13	50
	7.0	459	28	73
	14.0	1806	40	144
	21.0	1776	38	121
	28.0	1492	38	119
Total		5882	159	511

CQ World-Wide DX Contest

ALL-TIME C.W. RECORDS

zones, and countries. All-band and Multi-Operator records include a band-by-band breakdown of the world leader in each category.

Single Operator / Single Band

WORLD RECORD HOLDERS

1.8 ZC4RB ('67)	4,335	86	3	14
3.5 UC2AA ('66)	83,496	714	20	64
7.0 5A1TW ('64)	227,814	918	22	64
14 1G5A ('66)	792,370	1594	37	133
21 CR6GO ('68)	530,550	1409	37	94
28 PY2SO ('67)	532,956	1319	37	101

AFRICA

1.8 No Entrant				
3.5 No Entrant				
7.0 5A1TW ('64)	227,814	918	22	64
14 1G5A ('66)	792,370	1594	37	133
21 CR6GO ('68)	530,550	1409	37	94
28 9J2WR ('67)	260,190	877	32	73

ASIA

1.8 ZC4RB ('67)	4,335	86	3	14
3.5 4X4DH ('64)	55,440	301	14	49
7.0 4X4FA ('64)	174,505	781	25	60
14 HL9KH ('63)	339,920	910	37	103
21 JH1EYB ('68)	188,034	585	36	75
28 HZ1AB ('68)	132,390	578	21	55

EUROPE

1.8 OK1ZC ('64)	3,060	167	5	15
3.5 UC2AA ('66)	83,496	714	20	64
7.0 LZ1KPG ('68)	159,964	792	34	82
14 G2LB ('57)	213,112	701	36	100
21 G3HCT ('68)	240,468	848	32	84
28 DL4AAP ('57)	253,680	728	36	84

NORTH AMERICA

1.8 VO1FB ('66)	4,165	92	4	13
3.5 W1SWX ('68)	35,309	188	18	49
7.0 W6AM ('64)	161,991	468	37	86
14 W4AXE ('68)	396,414	836	39	123
21 W4KFC ('66)	211,106	609	32	87
28 K1JGD ('68)	158,510	520	28	82

OCEANIA

1.8 VK5KO ('64)	6	1	1	1
3.5 KH6EPW ('66)	7,068	132	9	10
7.0 VK3ADB ('66)	84,456	435	22	46
14 VK3APJ ('67)	422,240	1150	35	95
21 K1FNA/KG6 ('68)	380,064	1157	32	79
28 VK8UG ('67)	320,008	1048	32	72

SOUTH AMERICA

1.8 PY2BJH ('68)	99	6	4	5
3.5 PJ2VD ('68)	18,704	225	10	18
7.0 PY4AP ('64)	81,673	421	22	45
14 PY4OD ('68)	747,410	1621	39	116
21 PY4SO ('68)	479,385	1211	38	97
28 PY2SO ('67)	532,956	1319	37	101

Single Operator / All Band

AF ZD8J ('68)	1,709,955	1742	108	225
AS HL9KH ('62)	1,142,748	1554	103	221
EU LA0AD ('68)	1,035,188	1257	94	214
NA KV4FZ ('68)	1,947,456	2517	107	229
O VR2EW ('65)	2,499,536	2215	126	268
SA PY2SO ('66)	1,499,020	1642	102	209

WORLD RECORD

Station	Band	Contacts	Zones	Countries
VR2EW (1965) 2,499,536	1.8	—	—	—
	3.5	101	19	36
	7.0	514	27	54
	14.0	834	37	93
	21.0	737	37	73
	28.0	29	12	12
Total		2215	126	268

Multi-Operator / Single Trans.

AF ZS5QU ('67)	1,615,350	2005	94	181
AS 4L3A ('67)	3,084,536	2376	116	330
EU DL0KF ('68)	1,969,830	2329	128	302
NA TG0AA ('67)	1,948,360	2615	116	219
O VK5NO ('63)	945,248	1199	86	185
SA CX2CO ('66)	2,199,694	2278	104	225

WORLD RECORD

Station	Band	Contacts	Zones	Countries
4L3A (1967) 3,084,536	1.8	—	—	—
	3.5	306	13	49
	7.0	472	23	64
	14.0	604	31	88
	21.0	425	26	63
	28.0	569	23	66
Total		2376	116	330

Multi-Operator / Multi-Trans.

AF ET3FMA ('67)	1,387,680	1476	105	231
AS 4X9HQ ('62)	1,681,988	1975	84	224
EU OH2AM ('68)	4,118,688	3277	155	412
NA W3MSK ('68)	4,560,038	2696	166	423
O KG6FAE ('57)	691,601	1321	76	105
SA PJ0CC ('68)	8,258,787	6046	135	324

WORLD RECORD

Station	Band	Contacts	Zones	Countries
PJ0CC (1968) 8,258,787	1.8	57	4	5
	3.5	371	13	33
	7.0	1181	25	66
	14.0	2129	37	89
	21.0	1341	29	68
	28.0	967	27	63
Total		6046	135	324

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AN AUTOMATIC TRANSISTOR CHECKER

BY JOHN J. SCHULTZ,* W2EEY

The construction of a simple transistor tester is described which gives, by means of lamps, a simple go-no go indication of the condition of almost any NPN or PNP transistor.

TESTING transistors to generally determine whether they are still good, that is, have no internal shorts or opens, can be a fairly tedious task when a large number of them are involved. One can buy various inexpensive transistor testers, which are essentially simple ohmmeters, to do the job, but even then, one must do some switching or test lead reversing to completely check a transistor.

The construction of the simple transistor tester described in this article will allow the testing of a transistor for possible shorts or opens automatically without any control manipulation whatsoever. Simple lamp indications signal the condition of a transistor under test. The unit itself is composed of extremely simple and inexpensive components, many of which most amateurs can probably already find in their component collections.

Essentially, the tester performs ohmmeter type checks on a PNP or NPN transistor immediately when it is connected to the tester. The manual switching of the ohmmeter test leads normally necessary is done electrically by utilizing the fact that the a.c. power line provides an automatic switching mode.

Since the tester is sort of an automatic take-off on the ohmmeter method of checking transistors, the latter method should be appreciated before looking at the circuit of the tester itself.

Ohmmeter Transistor Checks

One can visualize a PNP transistor as composed of connected bars of P, N and P type material for the emitter, base and collector as shown in fig. 1 (A). Since each PN junction is the same as a diode, one can test portions of the transistor as individual diodes. Figure 1 (B) shows an ohmmeter check of the emitter-base junction. If the voltage source within the ohmmeter produces the polarity markings shown on the meter leads,

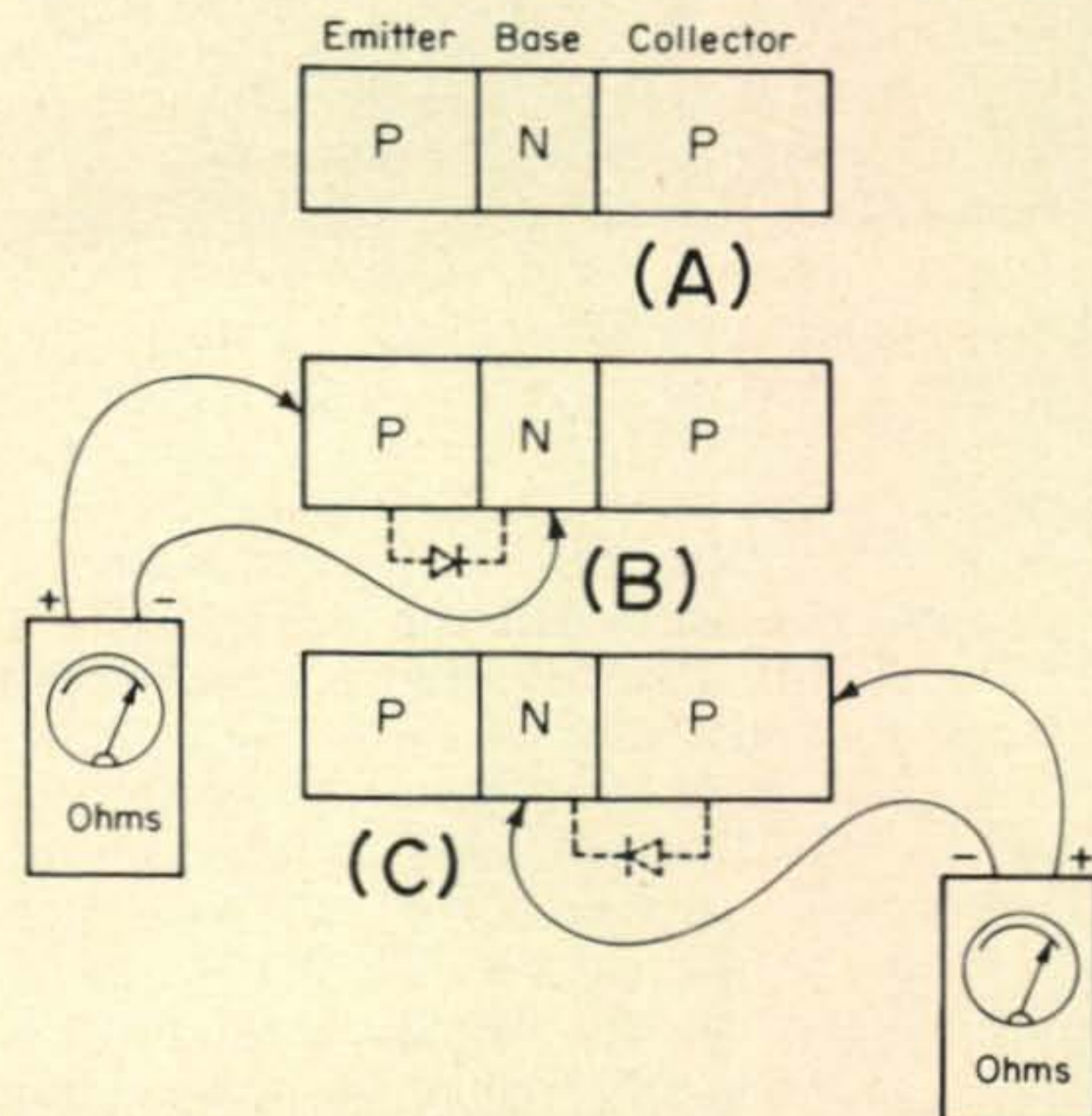


Fig. 1—An ohmmeter can be used to check the forward and reverse resistances of the emitter-base and collector-base junctions. Readings remain the same if test probe polarities are reversed for an NPN transistor.

*1829 Cornelia Street, Brooklyn, N.Y. 11217.

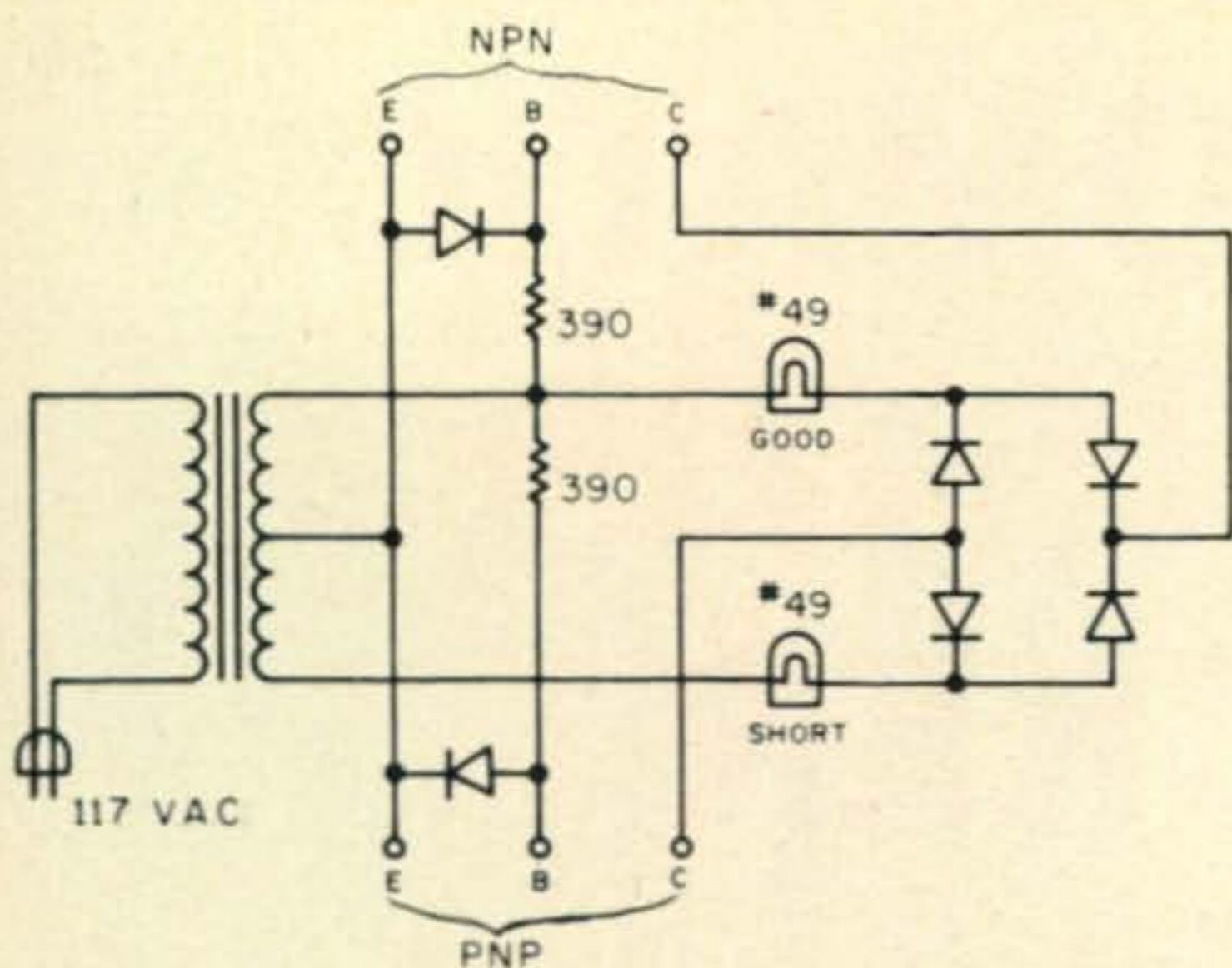


Fig. 2—Schematic of automatic tester. Transformer is 6.3 volt a.c. c.t. filament type. All diodes can be 1N34, 1N54 or equivalent.

the ohmmeter will produce a very low resistance reading for the connection shown. When the test leads to the emitter and base leads are reversed, a high resistance reading will result.

Figure 1 (C) shows an ohmmeter check of the collector-base diode junction. The readings are the same as for the emitter-base junction and the ohmmeter leads must be switched to obtain a low forward resistance reading and then a high reverse resistance reading.

Applying the ohmmeter leads between the emitter and collector terminals will generally produce no useful reading since essentially they are connected across two diodes in series back to back. If, however, some bias could be applied to the emitter-base junction, useful readings would result. When the emitter-base junction is forward biased (emitter positive with respect to the base), the emitter collector resistance path should fall to a low value. Alternatively, when the emitter-base junction is reverse biased, the emitter-collector resistance should rise to a high value. Normally, these measurements of emitter-collector resistance are impractical to make with an ohmmeter while biasing the transistor and ohmmeter checks are confined to the four steps of emitter-base forward and reverse resistance and collector-base forward and reverse resistance.

If one were dealing with an NPN transistor, the test situation would be the same except one has to imagine the dashed line diodes shown in figs. 1 (B) and 1 (C) as reversed and the ohmmeter readings will also be reversed for each step. Incidentally, if one does use an ohmmeter to test a transistor, the highest resistance range should normally be

used since minimum current flow will be produced in the transistor junction. The only exception occurs when a type ohmmeter is used which switches in an extra voltage battery on its highest range. A few types use up to 45 volt batteries on their extreme high ranges and such a voltage can break down the diode junction in some transistors when a reverse polarity resistance reading is taken.

Tester Circuit

The tester circuit shown in fig. 2 is configured to essentially perform the ohmmeter checks automatically, including the emitter-collector check.

The circuit operation can be understood if one imagines a PNP transistor connected to the PNP terminals. During one half of the a.c. line input cycle the upper lead of the secondary of the transformer will be positive with respect to the lower lead. If any appreciable current flows through the collector-base junction of the transistor, current will also flow through and light the SHORT lamp. The transistor under test also has its emitter-base junction reverse biased by the small voltage drop across the diode in the tester between the emitter and base test terminals. If any appreciable emitter-collector current should flow, the SHORT lamp will, therefore, also light. When the a.c. line input cycle reverses, the upper secondary terminal becomes negative. The emitter-base junction is now forward-biased and the current flow through the emitter-collector junction will cause the GOOD lamp to light. An emitter-base short will prevent the lamp from lighting.

One can imagine various combinations of shorts or opens that will not allow the lamps to light properly. If the transistor tested is in good shape, *only* the GOOD lamp will light. Various combinations of shorts or opens might cause both the GOOD and SHORT lamps to light or neither lamp to light. So, one has only to watch the tester and see that the GOOD lamp lights. An emitter-base short lamp is, of course, necessary although if one wanted to embellish the circuitry, one could devise various relay or gate circuits such that one need only have the "good" lamp visible and have it solely light or be extinguished depending upon the condition of the transistor under test.

Construction

There are no special features to the construction and the unit can be assembled in

[Continued on page 109]

CQ ATTENDS: THE THIRD ANNUAL MEDICAL AMATEUR RADIO COUNCIL (MARCO) MEETING

BY ALAN M. DORHOFFER,* K2EEK

IN 1965 we exchanged some correspondence with Bill Sprague, WA6CRN, a California physician who was gathering a list of all amateurs who were also doctors. The ensuing list prompted an organizational meeting in April of 1966. Bill met with 32 other Dr./amateurs at the old Astor Hotel in New York during an AMA Convention and formed the nucleus for a 92 man group called MARCO

*Managing Editor, CQ.

(Medical Amateur Radio Council, Ltd.). Besides their common occupation they shared an avid interest in amateur radio and hoped to make their combined talents available to those in need throughout the world.

On July 17, 1969, Marco held their third annual meeting and conference at the Holiday Inn in New York during the week of the annual AMA convention. Now with over 400 members, the group has expanded their membership requirements to include: (1) all those radio amateurs who are licensed and qualified in the United States as Doctors of Medicine, Doctors of Dental Surgery and Medicine, Doctors of Veterinary Medicine or Doctors of Osteopathy (2) holders of equivalent foreign degrees and licenses, or (3) holders of doctoral degrees and are practicing in one of the related paramedical sciences. Associate membership is available to those amateurs who are regular students in an accredited school for any of the above.

This year's meeting started with a business session and committee reports. Following lunch, Anson R. Hyde, M.D., W4QCG, incoming MARCO President for 1969-1970, hosted a series of lectures relating amateur radio topics and the medical profession. Guest speakers included: Prof. L. H. Montgomery, WA4UDB, Author, Lecturer, Instructor on Electronic Instrumentation, Vanderbilt University, Nashville, Tenn., Rev. Daniel Linehan, S.J., W1HWK, Director Weston Observatory, Weston, Mass., Executive Director, International Mission Radio Association (IMRA), Leo A. Green, M.D., F.A.C.S., K2QLX, and Lewis G. McCoy, W1ICP.

That evening following a reception, an informal dinner was held with over 60 members attending. After dinner, awards were presented to outgoing President Sam Samuel-

[Continued on page 98]

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14.060	1900 GMT	Daily	CW

From Western parts of North and South America to Aleutian Islands, Japan, Australia and Western Pacific areas:*

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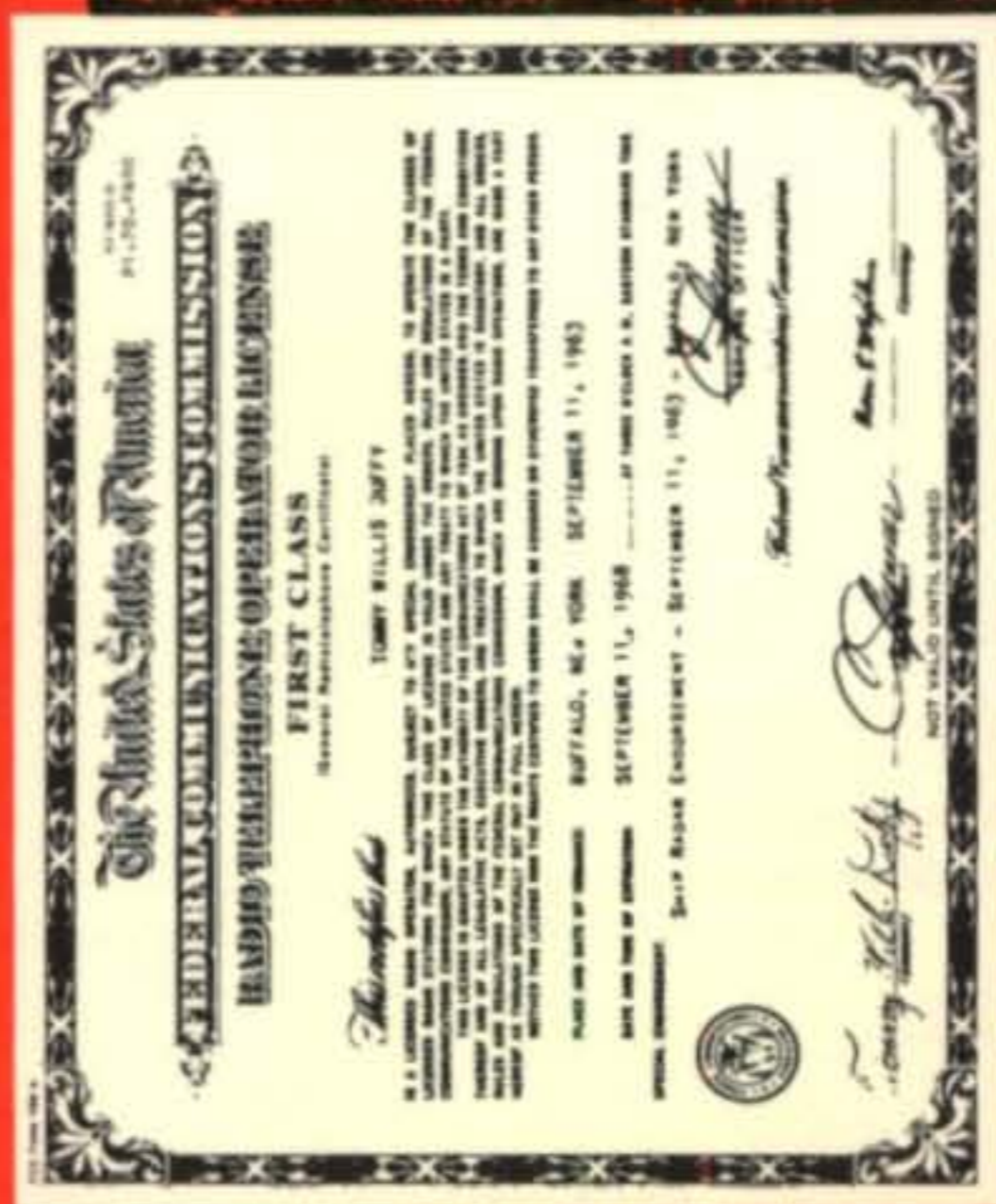
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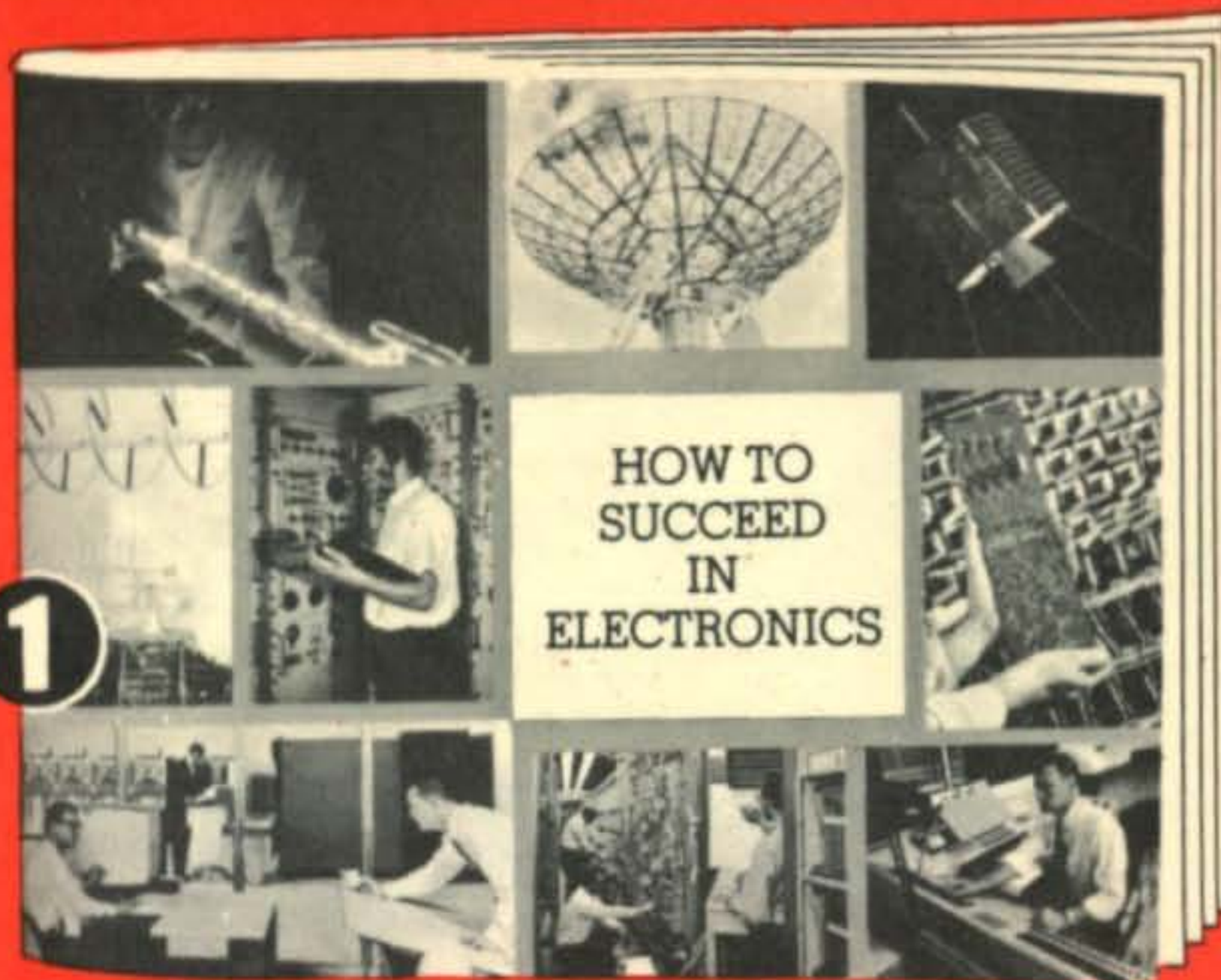
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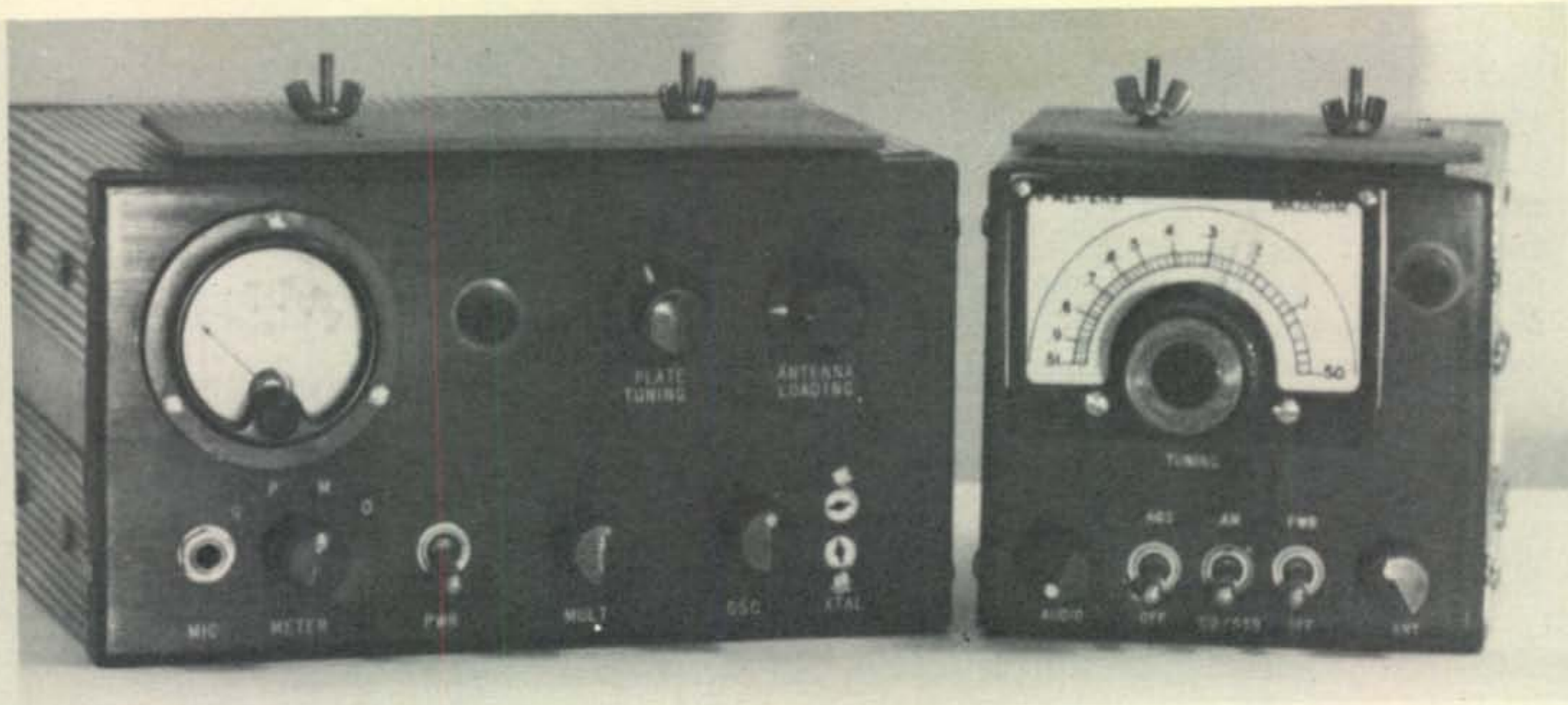
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BUILD A COMPLETE 6 METER STATION

BY IRWIN MATH,* WA2NDM

Part I

It is unfortunate in this technological age, that many of the newcomers (or for that matter, quite a few old timers) to amateur radio invariably buy their entire station from the transmitter down to the prepared patch cables. Very little construction is ever contemplated and quite a few amateurs have never even seen the inside of their equipment! Since the true amateur operator is as much an experimenter as rag-chewer, it is mandatory that he at least have some knowledge of what is behind the panel, and, the best way to obtain this knowledge is from the actual construction of something. The following article is directed to the ham with a bit of technical background (at least enough to pass the FCC exam.) and a desire to not only build a high quality v.h.f. amateur radio station, but to learn as he builds. The 6 meter station to be described may be used for mobile or fixed station operation. In all cases, straightforward design has been used and

each stage has been explained fully, with mathematics and heavy theory kept to an absolute minimum. Other than the components called for, the only additional electrical equipment necessary will be a soldering iron, v.o.m. or v.t.v.m. and a calibrated signal generator of the type used for radio alignment. With these in hand, we can get started.

Power Supply

The transmitter and receiver will require a heater supply of approximately 12 volts a.c. or d.c. at 3 amps (maximum) and a high voltage supply of 300 v.d.c. at 200 ma. Figure 1 is a schematic of the a.c. power supply for fixed station use. A simple full wave rectifier supply is used with C_1 , L_1 , and C_2 forming a pi-type ripple filter and R_1 acting as a bleeder resistor to discharge the capacitors when the a.c. power is removed. Silicon diodes are used for efficiency and then are protected against starting surges by two 10 ohm-1 watt resistors. Connections to the transmitter and receiver are made through

*162-01 Powells Cove Boulevard, Beechhurst, New York 11357.

Fig. 1—Circuit of the complete a.c. supply for fixed station operation. Be sure that the 5 volt and 6.3 volt windings of the power transformer are phased so that the output across them is approximately 12 volts not 1 volt.

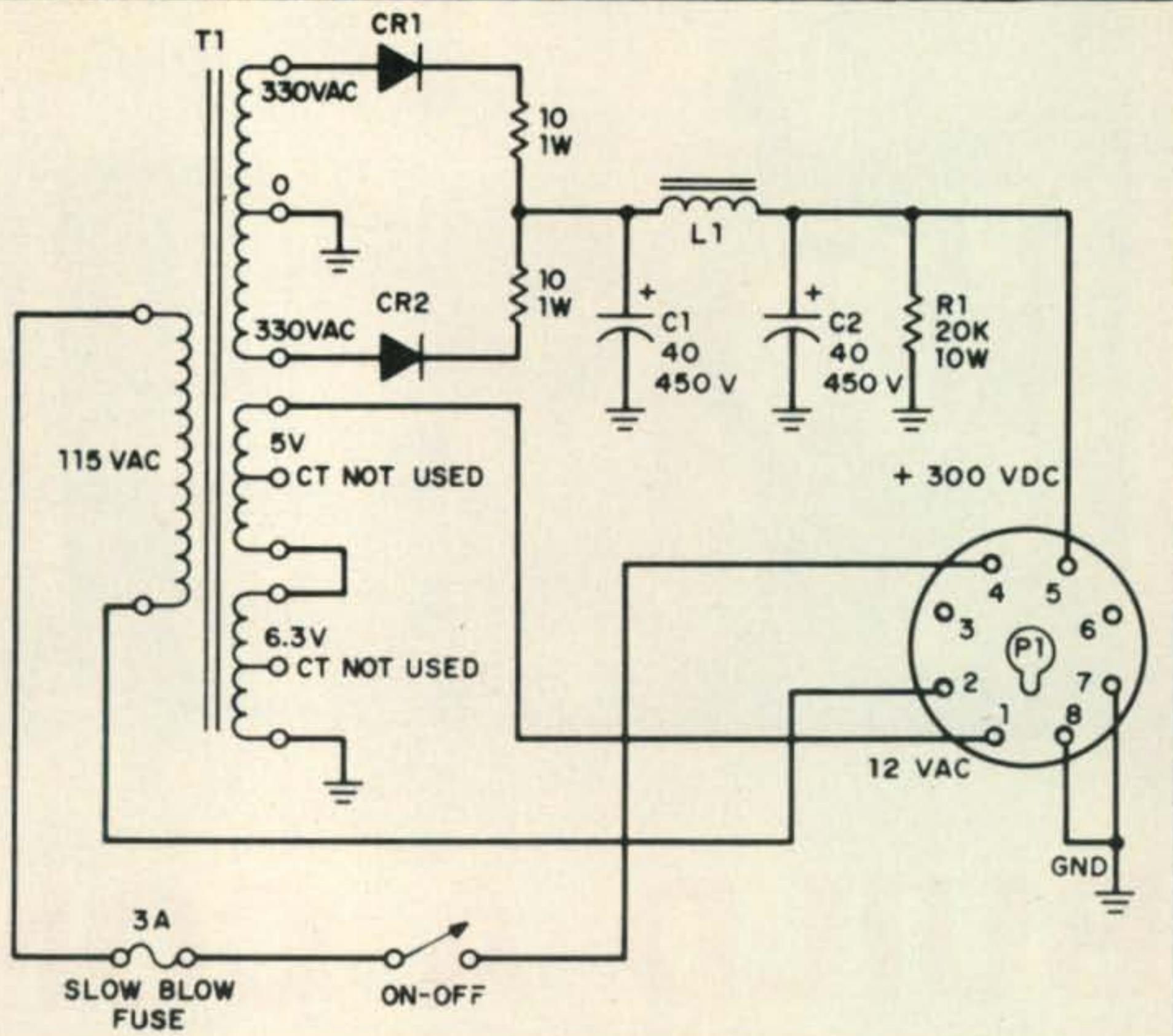
CR₁, CR₂—1N2864A silicon diodes.

C₁, C₂—Dual 40 mf, 450 v, electrolytic capacitor.

L₁—1.5h filter choke Stencor C-2327 or equiv.

P₁—Octal male chassis mounted plug. Amphenol 8PB or equiv.

T₁—Power transformer. Stancor P-5059 or equiv.



standard octal plugs and sockets. All schematics show the connections to be used for both the fixed station and the mobile modes of operation.

Figure 2 is a schematic of the d.c. supply for mobile use. This circuit is a conventional d.c. to d.c. converter. The basic principle of

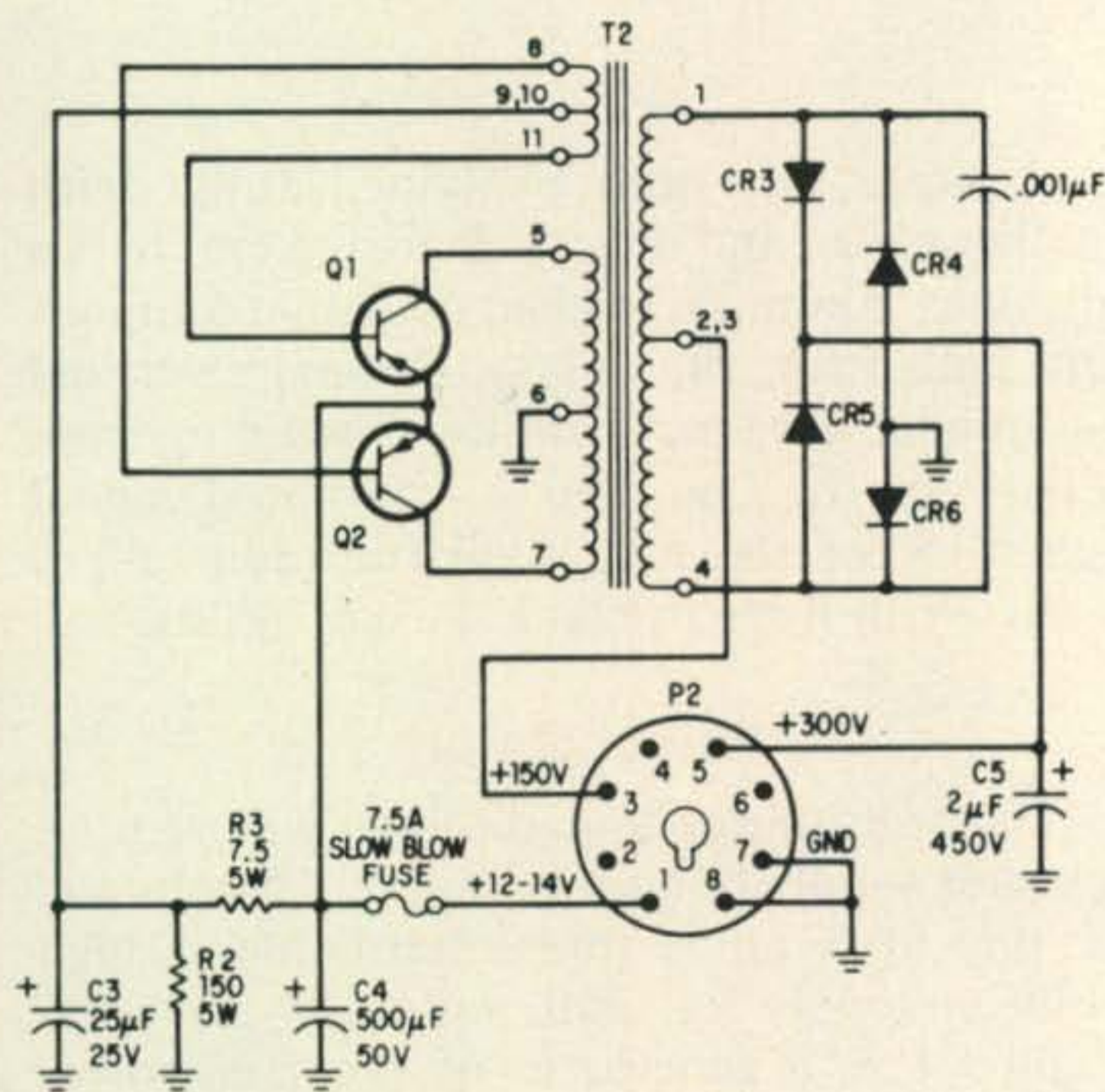


Fig. 2—Mobile d.c. power supply circuit.

CR₁, CR₂, CR₃, CR₄—1N3255 diodes.

P₂—Octal male chassis mount plug. Amphenol 8PB or equiv.

Q₁, Q₂—2N174 transistors mounted on heat sink, Delco #7270725 or equiv.

T₂—D.c. to d.c. converter transformer, Triad TV-79 or equiv.

operation is shown in fig. 3. The switch, S₁, constantly switches the 12 volt input to alternate sides of the primary winding of the power transformer producing an alternating current in the primary. This current is then stepped up in the secondary winding and rectified to produce the required d.c. In the actual circuit, Q₁ and Q₂ take the place of the switch, and are alternately turned on and off by the current fed back in a special winding on the transformer. Components R², R³ and C₃ bias the transistors in the proper area for this type of operation while C₄ filters the input line. The stepped up high voltage is rectified by a standard full-wave bridge circuit and filtered by C₅. Since the frequency of operation is about 1 kc, 2 mf is more than adequate for filtering. Capacitor C₆ is used to absorb any extremely high voltage, fast rise time, pulses that may be produced and consequently damage either the diodes or transistors. Figure 4 is a photograph of the mobile supply showing the placement of the heat sink, connector and the method used for mounting to the car's frame.

The two supplies are both built in commercially available housings, the details and modifications of which are left to the constructor. The layout of components is not at all critical and it is permissible to deviate widely from that shown in the photographs. Since the housings are made of aluminum, they can easily be worked with simple hand tools and a portable electric drill. One handy addition however, is a set of chassis punches.

These will greatly simplify the fabrication of the tube socket holes.

Certain precautions are necessary when building either of the two supplies. Be sure all holes in the chassis that will be carrying leads (*i.e.* the transistor leads on the mobile supply and the a.c. line on the fixed station version) be fitted with rubber grommets. It is also wise to be sure that all connecting wires are securely wrapped around lugs, terminals, etc., and that *mechanical strength* holds the wires in place, not just solder. Number 14 or 16 insulated wire should be used to wire the mobile supply but number 18 can be used in the a.c. supply if so desired.

After construction is finished, both supplies should be examined to make sure that no wrong connections or poor solder joints exist. When the builder is sure that everything is correct, final testing can begin. For the a.c. supply, it is only necessary to connect an a.c. line cord from pins 2 and 4 of the octal plug to the a.c. line and with the v.o.m., check for the presence of approximately 350 v.d.c. between pin 5 of the octal plug and ground, and 12 v.a.c. between pin 1 and ground.

Testing the mobile supply is somewhat more involved. Pin 1 of the octal plug on this supply should be connected to the positive terminal of an automobile storage battery (or other source of 12 v.d.c. at 6 amperes or more) and pin 8 to ground. This will produce a high pitched whistle from the supply and about 320 volts d.c. between pin 5 and 7 of the connector. Pin 3 should at this time also, exhibit a voltage of approximately 160 v.d.c. It is of the utmost importance that the proper polarities be observed when connecting the d.c. supply to the automobile battery. A wrong connection, and the transistors may be permanently damaged. Once the supplies have been tested and are in good working order, construction can begin on the receiver.

Receiver

The 6 meter receiver to be described, while not the ultimate in design, is a good selective and sensitive receiver, and will in most cases equal or outperform many commercially available units of the same general complexity. Figure 5 is a block diagram of the complete receiver. The 6AK5 and 6J6 form a sensitive 6 meter "front end" and the remainder of the circuit functions as a tunable i.f. amplifier covering a range of 550 kc

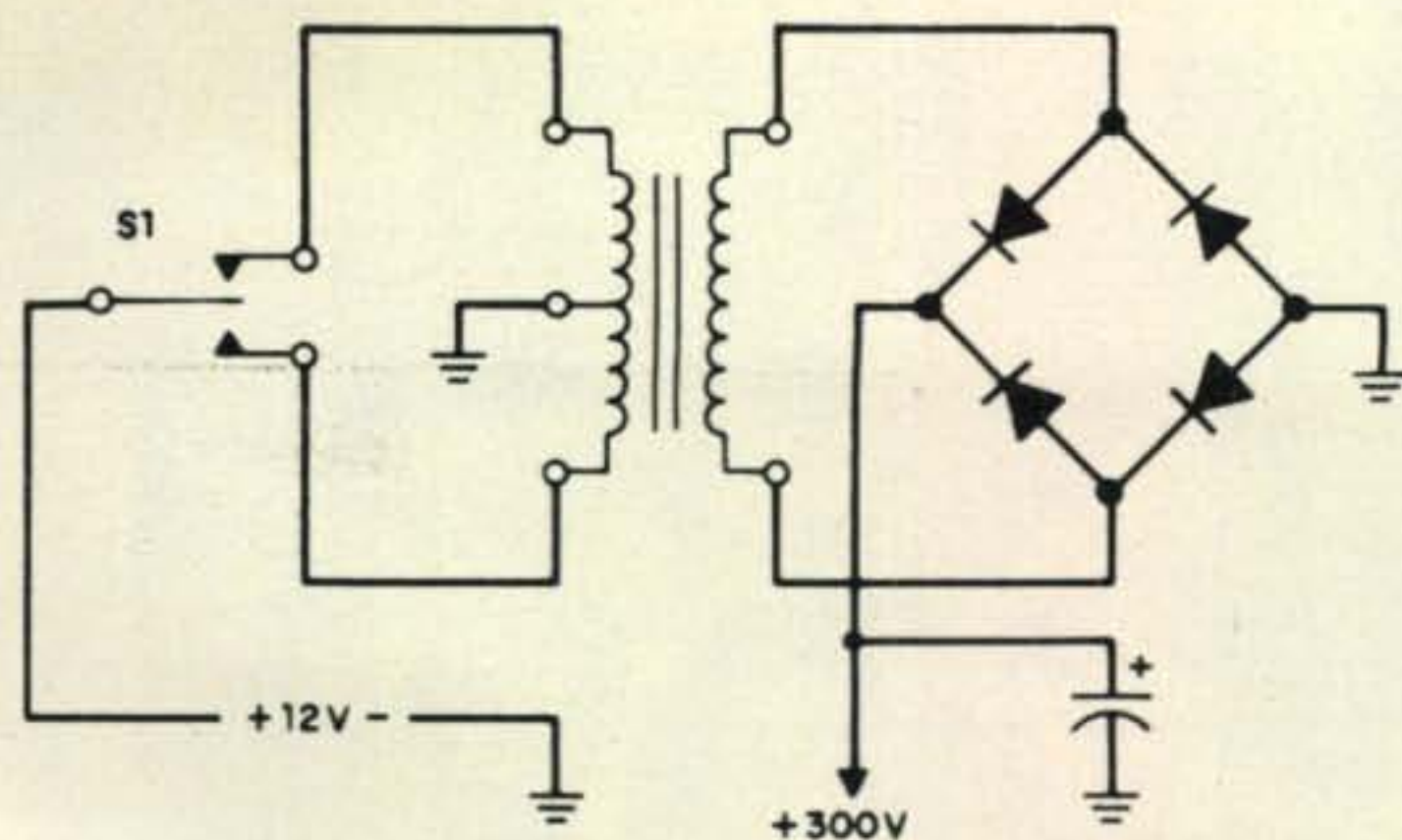


Fig. 3—Basic d.c. to d.c. converter circuit illustrating the principle of operation.

to 1.5 mc. This produces an overall receiving range of from 50.05 mc to 51.1 mc, the most often used portion of the 6 meter band. Other 1 mc segments of the band can be covered by the choice of other i.f. ranges but for simplicity, we will consider only the range mentioned.

The procedure used for building this receiver will be to work backwards from the speaker to the antenna input, wiring and testing "as we go" so that not only can each stage be completely tested, but the builder can see the true nature of the stage. The power supplies previously constructed will be used to supply the proper voltages in the various stages of the receiver, thereby providing the exact voltages the receiver will finally see. Figure 6 is a complete schematic of the tunable i.f. portion of the receiver and the photos show the top and bottom views of the receiver chassis.

Fabricate the chassis and mount all tube



Fig. 4—View of the mobile supply mounted in the car shows location of the two switching transistors on the sink and of the power cable and fuse.



Front view of the 6 meter receiver. The controls are, from left to right, A. F. Gain, A.G.C. On/Off, AM-SSB, Pwr-Off and Ant.

sockets, front panel controls, and the variable capacitor as shown in the layout of fig. 7. As in the power supply discussion, exact details are omitted because the particular size of the components available will probably vary considerably. It is simply recommended that the photos be followed closely.

With the chassis punched, the major components such as tube sockets, switches, terminal strips and shield should be mounted. If the unit is going to be used for mobile operation, lockwashers should be used under all of the nuts. For fixed station use these are not essential but it is good practice to use them at any rate.

At this point it will be helpful to wire all of the heaters and the pilot lamp as per the schematic. Actual construction will start with the audio output stage.

Begin by wiring V_7 and all of its associated components. This stage is simply an audio power amplifier. A 0.001 mf capacitor in the plate circuit acts as a low pass filter and attenuates very high frequency audio signals. It also lowers the overall response to pulse type noise somewhat. When wired, a 6AQ5 and 6FM8 should be plugged into their respective sockets and heater power applied. (The 6FM8 is necessary as the two heaters are in series with each other, across the 12 v. line.)

Testing

To test this portion of the circuit, power must be applied. In order to do this a cable must be connected between the receiver chassis and the fixed or mobile supply, as desired. Both cables are shown in fig. 8. The cables should be made with #12 wires used for wiring pins 1 and 8 of the cables and #16 wire for pin #5. Leave the pin 5 connection temporarily disconnected at the receiving plug and apply power from the 12 v.d.c. or 117 v.a.c. source, as directed. Connect the d.c. at pin 5 when B plus is needed for testing. When the testing is completed permanent connection can be made at this point.

The pilot lamp should light, as should the heaters of V_7 and V_5 . Now B plus can be applied. No sound should be produced by the speaker. Touching the control grid pin 1 or 7 and only the control grid of V_7 with a metal screwdriver should now produce an audible buzz from the speaker if all is functioning

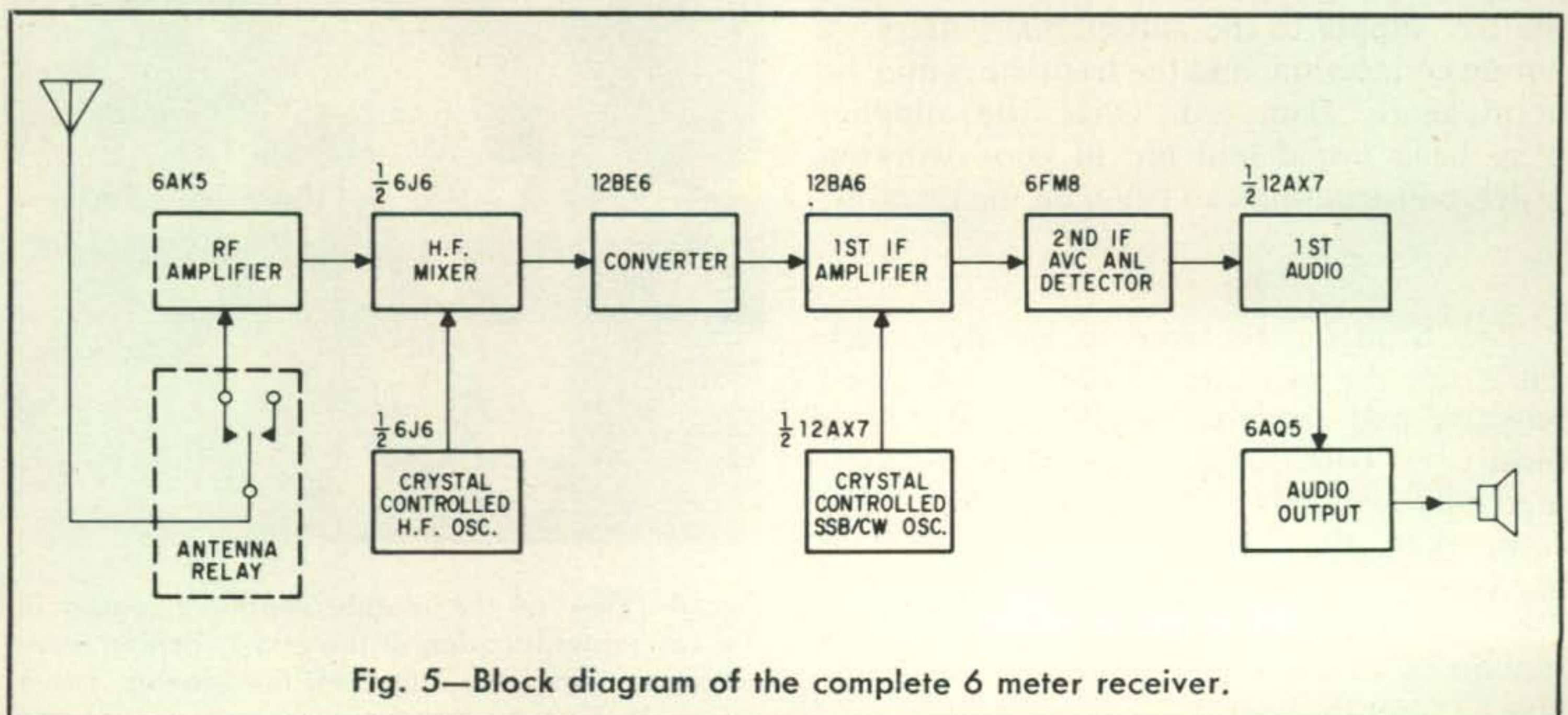


Fig. 5—Block diagram of the complete 6 meter receiver.

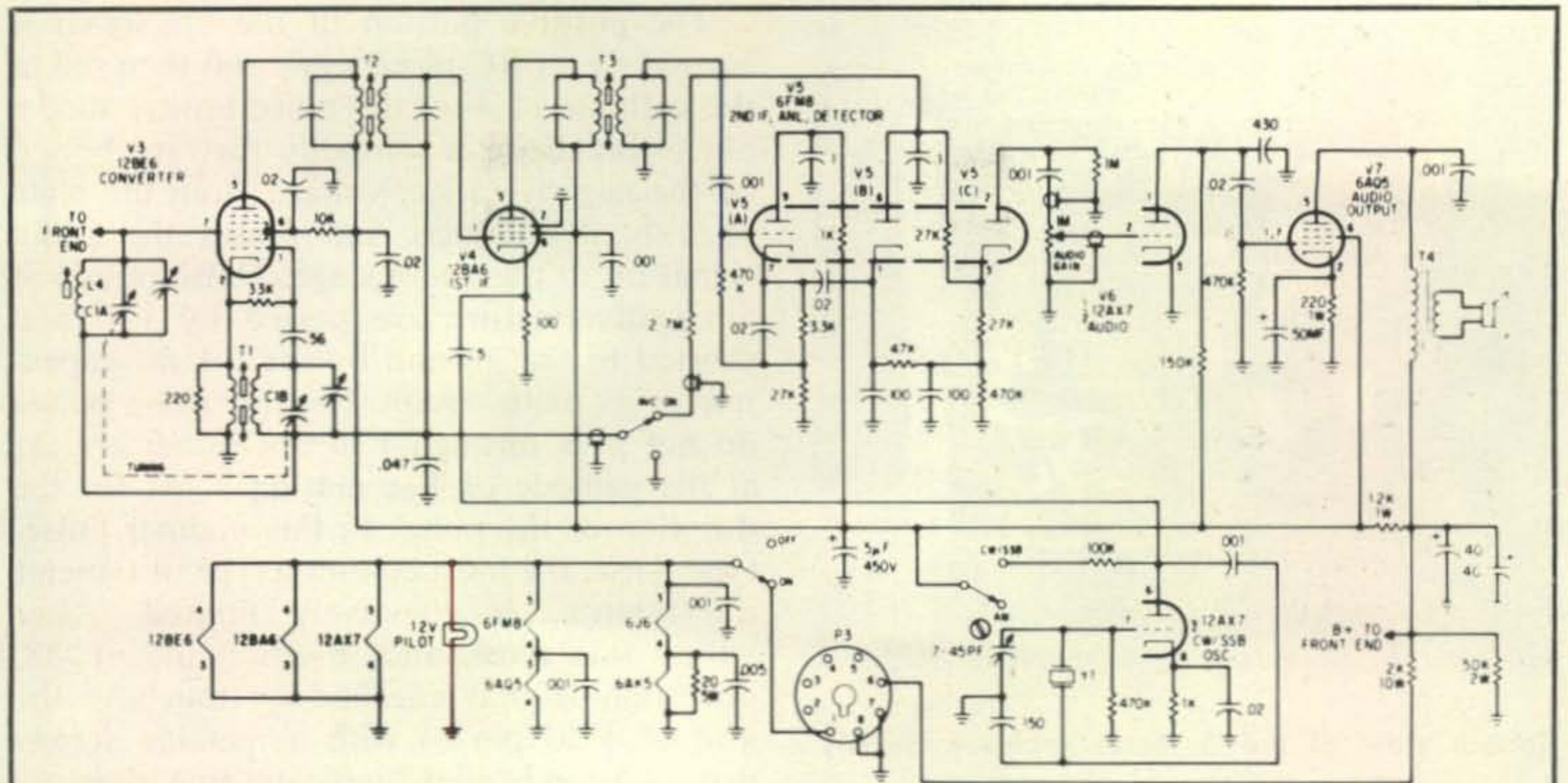


Fig. 6—Circuit of the tunable r.f. portion of the receiver which covers from 550 to 1500 kc. All resistors are 1/2 watt except where otherwise noted. Capacitors with values of one or more are in mmf and those with values of less than one are in mf except where otherwise noted.

- C₁, C₂—2 gang broadcast tuning capacitor 10-175 mmf and 15-435 mmf.
- L₄—Loopstick coil, such as Meissner type 14-9015.
- P₃—Male octal chassis mount plug. Amphenol 8PB or equiv.
- T₁—Oscillator coil, Miller #7 1 OSC or equiv.

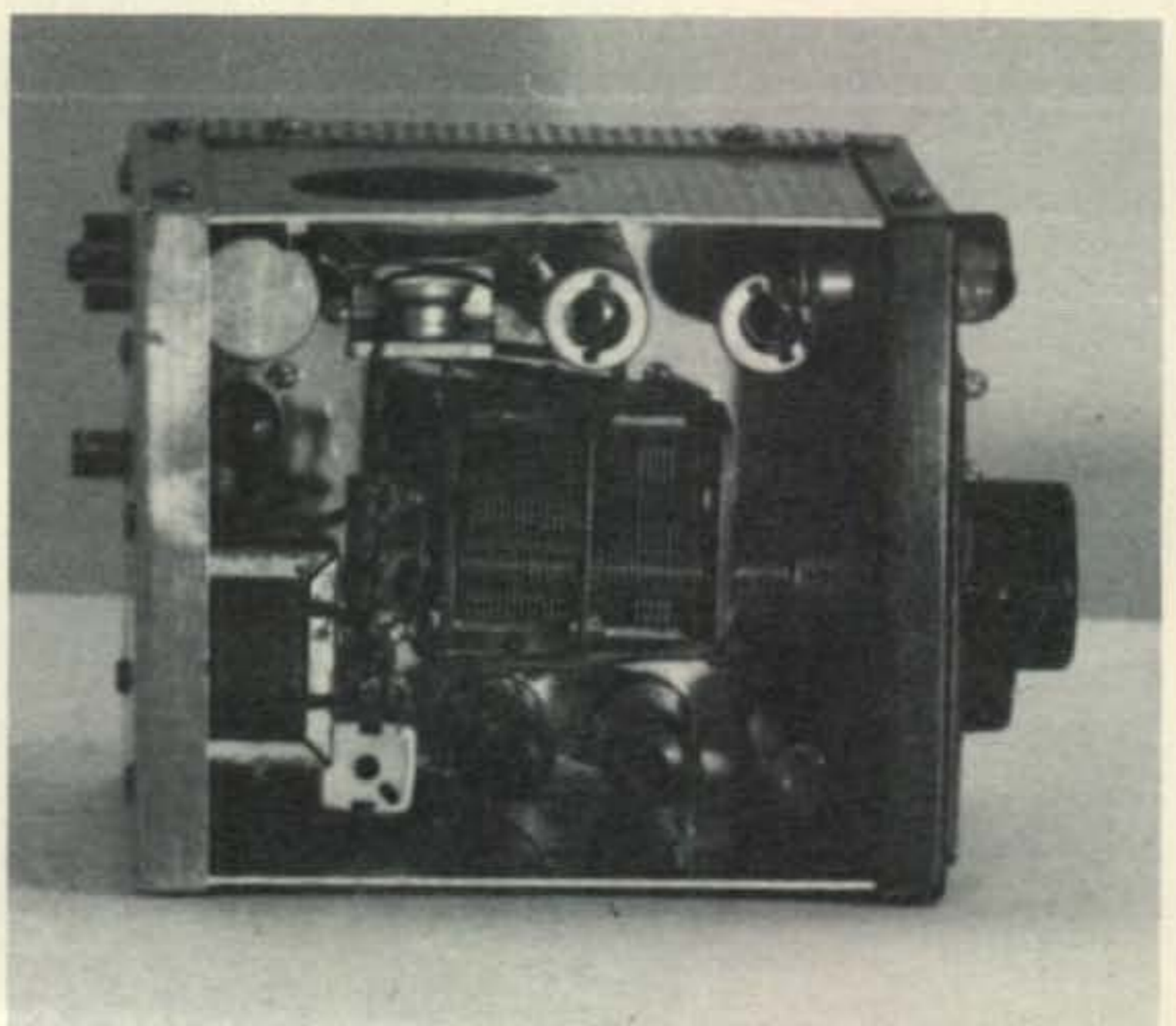
- T₂—455 kc input i.f. transformer. Miller 12C1 or equiv.
- T₃—455 kc output i.f. transformer. Miller 12C2 or equiv.
- T₄—Output transformer 4K/3.5 ohms, 3 w. Stancor A3328 or equiv.
- Y₁—455 kc crystal.

properly. When this is achieved, power should be removed and V₆ wired.

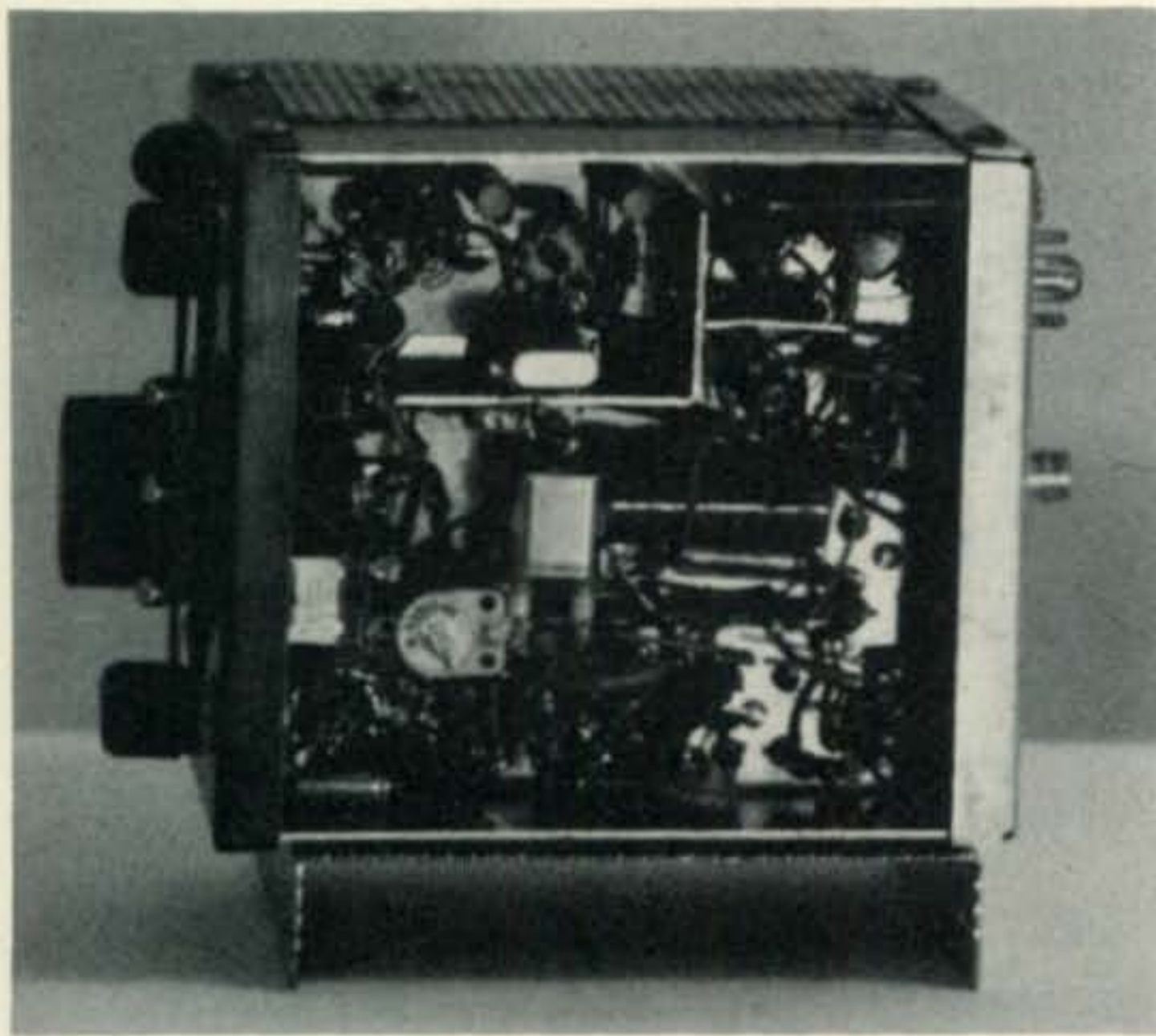
One half of V₆ acts as an audio amplifier and the other half, a 455 kc crystal controlled oscillator. The audio amplifier raises the level of the output from the detector to a value that is sufficient to drive the output stage to full undistorted output (about 2 watts in this circuit). This stage also incorporates some high frequency attenuation with the use of a 430 mmf plate bypass capacitor. When wiring the stage, be sure to use shielded cable to and from the volume control.

The second portion of the 12AX7 acts as a triode oscillator with the crystal connected from plate to grid. The purpose of this oscillator is to supply a carrier when s.s.b. signals are being received, and to provide a frequency for c.w. signals to beat against when they are received. For this purpose a 7-45 mmf trimmer capacitor is used to adjust the oscillator to the exact i.f. frequency. After V₆ is wired, a 12AX7 should be plugged in the socket and heater power

applied. When the heater lights, B plus can be applied. Now, by setting the volume control to maximum volume, a background hiss should be heard. Touching the hot end of the volume control with the screwdriver should



Top view of the 6 meter receiver chassis.



Bottom view of the 6 meter receiver chassis.

now produce a very loud buzz which can be varied in intensity by varying the setting of the volume control. Once this is achieved, the audio section of the receiver is operating. The second section of the 12AX7 will be tested later. For now, the A.M./C.W. S.S.B. switch should be left in the A.M. position.

In this receiver, V_5 performs three functions, that of i.f. amplifier, detector and automatic noise limiter. The triode section acts as a conventional cathode follower amplifying the signal from the second i.f. transformer. The gain here is a power gain however rather than a voltage gain. The signal is now fed to the cathode of V_5b and the negative portion appears at the plate. Here it is filtered and used as an a.v.c. voltage for the receiver's front end.

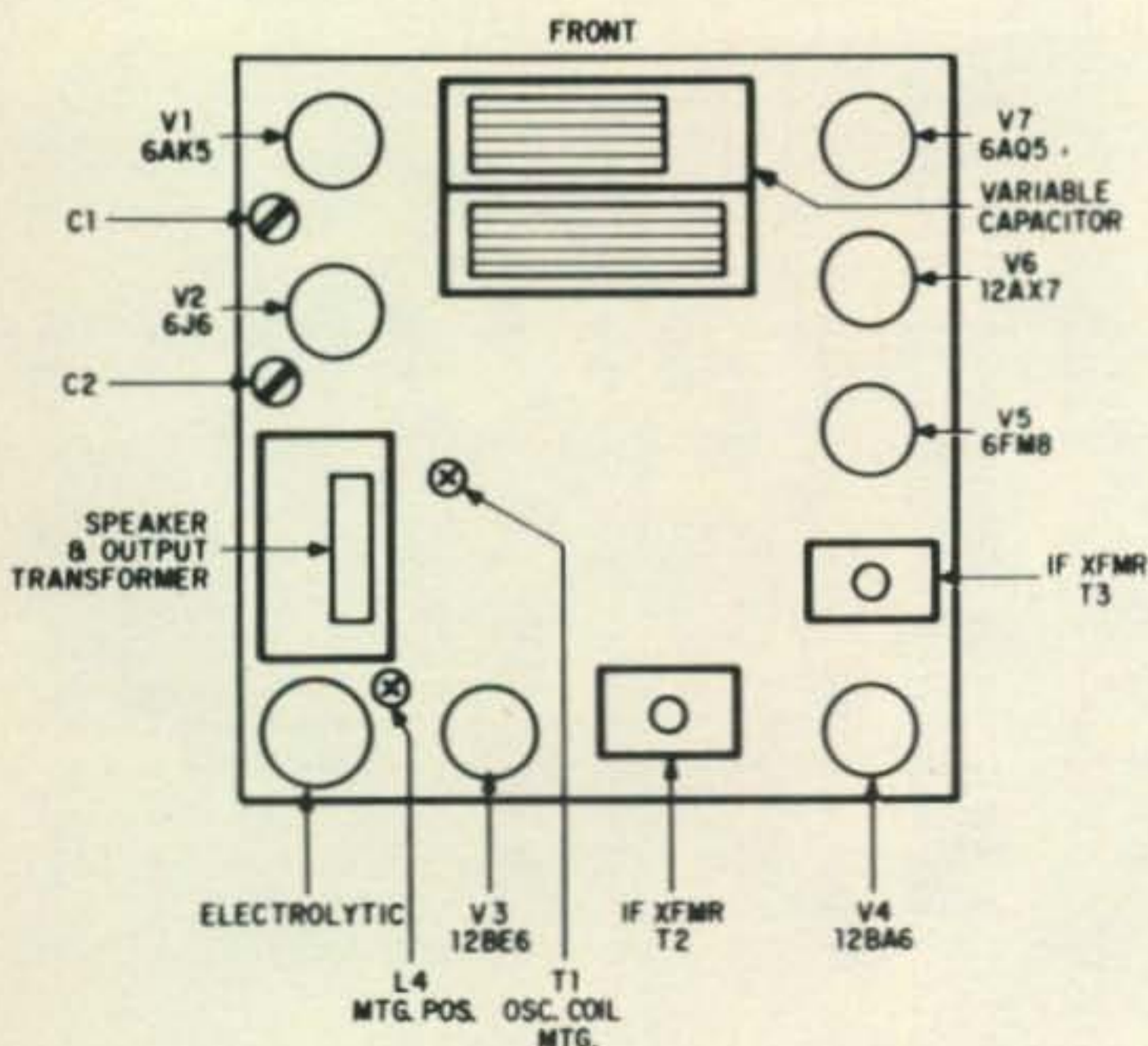


Fig. 7—Layout and major component locations for the 6 meter receiver.

The positive portion of the i.f. signal is filtered by an RC pi-network and then fed to the cathode of V_5c , the noise limiter diode. Since this diode is normally forward biased by the negative a.v.c. voltage from the plate of V_5b , it conducts and passes the audio signal on to the audio stage. Noise pulses of a negative nature are passed by V_5b and shorted to the ground by the 0.1 mf capacitor in its plate circuit. Positive noise pulses do not pass through V_5b but rather appear at the cathode of V_5c cutting it off for the duration of the pulse. In this manner pulse-type noise, the most common type of 6 meter interference, is effectively limited. After wiring this stage, and inserting the 6FM8, operation is best checked by touching the grid of V_5a (pin 8) with a metallic screwdriver. A loud "click" indicates that all is OK.

We now arrive at V_4 , the first i.f. amplifier. This stage is conventional tuned grid-tuned plate amplifier and serves to increase the level of the i.f. signal developed in the converter. An a.v.c. voltage is fed to its grid through T_2 to vary its gain with various

[Continued on page 100]

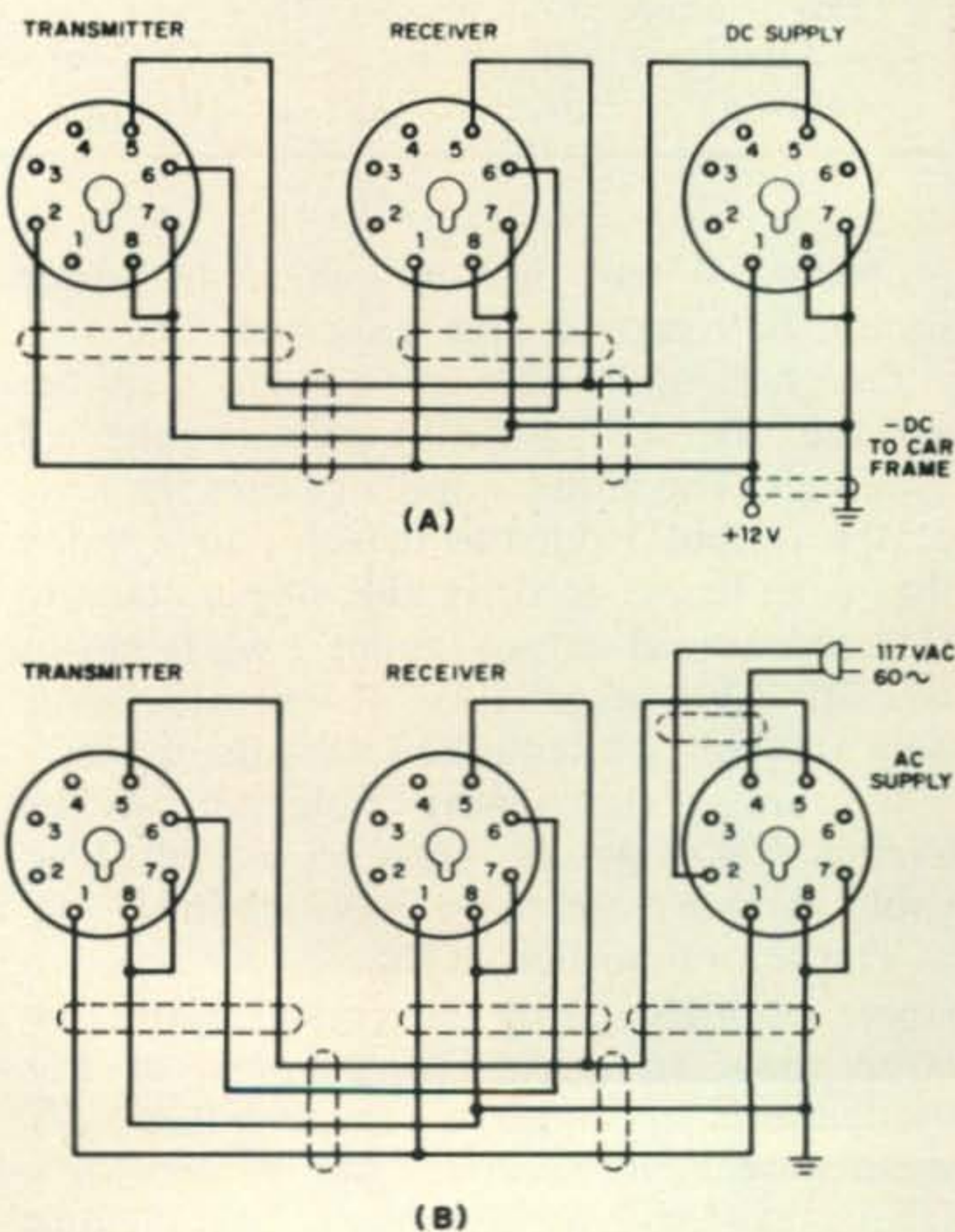


Fig. 8—Circuit of the interconnecting power cables for a.c. (A) or d.c. (B) operation. All connectors are Amphenol female sockets, type 78S8 and Amphenol cover shells, type 3-24, with cable clamps.



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ELECTRICAL					
Forward Gain	10.33db	9.45db	13.45db	14.5db	13.45db
Front-to-Back Ratio (Average)	23db	25db	28db	22db	20db
Front-to-Side Ratio (Average)	40db	35db	40db	30db	30db
Maximum Power (RF)	5 KW	5 KW	5 KW	5 KW	5 KW
VSWR (at resonance)	1.2:1 Max.	1.2:1 Max.	1.2:1 Max.	1.2:1 Max.	1.2:1 Max.
Feedpoint Impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Half-Power Beam Width (E Plane)	53	59	48	42	47.5
Half-Power Beam Width (H Plane)	72	79.5	64	54	60
Frequency Range (Megacycles)	14 to 14.35	7 to 7.3	14 to 14.35	28.0 to 29.7	21.0 to 21.150
Approx. Bandwidth at Resonance (2:1 SWR)	325 KC	225 KC	370 KC	600 KC	600 KC
Polarization	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.
MECHANICAL				18 ft.	24'8"
Longest Element	38 ft.	73.5 ft.	38 ft.	1½ in.	1½ in.
Element Diameter (Largest)	1½ in.	2½ in.	1½ in.	32 ft.	31'10"
Boom Length	31 ft.	46 ft.	46 ft.	3¾ in.	3½ in.
Boom Diameter (Largest)	4½ in.	4 in.	4 in.	17.6 ft.	20.3 ft.
Turning Radius	24.1 ft.	42.2 ft.	29.7 ft.	125 MPH	125 MPH
Maximum Wind Survival (No ice)	125 MPH	125 MPH	125 MPH	224 lbs.	274 lbs.
Wind Load (100 MPH)	360 lbs.	720 lbs.	555 lbs.	5.6	6.9
Total Wind Surface Area (Square Feet)	12.8	23.6	18.1	151 lbs.	151 lbs.
Net Weight (Assembled)	116 lbs.	250 lbs.	185 lbs.	6	5
Total Number of Elements	4	3	5	167 lbs.	167 lbs.
Shipping Weight	160 lbs.	300 lbs.	250 lbs.	7.8 cu. ft.	7.8 cu. ft.
Shipping Volume (Packaged BCP)	8.9 cu. ft.	21.9 cu. ft.	12.5 cu. ft.	2	2
Shipping Cartons	3	4	3		

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RECEIVER SENSITIVITY AND NOISE FIGURE

BY JOHN J. SCHULTZ,* W2EEY

Many amateurs confuse the terms sensitivity and noise figure and believe they are not related. Actually, they are very closely related and one can convert from one term to the other very simply with a nomograph. One can even measure noise-figure with a signal generator, if desired.

SENSITIVITY and Noise Figure still today are, unfortunately, two misused terms by many amateurs. Those working on 80-10 meters speak of "high-sensitivity" and those of us working the v.h.f. bands refer to "low-noise" r.f. amplifiers and converters as though the two terms were completely different and each was the distinct possession of the h.f. or v.h.f. operator. The terms, in fact, express the same information when properly used but the form of expression is different. The same information they convey is, of course, the figure of merit of a converter, r.f. amplifier or entire receiver.

Figure of Merit

This figure of merit or simply an indication of which unit is going to be able to receive the weakest signals best is not always easy to secure, understand or apply. For instance, as far as the usage of term sensitivity is concerned, suppose you were going to buy a receiver or transceiver (considering only the receiver function of the latter) and the following sensitivities were quoted in literature or otherwise told you. Which of the following receivers is the most sensitive? Take a few seconds to consider the problem.

A— $1/2 \mu\text{v.}$ for 6 db $S+N/N$ ratio.

B— $1 \mu\text{v.}$ for 10 db $S+N/N$ ratio.

C— $2 \mu\text{v.}$ for 20 db $S+N/N$ ratio.

D— $1/2 \mu\text{v.}$ ($S+N/N$ ratio unspecified.)

Well, you might have immediately dismissed the last figure (D) because it told you how much signal input was necessary ($1/2$

$\mu\text{v.}$) but told you nothing about how much the output signal of the receiver was above the noise. The amount which the signal at the output of the receiver has to be above the noise to produce an intelligible signal depends upon the type of detection, mode of transmission and even individual factors when c.w. is considered. In some processes of detection the signal, in fact, can be below the noise level by a considerable amount and still be detected although not on a real-time basis. That is, processing of the signal from the noise requires some time and is not instantaneous. These complexities, however, do not concern most amateur receiving applications and the objective is simply to secure the receiver which will provide the best signal to noise ratio output for the least amount of signal input.

What about A, B and C? Well, these figures are really meaningless as they stand, also, because no bandwidth was specified. If the sensitivity was measured with the receiver operating at a very narrow bandwidth, say 500 cycles, little of the noise generated in the front-end of the receiver is amplified by succeeding stages and less signal input is required to produce an output level which has a power a given number of times (or db) greater than that of the noise. If the bandwidth is increased, more noise power appears at the output and clearly more input signal power is necessary to produce the same output signal to noise ratio as before. However, let us assume that A, B, C were measured at the same exact bandwidth; which is now more sensitive? The problem is easily solvable once the db figures are converted to

*1829 Cornelia St., Brooklyn, N.Y. 11227.

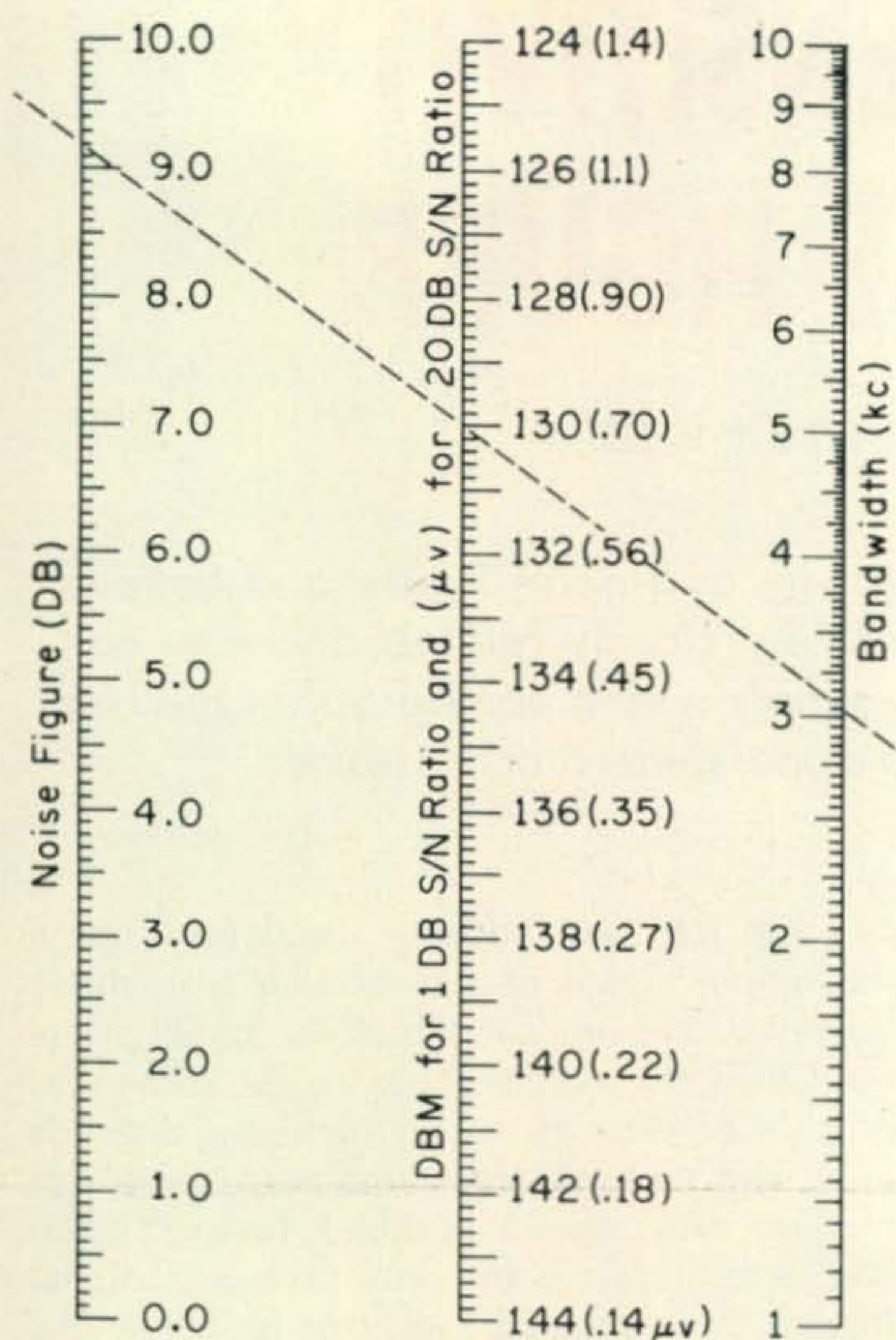


Fig. 1—Noise figure sensitivity comparison nomograph.

their numerical ratios:

A—1/2 μv. for 4 to 1 (6 db) $S+N/N$ ratio.

B—1 μv. for 10 to 1 (10 db) $S+N/N$ ratio.

C—2 μv. for 100 to 1 (20 db) $S+N/N$ ratio.

Since the receiver operates as a linear device to produce power amplification, the input and output powers are proportional. Decreasing the former to half reduces the latter to half. Again, assuming the input resistances of *A*, *B* and *C* are equal, 50 ohms for instance, *A* and *C* can be related to the 1 μv. level of *B*. *C* would then have a 25 to 1 output ratio and *A* a 16 to 1 output ratio. All other things being equal, *C* then would be the more sensitive unit.

Several generally minor points were neglected in the foregoing comparison, such as assuming that $S+N/N$ ratios can always be regarded as being particularly the same as true S/N ratio. However, it was only desired to highlight how difficult it can be to quickly compare the sensitivity figures quoted for various receivers and determine therefrom which receiver is really the most sensitive. Inept or clever advertising writing can make

a VW sound like a Cadillac as much in the radio equipment field as in the automotive field.

Noise Figure

The sensitivity figure certainly does have a useful purpose and the author does not mean to condemn it. If one wanted to calculate the signal strength that a certain transmitter would deliver to a distant point and the type of antenna necessary to receive this signal, knowledge of the sensitivity of a receiving system is useful. However, as a comparative term, sensitivity is unhandy unless everyone expresses sensitivity for the same set of conditions.

Noise figure, on the other hand, is a term that can be used for comparative purposes fairly universally since receiver bandwidth and different signal noise output ratios are not a part of the figure itself. Many manufacturers of more expensive equipment have begun to quote noise-figure in their specifications along with sensitivity for this reason.

The measurement of noise figure has been discussed in previous articles and will not be repeated here. Briefly, however, noise-figure relates the noisiness of an actual receiver to an ideal receiver processing the same input signal. The term can be expressed in various ways including:

$$\text{Noise Figure} = \frac{S/N \text{ power output ratio, ideal receiver.}}{S/N \text{ power output ratio, actual receiver.}}$$

The term is useful because it directly indicates the noisiness of a receiver and noise usually determines the weakest signal that can be received (assuming atmospheric noise is not dominant). Sensitivity indicates how much input signal, once the signal is received, is necessary to produce a certain signal to noise amplitude at the receiver output. It is a measurement that combines the factors of the noisiness and gain of the receiver.

Using a noise generator, noise figure is simply measured by adjusting the generator for twice the receiver noise output compared to receiver output noise alone. The noise figure can then be read from the generator for twice the receiver noise output alone. The noise figure can then be read from the generator or calculated. Bandwidth or receiver gain need not be determined. Noise figures vary from 2 db for sophisticated u.h.f. amplifiers to 30-40 db for broadcast band r.f. stages. The figure is usually expressed in db

because it derives from noise power ratios but it could be just as well expressed as a simple numeric. The noise figure alone doesn't indicate how many microvolts of signal an antenna must apply to achieve reception but it does not indicate the comparative noisiness of different receivers. Gain is easily enough achieved in a receiver but low-noise performance is not.

Measuring NF

Noise figure can be measured using the usual r.f. signal generator in a technique similar to making a sensitivity measurement. The results are not as quickly attained nor are they quite as accurate as those obtained using a noise generator but, unless one is dealing with equipment with noise figures of only several db, the results are still quite useful. The signal generator and receiver input impedances should match for best results. The generator is connected to the receiver input and an output meter connected across the receiver output. The receiver a.v.c. and noise limiter circuits are disabled. The gain controls are set for a convenient noise power output with the signal generator off. The generator is then turned on, its frequency carefully rocked back and forth until it is in the center of the receiver response, and then its output increased until the output indicator on the receiver indicates twice the power level previously noted (1.4 times the voltage on an AC voltmeter or 3 db increase on a db meter). The noise figure is then calculated from:

$$NF \text{ db} = 10 \log_{10} \frac{E_{gen}^2}{R_{gen} KTB}$$

where K = Boltzmann's constant.
 T = Temperature in degrees Kelvin.
 B = Receiver bandwidth in c.p.s.

Generally, a reference temperature of 290° K (62.6F) is used and the term KT has the value 4×10^{-21} . Extremely small values of signal generator voltage are involved as the noise figure becomes small and a 20 db pad is usually necessary between the generator and receiver so the generator can be set to a value which can be easily read on its output meter. The measurement is the same as obtaining the input signal necessary when making a sensitivity measurement for a 3 db $S+N/N$ ratio.

Nomographs, such as that in figure 1, are available in various reference books which relate noise figure to sensitivity. Figure 1 is

Noise figure in db for 3 db $S+N/N$ ratio.			
$\mu\text{v. across } 50 \Omega$	Bandwidth		
	10 kc	3 kc	1 kc
2	33	38	42.5
1	27	32	36.5
1/2	20.5	26	30.5
1/4	15	20	24.5
1/10	7	11.5	16.0
120	2	6.0	10.5
1/30	—	2.5	7.0

Correction factor to be added to above noise figures for different $S+N/N$ ratios.	
$S+N/N$ Ratio	Correction
3 db	0
6 db	5.0
9 db	7.5
10 db	9.5
15 db	14.8
20 db	20.0

Fig. 2—Sensitivity noise-factor comparison table. If room temperature is not between 68-80°F table should not be used for noise figures below 5 db.

valid only for 50 ohm input impedance receivers. A straight line is drawn through, connecting the known quantities to obtain the unknown one. For instance, a receiver which shows a 0.7 microvolt sensitivity for a 20 db S/N ratio at 3.1 kc. bandwidth has a noise figure of 9.2 db. The dbm scale uses a reference of 1 milliwatt into 50 ohms and is frequently used commercially instead of microvolts to express sensitivity.

Figure 2 is a useful table which can either be employed to find the noise figure when one has measured sensitivity or to find the sensitivity from the noise figure. Basically, in table form, it presents the same information as fig. 1.

If, for instance, sensitivities of 1/4 $\mu\text{v.}$ for 15 db $S+N/N$ at 1 kc bandwidth for one receiver and 1 $\mu\text{v.}$ for 10 db $S+N/N$ at 10 kc bandwidth were quoted what are the receiver noise figures? From fig. 2, 1/4 $\mu\text{v.}$ at 1 kc gives a 24.5 db noise figure at 3 db $S+N/N$ ratio. Subtracting the 14.8 correction for 15 db $S+N/N$ ratio gives a noise figure of 17.5 db for the second receiver. The second receiver is quite a bit noisier but it would be pretty difficult to discern this from the sensitivity figures alone. ■

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Illustrated: Tristao MM-35 "Mini-Mast"

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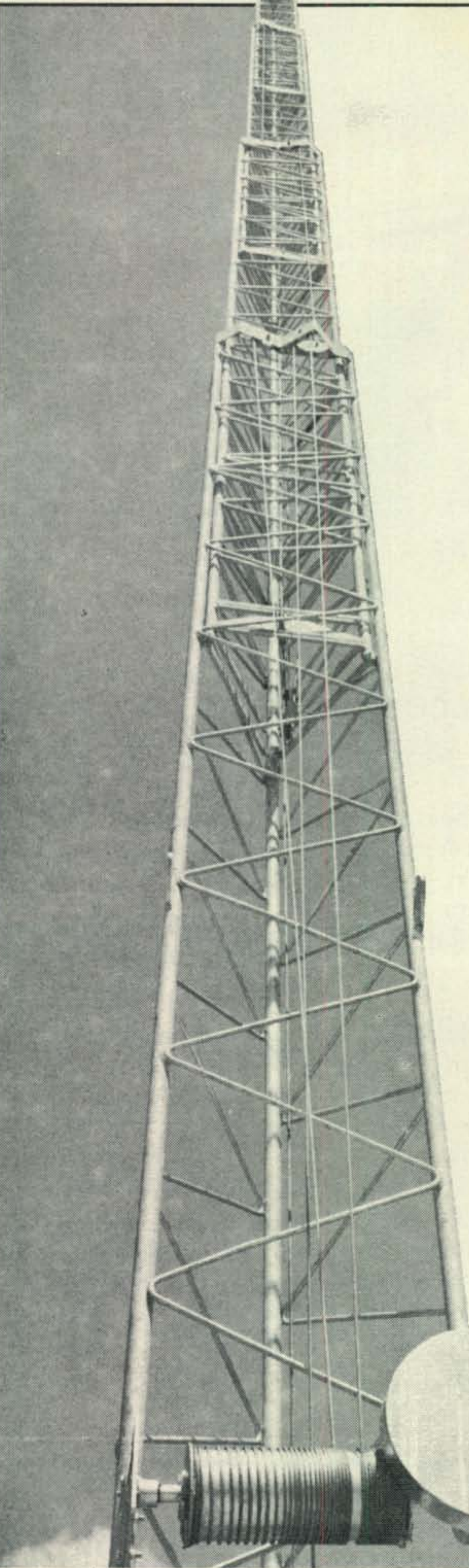
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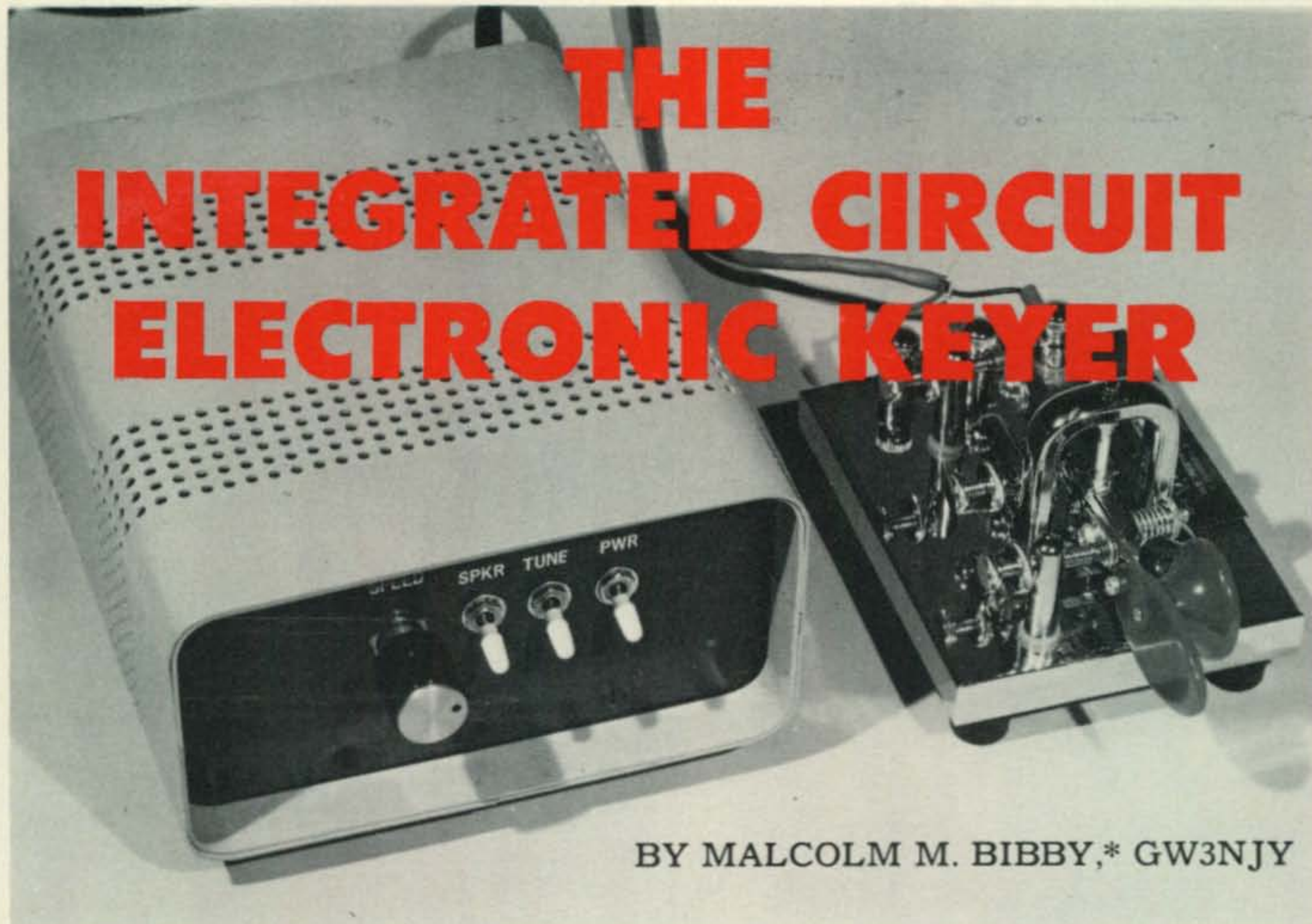
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THE INTEGRATED CIRCUIT ELECTRONIC KEYS



BY MALCOLM M. BIBBY,* GW3NJY

WHEN the circuit of an electronic keying unit, by W2VYO appeared incorporating dot memory, the unit was quickly constructed and has given good service since. With the recent advances in the state of the art, however, the design is now obsolete, and the appearance of the Micro-TO-Keyer in *QST*² stirred the author to start on better things. When the article by W1WCG on the ICKEY appeared in *QST*³ the author had already

bread-boarded his design and although dot and dash memories are incorporated as in the ICKEY, there are some worthwhile differences in design approach which bear consideration.

Digital Logic Reviewed

Table 1 shows the truth table for the four different types of two input gates and their associated Boolean algebra expressions.

Conventionally, state '1' signifies the higher potential of two possible potentials and the state '0' represents the lower value. The table shows the outputs to be expected for all possible input combinations. Thus for an OR gate we see that we have a '1' on the output

*2748 Juno Place, Akron, Ohio 44313.

¹Muir, D., "The Penultimate Electronic Key," *QST*, March 1962, p. 15.

²Opal, C., "The Micro-TO Keyer," *QST*, August 1967, p. 17.

³Van Cleef, F., "ICKEY," *QST*, November 1968, p. 28.

INPUT		OR	AND	NOR	NAND
A	B	A+B	A·B	$\overline{A+B}$	$\overline{A \cdot B}$
0	0	0	0	1	1
1	0	1	0	0	1
0	1	1	0	0	1
1	1	1	1	0	0

Table I—Truth tables for four different types of two input gates.

IN-PUT	OUT-PUT	
	0	1
0	AND	NAND
1	NOR	OR

IN-PUT	OUT-PUT	
	0	1
0	OR	NOR
1	NAND	AND

Table II—OR gate functions and AND gate functions.

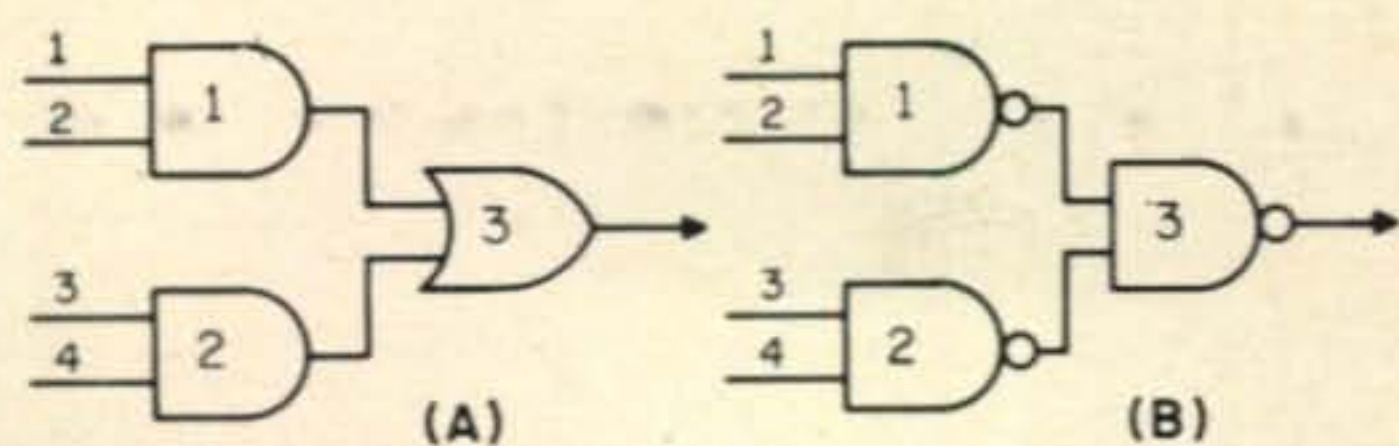


Fig. 1(A)—AND-OR circuit made up of two AND gates (1 and 2) and an OR gate (3). The same circuit function can be had from 3 NAND gates shown in (B) above.

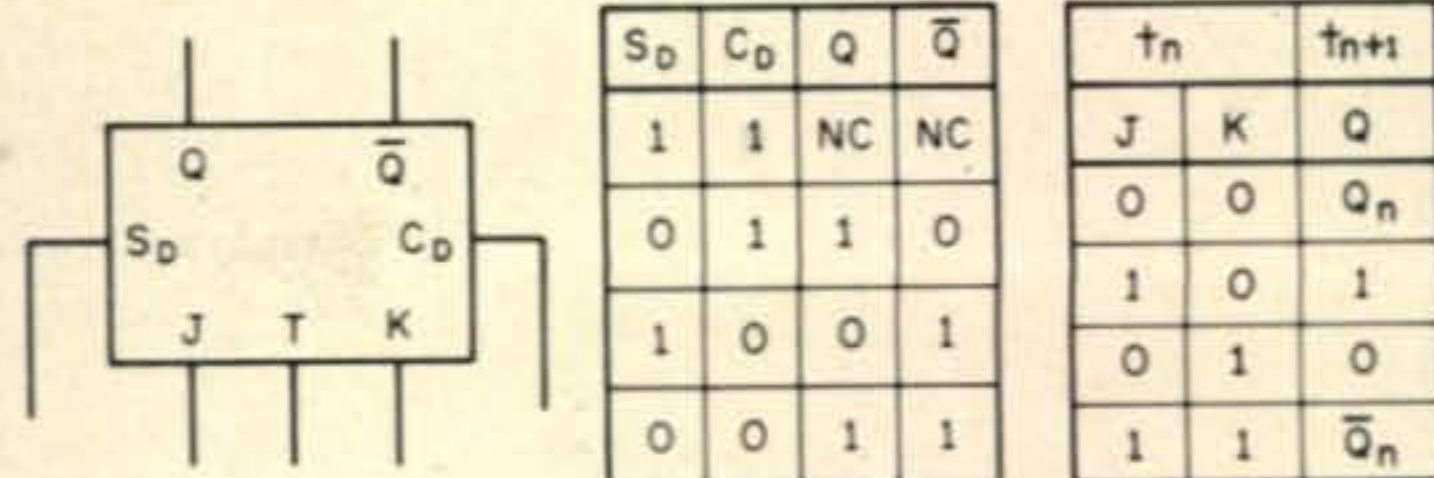


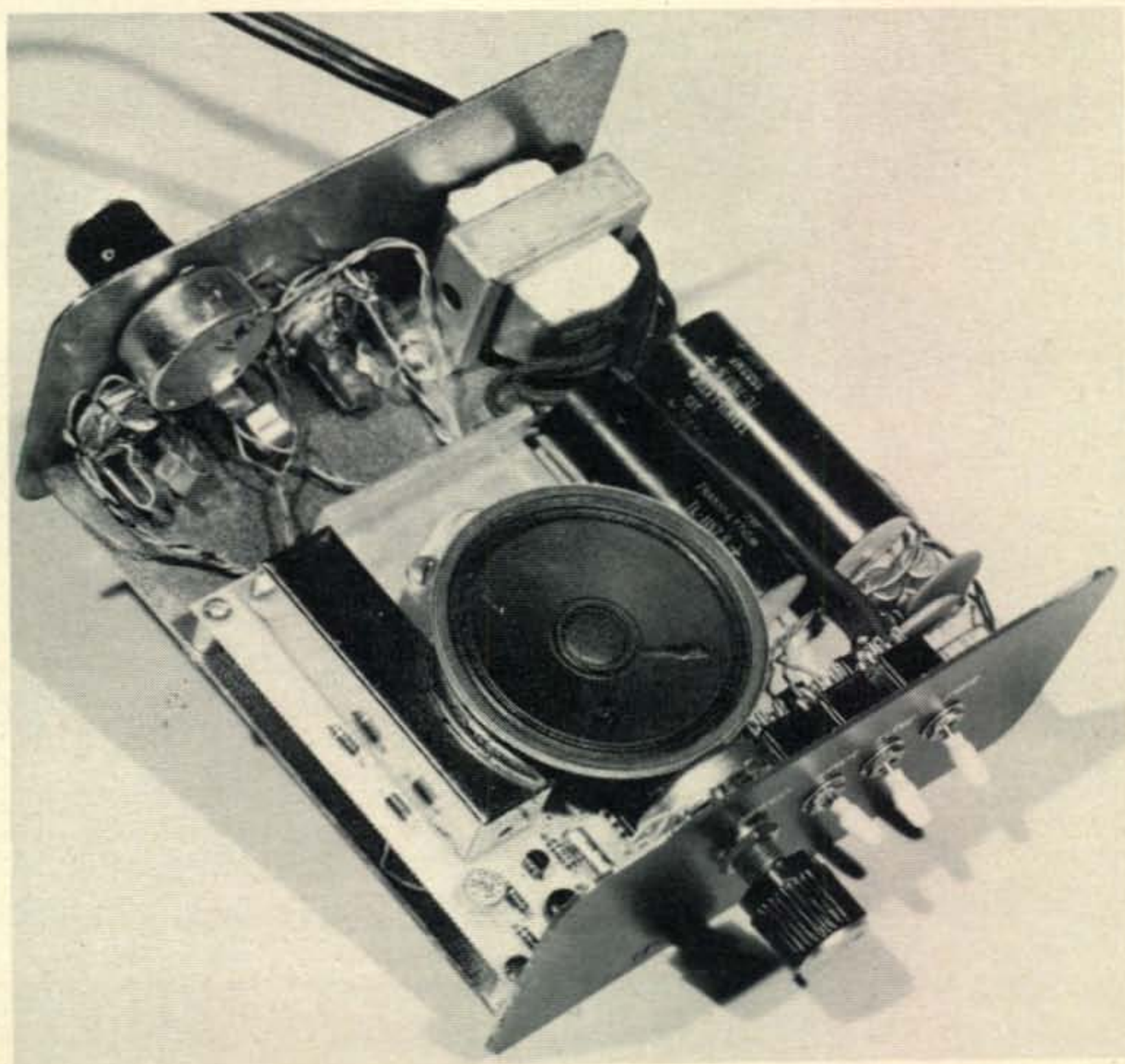
Fig. 2—The normal form of presentation for a J-K flip-flop and its associated truth tables. For the truth table above, t_n = time after the n^{th} clock pulse and t_{n+1} = time after the $(n+1)^{\text{th}}$ clock pulse.

for all input combinations except when both are '0.' For an AND gate, however, we have a '1' on the output only when we have ones on both the inputs. We can look at these gates from another point of view by observing that the OR gate only has an '0' on the output when both inputs are at '0' and the AND gate has '0' on the output for all input conditions except when both are '1.' Here we can see that by reversing the roles of the '1' and the '0' we have also reversed the functions of the gates. A gate which acts as an OR gate for '1' (with a '1' output) and a gate which acts as an AND gate for '1's input (and a '1' output) also acts as an OR gate for '0's (with a '0' on the output).

So far, we have discussed only two types of gates but by introducing an inverter after

these gates we obtain two further gates, namely, the NOR and NAND gates. When first introduced to the subject of digital logic, it is convenient to think only in terms of '1's but to obtain the maximum versatility from digital logic, it is essential to think of operation with both '1's and '0's. By using both the concepts of '1' and '0' known as positive and negative logic, it is possible to accomplish the same function by more than one method. To illustrate, consider the circuits shown in fig. 1A and fig. 1B. Both circuits perform the same function, namely, when either both inputs 1 and 2 or both inputs 3 and 4 are high, then a high output is obtained from gate three. This is a useful AND-OR circuit used in digital systems for multiplexing or channel switching. The circuit of fig. 1B does exactly

Internal view of the GW3-NJY keyer using IC logic. The pulse generator is situated in the lower left corner, the 5 I.C.'s are almost hidden under the speed control and switches. The audio oscillator is at the front right-hand corner. The speaker is glued onto an empty space on the vector board. The pot at the rear is a 100 ohm volume control in series with the speaker.



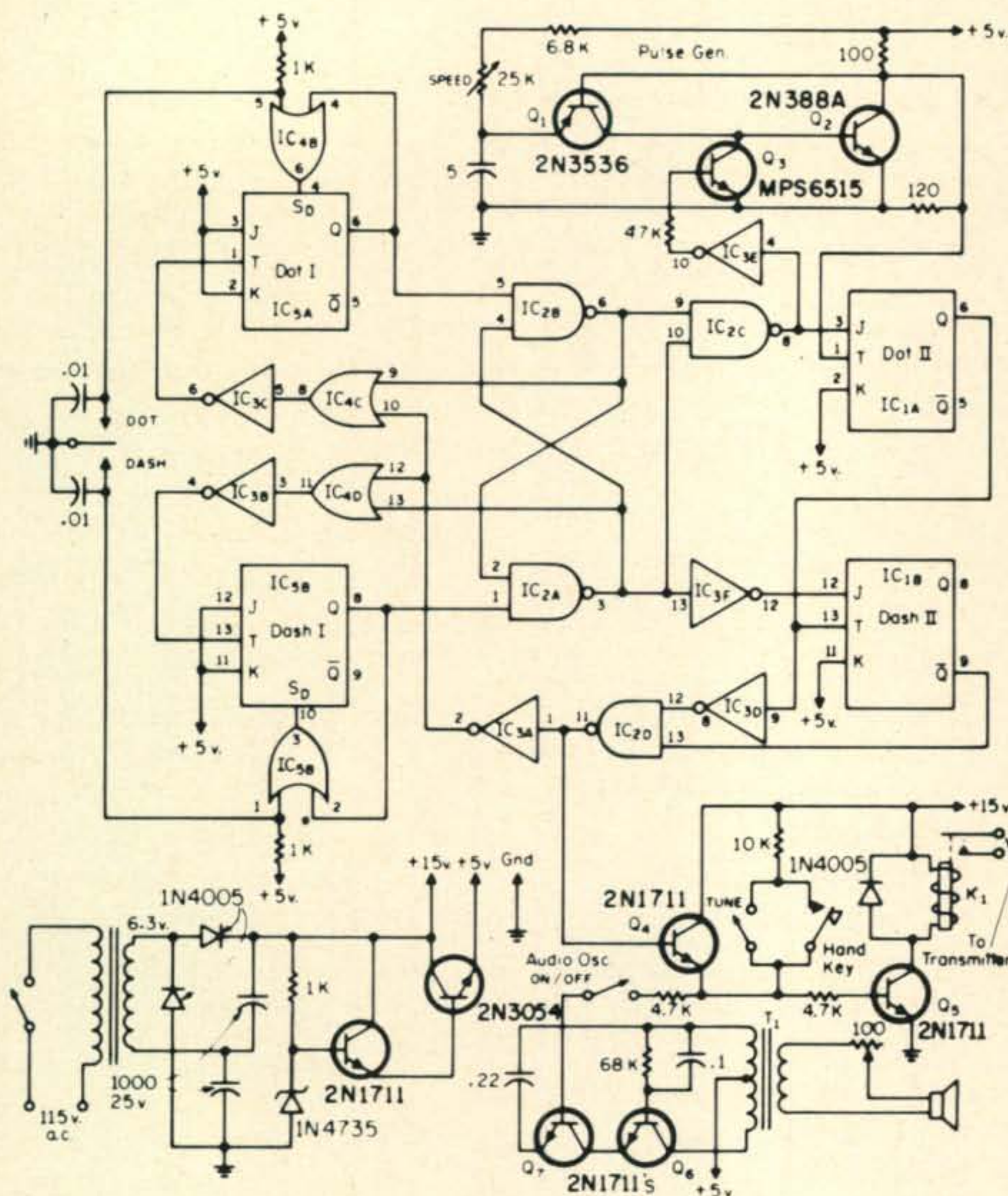


Fig. 3(A)—Circuit of the GW-3NJY electronic keyer which incorporates dot and dash memory. The block wiring of the IC's are shown in fig. 3. (B).

- IC₁, IC₅—J-K flip flops. Motorola MC853P.
- IC₂—4 NAND gates. Motorola MC846P.
- IC₃—Hex Inverter. Motorola M836P.
- IC₄—4 OR gates. Motorola MC3003P.
- K₁—Potter & Brumfield JF-1045, 12 v. coil, 10 VA contacts.
- T₁—Output transform 400 ohms c.t. to 3.8 ohm voice coil.

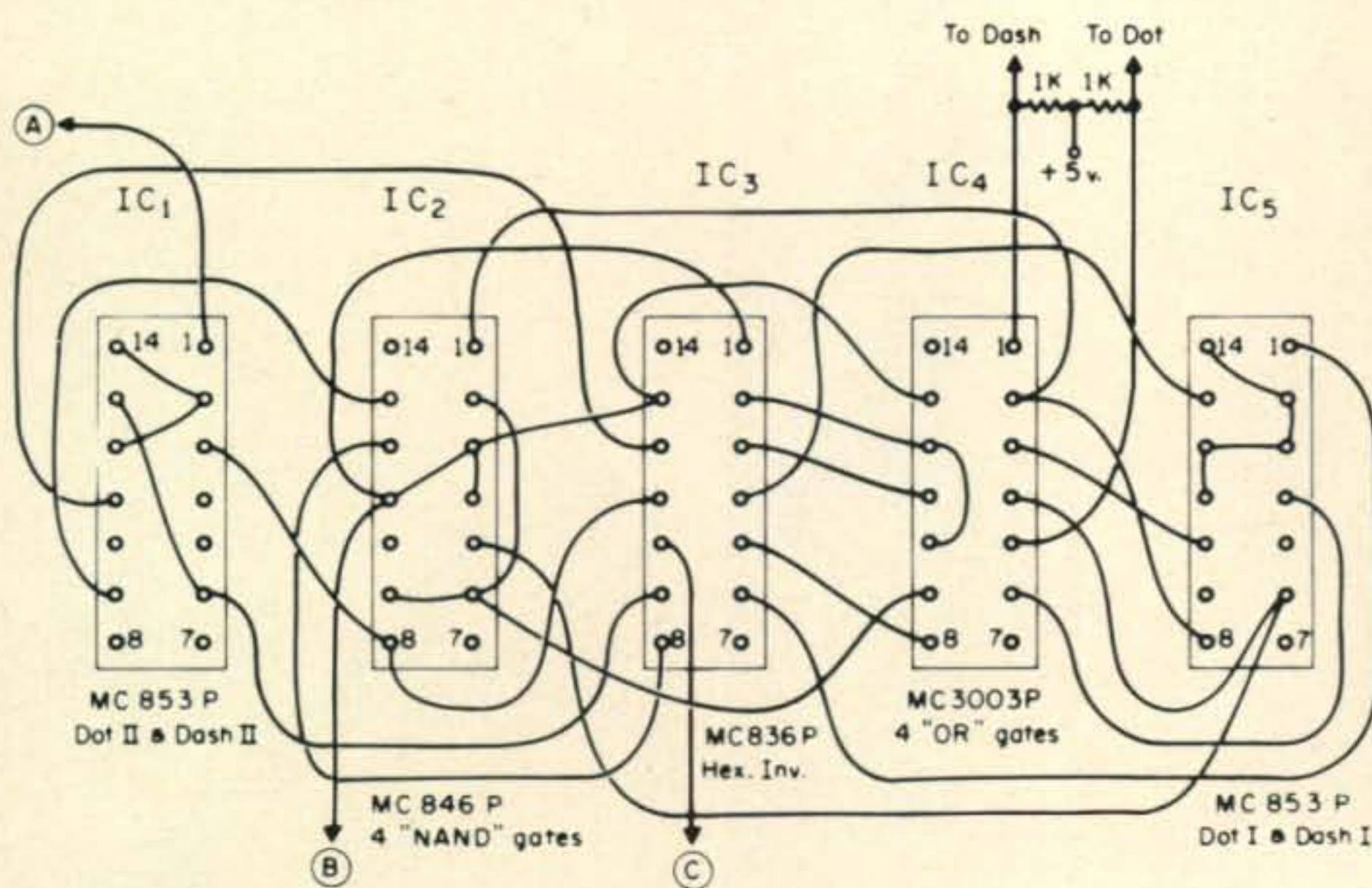


Fig. 3(B)—Block wiring diagram for the five IC's showing their interconnections (bottom view). All pin # 14's are connected to the plus 5 volt line and all #7 pins are connected to the zero volt or ground buss. The three points A, B and C, connect to the similarly marked points in fig. 3A.

- IC₁—MC853P Dot II and Dash II.
- IC₂—MC846P 4 NAND gates.
- IC₃—MC836P Hex Inverter.
- IC₄—MC3003P 4 OR gates.
- IC₅—MC853P Dot I and Dash I.

the same job however, and is constructed of NAND gates only, an important point from the manufacturing and large systems angle. Table II was devised to assist in the decision of which gates do what.

To use Table II one decides whether an AND or an OR circuit is required and knowing what levels are to be significant at the input

and the output of the gate then the choice is made directly from Table II. To illustrate, consider fig. 1B again. The first two NAND gates operate as AND gates with '1's significant at the input and '0' at the output. The third NAND gate, however, acts as an OR gate with '0's significant at the input and '1' at the output.

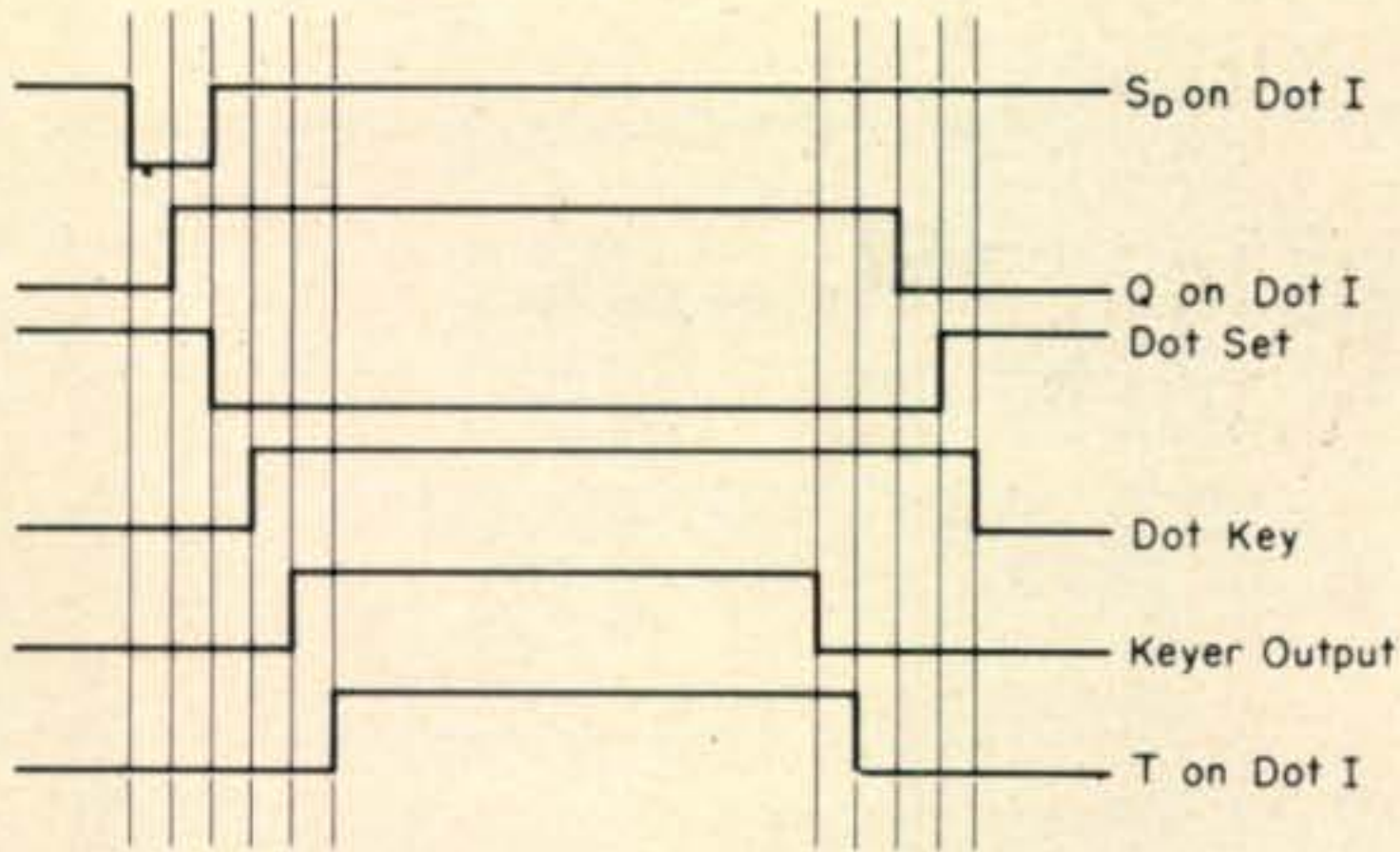


Fig. 4—Timing sequence observed during the production of one dot by the IC electronic keyer.

The J-K Flip Flop

Before describing the keyer, however, the J-K flip flop must be mentioned. As the operation of this type of flip flop is complicated and as it was discussed in a previous issue of *CQ*[†] it will be omitted here. The 'how-to-use-it' aspect of the device will be discussed, however. The block in fig. 2 represents a J-K flip flop with the most significant terminals marked. The points Q and \bar{Q} are complementary outputs and by applying a '0' to the C_D (direct clear) terminal Q will assume a '1' state and \bar{Q} will change to an '0' state. This transition will occur immediately when the '0' is applied to S_D and can be reversed at anytime by applying a '0' to C_D . It should be noted that once a '0' has been applied to S_D then S_D can be changed to a '1' but Q will remain at '1' similiary for C_D .

The terminals J , T and K are used quite differently; T is known as the clock input and on application of a pulse train the Q and \bar{Q} outputs will toggle each time the clock input goes from '1' to '0' provided the J and K terminals are not both high. Then, on the first available high to low transition, the Q and \bar{Q} outputs will assume the conditions shown in the truth tables accompanying fig. 2. In these truth tables t_n means "time after the n^{th} clock pulse" and t_{n+1} means "time after the $(n+1)^{\text{th}}$ clock pulse. Thus, after the $(n+1)$ pulse, Q assumes the state it was in after the n^{th} clock pulse; i.e. Q_n , i.e. no change, if J and $K=0$. If $J=K=1$, the clock pulse toggles the flip flop and Q_n results, that is, the output is complemented. Finally, manufacturers data sheets usually define their products with positive logic in mind but this should always be checked particularly with the older lines of logic.

[†]McWilliams, F.B., "Introduction to IC Binary Logic," *CQ*, February 1969, p. 14.

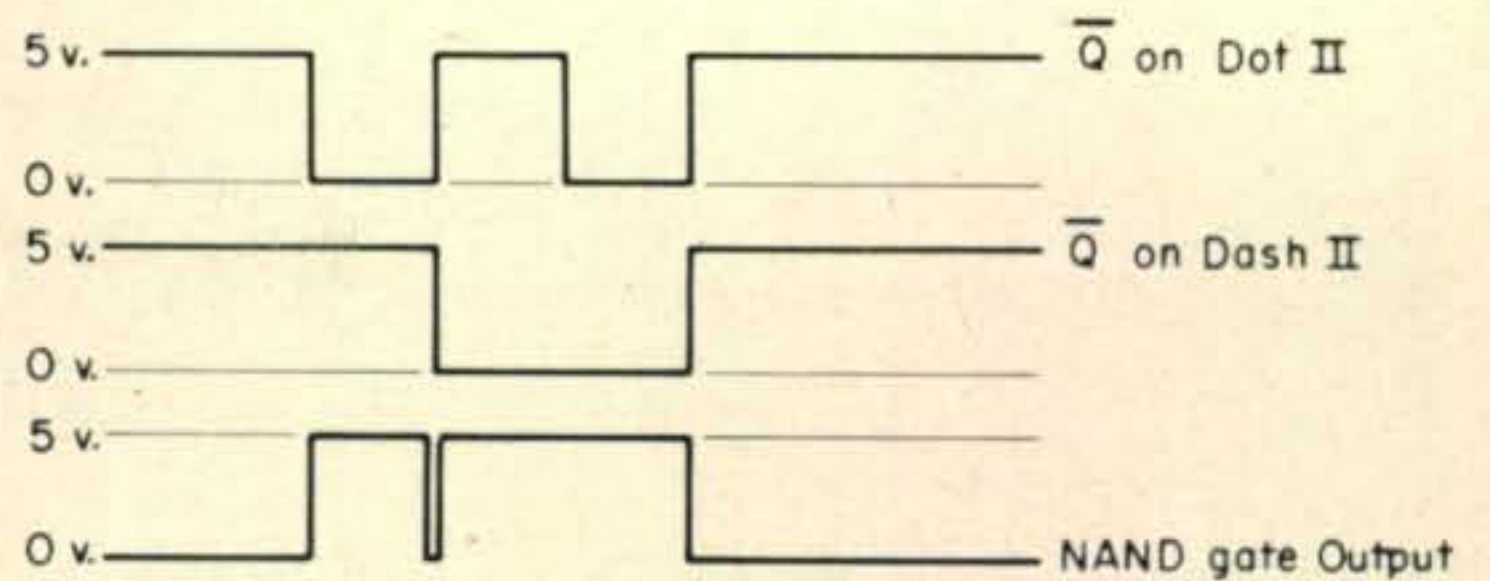


Fig. 5—Timing diagram illustrating the need for the inverter between Dot II and the output gate. The above timing diagram assures no inverter is in use and thus the reference to Q on Dot II, not \bar{Q} as indicated.

Keyer Operation

The circuit for the GW3NJY electronic keyer is shown in fig. 3. The pulse generator and audio oscillator are similiar to those used in the Micro-TO-Keyer. As DTL (diode-transmission logic) and TTL (transistor-transistor-logic) are used in this keyer, the V_{CC} voltage has to be 5 volts. This has no significant effect on the operation of either oscillator. The decision to use DTL and TTL was made mainly due to the improvement in the noise margin realized with these two forms of logic compaed with that obtainable from RTL (resistor-transistor-logic) (1 v. versus 0.4 volts). Noise margin is a measure of the

[Continued on page 94]

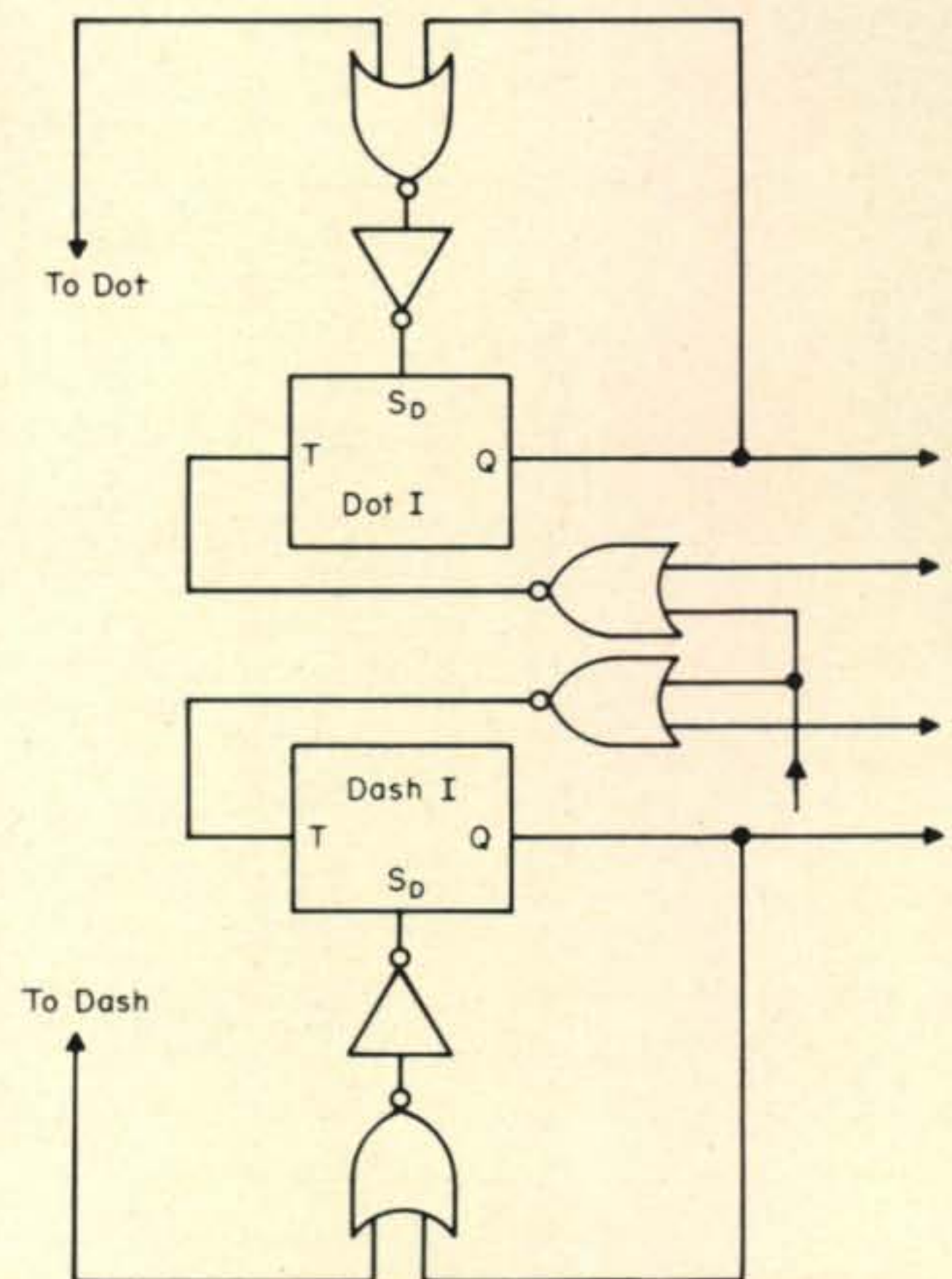


Fig. 6—Circuit changes necessary in the keyer logic section in order to use NOR gates instead of OR gates.

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Galaxy V Mk II w/AC	\$319.00	HQ 110C	\$89.00	NCX 500 w/AC	\$379.00
		HEATH SB 110A w/AC	\$309.00	NC 155	\$ 95.00
		VHF-1	\$ 99.00	SBE SB34	\$255.00
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MODIFYING THE HEATH HP-24 POWER SUPPLY FOR USE WITH SCREEN-GRID TUBES

BY JOHN J. SCHULTZ,* W2EEY

Although designed for use with a linear amplifier using triode tubes, the Heath HP-24 power supply can be easily modified to make an excellent supply for 1 kw s.s.b. linears using a variety of screen grid tubes.

THE Heath HP-24 a.c. power supply was designed for use with the Heath HA-14 linear. The linear uses two 572/T-160L triodes and operates at 1 kw s.s.b. or 1 kw c.w. input. The power supply is sold separately, however, and with some minor modifi-

cations can be used as a very economical and compact power supply for 1 kw linears employing such screen-grid tubes as 4-125's, 7094's, a 4-250A, 4X150's, etc. In many cases, such as for the 4X150 tubes, the power supply will furnish not only the plate, screen and bias voltages but the filament power as well. Thus, especially for linears using tubes

*1829 Cornelia St., Brooklyn, N.Y. 11227.

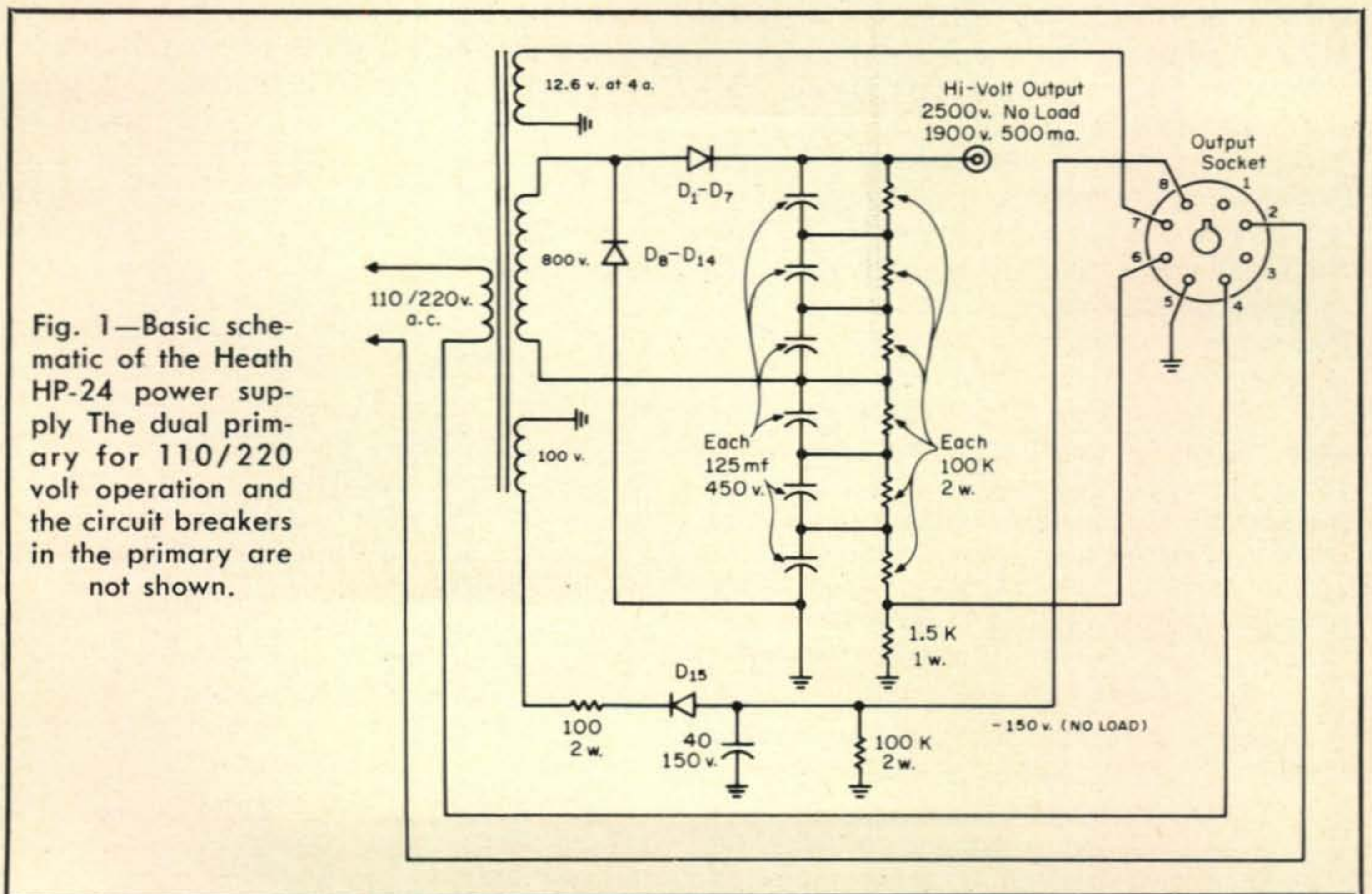


Fig. 1—Basic schematic of the Heath HP-24 power supply. The dual primary for 110/220 volt operation and the circuit breakers in the primary are not shown.

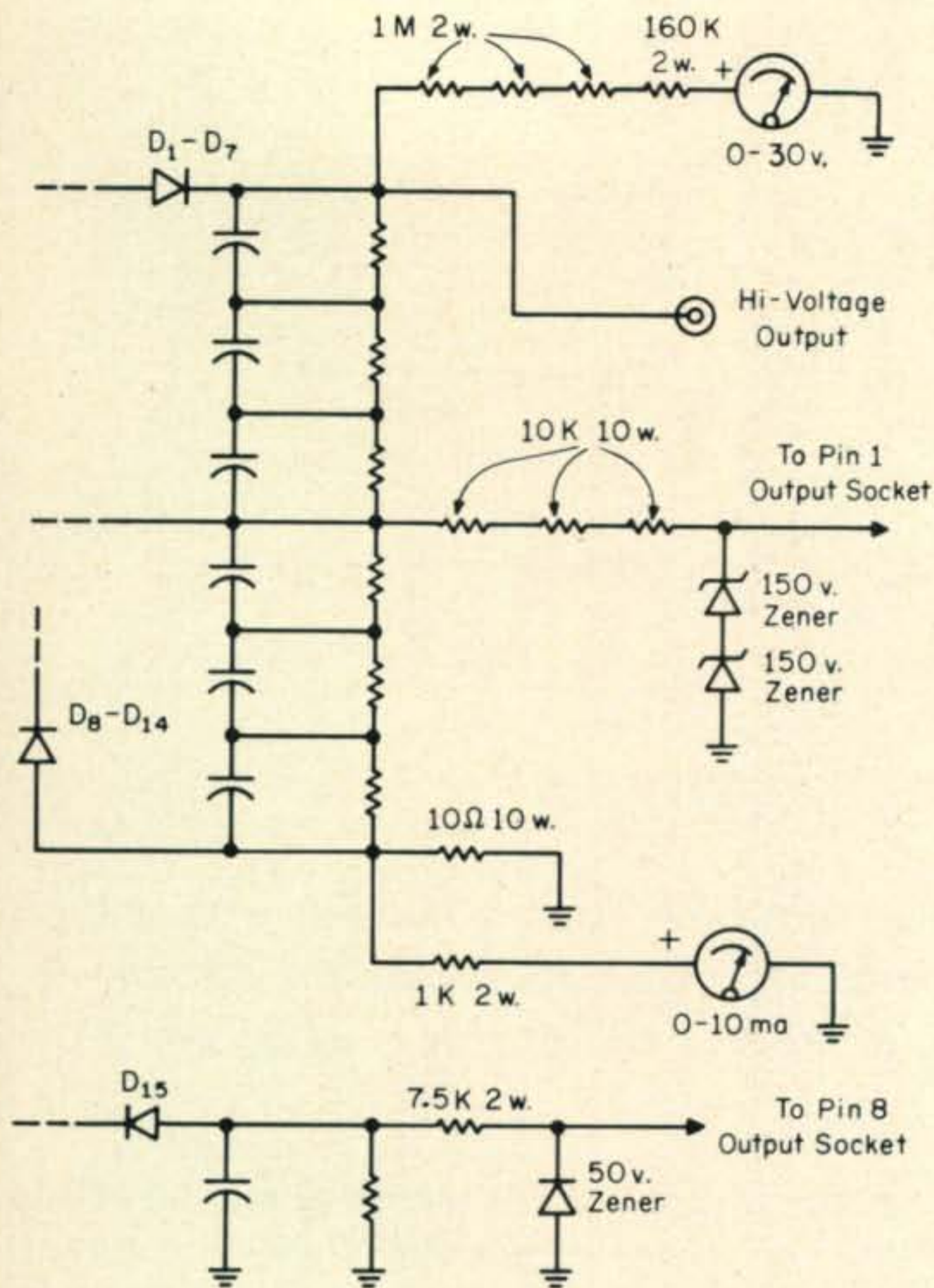


Fig. 2 — Modifications made to HP-24 power supply for operation with screen grid linears. Except for the diodes which are part of the original supply, only the parts added have been designated.

such as the 4X150 on v.h.f., the modified HP-24 makes an ideal power supply.

The modifications described do not alter the basic capability of the power supply, although it cannot be normally used as a dual power supply for both its original application and to power a screen grid tube linear. Also, the modifications described provide a degree of performance that one might not normally include in a homebrew power supply such as regulated screen and bias voltage outputs. The cost to provide these refinements however, is rather small and they are highly recommended. Metering circuits are shown for both the high voltage output and the total plate/screen current output. They may, of course, be disregarded if such metering circuits are provided in the linear itself.

Basic Power Supply

Figure 1 shows the schematic of the original HP-24 power supply. A straight-forward voltage doubling circuit is used to supply the high voltage output. Filament and bias supply voltages are obtained from separate wind-

ings on the single power transformer. The high voltage output will provide 2500 volts under very light loads and 1900-2000 volts under 500 ma (1 kw) loads at the 33-50% duty cycles which are typical of c.w. or s.s.b. operation. It cannot be used for 1 kw a.m. linear operation.

The filament winding will provide 12.6 volts at 4 amps continuously. The 100 volt a.c. bias winding will supply a continuous 40 ma output. A small positive voltage derived from the chain of discharge resistors across the high voltage filtering circuit is connected to pin 6 of the output socket. This voltage acts as an a.l.c. threshold voltage for the HA-14 linear and is only used when the linear is driven by a Heath transmitter having the necessary a.l.c. interconnections.

Circuit Modifications

Figure 2 shows, essentially, only the circuit modifications which need be made to the power supply to adapt it for use with a screen-grid linear. First the modified voltage outputs will be described and then the metering circuits, as the latter are optional features.

A series of 10K ohm resistors are connected halfway down on the original high voltage filter capacitor chain in order to derive a zener regulated screen voltage output. The actual screen voltage output required depends upon the screen-grid tubes used in a linear amplifier but the 300 volt output shown is typical. One can purchase 300 volt zeners but, generally, it is much more economical to use two or three lower voltage zeners in series. Ten watt stud-mounted zeners with voltage ratings of up to 180 volts are available at \$1 from various mail-order suppliers. The original bias voltage output of the HP-24 (-150 volts at no load) is generally too high for use with most screen-grid tubes. Instead of modifying the original rectifier circuit for the bias voltage, however, it is left intact and a series resistor and zener diode regulator used to simultaneously reduce and regulate the bias voltage. The bias voltage output is left connected to the original terminal on the output socket while the new screen grid voltage output is connected to pin 1 on the output socket which was originally unused.

Zener Selection

Since one may wish to modify the power supply for various screen voltage or bias voltage outputs using zener regulators, it

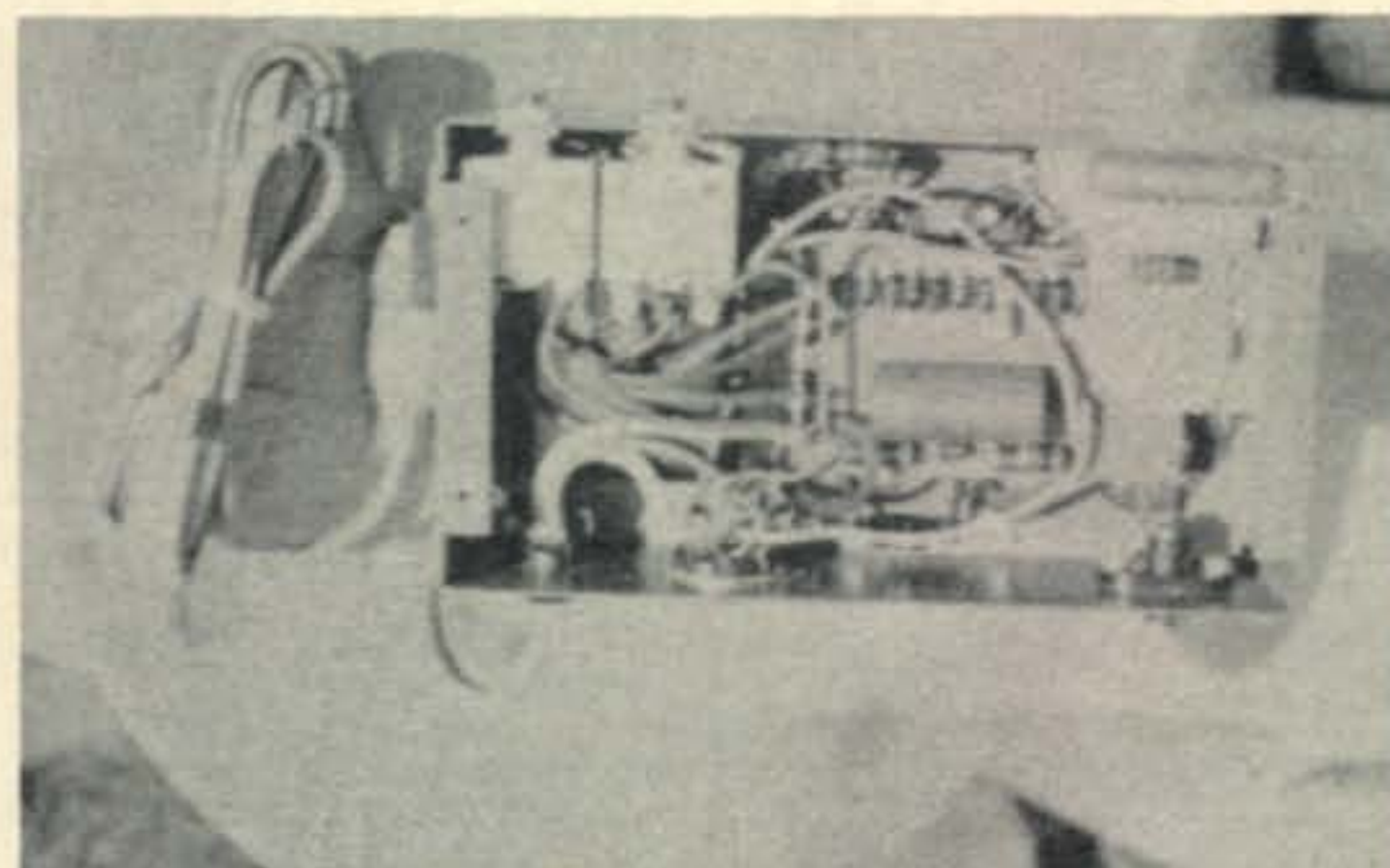
may be useful to briefly discuss the considerations involved in choosing the correct zener regulators and the series voltage dropping resistors used in conjunction with them. Basically, one should analyze the zener regulator circuit under both full load and no-load conditions in order to determine if it is operating properly. For instance, the screen voltage desired may be 300 volts at a maximum current demand of 20 ma. Two 10 watt 150 volt zeners used in series are chosen to regulate the voltage. Since these are 10 watt/150 volt units, their maximum current flow can be about 60 ma. In order that the zeners keep regulating properly, a minimum current of roughly 10% of their maximum rating should flow through them under full load conditions. Say 5 ma is chosen as the minimum current. Then at full load 20 ma from the load and 5 ma from the zeners will combine to produce a 25 ma flow through the series resistors. Since the zener voltage is fixed, the voltage drop across the resistor will be about 750 volts. This value combined with the 25ma current requires a resistance value of 30K ohms. Now, however, the no-load dissipation condition of the zeners must be checked. Under no-load conditions, the zener voltage remains at 300 volts and the voltage drop across the series resistor about the same as before — 750 volts. The entire 25 ma current necessary to maintain these voltage relationships has only one path to flow through now, the zener regulators. Twenty five ma flowing through each 150 volt zener will produce a dissipation of $3\frac{3}{4}$ watts, which is well below their 10 watt dissipation limit.

The same analysis can be applied to any zener regulated circuit for any desired value of load current, zener voltage, *etc.* It should be noted that although maximum zener unit dissipation occurs only under no-load conditions, the series resistor used with the zener dissipates the same power level *continuously*. In the example discussed, it is about $18\frac{1}{2}$ watts.

The zener regulator used in the bias voltage circuit can be determined only from no-load circuit conditions as essentially no current demand exists on this circuit with the usual screen grid linear.

Metering

The optional metering circuits shown in fig. 2 allow measurement of both the high



Using the mounting screw which is part of the main original circuit board, an auxiliary circuit board is mounted in the lower right hand section of the HP-24 to accommodate the added screen and modified bias voltage circuit components. The added circuit board is separated from the original circuit board by means of a 1/4" spacer used between the board's mounting screw.

voltage output and the combined plate/screen current demand from the power supply. The meters themselves can easily be mounted on the HP-24 enclosure, if desired, or their functions transferred to the linear amplifier via the spare contacts available on the power supply output socket.

The high voltage measuring circuit uses a conventional string of multiplier resistor to drive a 0-30 volt meter. Using the multiplier resistors, the meter scale actually reads 0-3000 volts. It is very convenient to use a basic 0-30 volt meter and although inexpensive meters with such a calibration range are available (such as the EMICO RF-2 $\frac{1}{2}$ C type sold by Lafayette) one may be forced to settle for a more conventional 0-10 volt basic d.c. meter having the standard 1000 ohms/volt sensitivity. In such a case, the string of multiplier resistors should have a total of 3 megohms, instead of the 3.16 megohms shown, to produce the same 0-3000 volts meter reading. Five per cent tolerance resistors should be used for the multiplier in order to provide reasonably accurate voltage readings.

The combined screen/plate current demand (including the standby current due to the screen zener regulator circuit) is measured by noting the voltage drop across the 10 ohm resistor placed in series with the single ground return point in the power supply output. The 1K ohm resistor in series

[Continued on page 102]

Rules: 1969 CQ World-Wide DX Contest

October 25-26 & November 29-30

Starts 0000 GMT Saturday Ends 2400 GMT Sunday

I. CONTEST PERIOD

Phone: Oct. 25-26, C.W.: Nov. 29-30.

The contest is always held on the last full weekend of October and November.

II. OBJECTIVE

The object of the contest is for Amateurs around the world to contact as many other Amateurs in as many different Zones and Countries as they can during the 48-hour contest period.

III. BANDS

All Amateur bands, 10 thru 160 meters.

IV. TYPES OF COMPETITION

1. Single Operator.
 - a. Single Band.
 - b. All Band.
2. Multi-Operator (all-band operation only).
 - a. Single Transmitter (only one signal permitted).
 - b. Multi-Transmitter (only one signal per band permitted).

V. NUMBER EXCHANGE

1. Phone: 4 numbers, RS report plus Zone number. (i.e.: 5805)
2. C.W.: 5 numbers, RST report plus Zone number. (i.e.: 58905)

VI. MULTIPLIER

Two types of multipliers will be used:

1. A multiplier of one (1) for each different Zone contacted on each band.
2. A multiplier of one (1) for each different Country contacted on each band.

Stations are permitted to contact their own Country and Zone for multiplier credit.

The CQ Zone Map, DXCC country list, WAE country list and WAC continental boundaries are the standards.

VII. POINTS

1. Contacts between stations on different continents are worth three (3) points.

2. Contacts between stations on the same continent but different countries are worth one (1) point.

(Exception: Contacts between stations within the North American continental boundaries will count two (2) points. This applies to N.A. only).

3. Contacts between stations in the same country are permitted for Zone or Country multiplier credit but have Zero (0) point value.

Only one contact with the same station on the same band is permitted.

VIII. SCORING

All stations: The final score is the result of the total QSO points multiplied by the sum of your Zone and Country multipliers.

Example: 1000 QSO points \times 100 multiplier (30 Zones + 70 countries) = 100,000 (final score).

IX. AWARDS

First place certificates will be awarded in each category listed under Sec. IV.

1. In every participating country.
2. In each call area of the United States, Canada, Australia and Asiatic USSR.

All scores will be published. To be eligible for an award a Single-operator station must show a minimum of 12 hours of operation. Multi-operator stations must operate a minimum of 24 hours. A single-band log is eligible for a single-band award *only*. If a log contains more than one band it will be judged as an all-band entry, unless specified otherwise.

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

X. TROPHIES & PLAQUES

A handsome award will be made to the highest scoring stations in the following categories.

Donors—Single Operators, Single Band.

1. World—Phone. (*Dr. Harold Megibow, K2HLB Memorial—North Jersey DXA*)
2. World—C.W. (*Earl Lucas, W2JT Memorial—NJDXA*)
3. Canada—Phone. (*Gene Krehbiel, VE6TP*)
4. Caribbean / C.A. — Phone. (*Gus Kuether, HR2GK*)

Donors—Single Operator, All Bands

5. World—Phone. (*Bill Leonard, W2SKE*)
6. World—C.W. (*Larry LeKashman, W9IOP*)
7. USA—Phone. (*Potomac Valley Radio Club*)
8. USA—C.W. (*Frankford Radio Club*)
9. Europe—Phone. (*W4BVV Operators*)
10. Europe—C.W. (*W3MSK Operators*)
11. Caribbean / C. A. — Phone. (*Harold Fox, W3AA*)
12. Caribbean/C.A.—C.W. (*Harold Fox, W3AA*)
13. Africa—Phone. (*Gordon Marshall, W6RR*)
14. Africa—C.W. (*Gordon Marshall, W6RR*)
15. Oceania—Phone. (*Jack Chalk, KW6EJ*)

Donors—Multi-Operator, Single Transmitter

16. World—Phone. (*John Knight, W6YY*)
17. World—C.W. (*Dr. Anthony Susen, W3AOH*)

Donors—Multi-Operator, Multi-Transmitter

18. World—Phone. (*Radio Club Venezolano*)
19. World—C.W. (*Hazard Reeves, K2GL*)

Donors—Contest Expeditions

20. World—Phone. (*Stuart Meyer, W2GHK*)
21. World—C.W. (*Don Miller, W9WNV*)

The Canadian, Caribbean/Central American and African awards are open to residents *only*.

Trophy winners may win the same trophy only once within a three-year period.

Top scoring stations who are ineligible for a trophy will be awarded championship plaques. (Donated by CQ)

There are no "three year" restrictions on the

WORLD-WIDE DX CONTEST Page 2 of 4 Pages

CALL OK1XX Log For 7 Mr. Band COUNTRY CZECHOSLOVAKIA
 (Use separate log for each band.) PHONE CW

DATE	TIME (GMT)	STATION	SERIAL NUMBER		Fill in only when QSO is multi.		Points
			Sent	Received	Zone No.	COUNTRY	
Nov 26	0057	DLARN	58916	58918	14	GERMANY	1
	58	DL2BY	589	57819			1
	59	DM7L	579	57919			1
	0109	DJ9RU	579	579 M			1
	12	ORIND	589	589 15	15	CZECHOSLOVAKIA	0
	15	OR1P	589	589 15			1
	18	PABRC	589	579 14		HOLLAND	1
	19	OR1Y	589	579 M		ENGLAND	1
	0208	GZXT	579	579 14			1
	19	668A	589	579 19			1
Nov 27	29	PABRC	589	589 14		(DUP.)	0
	49	6822	589	579 M			1
	0322	Q3DNY	579	579 19			1
	36	WAPFA	579	579 19	19	ASIATIC SSR	3
	55	GM3NB	579	583 19		SCOTLAND	1
	0916	DM7M	579	589 14			1
	23	WAPFA	589	579 14		(DUP.)	0
	2128	DV1T	579	567 14			1
	37	DLRFR	589	579 19			1
	0256	F1RC	589	589 M			1
59	GM3NP	569	579 15		ITALY	1	
0312	WRFAY	569	569 04	04	U.S.A.	3	
17	WAPFA	569	567 04			3	
29	W4BVV	569	569 05	05		3	

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 CQ Form 1056 eff. May, 1962.

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XI. CLUB COMPETITION

A handsome plaque will be awarded to the Club submitting the highest aggregate score of the phone and c.w. scores submitted by its members. (Donated by CQ)

1. The club must be a local group and can not be a national body.
2. Participation is limited to active club members operating within local geographic area (except for DX-peditions especially organized for operation during the contest and manned by club members).
3. To be eligible for an award a minimum of 3 logs must be received and an officer of the club must submit a list of participating members and their scores, both phone and c.w.
4. Each participating member must clearly indicate the name of his club on his Summary sheet.

XII. LOG INSTRUCTIONS

1. All times must be kept in GMT.
2. Use a separate log for each band.
3. Indicate Zone and Country multipliers only the FIRST TIME they are contacted on each band.
4. Logs must be checked for duplicate contacts, correct QSO points and multipliers, and recopied logs must be in their original form, with corrections clearly shown.
5. Each entry must be accompanied by a Summary Sheet showing all scoring information, the

(Please circulate this information to your DX friends and radio clubs.)

World Wide DX Contest 1968

Call Sign WIWY Country U.S.A.
 Last Full Weekend of October (Phone) & November (CW)

Competition: Single Operator Multi-Operator (All Band Only)
 Phone: CW Single Band All Band Single Transmitter Multi-Transmitter

Band	QSO's	QSO Points	Zone Multiplier	Country Multiplier	Score
1.8 mc	2	2	X 2	+ 4	8
2.8 mc	18	9	X 12	+ 50	108
7.8 mc	44	32	X 28	+ 121	392
14 mc	128	26	X 53	+ 361	1098
21 mc	61	16	X 33	+ 169	528
30 mc	3	3	X 3	+ 9	9
All Bands	256	78	X 131	+ 714	149,226

How to score: QSO Points x (Zone + Country) = Final Score
 EXAMPLE: 1000 QSO Points x (30 Zone + 70 Country) = 100,000 points

Station Description: _____
 Antenna: _____
 Operator: _____
 Remarks (Biggest Multi in Contest, unusual story, comments, etc.): _____

Worked OH2AM on 5 Bands -
3.5 thru 2.8 mc!

Club Competition (Minimum 3 logs): _____

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

Frank Anzalone, WIWY
 Name FRANK ANZALONE Call WIWY
 Address 14 SHERWOOD ROAD
STAMFORD State or Country CONN. USA Zip 06905

Logs must be postmarked no later than December 1st for PHONE and January 15th for CW. Mail to: CQ Contest Committee, 14 Vanderventer Ave, Port Washington, N.Y. U.S.A. 11050

A sample summary sheet. Free summary sheets, log pages and zone maps may be obtained upon receipt of a large s.a.s.e. or, if outside the U.S., sufficient IRC's. When you send in your score... include photos.

category of competition, the contestant's name and address in BLOCK LETTERS, and signed declaration that all contest rules and regulations for amateur radio in the country have been observed.

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

If official forms are not available you can make up your own by following the attached inch paper.bffl sample, with 40 contacts to the page on 8 1/2 x 11 inch paper.

XIII. DISQUALIFICATION

Violation of amateur radio regulations in the country of the contestant, or the rules of the contest; unsportsmanlike conduct; taking credit for incorrect QSOs or multipliers or duplicate contacts in excess of 3% of the total made will be deemed sufficient cause for disqualification.

Actions and decisions of the Committee are official and final.

XIV. DEADLINE

All entries must be postmarked NO LATER than December 1, 1969 for the Phone section and January 15, 1970 for the C.W. section. In rare isolated areas the deadline will be made more flexible. Logs go to:

CQ WW Contest Committee
 14 Vanderventer Avenue
 Port Washington, L.I., N.Y. USA 11050.
 (Indicate phone or c.w. on envelope)

You say your taxes were raised?

You missed three payments on your Jaguar XK-E?

You had to turn in your Playboy Club Key?

Your salary was cut?

You say the F.C.C. has expressed interest in your four different calls?

You say food is so expensive it's cheaper to eat money?

You say you invited your boss to dinner and during the soup course the finance company repossessed your furniture?

You say your XYL backed the family car out of the garage after you backed it in the night before, and now you can't get to the Newsstand to get your monthly copy of CQ?



HOLD IT!!

While we are in no position to alter the tax structure, give you a raise, or sway the F.C.C., We can save you a pile of cash on CQ! So drop that anchor, pick up a pen and dash off a CQ subscription right away!

1 yr.	I PAY ONLY \$ 6.00	a savings of \$ 3.00
2 yrs.....	I PAY ONLY \$11.00	a savings of \$ 7.00
3 yrs.....	I PAY ONLY \$15.00	a savings of \$12.00

And now with all this newfound money at your disposal, you can begin to really live again!

CQ • 14 Vanderventer Avenue • Port Washington, N.Y. 11050

Dear OM:

Enclosed please find \$..... for Year(s) Subscription to CQ, The Radio Amateur's Journal.

- NEW: Start with.....issue.
- RENEWAL

Name Call

Address

City State Zip

RATES: 1 Year.....\$6 2 Years.....\$11 3 Years.....\$15

CQ Reviews: The Heathkit SB-500 2-meter Transverter



BY WILFRED M. SCHERER,* W2AEF

As far as receiving goes, getting on a v.h.f. band with s.s.b. is easily done if a converter is available for use with an h.f. s.s.b. receiver which provides a tunable i.f. receiving setup. On the other hand, an s.s.b. transmitting setup for v.h.f. is not as readily obtained, inasmuch as this requires rigging up a system for heterodyning or converting a lower-frequency s.s.b. exciter or transmitter up into the v.h.f. band and adding suitable amplifiers and a v.h.f. power-output amplifier designed for s.s.b. service.

A more convenient arrangement that is becoming popular is use of a "Transverter". This is a v.h.f. transceiving-type accessory that has both the receiving- and transmitting-conversion equipment with a p.a. all in one package. Such a job is the Heathkit SB-500 Transverter which is designed for use along with existing 6- or 10-meter-band s.s.b. gear to provide s.s.b. (or c.w.) operation on the 2-meter band.

The specific s.s.b. units with which the SB-500 is designed to operate are the Heath SB-300/301 and SB-400/401 receiver-transmitter combinations, the SB-100/101 and HW-100 transceivers and the SB-110/110A 6-meter transceiver. This does not preclude the possibility of operation in conjunction with other types of s.s.b. gear as will be discussed later.

The p.e.p. input of the SB-500 is rated at 140 watts with an output of 50 watts (50% duty cycle) with operation into 50-ohm loads or those presenting a maximum s.w.r. of 2:1 to the transmitter. The Transverter's receiving sensitivity is rated at $0.2 \mu\text{v}$ for 10 db S+N/N.

The frequency coverage for the unit is 144-148 mc when used with 28-32 mc or 50-54 mc associated equipment employed as the

*Technical Director, CQ.

i.f. A 1 mc crystal calibrator is included.

Spurious responses are rated below $0.1 \mu\text{v}$, except at 145.390 mc (with 50 mc i.f. only).

Plate and screen voltages for the Transverter p.a. are obtained from the lower-frequency driving unit. All other operating voltages are provided by a built-in power supply in the Transverter. Operation may be had from a 120 or 240 v.a.c., 50/60 c.p.s. source.

Switching between 2-meter operation with the SB-500 and straight-through normal operation using only the associated s.s.b. gear on the lower bands is simply had by the flick of a switch on the Transverter. There is no need for changing around interconnecting cables. When the Transverter is in operation, its receive-transmit functions are automatically controlled by the associated gear.

A panel meter on the unit may be switched to read the p.a. cathode current or the relative r.f.-power output.

Principle of Operation

Referring to the block diagram at fig. 1, the SB-500 functions as follows:

On receive, the input signal goes through

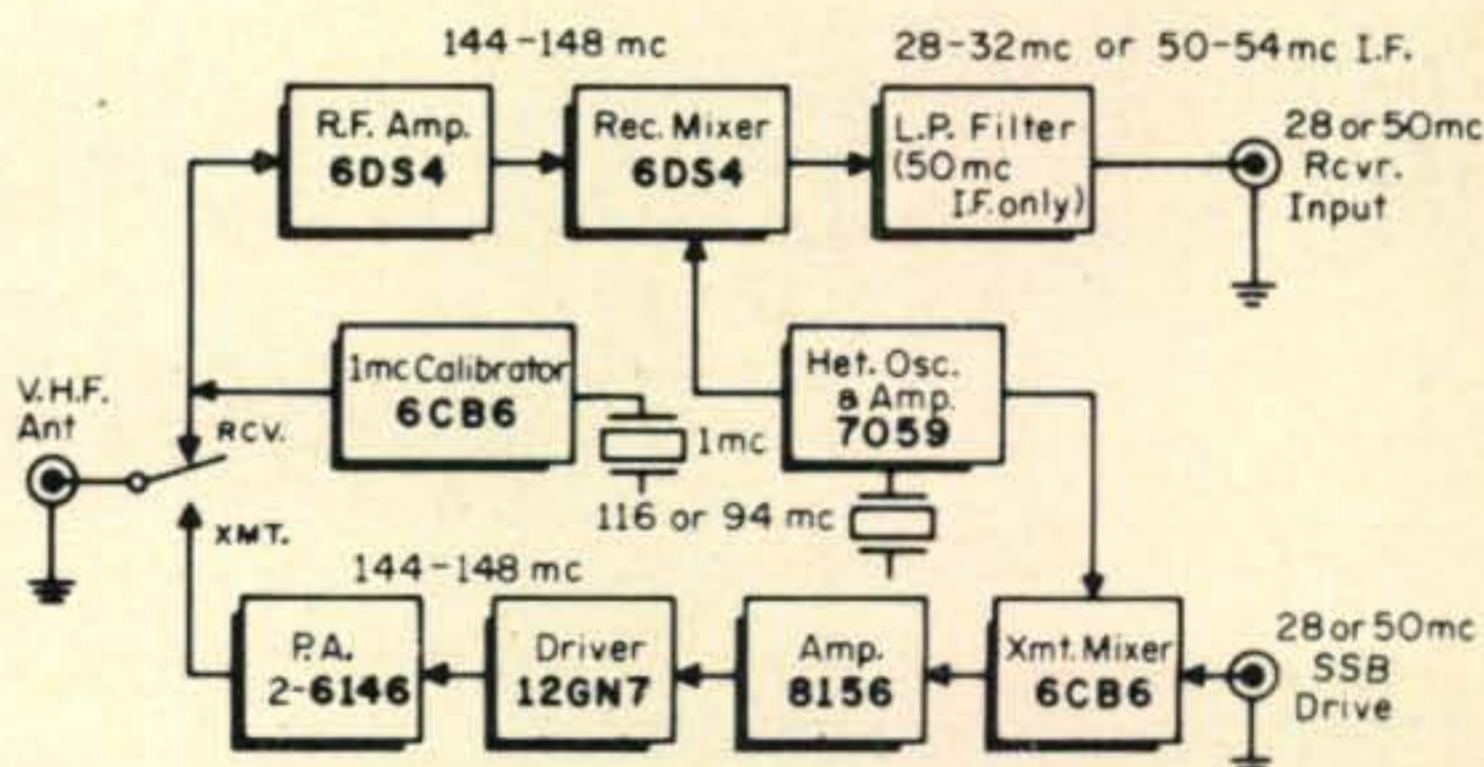


Fig. 1—Block diagram for the SB-500.

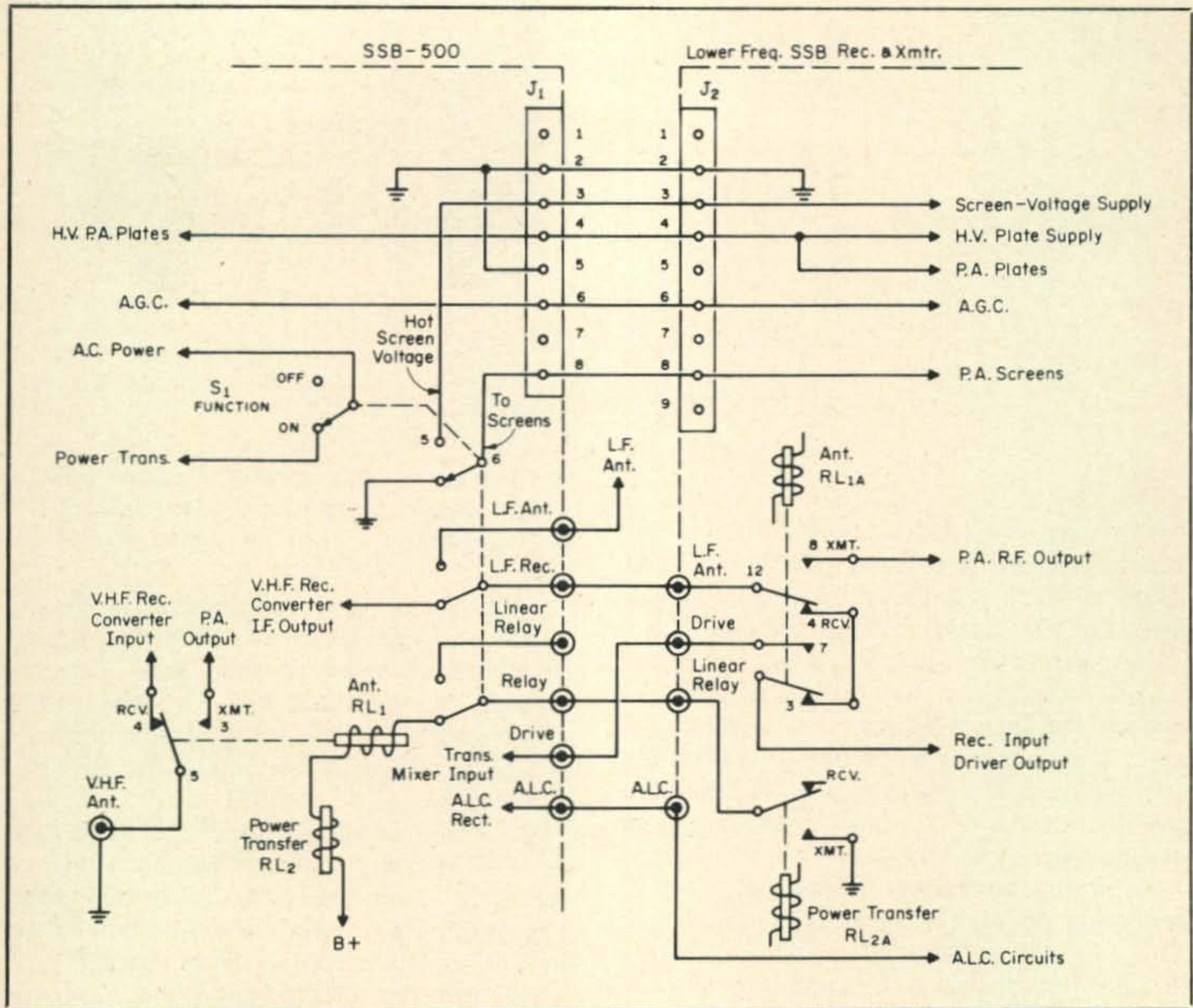


Fig. 2—Switching circuits and interconnections used with the SB-500. The function switch, S_1 , is shown in the Transverter power-on position. Not shown are the Xmt-Rcv contacts and circuits for the power relay RL_1 . The relay contacts of the associated s.s.b. gear are shown in the receive position, and the related relay-contact numbers are those for the HW-100.

S_1 removes the screen voltage from the PA of the s.s.b. transmitter, thus preventing any plate-current flow in the PA. This eliminates any load by the PA on the h.v. power supply for the s.s.b. transmitter.

Antenna relay, RL_1 , contacts 4 & 5 connect the v.h.f. antenna to the input of the SB-500 receiving converter the output of which is connected to the s.s.b. receiver through S_1 contacts 1 & 9 and the s.s.b. equipment antenna relay, RL_{1A} , contacts 4 & 12 and 3 & 11.

On transmit, the transfer-relay control circuit on the s.s.b. gear grounds the coil of RL_1 in the SB-500 through S_1 contacts 3 & 4, activating both RL_1 and RL_2 . RL_1 contacts 3 & 5 then close and connect the SB-500 p.a. output to the v.h.f. antenna; while RL_2 operates the receiving-converter muting circuits and makes the necessary power transfer, one of which is application of p.a. screen voltage obtained from the SB-500

power supply. The h.v. supply in the associated s.s.b. gear is always connected to the plate-voltage feed for the p.a.'s in both units.

S.s.b. drive for the SB-500 is obtained from the driver output in the s.s.b. gear through RL_{1A} contacts 7 & 11.

When S_1 is at off, a.c. power is removed from the Transverter and normal operation with the associated s.s.b. gear alone is automatically obtained. In this case the l.f. antenna is connected to the s.s.b. receiver input through S_1 contacts 8 & 9 and RL_{1A} contacts 4 & 12 and 3 & 11. During transmit with the s.s.b. gear alone, S_1 contacts 5 & 6 connect the s.s.b. screen supply to its screen grid circuits and its p.a. output goes to the l.f. antenna through RL_{1A} contacts 8 & 12 and S_1 contacts 8 & 9. If a linear amplifier is used with the s.s.b. gear, its relays will be activated through S_1 contacts 2 & 3.

When the Transverter is not connected to the s.s.b. gear, the latter may be operated normally by inserting a plug at J_2 with terminals 3 & 8 connected together. This will complete the screen-voltage supply to the p.a. screen circuits. The antenna is connected to the normal antenna jack on the s.s.b. gear and if needed, the linear-amplifier relay circuit is connected over to the appropriate jack.

the antenna relay to a 144 mc converter consisting of an r.f. amplifier and a mixer with a crystal-controlled heterodyning oscillator the frequency of which is 116 mc when a 28 mc-band i.f. is desired. For a 50mc-band i.f., a 94 mc crystal is used.

The mixer output goes to the r.f. input of the associated s.s.b. receiver which is then used as a tunable i.f. for the converter. When a 50 mc receiver is used, a low-pass filter is provided at the mixer i.f. output to eliminate certain unwanted responses that may otherwise show up.

On transmit, the r.f. drive (at 28 or 50 mc) from the associated s.s.b. exciter is applied to a transmitting converter or mixer along with heterodyning signals from the crystal oscillator operating at the same frequency required for the i.f. used on receiving (the same band on the associated gear must be used on both receive and transmit). A 144 mc-band output is then obtained from this mixer. The 144 mc signals are next amplified and applied to a driver stage for the final p.a.

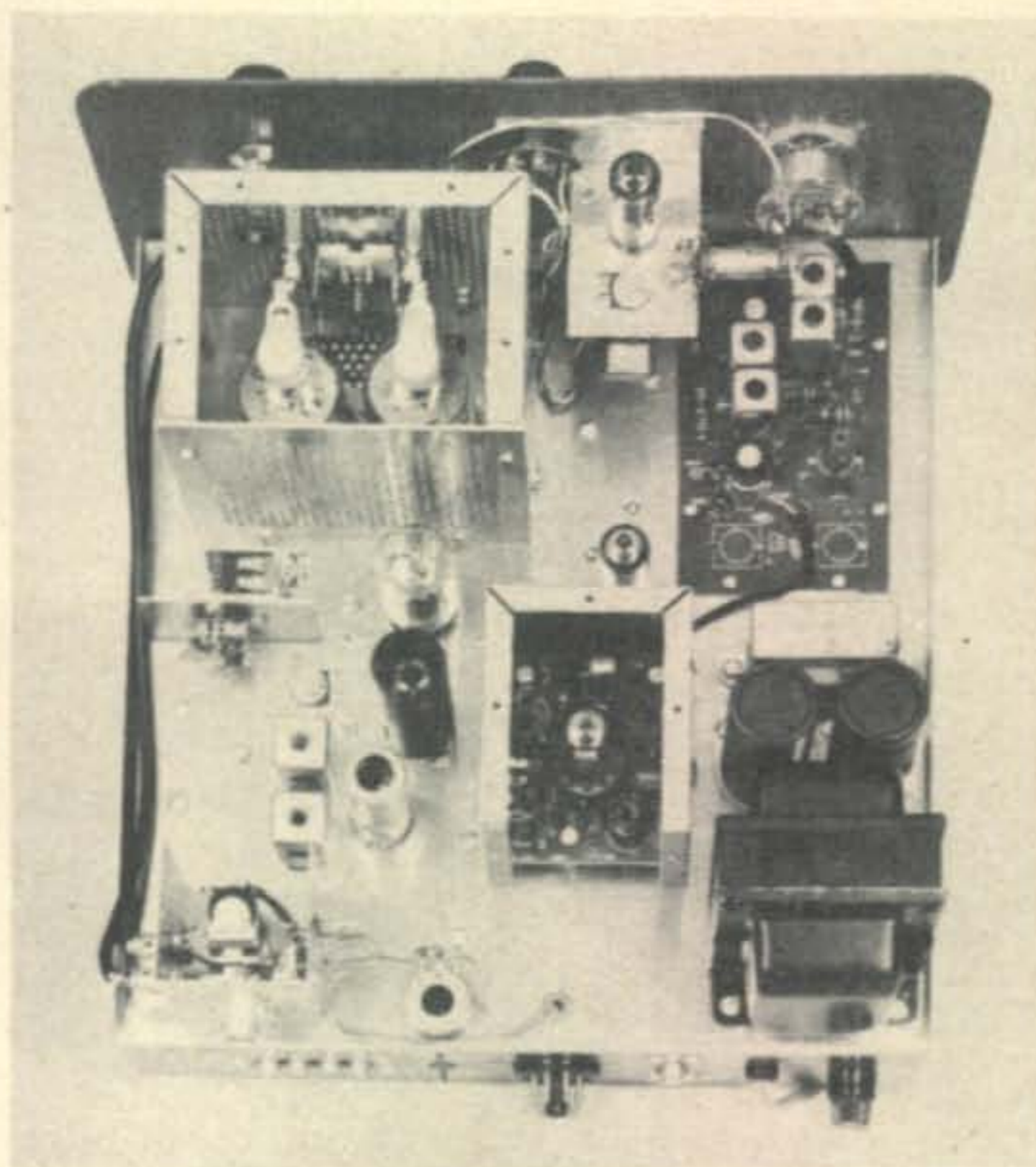
Circuit Details

The receiving converter in the SB-500 employs a 6DS4 Nuvistor which functions as a neutralized-triode amplifier. A single tuned-input circuit is used with its inductor tapped to match a 50-ohm antenna impedance. Two tuned circuits make up a bandpass coupler to the mixer input. All three circuits are capacitively gang-tuned for peaking the signal, thus ensuring the rated sensitivity over the entire range.

The amplifier is neutralized by feeding back an out-of-phase voltage between the plate and grid of the tube. This is accomplished by an *L/C* series-connected combination. A.g.c. for the amplifier is obtained from the associated s.s.b. receiver.

Another 6DS4 is used for a triode mixer with the r.f. signal applied to its grid and the heterodyning-oscillator signal applied to the cathode. The mixer plate is broadly fix-tuned for the required 28 or 50 mc i.f. with a capacitive divider provided for matching to the low-impedance input of the associated s.s.b. receiver.

The heterodyning oscillator uses a 5th-overtone series-resonant crystal in a grounded-grid circuit with the triode section of a 7059. The pentode section of the tube functions as an amplifier with its output tuned for the required frequency. A link winding at the output inductor couples the



Top view of the SB-500. The covers have been removed from the shielded enclosures for the p.a. (upper left), the antenna relay (lower left) and the heterodyning oscillator (center). The receiving-converter board is at the upper right with the calibrator attached to the panel at its left.

signal to the receiving mixer.

Transmitting Section

A 6CB6 pentode is used for the transmitting converter with the heterodyning-oscillator signal applied to the grid through a series-tuned *L/C* circuit capacitively-coupled to the oscillator-amplifier plate. The 28 or 50 mc s.s.b. signal from the associated exciter is applied to the mixer grid with a 51-ohm resistor used for properly terminating a coax-input line.

The 144 mc-band output from the mixer is bandpass-coupled to a 12GN7 pentode amplifier. The two tuned circuits of the coupler are series-tuned with variable capacitors. A Pi-network couples and matches the amplifier output to an 8156 pentode driver, the plate circuit of which has a center-tapped balanced tank also series-tuned by a variable capacitor. The variable capacitors for all the low-power r.f. circuits are gang-tuned for peaking up the drive.

The p.a. employs two neutralized 6146's operated in push-pull as a class AB_1 linear amplifier. The grids are coupled to the driver tank through a center-tapped link with fixed bias applied through an r.f. choke at the tap.

The p.a. tank is a silver-plated hairpin loop

tuned by a butterfly-type variable capacitor. Coupling to the antenna circuit is accomplished with another loop that is series-tuned with a variable capacitor for optimizing the loading and power output.

A conventional a.l.c. setup is used for preventing p.a. overdrive.

Switching and Interconnections

Switching is accomplished using a power switch with two relays in the SB-500 and three sets of d.p.d.t. relay contacts in the associated s.s.b. gear. This setup and the interconnections required between the various gear are described at fig. 2. As for the associated equipment, some modifications are required to be first made in it. Complete details are given in the manual for doing so on the Heath units specified earlier.

Not shown at fig. 2 is that the s.s.b. driving signal for transmitting is obtained from a link winding that already exists at the driver-plate inductor in the SB-100/101 and HW-100 or from a similar link which must be installed in the SB-110/110A and the SB-400/401. With the transceivers, the driver circuit is common to the receiver-input section, so the link also couples the antenna input to the receiver during reception.

For use with other type units, the system may be worked out according to this prin-

ciple and those shown at fig. 2. Besides the added link, in some cases this may require the installation of more connectors and an additional relay in the associated s.s.b. gear if the necessary facilities are not already available. Some ingenuity on the part of the modifier also may be needed.

Power Supply

Besides furnishing all heater voltages, the power supply has a silicon-diode voltage doubler which provides 300 v.d.c. for the low-power transmitting stages and 220 v.d.c. for the p.a. screens. A half-wave silicon rectifier furnishes 150 v.d.c. for muting-and operating-bias potentials. 800 v.d.c. for the p.a. plates are obtained from the associated s.s.b. transmitter.

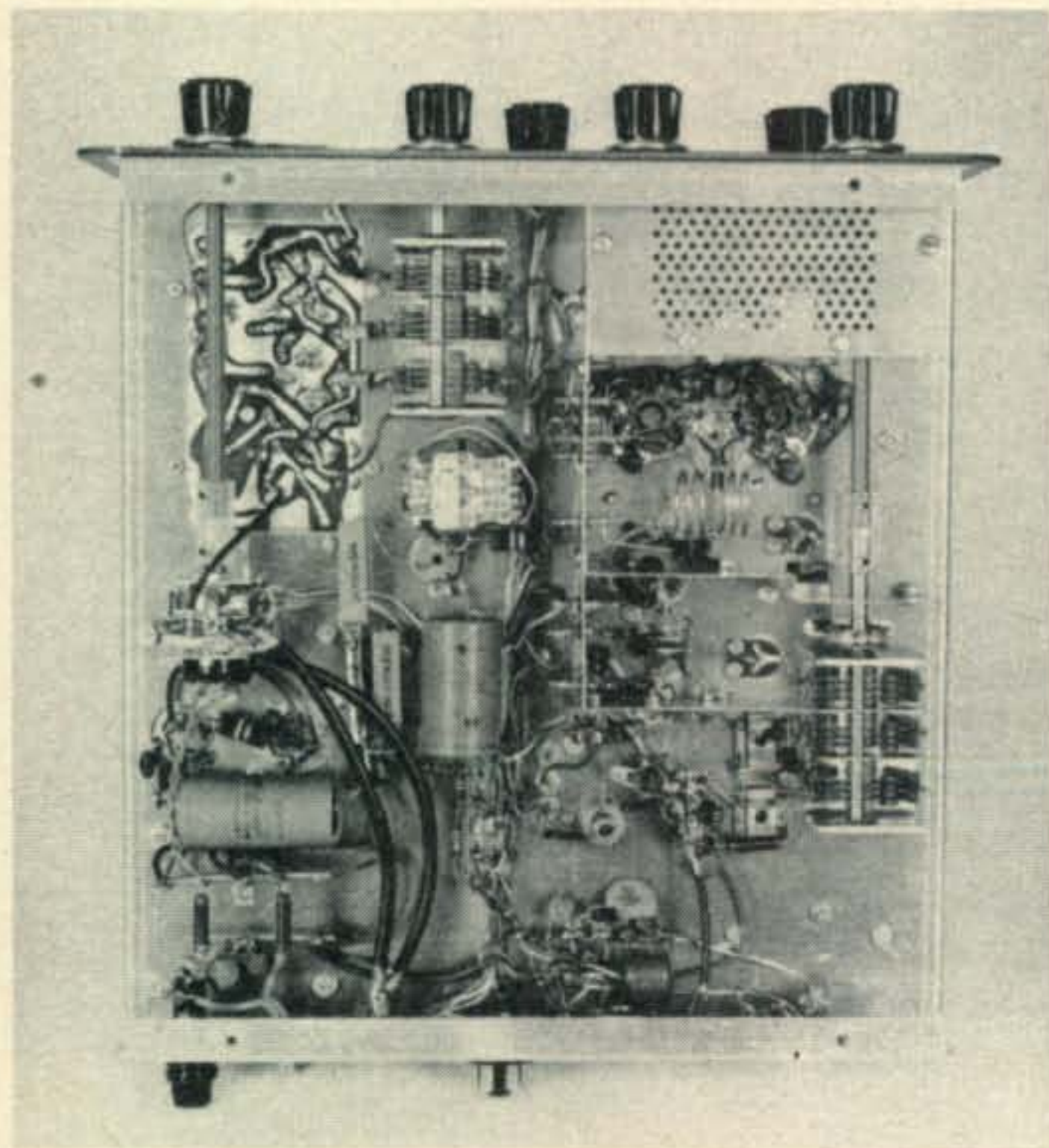
An 0A2 gaseous regulator provides a regulated potential of 150 v.d.c. for the receiving converter, the heterodyning oscillator and the 1 mc crystal calibrator. This is particularly important with s.s.b. for maintaining frequency stability of the heterodyning oscillator which, although the oscillator is crystal-controlled, could otherwise vary somewhat with plate- or line-voltage variations that might require frequent receiver retuning or result in frequency modulation during transmissions.

Assembly

When the SB-500 is assembled, it is done so for only 28 mc- or only 50 mc-i.f. operation. The receiving converter and the heterodyning oscillator are assembled by the user on two separate printed-circuit boards which simplifies some of the needed construction. The rest of the unit is built using point-to-point wiring, tie-point strips and a wiring harness. The work is quite easily done even though there are a few tight spots that require diligent care. One such place is at the p.a.-tube sockets when the components are installed (manual pages 24-25). Here it would be wise to look ahead and determine by test the exact position for the r.f. shield (page 26) and the final link shield (page 29), so that the position of some of the socket components will not interfere with the installation of the shields.

Our total assembly time, including initial tests and preparation of auxiliary cables and connectors, involved 22 hours. Modifying the associated s.s.b. gear and subsequent alignment of the SB-500 requires another 3-4

[Continued on page 87]



Bottom view of the SB-500. The three-gang capacitor near top center is for the driver tuning, the one near lower right is for the receiving-converter tuning. The p.a. hairpin inductor and the antenna-coupling loop extend into the compartment at upper right.



BY JOHN A. ATTAWAY,* K4IIF

ELEGY WRITTEN TO A COUNTY DXER
(With apologies to Thomas Gray)

*The curfew tolls the knell of parting day,
The blowing herd winds slowly to the
freeway,
The salesman homeward creeps his weary
way,
And leaves the world to DX and to me.*

The month of June was travel time for ye olde DX Editor. Business took us to the west coast, and we were able to spend several enjoyable days in that hot bed of modern DXing activity, sunny California. On June 13 we were the guest of the Northern California DX Club at its monthly meeting in Palo Alto, following which we participated in the DX program at the Pacific Division ARRL Convention in Sacramento. One June 16 we took part in a joint meeting of the Southern California and San Fernando Valley DX Clubs, followed on June 18 by the San Diego DX Club.

While in 6-land we announced the comparative scores of last fall's club competition between the Northern and Southern California DX Clubs, in which the NCDXC boys nosed out their Southern rivals 13,900,000 to 13,700,000. This was greeted by great elation in the Bay area, and by determination, rather than dejection, in the Los Angeles basin. The Southern Cal. boys made it plain that they expect to win this year.

In all our travels back and to across the country we have never seen the enthusiasm and spirit for DX that is found in 6-land. The Northern Cal-Southern Cal interclub competition in the CQ Worldwide Contests is the west coast equivalent of the Potomac Valley-Frankford Radio Club rivalry. It's already become a tradition in the DX and Contest world, and the action grows hotter every year.

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

And speaking of contests, that time is almost here. The full dope is elsewhere in this issue of course, but in summary the CQ Worldwide Phone extravaganza takes place on Oct. 25 & 26, followed by the C. W. melee on Nov. 29-30. We also mustn't forget the excellent contests sponsored by our oversea's friends. The All Asian DX Contest hits Aug. 30-31, the DARC WAE Phone Contest Sept. 13-14, the VK/ZL/Oceania Phone Contest on Oct. 4-5, and the VK/ZL/Oceania C.W. Contest on Oct. 11-12 as is the RSGB 28 mc Phone Contest. Those c.w. buffs not wishing to participate in the CQ Worldwide Phone affair on Oct. 25-26 will find the RSGB 7 mc c.w. contest on that same weekend.

Participation in the contests sponsored by oversea's societies is a wonderful way to build international goodwill, and consequently we were pleased to set by Frank's column in the June issue (p. 82) that there was considerable U.S. participation in 1968. W1MDA was 4th world high in the OZ-CCA affair, W1TX, W3BDX, and W9JQD had high scores in the Swiss contest, and there were many high scores from W, K-land in the German (DARC) contest and the All Asian contest.

De Extra

The life of a QSL Manager is always tough, but the advent of the 5-band award fad has made things rougher than usual. We've received letters from many of the fellows asking that De Extra pass the word on bad QSLing practices, so here goes.

First of all, when you work a station on more than one band please don't send all the cards with just one self-addressed, stamped envelope (s.a.s.e.). When you do this it adds another step to the QSL Manager's load as

SSB DX Honor Roll

WA2RAU	319	W6YMV	303	K0UKN	292	G3WW	269
W2TP	318	W8QVZ	303	W2LV	286	MP4BBW	267
W9ILW	316	XE1AE	302	W6EUF	286	W8BVF	266
W3NKM	315	W2BXA	302	K8RTW	286	G2PL	265
T12HP	314	G3AWZ	301	W9EXY	284	G2BVN	264
W2RGV	314	G3DO	301	SM6CAS	281	W2FXE	264
DL9OH	313	G6TA	301	W3KT	281	W2MJ	261
WA21ZS	312	W3DJZ	301	W1LLF	280	W9QLD	261
K6LGF	312	G3HDA	300	W6UOU	280	W8PTS	260
W8DE	312	W41C	300	DL3RK	280	W6WNE	259
G3FKM	310	W9JT	300	WA2EQQ	279	PJ2AA	258
KP4CL	310	W4SSU	299	W3FWD	279	K1SHN	257
W4NJF	310	5Z4ERR	298	W4RLS	279	PA0EEM	256
WA8AJI	310	VE3ACD	297	K4OEI	279	W6BAF	254
R4OPM	309	K2DX	297	DL11N	276	K6CAZ	254
K6YRA	309	W4QCW	297	K4HYL	276	HP1JC	252
I1AMU	308	W8BT	297	W7DLR	276	PA0SNG	252
G8KS	307	W4PAA	294	PZ1AX	274	K4GXD	252
W5KUC	307	W8EVZ	293	K9EAB	273	W6GLD	252
SM5SB	305	K8ONV	293	K9LUI	273	VE6TP	251
W2ZX	305	F2MO	292	W6RKP	272	W1AOL	250
K6CYG	305	W2FXN	292	G3NUG	270		



Presentation of the 4th DX Hall of Fame plaque to Dick Spenceley, KV4AA. The presentation was made by Frank Anzalone, W1WY, CQ Contest Editor, on his recent trip to the Virgin Islands.

he has to set up a routine of passing this envelope along from band-log to band-log. It may seem like a lot of trouble to make out an s.a.s.e. for each band contact, but when you imagine what WA4WIP or W4ECI is up against at the other end it becomes child's play. If you are an active DXer, the thing to do is sit down some evening and address 50-100 envelopes to yourself so that you will always have plenty on hand, then clip one to each card when you send your cards to the QSL Manager.

Another practice strongly objected to by many QSL Managers is that of QSLing more than one contact on the same card. Several managers have reported getting cards with as

many as 3 QSO's on 3 different bands listed on the one card. This is *definitely not* a good practice. If it's worth taking the time to work him on those different bands, it's certainly worth the time to send a separate card and s.a.s.e. for each contact.

With a lot of new DXers coming along there continue to be some who don't use Greenwich Mean Time (GMT), the universal worldwide time of DX. GMT is a must as all DXpeditions and most all DX stations use it. A QSL Manager faced with several hundred cards can't take time to do your homework for you. He'll probably return your card.

Despite wild rumors you may hear, QSL Managing doesn't pay. It isn't the equivalent of owning an oil well. Some QSL Managers use up to \$100/year of their own money to keep things going. So don't get a mad on against the poor guy if he's a little slow some times. Without him you would never get a confirmation of many rare contacts. The next time you say a prayer or light a candle, put in a good word for your favorite QSL Manager.

QSL Services

Previous issues have given you a run-down on the fine QSL services offered by W3GJY and W3KT. To be fair to all we would like to mention that a major new service has been organized by Loyd Colvin, W6KG, and Iris Colvin, W6DOD. It is called the World QSL Bureau and will handle stateside cards as well as DX cards. They also have a special arrangement by which cards may be forwarded to participating clubs. Loyd and Iris can be contacted at 5200 Panama Ave., Richmond, California 94804.

Re: RM-1393

The May, 1969 issue of the monthly bulletin of the Wireless Institute of Australia, published by the Council of New South Wales Division, commented favorably on De Extra's petition. They pointed out that unless RM-1393's recommendations were followed, almost all of the U.S./40 meter c.w. operators would be concentrated between 7050 and 7100 kc, which is the phone band in Australia, New Zealand, and many other countries where the entire 40 meter ham band is 7000 to 7100. They feel that the high power and 7 mc beams in the U.S. will make a shambles of their communications.

Here are comments from some of the readers:

C.W. WPX

951.....KØDYM 953.....SP5GH
952.....YO3RK 954.....LU6FBR

Mixed WPX

202.....W9ZTD

S.S.B. WPX

433.....XE2IH
434.....ZS3D
435.....XE1OOL

WPX Endorsements

SSB: DL1MD-400, YV4IQ-400, XE2IH-350, DL9XN-300, and GM5AHS-300.

CW: SM7TV-600, OK2DB-500, VE2IJ-500, SP1BHX-400, SP5GH-400, KØDYM-350, LA9TG-350, and W4HHN-350.

Phone: W2LEJ-350.

Mixed: DL1MD-550.

80 Meters: SP5GH.

20 Meters: LU6FBR and SM7TV.

15 Meters: SM7TV.

Europe: DL9XN, SP1BHX, and SP5GH.

South America: WA5LOB.

de WAØOTE: "I think the proposed sub-bands should go into effect this November. It will take that for many people to go to work and get them back. I think the FCC should then review band occupancy, as it said it would, in maybe another year. I could see a reduction in the extra class c.w. segments, possibly giving the top 25 kc to the advanced class holders. The little bit of space in the phone portions of 15 and 75 meters which is currently extra class should remain that way."

de W9FJX: "We all appreciate what you have done in filing RM-1393. All 43 members of our club voted unanimously to support you. Incentive licensing was a double cross to hundreds of us oldsters. It was like saying you graduated from college over 10 years ago so you are no good anymore. Go and dig ditches. For the record I was Class A almost from the beginning."

de W8TSF/Ø: "Sir I'm too late to support your petition, but hopefully it received backing from other hams. Even though I have my Extra license I feel right now that 50 kHz is just too much for us to play around in. Gotta keep those bands utilized."

de W8LAU: "Keep after em. It is my prediction that through the efforts of you and others the incentive licensing will end and we will see a rebirth of Ham Radio. Our great hobby will be restored to its original purpose."

Here and There

New and Rare Prefixes:

C3A-C3Z—This is reported to be a new call-sign series for Andorra.

CM1-CM9—This series goes to newly licensed Cuban amateurs. CO1-CO9 prefixes go to Cuban hams after a year's experience and conveys full privileges.

DX2-DXØ—These were special prefixes in use July 4 to commemorate the anniversary of Philippine Independence.

S.S.B. DX Awards

100 Countries

570.....CE6EW 572.....SM3AF
571.....SM6DHU 573.....SM6CMK

200 Countries

175.....W6PTS 176.....W8BVF

300 Countries

43.....G3DO 44.....SM5SB

S.S.B. WAZ

688.....XE2IH 692.....VP7NH
689.....F9RM 693.....VE3CUS
690.....K7YDO 694.....DL1BO
691.....W6KOE

Phone WAZ

413.....XE2IH

C.W.—Phone WAZ

2689.....VE4XJ	2705.....K4OCE
2690.....OZ5CV	2706.....VE3HL
2691.....W3AES	2707.....WB60LR
2692.....WB2CDZ	2708.....WA6LBP
2693.....WAØOTE	2709.....DJ3WU
2694.....W4REZ	2710.....OE1MFW
2695.....K9KXA	2711.....W6OL
2696.....K9IFB	2712.....JA3LGG
2697.....KH6GLU	2713.....LU4ECO
2698.....VE5GF	2714.....I1ZMI
2699.....W9JCK	2715.....DJ1QT
2700.....W4GTS	2716.....VE3DLC
2701.....W9EZ	2717.....W6BS
2702.....K6NCG	2718.....W9ALP
2703.....W2YWO	2719.....WA9IVL
2704.....W3AIZ	

ITØ—The call *ITØARI* was used by I1IJ from the Mediterranean Fair in Palermo. QSL to *IT1TAJ*.

JD1—*JD1YAB* and *JD1YAA* are QRV on all bands from Volcano and Marcus Island respectively.

JW8—*JW8MI*, Carl, is on Spitsbergen. He likes 14050 and 14190–195. QSL to *LA8FI*.
JX4—*JX4YM*, 14203 kc at 1150 GMT. QSL to *LA7RF*.

JX5—*JX5CI* is active on 14 mc c.w. near 14001 kc.

KF7—*KF7BSA* was a special Boy Scouts of America National Jamboree station at Faragut State Park, Idaho.

LI2—*LI2B* was Thor Heyerdall's reed boat *Ra* bound from Europe to the West Indies. QSL to *LA5KC*, P.O. Box 150, Slependsen, Norway with 5 IRC's.

WB9—*WB9BUB* writes that he had trouble getting an answer when using this new prefix, especially when in the *Extra Class* portions of the band. (We can think of several jibes we could make, but we won't say a thing.)
2B3—*2B3DC* is active on 21400 ± 5 kc from 1700 GMT. QSL to Box 113, Zurich 47, Switzerland.

3Z1-3Z9—This prefix series is valid in Poland between July 22, 1969 and July 22, 1970. The usual WPX rules will apply.

4KI—*4KI1TU* has been used by HB amateurs working in the ITU building.

4M7-4M7AV was a special callsign for the YV contest.

9M6 - 9M6HM in Sabah was reported on 14220 at 1300 GMT. QSL to K6ZIF.

Activity from the Rarer Zones:

Zone 18-UAØAI, 14195 kc at 1225 GMT.

Zone 19: UAØRV, Ken in Yakutsk, 14195 at 1225 GMT.

Zone 21: EP2BQ, 21284 kc at 0427 GMT. MP4TCH, 21391 kc at 2214 GMT.

Zone 22: 4S7PB, 14207 kc at 1145 GMT. VU2DK, 14202 kc at 1325 GMT. 9N1MM, 21309 kc at 0210 GMT.

Zone 23: JT1AK, 21026 kc and 21040 kc between 1600 & 1700 GMT. JT1AG, 14205 kc at 1440 GMT.

Zone 24: BV2A, 14025 kc at 1145 GMT. VS6DR, 21355 kc at 1622 GMT, QSL to W2CTN.

Zone 28: YBLBM, 14182 kc at 0845 GMT, QSL to Box 8, Bandung, Indonesia. 9M8RY, 14202 kc at 1317 GMT. 9M2CP, 14072 kc at 1130 GMT. 9M2CP, 14072 kc at 1130 GMT. VK9BS, 14206 kc at 1157 GMT. VK9DH, 14027 kc at 1107 GMT, QSL to WA6TVH. CR8AI, 14042 kc at 1340 GMT.

Zone 34: 5A3TX, 14200 at 0600 GMT, QSL to WA3HUP. 5A1TN, 21333 kc at 1915 GMT.



Two real stalwarts of the DX and Contest world played major roles in the drama of the *Ra*, a papyrus boat used by Thor Heyerdahl of *Kon Tiki* fame to prove that the ancient Egyptians could have sailed to the Caribbean. Dick Ehrhorn, W4ETO, photo left, head of Signal One, who furnished the gear for *Ra*, was in charge of the daily communications via amateur radio with the reed boat. W4ETO is always one of the top five US stations in the CQ W.W. DX Contests.



On the right in the photo is Herb Schoenbaum, KV4FZ/WØVXO, winner of the 1968 CQ W.W. DX C.W. Contest and runnerup in the Phone portion. Herb is shown boarding the rescue ship *Shenendoah* which stood by the *Ra* in its last days.

San Diego DX Club

(This is the latest in the continuing series of short stories dealing with the history and activities of prominent DX clubs. It was contributed by WB6OLR.)

The San Diego DX Club was founded in 1949 by a group of prominent San Diego County DXers for the purpose of promoting DX, good sportsmanship, and fellowship.

Notable among the club's past activities is its 1958 DXpedition to Clipperton Island where operations were conducted under the call sign FO8AT.

Since 1959 the San Diego DX Club has operated the 6th Call Area QSL Bureau which serves the over 40,000 California hams. With an average volume of over 50,000 incoming cards per month it is probably the largest QSL Bureau in the world.

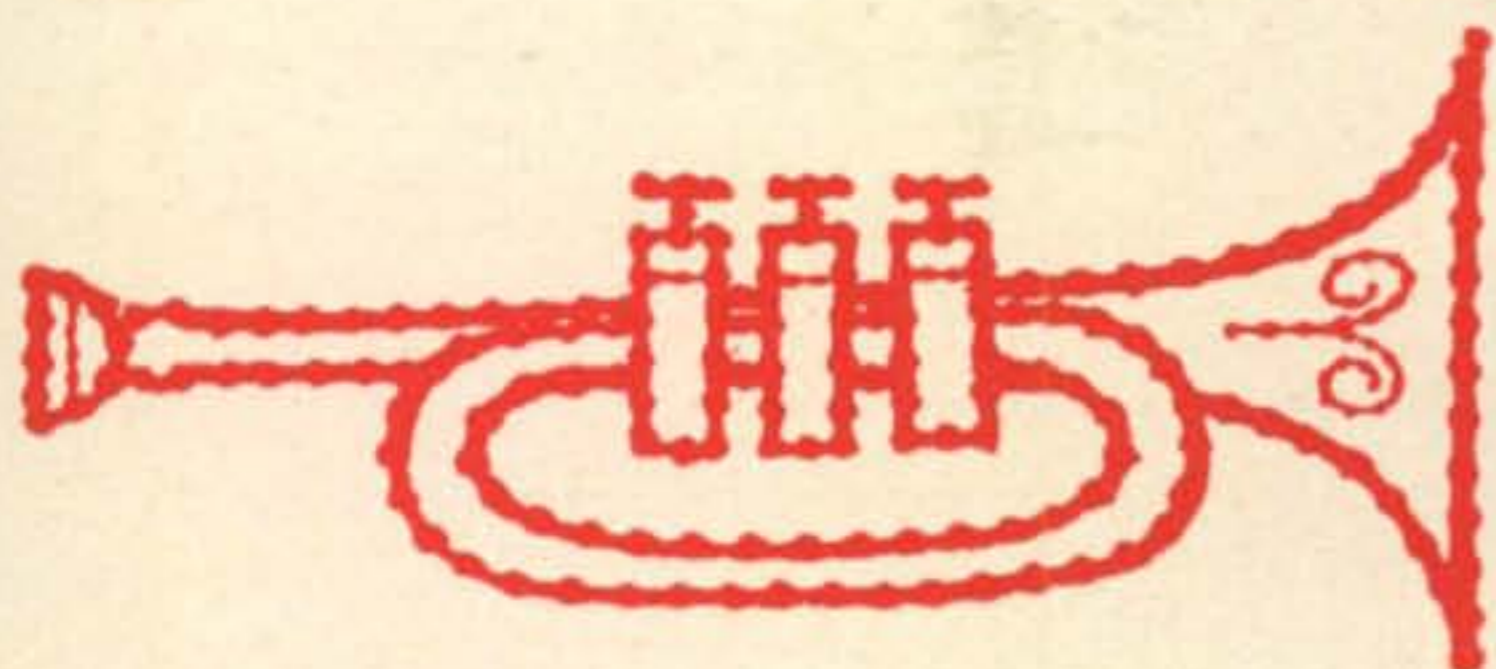
Eligibility for membership requires the attainment of either DXCC or WAZ. The present roster number 22, with over half having confirmed over 300 countries and several on the Honor Roll. The officers are Pat Herndon, WB6OLR, President; Walt Manning, K6VZA, Vice-President; and Tom Cairns, W6LAG, Secretary-Treasurer.

Those actively working in the QSL Bureau are W6PT, K6CF, K6SDR, K6VZA, W6LAG, W6CHV, W6ID and WB6OLR.

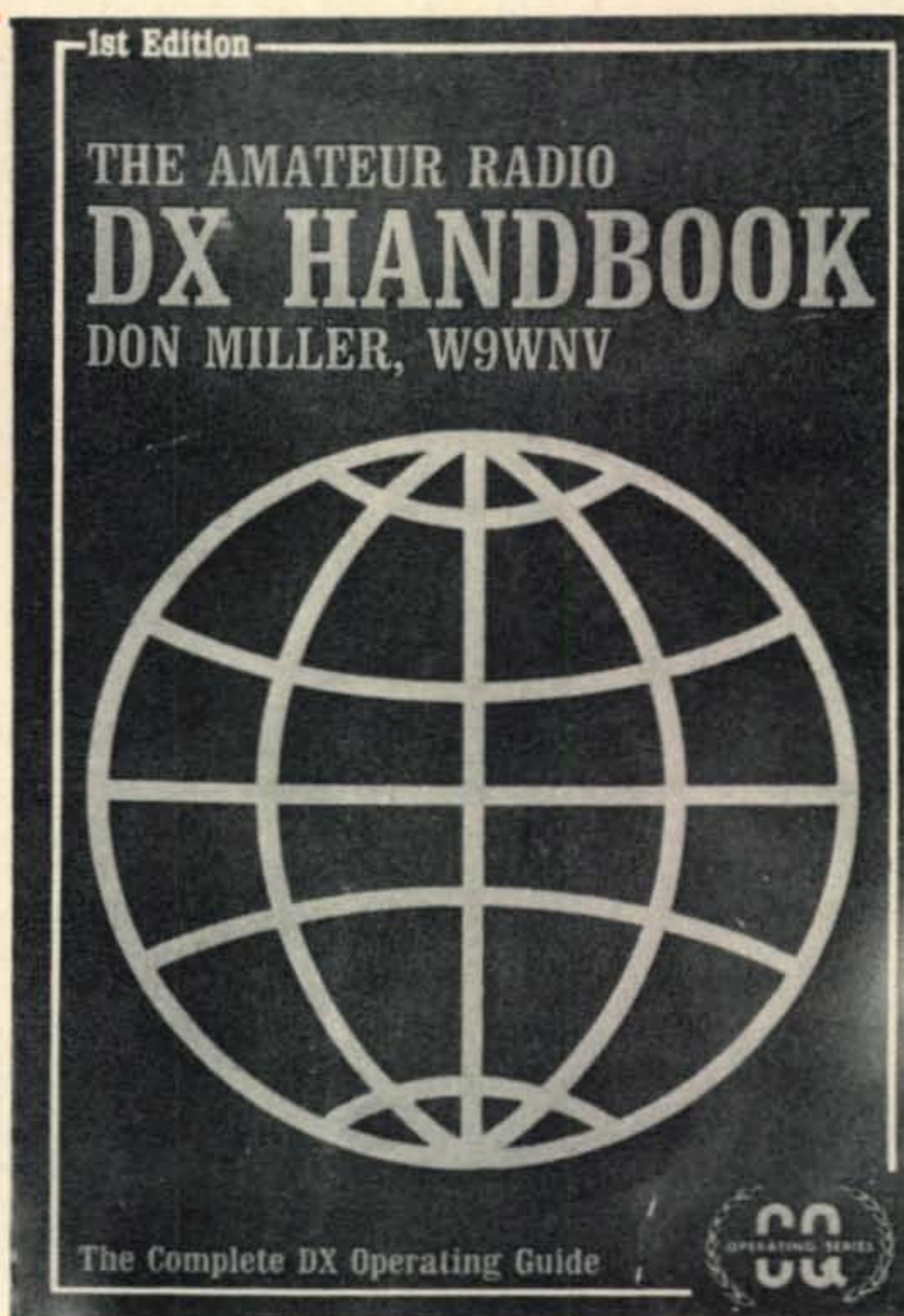
From the Readers

de GM5AMS: In reference to the June listing for ZA1AM, it appears that he is in the same category as previous ZA stations. My

[Continued on page 89]



Rather than "Toot Our Own Horn" we decided to present what the Radio Society of Great Britain (RSGB) had to say in their April issue of *Radio Communications* about *The Amateur Radio DX Handbook*. See their review below.



DX-ing starts here

A big gap in amateur radio publishing is filled by a new book from *CQ Magazine*, the *Amateur Radio DX Handbook*, By Don Miller, W9WNV.

Everything DX-wise concerning the radio amateur or SWL is included in the DX Handbook. It runs to 200 pages of concise text plus a mass of drawings, tables, graphs and pictures. The amount of factual content is quite staggering.

W9WNV starts with an admirably straightforward survey of propagation, one of the best short treatments of the subject seen. He surveys the various bands from the DX point of view and then covers the many small factors that make for efficient operation. Following this are sensible

suggestions for the station with the merits of various aerials thoroughly covered.

The best chapter in the book has the explanatory title of "Working DX from the Home Station." Especially useful here are language conversion tables for radio terms. Another chapter on contest working is one of the best analysis of contest work yet written while the piece on DX'ing from the rare location should be compulsory reading for all DX stations!

Sundry other topics such as award chasing and mobile DX'ing are adequately covered. There is even a section on vhf uhf DX!

Cowan Publishing Corp., 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

THE AMATEUR RADIO DX HANDBOOK, \$5.00 each, Postpaid

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Sept. 6-7	LABRE Phone DX Contest
Sept. 6-7	VU2/4S7 Phone Contest
Sept. 6-8	Washington St. QSO Party
Sept. 13-14	DARC WAE Phone Contest
Sept. 20-21	VU2/4S7 C.W. Contest
Sept. 20-21	SAC C.W. Contest
Sept. 20-22	Pennsylvania QSO Party
Sept. 24-26	YL "Howdy Days" Party
Sept. 27-28	SAC Phone Contest
Sept. 27-28	County Hunters C.W. Party
Sept. 27-29	MARC VE/W Contest
Oct. 4-6	California QSO Party
Oct. 4-6	CARTG WW RTTY Contest
Oct. 4-5	VK/ZL/Oceania Phone
Oct. 11-12	VK/ZL/Oceania C.W.
Oct. 4-12	Labanese DX Contest
Oct. 11-12	Floridora QSO Party
Oct. 11-12	IARU Region II Contest
Oct. 11-12	RSGB 28 mc Phone Contest
Oct. 15-16	YL-AP C.W. Contest
Oct. 18-19	Boy Scouts Jamboree
Oct. 18-19	KR6 DX Contest
Oct. 18-19	WADM C.W. Contest
Oct. 25-26	CQ WW Phone Contest
Oct. 25-26	RSGB 7 mc C.W. Contest
Nov. 5-6	YL-AP Phone Contest
Nov. 8-9	RSGB 7 mc Phone Contest
Nov. 8-9	ARRL SS Phone Contest
Nov. 15-16	ARRL SS C.W. Contest
Nov. 29-30	CQ WW DX C.W. Contest

SAC DX Contest

C.W.—Sept. 20-21 Phone—Sept. 27-28

Starts: 1500 GMT Saturday

Ends: 1800 GMT Sunday

It's the world working the Scandinavians on all bands, 3.5 thru 28 mc. The same station may be worked on each band for QSO and multiplier credits.

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

Exchange: Five or six figures, RS/RST report plus a progressive QSO nr. starting with 001. Multi transmitter stations will use separate series of numbers for each band.

Scoring: Each completed QSO counts 1 point. The multiplier is determined by the SAC countries worked on each band. (LA, JW, JX, OH, OH0, OX, OY, OZ, SM/SL/SK, Max. of 9 per band.)

Final Score: Total QSO points times the total multiplier from all bands. Max of 45.

*14 Sherwood Road, Stamford, Conn. 06905.

Score is determined on all band operation.

Awards: Certificates to the two top scorers, both phone and c.w., in each country and each US call area.

Logs: Date/time in GMT, station worked, number sent/rec'd, band and each new multiplier as worked. Also a summary sheet showing the scoring, name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed.

This year logs go to: N.R.R.L. Contest Committee, P.O. Box 21, Refstad, Oslo 5, Norway.

Pennsylvania QSO Party

Starts: 2300 GMT Saturday, September 20

Ends: 0200 GMT Monday, September 22

This 12 annual party is sponsored by the Nittany A.R.C. The same station may be worked on different bands and modes for QSO points.

Exchange: QSO nr., RS/RST and QTH; county for Penn. stations, ARRL section or country for all others.

Scoring: Penn. 3 points for out of state contacts, 1 point if with another Penn. station. Multiply total QSOs by ARRL sections and countries worked. Out-of-state stations, 1 point per QSO multiplied by Penn. counties worked. (Max. of 67.)

Frequencies: Activity will be found 75 kc. from edge of each c.w. band. One phone, 3880, 7280, 14280, 21325. Check phone bands on even GMT hours.

Awards: Certificates to first place stations in each ARRL section and country, 2nd and 3rd place awards where activity justifies.

Awards also to the top Penn. and non-Penn. scorer.

Mailing deadline October 20th to: Nittany A.R.C., P.O. Box 60, State College, Penn. 16801.

YL-RL "Howdy Days"

Starts: 1800 GMT Wednesday, September 26

Ends: 1800 GMT Friday, September 28

Scores will be based on contacts between licensed women operators only. All bands and modes may be used, but only one contact with each station is permitted. Cross-band and net contacts do not count.

Scoring: Score 2 points for each YLRL member worked, 1 point for each non-member. There is no multiplier.

Awards: Top scoring YLRL member will

receive her choice of a YLRL pin, charm or stationary. Non-member receives a year's membership in the YLRL.

Logs must be received by October 14th and go to: Ebba Kristjansson, VE5DZ, Box 71, Colonsay, Sask. Canada.

County Hunters C.W. Party

Starts: 0000 GMT Saturday, September 27

Ends: 2400 GMT Sunday, September 28

The County Hunters Net encourages mobile and portable operation in less active counties. The same station may be worked once on each band, and again if QTH has been moved to another county.

Exchange: QSO nr., RST, state, province or country, and county for U.S. stations.

Scoring: Multiply number of QSO's by number of different counties worked. (Mobiles calculate their score on basis of total contacts within a state.)

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

Awards: Certificates to the top scoring stations in each state, province and country, with 100 or more points. And the top mobile in each U.S. call area with operation from three or more counties.

Logs: Date/time in GMT, station worked, exchange and band. Include a summary sheet showing scoring and location, and a check sheet of counties worked if 100 or more contacts are made.

Mailing deadline November 1st to: C. W. County Hunters Net, Att: L. B. Chebik, W4-RNL, 245 Morning View Drive, Athens, Georgia 30601.

MARC VE/W Contest

Starts: 2300 GMT Saturday, September 27

Ends: 0200 GMT Monday, September 29

The Montreal Amateur Radio Club has made some worthwhile changes in the rules of this year's contest. Power and bonus multipliers have been eliminated and the log format simplified.

Only contacts between W/K and VE/VO stations are valid of course, and you are permitted 20 hours out of the 27 hour contest period. Times on/off must be indicated on the log. The allowable off period is a minimum 15 minutes.

The contest is divided into two parts, phone and c.w. and each must be scored separately. Also two classes, single and multi-operator.

Exchange: QSO nr., RS/RST and QTH. ARRL section for W/K's, geographical areas for VE/VO's. (Provinces, total of 13).

Scoring: Count 2 points for each completed QSO and multiply by number of sections worked.

Frequencies: All bands may be used but it is recommended that operation be in the "general" portion of the bands.

Awards: Certificates to the top scorers in each section for both phone and c.w. entries. Multi-operator awards will be made only in sections with 3 or more entries. There are also two Trophies, top US and Canadian winners.

Logs: Sheets should be columned as follows: Band, time on/off, nr of QSO, time in GMT, station worked, report sent/rec'd, nr. rec'd, section, each new multiplier and QSO points. Stations making over 100 contacts *must* submit a check list, and a summary sheet showing the scoring, name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed.

Mailing deadline October 31st to: MARC Contest Committee, 676 Wiseman Ave., Outremont, P.Q., Canada.

California QSO Party

Starts: 2000 GMT Saturday, October 4

Ends: 0200 GMT Monday, October 6

The 4th annual party is again sponsored by the North Hills Radio Club. Use all bands and modes. The same station may be worked once on each band and mode.

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

Scoring: Calif. multiply total QSOs by ARRL sections and DX countries worked. Non-W6 stations multiply QSOs by Calif. counties worked. (Max. of 58) Calif. may work other W6 stations but for QSO credit *only*. Additional county credit may be claimed by non-W6's for each 6 different stations worked per county.

Frequencies: 3550, 3725, 3900, 7075, 7175, 7250, 14075, 14270, 21075, 21175, 21370, 28075, 28700.

Awards: First place certificates to the winners in each of the 74 ARRL sections and DX country. Additional awards in sections of high activity.

Mailing deadline November 7th and logs go to: John F. Minke, III, WA6JDT, 6230 Rio Bonito Drive, Carmichael 95608. Include a large s.a.s.e. for copy of results.

CARTG WW RTTY Contest

Starts: 0200 GMT Saturday, October 4

Ends: 0200 GMT Monday, October 6

The 9th world wide RTTY DX "Medallion" Sweepstakes are again sponsored by the Canadian Amateur Radio Teletype Group.

Operation is limited to 36 out of the 48 hour contest period. The 12 hour non-operating period may be taken any time but in periods of not less than 2 hours.

Use all bands 3.5 thru 28 mc, the ARRL country list and the CPR zone map.

Exchange: Message nr., time in GMT, zone, country and continent.

Points: Two point for contacts with stations

in one's own zone. Contacts with stations in other zones, score points as listed in the exchange table. The same stations may be worked on each band for contact and multiplier points.

Multiplier: Each country worked on each band, including one's own, is a multiplier of one. (ARRL list plus KL7, KH6 and VO).

Scoring: Total QSO points, multiplied by sum of countries from each band, and again by the continents worked. (Max. of 6.)

Awards: Certificates for high score in each US and Canadian districts. And a total of 12 Medallions in many categories.

It's suggested you write to the CARTG for log forms, and CPR map and exchange table.

Logs must be received no later than November 30th and go to: C.A.R.T.G. 85 Fifeshire Road, Willowdale, Ontario, Canada.

VK/ZL/Oceania DX Contest

Phone—October 4-5 C.W.—October 11-12

Starts: 1000 GMT Saturday

Ends: 1000 GMT Sunday

This year's contest is run as part of New Zealand's Bi-Centennial Celebration and special certificates, trophies and medallions will be awarded.

Rules apply to stations other than VK/ZL.

Exchange: Usual 5 and 6 figures, RS/RST plus a progressive 3 digit contact number starting with 001.

Scoring: *Oceania stations:* 2 points for VK/ZL contacts, 1 point for rest of world. *Outside Oceania:* 2 points for VK/ZL contacts, 1 point for Oceania. *Final score:* Total points multiplied by sum total of VK/ZL call areas worked on all bands. (Single band scores are also acceptable).

Logs: Must show in this order: Date/time in GMT, station worked, number sent/rec'd, and QSO points. Underline each new VK/ZL call area worked on each band, and use a separate log sheet for each band.

A summary sheet showing the scoring and other pertinent information is also requested. Your name and address in BLOCK LETTERS, and include a signed declaration that all rules and regulations have been observed.

Awards: Certificates to top scorers in each country and call areas for W/K, JA and UA, both on all bands and each individual band.

This year there will be additional awards of plaques and NZART badges to the top scorers in each continent and top world scores in the different categories.

There are awards for clubs too. Their score is figured on the total membership score from both phone and c.w. contests. Stations must indicate name of their club on their logs.

There is also a s.w.l. section, only VK/ZL stations are to be listed. Include call of station being worked and serial number sent. Log procedure same as above.

Logs go to: NZART Contest Manager, Box 489, Wellington, New Zealand or 152 Lytton Road, Gisborne, New Zealand. And must be received on or before January 23rd, 1969.

Lebanese DX Contest

Starts: 0001 GMT Saturday, October 4

Ends: 2359 GMT Sunday, October 12

The Lebanese Amateur Radio Association announces its 20th anniversary DX contest.

Objective: Work as many OD stations, on as many bands as possible, either phone or c.w. Each OD station may be worked once per band.

Points: Contacts from Europe, Africa and Asia count 1 point on 10, 15 and 20 meters; 2 points on 40; and 3 points on 80 meters.

Contacts from North and South America, Oceania and Antarctica count 2 points on 10, 15 and 20 meters; 4 points on 40; and 6 points on 80 meters.

Scoring: Final score is the total QSO points from all bands, no multiplier.

Awards: Certificates to the high scorers in each country and U.S. call area. And a silver cup to each continental leader.

The "Top Banana" of the contest is invited to go to Lebanon for a special presentation. In cooperation with the Lebanese Ministry of Tourism and through the courtesy of the Middle East Airlines and the Cadmos Hotel in Beirut, he will be provided transportation for two from any point on the MEA route to Beirut, plus accommodations for a week.

Logs: Must show date/time in GMT, station contacted, band and points. Mailing deadline is November 1st to: R.A.L. Contest, P.O. Box 1217, Beirut, Lebanon.

CQ WW DX Contest

Complete rules including a list of Special Awards will be found on page 25 of this issue. A brief-down was given in last month's *CAL-NDAR*. No changes from last year's rules.

Official log and summary sheets are available from *CQ*. Indicate the amount you need and include a large s.a.s.e. with your request. International log sheets are available for Canadians from Daystrom Limited, 1480 Dundas Highway East, Cooksville, Ont. Canada.

Editor's Notes

Shortly after the C.W. Contest results had been completed, Anne and I boarded the M/S Victoria and took off for a two week cruise to the Caribbean.

We did not attempt to locate "hams" in all the islands we visited but we did have the pleasure of meeting Alicia and Felix, KP4CL and KP4CK, and spent a delightful day and evening with them. And Paul, KP4CB who I

[Continued on page 98]

VHF TODAY

BY ALLEN KATZ,* K2UYH

DESPITE the existence of several v.h.f. handbooks and hundreds of construction articles, very little has been written on how to get the devices described in these publications working. We shall concentrate this month on the procedure for putting a newly constructed power amplifier on the air. Due to the fact that in many cases it is impossible to duplicate a particular construction article exactly, the techniques described here will be mainly of the trial and error type. Furthermore, we shall discuss a vacuum tube circuit, although many of the ideas suggested here will apply equally as well to transistor amplifiers.

To begin with, start at the input or grid circuit. It should be checked with a grid dip oscillator (g.d.o.) to make sure it resonates at the frequency it is to be operated on. Most g.d.o.'s will work well on 144 mc and even on 220 mc, but will perform poorly (or will not reach) on the higher bands. If you don't have a working g.d.o., the following approach may be taken. Disconnect any protective bias circuit used with the amplifier and connect the grid directly to ground through a resistor and milliammeter as shown in figure 1. The size of the resistor and the value of the milliammeter will depend on the particular amplifier being tested. For a 4CX250 amplifier (as the one described in the July 1968 VHF COLUMN) a 10K resistor and a 25 ma meter would make good initial choices. Then, with only heater voltage supplied to the amplifier and driving power applied, tune the grid circuit capacitor until the current registered on the milliammeter peaks. If maximum current occurs at one extreme or the other of the grid capacitor's tuning range, the input circuit must be modified accordingly until the current peak occurs within the capacitor's

tuning range. If the meter does not read any current at all, reduce the value of resistance and meter range until a reading is obtained. If you still cannot get any grid current reading, something is drastically wrong with the grid circuit or your driver is not functioning.

If transformer coupling is used, the size of the input loop (along with its position) should next be adjusted for maximum grid current. A 4CX250B requires at least a 100 volts of grid drive or 10 ma of grid current through a 10K resistor for class C operation.

Once you are satisfied that the grid circuit is performing properly, proceed to the plate circuit. This circuit should also be checked for resonance at the proper frequency before plate (and screen) voltage is applied. Where a g.d.o. is unavailable, there are several alternate approaches. One method which we commonly use is to take advantage of the power which feeds through from the input to output circuits. Even in amplifiers which do not require neutralization, this energy is usually measurable. By placing a diode and microammeter at the output as shown in figure 2A, the effect of the plate circuit on this feed-through power may be determined. At resonance, a sharp peak in the diode current will occur. Hence the same procedure as used for adjusting the grid circuit may be followed to make the plate circuit resonate at the proper frequency. At this point (if neutralization is required) it may be also convenient to adjust the neutralization minimum output indication.

Another method for determining the resonant frequency of the plate circuit is illustrated in figure 2B. In this method, an r.f. source of the frequency the amplifier is to be operated on (possibly the driver) is fed into the output coupling loop and the final tube itself is used as the diode. The procedure

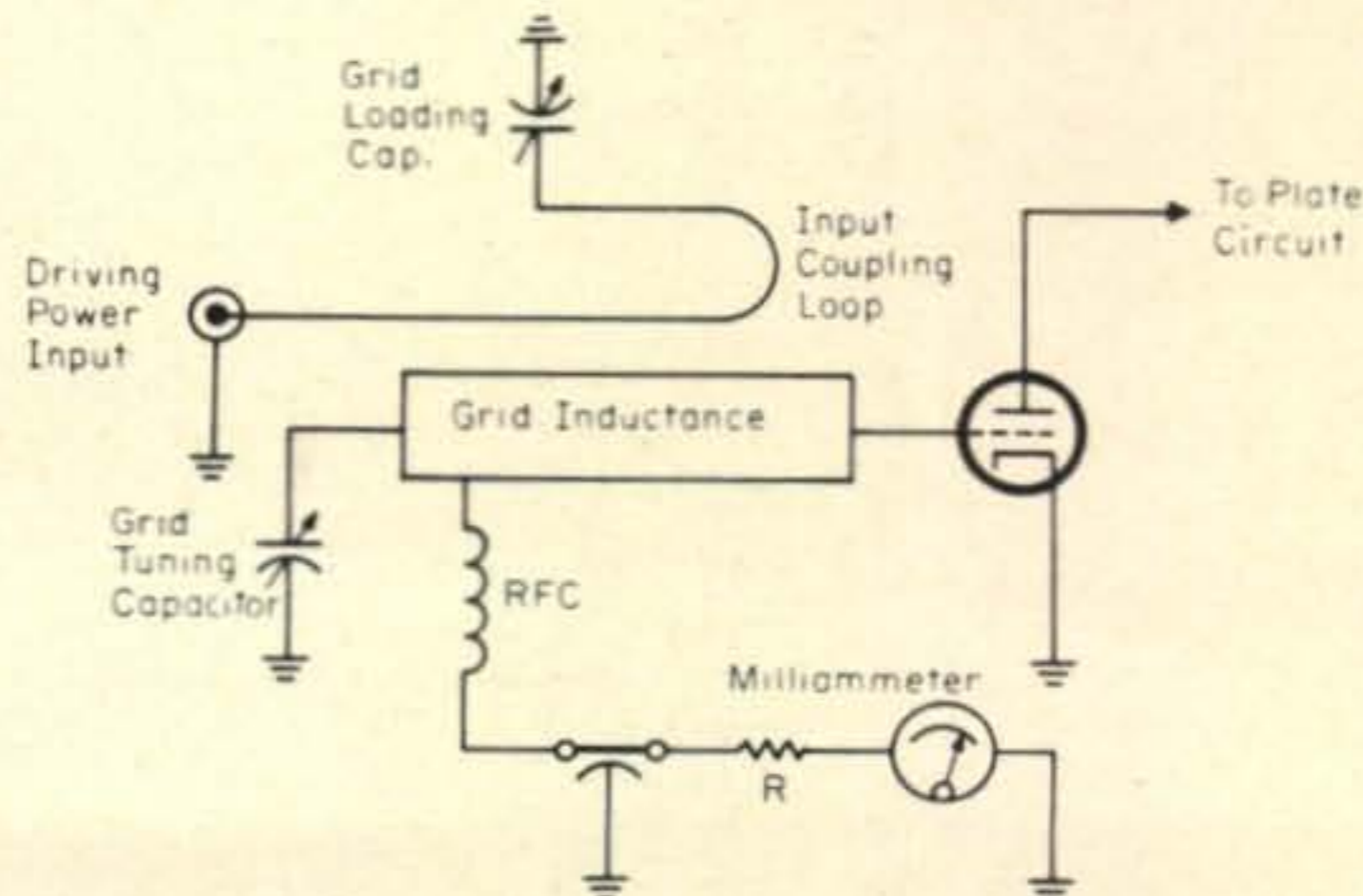
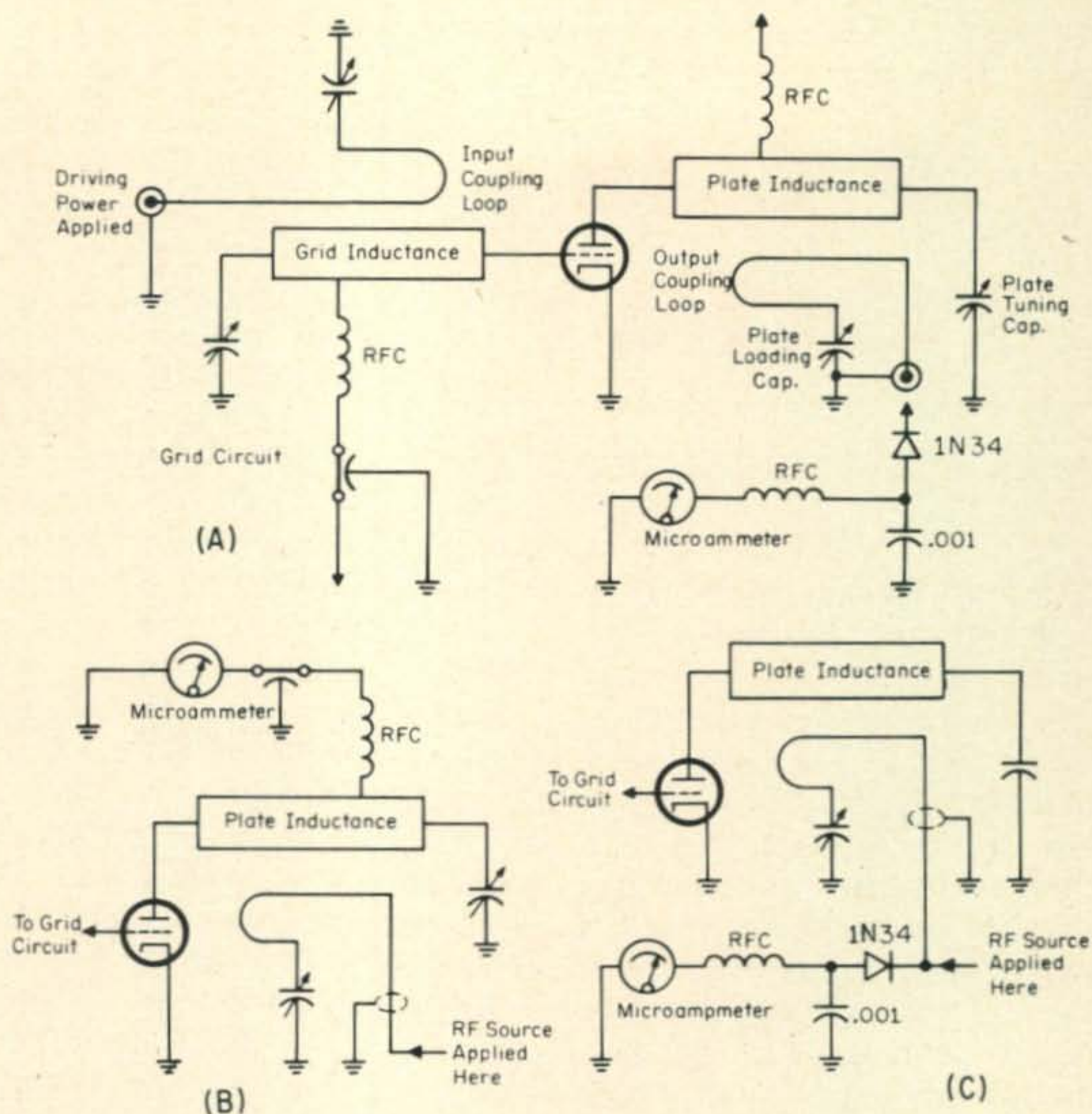


Fig. 1—A v.h.f.-u.h.f. amplifier grid circuit.

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

Fig. 2—Technique for determining resonant frequency of a tuned circuit.



otherwise is the same as in the previous case.

A third approach, referred to as the "suck out" method is shown in figure 2C. In this instance, a diode and a signal generator are connected to the amplifier's output. When the signal generator is tuned to the resonant frequency of the plate circuit, the diode current will dip to a minimum value. This effect oc-

curs since the output circuit will absorb maximum power when excited at its resonant frequency.

Once the resonance of the input and output circuits has been determined and the neutralization adjusted, the protective bias may be set. A typical bias supply is shown in figure 3. With no driving power applied, but with plate (and screen) voltage on, the protective bias voltage should be adjusted to a level such that the plate current is zero or some small value well within the plate dissipation ratings of the amplifier. The above adjustment is not necessary in some cases where the protective bias voltage is specified in the amplifier design.

Next, the final amplifier may be connected to a dummy load or antenna through a directional coupler or some sort of powermeter, and the power tested. If the output power is not quite up to what you had anticipated do not get depressed (not yet). The output coupling loop still has to be adjusted. Try different positions and sizes of output coupling loops until you are satisfied that you are

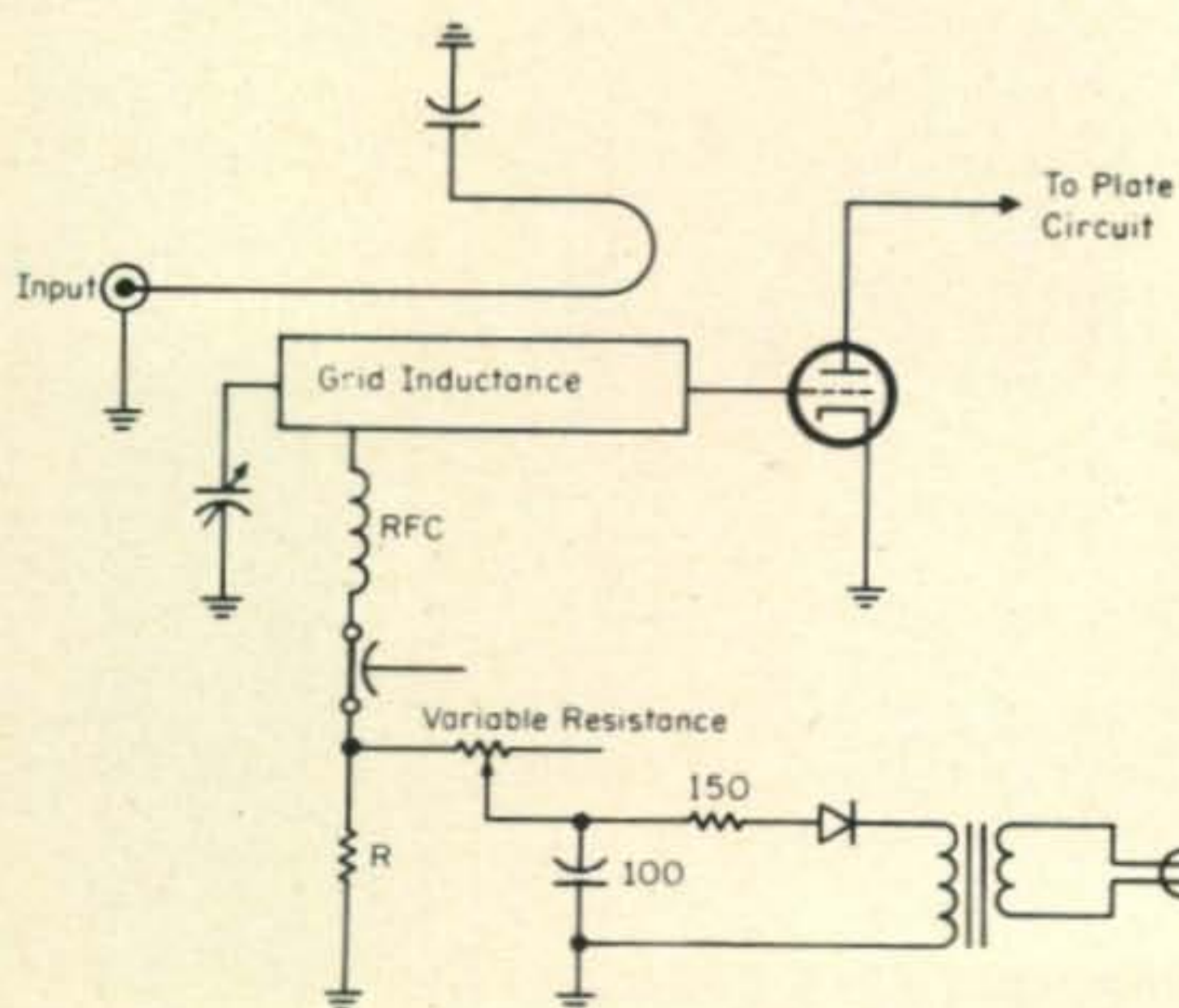


Fig. 3—Common protective grid bias circuit.

[Continued on page 88]

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

Manual for Eldico SBA-1

QUESTION: Can you advise a source for a manual, which I can buy or obtain on loan, on the Eldico Model SBA-1? I have written to several possible sources with negative results. Letters to Eldico have been returned "moved, left no address".

ANSWER: We have been unable to locate a manual for the Eldico SBA-1, even by a phone call to the former operators of Eldico.

We therefore are putting out a call to our readers for help in this matter. Correspondence related to such should be addressed directly to the questioner: W. C. Schroeder, WA6VSF, 501 North Poppy Street, Lompoc, California 93436.

Locating Defective Antenna Traps

QUESTION: How can I find a defective trap in my TA-33Jr antenna. When its windy, even just a calm breeze, I hear a click and the signal comes up; then another click and the signal goes down. Its not a mechanical part, as I've checked everything, made sure all screws are tight, etc. There must be a defective trap.

ANSWER: The possibility of a defective antenna trap may be determined by lowering the antenna and then checking the resonant frequency of each trap using a g.d.o. While doing so, wiggle or shake the trap and note whether or not the resonant frequency shifts. If it does, the trap is defective. In making these tests it would be best to remove the trap from the antenna; otherwise the adverse effects may be indicated due to other causes.

We have a feeling that your problem is not caused by a trap, but is due to some other poor connections such as a corroded joint, feedline connectors or a defective transmis-

sion line. You might localize this by shaking various sections of the antenna or feedline, particularly at joints or the connectors.

Also make sure the problem is not due to a defect in your receiver. Monitoring the s.w.r. while the transmitter is on is a good way to determine if the problem actually exists in the antenna system. This would be indicated by a changing s.w.r.

Gonset Communicator and Linear Amplifier Improvements

QUESTION: I should like some information on improving the performance of a 6-meter Gonset Communicator and Linear Amplifier. Is there a replacement for the 826? Will the 826 or a replacement take the increased voltage if silicon diodes are used instead of the 5U4?

ANSWER: The only data we have on Gonset Communicator improvements will be found in *CQ* for January 1957, page 30, under the title of "W6TNS's Communicator Notes". Xeroxed copies of the article are available at \$1.00 each from our Circulation Department

Besides a general run-down, the article describes a tubeless v.f.o., improving receiver stability, a high-power linear using a pair of 829B's, receiving c.w., plug-in S-meter, external modulator for better modulation, TNS noise limiter/squelch, m.c.w. transmissions, low-noise pre-amp, and data on communications relays.

We know of no direct replacement for the 826's in the linear. Use of silicon-diode rectifiers should be okay in place of the 5U4 vacuum-tube rectifier. The increased voltage should not be significant as far as the tubes go and if it is not above the breakdown ratings of other components.

Meter Repairs

QUESTION: I have two burned-out 3" Triplet meters. One is a 0-1 ma unit, the other is a 0-2500 v.d.c. one, 1000 ohms-per-volt. Do you know of any meter repair shops in Chicago, Detroit or Cleveland? I tried Triplet and they said they do not do this work.

ANSWER: One meter-repair shop we know of is located in New York: Nilson Electric Lab., Inc., 103 Lafayette Street, New York, N.Y. 10013. The cost of repairing a burned-out meter usually runs \$7-\$11. If the cost is not justifiable for the type meters you wish repaired, they may be replaced with less expensive surplus meters. A 0-2500 volt,

*Technical Director, *CQ*.

1000 ohm-per-volt meter can be set up using a 0-1 ma meter with a 2.5 megohm series-dropping or multiplier resistor.

If you wish to send meters for repair in New York, we suggest you use United Parcel for the shipper.

Overheated Bypasses

QUESTION: The bypass capacitors around the 6146 tube in my DX-60B transmitter badly overheat. There are all .005 mf and the solder at the connections usually is molten after 15 minutes of operating. How can I remedy this?

ANSWER: This is a most unusual situation, especially if *all* the capacitors heat excessively, but the suspicion is that this takes place with only those at the cathode terminals (C_{16} , C_{17} & C_{18}). The cause may be self-resonance in the capacitors or with the internal tube leads at a point near your operating frequency, causing high r.f. current through the capacitors. This might be traced down by noting if the heating occurs on all bands or near only a particular frequency on a band.

If the problem exists only around a given frequency range, capacitor resonance would be the prime suspect, in which case the particular batch of capacitors supplied with your unit may just happen to resonate at a bad spot (.005 mf discs often resonate around 7 and 30 mc). Try changing the capacitors to .0047, .0062 or .0068 mf. On the other hand, you might try changing the lead lengths, slightly, on the present ones. The problem also may be due to parasitics. Make sure the parasitic suppressor, PC , at the plate of the 6146B is okay. Also check the neutralization.

Filter-Capacitor Failure

QUESTION: One of the electrolytic filter capacitors in my DX-40 power supply keeps blowing out. This happens when the transmitter is on and switched to the c.w. position, but I am not transmitting at the time. I changed the capacitors to 600-volt ones instead of the original 450-volt ones and reduced the value of their shunting resistors by one-third. This worked alright for a week and then one of the capacitors blew. What do you think is the cause?

ANSWER: The cause of the capacitor failure in this case may be due to high voltage spikes that could occur through arcing on a defective rectifier-tube socket. A socket replacement might provide a solution. Also try

another rectifier tube, since the base on the present one may have a carbonized arc-trail either inside or outside of it.

Pin 1 of the socket is used as a tie point for one end of the filter choke, so arcing may be occurring at this point. Also make sure the insulation on the h.v. a.c. and d.c. leads has not deteriorated.

Another possibility of the trouble is a defective filter choke or power transformer and poor connections that could cause arcing or high inductive-voltage kickbacks.

Further checks may be made to localize the source of the problem by using a voltmeter at various points to monitor the d.c. voltages under key-up conditions for determining if and where excessive voltages appear either in a steady state or as intermittent fluctuations.

Panadapter for HRO-60

QUESTION: Do you know of any panadapter that can be used with the HRO-60 receiver?

ANSWER: With the HRO-60, a panadapter will have to be a 455 kc i.f. job for receiver frequencies below 7 mc. A 1990 kc one for frequencies above 7 mc will be needed.

The only panadapter that we know of that will fit the bill is the Heathkit SB-620 Scanalyzer, inasmuch as it may be wired for *either* a 455 kc or a 1990 kc i.f. For 1990 kc you use the components designated for 1680/2075 kc. The panadapter input connection should be made through a small value coupling capacitor to the plate (pin 5) of the first mixer, V_3 .

Weather-Satellite Picture-Receiving Equipment

A recent release by NASA is an 85-page publication "Weather Satellite Receiving Stations", a report by Charles H. Vermillion. It describes how to build and operate your own gear for receiving and recording Automatic Picture Transmissions (APT) from Weather Satellites. The equipment includes a beam antenna, an antenna-mounted 136 mc f.e.t. pre-amp, a 136 mc f.e.t. converter, an associated 17.55 mc crystal-controlled vacuum-tube f.m. receiver with video detector and a solid-state electronics system using transistors and IC's for operating an oscilloscope from which the pictures are photographed. Photographic data is included.

[Continued on page 88]



BY GEORGE JACOBS.* W3ASK

ANOTHER sign now indicates that the peak of the present sunspot cycle may have taken place during November, 1968. The Swiss Solar Observatory reports a mean sunspot number of 102 for June, 1969. This results in a smoothed sunspot number of 110 centered on December, 1968. This is slightly lower than the peak value of 111 recorded during November, and may indicate the beginning of the downward trend for the present cycle.

September Propagation Charts

September is the one month of the year in which both short-skip and DX propagation charts appear at the same time. The need for both sets of charts results from the marked seasonal change in propagation conditions which generally takes place on the high frequency bands during September. The short-skip charts in this month's column are valid through November 15, while the DX charts are valid through October 15.

During September a greater number of DX openings are expected during the daylight hours on 10, 15 and 20 meters, although these bands will close somewhat earlier than during the summer months. Improved nighttime DX propagation conditions are forecast for 40, 80 and 160 meters, with considerably lower static levels and with the bands remaining open somewhat longer than during the past few months.

During September, and continuing through the early fall season, there is a noticeable improvement in h.f. propagation conditions on long circuits between the northern and southern hemispheres.

This should result in more frequent DX openings between the USA and such areas as South America, South Africa and Australasia, etc., on all amateur bands between 10 and 160 meters.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for
Sept. 1, through Oct. 15, 1969

	Forecast Rating & Quality			
	Days (2)	(1)	(4)	(3)
Above Normal: 7, 10, 24, 27.6	B	B-C	A	A-B
Normal: 1-2, 5-6, 8-9, 11-13, 15-16, 21-23, 25-26, 28-29, 2-5, 7-9, 11-15	C	D	A-B	B
Below Normal: 3-4, 14, 17, 19-20, 30, 1, 10, 13, 15	D	E	B-C	C-D
Disturbed: 18, 14	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 forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthesis 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 valid through Nov. 15, 1969. These Charts are prepared from basic propagation data published monthly by the Institute for Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

V.H.F. Ionospheric Openings

Although solar activity may be decreasing, the level is still high enough to permit at least an occasional F-layer 6 meter opening this September between the USA and South America, and perhaps also with South Africa and Australasia.

Propagation favors the southern half of the USA, and the best time to look for these openings is between noon and sundown local

time, especially after the middle of the month.

Trans-equatorial, or TE-scatter propagation should be possible on 6 meters virtually every night during September, between most areas of the USA and Central and South America. The optimum time period to look for TE openings is between 8 and 11 P.M., local time at the path mid-point.

Although the summertime sporadic-E propagation season usually comes to an end during September, some 6 meter short-skip openings are still likely to occur over distances ranging between approximately 1000 and 1300 miles. Some v.h.f. ionospheric openings may also result from an increased level of auroral activity expected during September. Check the "Last Minute Forecast" at the beginning of this column for periods that are forecast to be disturbed or

below normal, as these are the days on which auroral type openings are likely to occur during the month.

Meteor activity is generally at a very low level during September. No major meteor showers are scheduled, and few, if any significant meteor-scatter openings are likely to take place.

CQ DX Contest Special

This year's CQ Worldwide DX contest will be held on the following dates:

Oct. 25-26 Phone section

Nov. 29-30 C.W. section

As has been the practice for the past 18 years, next month's Propagation Column will be devoted to a special, comprehensive forecast which will include both contest sections.

73, George, W3ASK

September 15-October 15, 1969

TIME ZONE: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	07-09 (1) 09-10 (2) 10-12 (3) 12-14 (2) 14-15 (1)	07-08 (1) 08-10 (2) 10-13 (4) 13-14 (3) 14-16 (2) 16-18 (1)	01-03 (1) 03-05 (2) 05-09 (3) 09-11 (2) 11-14 (3) 14-16 (4) 16-20 (3) 20-01 (2)	17-18 (1) 18-20 (2) 20-22 (3) 22-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-00 (2)* 00-03 (1)*
Northern Europe & European USSR	08-09 (1) 09-12 (2) 12-13 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1)	02-05 (1) 05-07 (2) 07-10 (3) 10-12 (2) 12-16 (3) 16-18 (2) 18-20 (1)	17-19 (1) 19-03 (2) 03-04 (1) 20-03 (1)*
Eastern Mediterranean & Middle East	08-09 (1) 09-11 (2) 11-13 (1)	07-08 (1) 08-11 (2) 11-13 (3) 13-15 (2) 15-17 (1)	06-08 (2) 08-14 (1) 14-16 (2) 16-20 (3) 20-22 (2) 22-00 (3) 00-02 (2) 02-06 (1)	18-20 (1) 20-23 (2) 23-00 (1) 21-23 (1)*
West & Central Africa	08-11 (1) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-21 (1)	04-07 (2) 07-14 (1) 14-16 (2) 16-17 (3) 17-20 (4) 20-23 (3) 23-02 (2) 02-04 (1)	19-22 (1) 22-01 (2) 01-03 (1) 00-02 (1)*
South Africa	08-10 (1) 10-12 (2) 12-13 (1)	06-10 (1) 10-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	05-07 (2) 07-14 (1) 14-15 (2) 15-18 (3) 18-23 (2) 23-02 (3) 02-03 (2) 03-05 (1)	18-21 (1) 21-23 (2) 23-01 (1) 22-00 (1)*

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

East Africa	09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-10 (2) 19-20 (1)	11-13 (1) 13-16 (2) 16-20 (3) 20-00 (2) 00-02 (1)	19-00 (1)
Central & South Asia	08-10 (1) 19-21 (1)	07-08 (1) 08-10 (2) 10-11 (1) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-21 (2) 21-00 (1)	19-22 (1) 04-06 (1)
South-east Asia	10-13 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-18 (1) 18-20 (2) 20-21 (1)	05-07 (1) 07-09 (2) 09-11 (1) 14-17 (1) 19-20 (1) 20-23 (2) 23-01 (1)	05-07 (1)
Far East	08-10 (1) 17-19 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-17 (1) 17-19 (2) 19-21 (1)	06-07 (1) 07-09 (3) 09-11 (2) 11-13 (1) 17-19 (1) 19-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	05-07 (1)
South Pacific & New Zealand	08-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-21 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-16 (2) 16-20 (3) 20-21 (2) 21-23 (1)	11-19 (1) 19-21 (2) 21-23 (3) 23-01 (4) 01-03 (3) 03-07 (2) 07-09 (3) 09-11 (2)	00-01 (1) 01-02 (2) 02-05 (3) 05-07 (2) 07-08 (1) 03-07 (1)*
Australia	09-11 (1) 15-16 (1) 16-18 (2) 18-20 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-16 (1) 16-19 (2) 19-21 (1)	06-08 (2) 08-10 (3) 10-12 (2) 12-15 (1) 15-17 (2) 17-20 (1) 20-22 (2) 22-01 (3) 01-03 (2) 03-06 (1)	02-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Northern & Central South America	07-08 (1) 08-09 (2) 09-13 (4) 13-16 (3) 16-18 (2) 18-19 (1)	05-06 (1) 06-07 (2) 07-10 (4) 10-12 (3) 12-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	02-04 (2) 04-06 (3) 06-09 (4) 09-14 (2) 14-16 (3) 16-22 (4) 22-02 (3) 2-3	18-19 (1) 19-20 (2) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-03 (2)* 03-05 (1)*

Brazil, Argentina, Chile & Uruguay	07-08 (1)	06-07 (1)	09-15 (1)	20-23 (1)
	08-11 (2)	07-10 (2)	15-17 (2)	23-04 (2)
	11-13 (1)	10-13 (1)	17-19 (3)	04-06 (1)
	13-14 (2)	13-15 (2)	19-00 (4)	00-05 (1)*
	14-15 (3)	15-16 (3)	00-03 (3)	
	15-17 (4)	16-19 (4)	03-05 (2)	
	17-18 (2)	19-21 (3)	05-07 (3)	
	18-19 (1)	21-22 (2)	07-09 (2)	
	22-00 (1)			
McMurdo Sound, Antarctica	16-18 (1)	11-14 (1)	15-17 (1)	22-00 (1)
		14-17 (2)	17-21 (2)	00-04 (2)
		17-20 (3)	21-00 (3)	04-06 (1)
		20-21 (2)	00-03 (2)	03-05 (1)*
		21-22 (1)	03-07 (1)	
			07-09 (2)	
		09-10 (1)		

Far East	15-17 (1)	09-11 (1)	06-07 (1)	02-04 (1)
	17-18 (2)	13-15 (1)	07-08 (2)	04-06 (2)
	18-19 (1)	15-17 (2)	08-10 (3)	06-08 (1)
		17-20 (3)	10-12 (2)	05-07 (1)*
		20-21 (2)	12-16 (1)	
	21-22 (1)	16-20 (2)		
		20-22 (1)		
		22-00 (2)		
		00-02 (1)		
South Pacific & New Zealand	10-14 (1)	08-12 (1)	03-07 (2)	23-00 (1)
	14-16 (2)	12-16 (2)	07-10 (3)	00-06 (3)
	16-18 (3)	16-18 (4)	10-12 (2)	06-07 (2)
	18-19 (2)	18-20 (3)	12-17 (1)	07-08 (1)
	19-21 (1)	20-22 (2)	17-19 (2)	01-03 (1)*
		22-00 (1)	19-21 (3)	03-06 (2)*
			21-23 (4)	06-07 (1)*
		23-03 (3)		

TIME ZONES: CST & MST (24-Hour Time)

CENTRAL USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	08-10 (1)	07-09 (1)	05-06 (1)	17-19 (1)
	10-12 (2)	09-11 (2)	06-08 (2)	19-22 (2)
	12-13 (1)	11-13 (3)	08-12 (1)	22-00 (3)
		13-15 (2)	12-15 (2)	00-01 (2)
		15-16 (1)	15-18 (3)	01-02 (1)
		18-22 (2)	20-22 (1)*	
		22-02 (1)	22-00 (2)*	
			00-01 (1)*	
Northern Europe & European USSR	09-12 (1)	07-08 (1)	05-06 (1)	19-22 (1)
		08-12 (2)	06-08 (2)	22-00 (2)
		12-14 (1)	08-11 (1)	00-01 (1)
			14-16 (3)	
			16-18 (2)	
		18-20 (1)		
		00-03 (1)		
Eastern Mediterranean & Middle East	09-12 (1)	07-08 (1)	05-06 (1)	19-22 (1)
		08-10 (2)	06-08 (2)	20-22 (1)*
		10-12 (3)	08-13 (1)	
		12-13 (2)	13-15 (2)	
		13-15 (1)	15-19 (3)	
			19-21 (2)	
		21-23 (2)		
		23-00 (2)		
		00-01 (1)		
West & Central Africa	09-11 (1)	06-09 (1)	04-07 (2)	19-22 (1)
	11-13 (2)	09-12 (2)	07-14 (1)	22-00 (2)
	13-15 (3)	12-14 (3)	14-16 (2)	00-01 (1)
	15-16 (2)	14-16 (4)	16-18 (3)	22-00 (1)*
	16-17 (1)	16-17 (3)	18-20 (4)	
		17-19 (2)	20-22 (3)	
		19-20 (1)	22-01 (2)	
		01-04 (1)		
South Africa	08-10 (1)	06-08 (1)	05-07 (2)	19-20 (1)
	10-12 (2)	08-11 (2)	07-13 (1)	20-22 (2)
	12-13 (1)	11-12 (3)	13-15 (2)	22-00 (1)
		12-14 (4)	15-18 (3)	20-22 (1)*
		14-15 (3)	18-21 (2)	
		15-16 (2)	21-23 (3)	
		16-17 (1)	23-00 (2)	
			00-05 (1)	
East Africa	10-12 (1)	08-09 (1)	12-14 (1)	20-23 (1)
	12-15 (2)	09-12 (2)	14-16 (2)	
	15-16 (1)	12-16 (3)	16-19 (3)	
		16-17 (2)	19-22 (2)	
		17-18 (1)	22-00 (1)	
Central & South Asia	07-09 (1)	08-10 (1)	06-07 (1)	05-07 (1)
	18-20 (2)	17-18 (1)	07-09 (2)	18-20 (1)
		18-20 (2)	09-11 (1)	
		20-21 (1)	16-18 (1)	
			18-21 (2)	
			21-00 (1)	
Southeast Asia	10-11 (1)	08-10 (1)	06-07 (1)	04-07 (1)
	11-12 (2)	10-12 (2)	07-08 (2)	
	12-14 (1)	12-14 (1)	08-10 (3)	
	16-17 (1)	17-18 (1)	10-12 (2)	
	17-18 (2)	18-19 (2)	12-18 (1)	
	18-19 (1)	19-21 (1)	18-21 (2)	
			21-23 (1)	

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

TIME ZONE: PST (24-Hour Time)

WESTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western Europe & North Africa	08-11 (1)	07-08 (1)	05-06 (1)	19-20 (1)
		08-12 (2)	06-09 (2)	20-22 (2)
		12-14 (1)	09-11 (1)	22-23 (1)
		21-23 (1)	11-13 (2)	20-22 (1)*
			13-16 (3)	
		16-18 (2)		
		18-20 (1)		
		22-00 (1)		
Central & Northern Europe & European USSR	Nil	07-08 (1)	05-06 (1)	19-23 (1)
		08-10 (2)	06-08 (2)	
		10-12 (1)	08-11 (1)	
		21-23 (1)	11-16 (2)	
			16-18 (1)	
		20-22 (1)		
Eastern Mediterranean & Middle East	08-10 (1)	07-08 (1)	04-06 (1)	19-22 (1)
		08-10 (2)	06-09 (2)	
		10-11 (1)	09-13 (1)	
		19-21 (1)	13-15 (2)	
			15-18 (1)	
			18-21 (2)	
		21-22 (1)		
West & Central Africa	09-11 (1)	07-10 (1)	00-06 (1)	20-23 (1)
	11-14 (2)	10-12 (2)	06-08 (2)	
	11-16 (1)	12-14 (3)	08-13 (1)	
		14-16 (4)	13-15 (2)	
		16-17 (3)	15-17 (3)	
		17-18 (2)	17-19 (4)	
		18-19 (1)	19-22 (3)	
			22-00 (2)	

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

DON'T FORGET TO CHECK THE RULES FOR THE 1969 CQ WORLD WIDE DX CONTEST ON PAGE 56 .

September 15-October 15, 1969
LOCAL STANDARD TIME AT PATH MIDPOINT
(24-HOUR TIME SYSTEM)
Distance From Transmitter (Miles)

Band (Meters)	50-250	250-750	750-1300	1300-2300
10	Nil	09-14 (1)	07-09 (1) 09-11 (1-2) 11-13 (1-3) 13-14 (1-4) 14-16 (0-3) 16-18 (0-2) 18-21 (0-1)	07-08 (1-2) 08-09 (1-3) 09-13 (3-4) 13-14 (4) 14-16 (3) 16-17 (2-3) 17-18 (2) 18-19 (1-2) 19-21 (1)
15	Nil	07-09 (0-1) 09-13 (0-2) 13-14 (0-3) 14-16 (0-2) 16-21 (0-1)	07-09 (1-2) 09-13 (2-4) 13-14 (3-4) 14-16 (2-4) 16-19 (1-3) 19-21 (1-2) 21-07 (0-1)	07-08 (2) 08-09 (2-3) 09-16 (4) 16-19 (3) 19-21 (2-3) 21-22 (1-2) 22-00 (1) 00-07 (1-0)
20	11-13 (0-1) 13-16 (0-2) 16-21 (0-1)	07-09 (0-3) 09-11 (0-4) 11-16 (2-4) 16-21 (1-3) 21-02 (0-2) 02-07 (0-1)	07-09 (3-4) 09-16 (4) 16-21 (3-4) 21-00 (2-3) 00-02 (2) 02-07 (1)	07-09 (4) 09-15 (4-3) 15-21 (4) 21-23 (3-4) 23-00 (3) 00-02 (2) 02-07 (1-2)
40	07-09 (2-3) 09-18 (4) 18-20 (3-4) 20-22 (2) 22-05 (1) 05-07 (1-2)	07-09 (3-4) 09-11 (4-3) 11-15 (4-2) 15-17 (4-3) 17-20 (4) 20-22 (2-4) 22-00 (1-4) 00-05 (1-3) 05-07 (2-3)	07-09 (4-2) 09-11 (3-1) 11-15 (2-1) 15-17 (3-2) 17-20 (4-3) 20-00 (4) 00-06 (3-4) 06-07 (3)	07-09 (2-1) 09-15 (1-0) 15-17 (2-1) 17-19 (3-2) 19-20 (3) 20-06 (4) 06-07 (3) (3) - (3-2) -- (2-3)
80	06-11 (4) 11-18 (4-3) 18-23 (4) 23-06 (3-4)	06-08 (4-2) 08-11 (4-1) 11-16 (3-1) 16-18 (3-2) 18-06 (4)	06-08 (2-1) 08-16 (1-0) 16-18 (2-1) 18-21 (4-2) 21-03 (4) 03-05 (4-3) 05-06 (4-2)	06-08 (1) 08-16 (0) 16-18 (1) 18-21 (2) 21-03 (4-3) 03-05 (3-2) 05-06 (2-1)
160	16-18 (1-0) 18-20 (2-1) 20-05 (4) 05-07 (3-2) 07-09 (2-1) 09-11 (1-0)	17-19 (1-0) 19-20 (1) 20-02 (4-3) 02-05 (3-2) 05-07 (2-1) 07-09 (1-0)	19-20 (1-0) 20-22 (3-1) 22-02 (3) 02-05 (2-1) 05-07 (1)	20-22 (1-0) 22-02 (3-2) 02-05 (1) 05-07 (1-0) (1-2) (2-2) - (1-2)-

HAWAII

OPENINGS GIVEN IN HAWAIIAN STANDARD TIME†

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	11-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-00 (3) 00-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-23 (2) 23-00 (3) 00-01 (2) 01-02 (1) 20-22 (1)* 22-00 (2)* 00-01 (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.

[Continued on page 102]



THE awards PROGRAM



BY ED HOPPER,* W2GT

FLASH!

Phillip W. Carlson, WAØEVD

Has qualified for #11

USA-CA-3079 All Counties Plaque

USA-CA-3079 All Counties Plaque

SEE WAØEVO "STORY" FEB. 1969 CQ

THE September, "Story of The Month", about Merle Green, W6HVU, after this data on awards is processed. An item I failed to mention last month was that 3 (yes, THREE) applications for ALL 3079 COUNTIES were received in the month of May. Louis Van Duyn, K8IWI applied for #8 on May 2nd; Harry McNutt, K8KOM, applied for #9 on May 13; then Leo Staley, WA5AEB, applied for #10 on May 21st. Now Phil Carlson, WAØEVO, has applied for #11. Merle Green, W6HVU was awarded a USA-CA-3000 award. Ron Nevers, K1VTM, was issued mixed USA-CA-2500 and 2000 awards. Juls Pflum, K7ZJP, had me burning the midnight oil checking his applications for Mixed USA-CA-2500; USA-CA-2000 endorsed All 20 meter S.S.B.; USA-CA-1500 and 1000 endorsed All S.S.B. Mobile and All 20 meter S.S.B.; and USA-CA-500 award endorsed All 75 meter S.S.B. Ennis Royer, W3CDG, was issued mixed awards for USA-CA-2000 and 1500. John Steward, WB4KGJ, won a mixed USA-CA-1000 award and a USA-CA-500

award endorsed All 20 meter S.S.B. Mobile. Willie Carr, WA4RDV, received a USA-CA-500 award endorsed All 75 meter S.S.B. Jim McKay, VE4GV was issued a USA-CA-500 award endorsed All 14 mc S.S.B., the first award to a VE4, none yet to a VE5 or VE8.

Merle A. Green, W6HVU

This active County Hunter was born in Toledo, Ohio, on September 12, 1903 and received his formal education in Shelby and Piqua, Ohio.

At the age of 17, Merle became so interested in radio that he entered the Army, with his parents consent. Training was received as a Military Telegrapher with the 55th Field Signal Battalion at the Camp Alfred Vail School, this now known as Fort Monmouth, N.J.

When they started to reduce Army personnel in 1922, Merle made an application for a discharge.

Upon moving to Detroit, Michigan, the call 9MG (yes, no W, WA, WB, WN, nor K-Hi.) was received under the old Department of Commerce, and used for about 5 years.

Merle went through WW2 in New Guinea. Again an interest in amateur radio was revived and W6HVU was received in 1950.



Merle Green, W6HVU, 1951.

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

USA-CA HONOR ROLL

3000		2000		1000	
W6HVU	21	W3CDG	68	K7ZJP	160
2500					
K1VTM	49	K1VTM	69	WB4KGJ	161
K7ZJP	50	K7ZJP	70	500	
		1500		WA4RDV	720
		W3CDG	97	VE4GV	721
		K7ZJP	98	K7ZJP	722
				WB4KGJ	723



Merle Green, W6HUV, 1968.

Many years were spent operating Maritime Mobile while going to sea as Chief Electrician aboard various ships. Since being initiated into the wonderful world of County Hunters, this has crowded out DX chasing.

Our records show the following: #621 USA-CA-500 and #113 USA-CA-1000 issued in May 1967. USA-CA-1500 #80, USA-CA-2000 #51 and USA-CA-2500 #34 were issued in October 1968. The big USA-CA-3000 award #21 was issued in June 1969. As usual, the Independent County Hunter Net (14336) and the many mobiles have been a great help. Just to mention one example of mobile help, was that received from Jerry Van Vactor, WAØLYO/M who helped Merle complete North Dakota and South Dakota in the period of just a few hours.

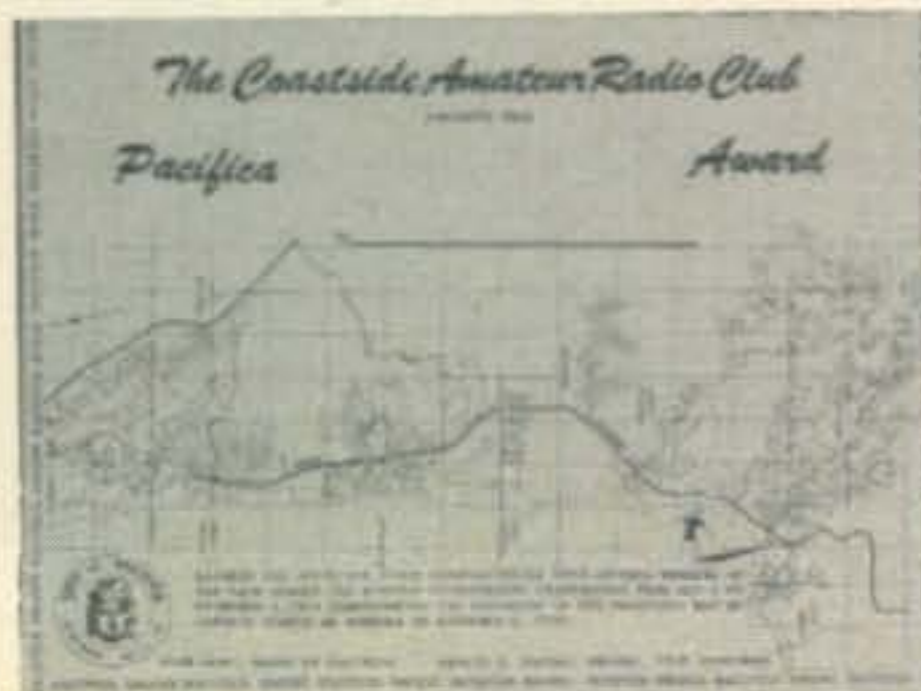
Letters

Bob Schroeder, WA9WLF, writes: "I first ran across the Independent County Hunters on 14336 on February 27, with my first contact being with Paul, W4YWX. Since then I have worked nearly 250 counties with much help from W4YWX, WA4LMR, WØYLN, W5ULN, WB2ZSO, WA7IRD, WA1KDC and a sundry of other nice county hunters—to name them all would fill your column.

"I want to express my sincere thanks to all as I am only 16 and on A1.

"I hope to acquire a phone rig soon and when I can get my driver's license, I hope to repay all by giving out some rare counties".

Vic Samardza, W4EXI (exW2PVV), writes: "Happy (Harry Hopkins), W4SHJ and my-



Pacifica Award.

WSA Certificate



self put on 13 counties in the Southeast and South-central part of Virginia during the Virginia QSO Party.

"Please inform your readers that W4EXI QSL cards for this and all country operations in the future may be obtained through W2GHK, Box 7388, Newark, New Jersey 07107. Please enclose s.a.s.e."

Awards

QRP Amateur Radio Club International: Has a new corresponding secretary—Elmer J. Worth, K3YNN, 946 Franklin Street, Reading, Pa. 19602. They issue five awards that I hope to soon tell you about, but if you can not wait, send an s.a.s.e. to K3YNN for membership information, etc.

The Pacifica Award: The Coastside Amateur Radio Club announces that the Pacifica Award has been created in commemoration of a historic discovery on November 6, 1769, as Captain Gaspar de Portola and members of his expedition looked out across a ridge 1200 feet above sea level and marveled at the spectacular sight of the world's largest harbor—SAN FRANCISCO BAY. This award is available to any amateur or s.w.l. for working or hearing two (2) members of the club on any band and mode between May 6 and November 6, 1969. Send QSL card with call letters and dates worked plus 2 IRC to CARC, 812 Arguello Blvd., Pacifica, California 94044. All CARC members will call CQ like this: WA6PJY calling CQ from scenic Pacifica and on c.w. CQ de W6GJV Pacifica.

Worked All South America: This new WSA certificate is available to all amateurs for working all 13 countries of South America on 2 × s.s.b. or a combination of phone and c.w. Send confirmations and \$1 to HC1TH, Box 583, Quito, Ecuador, South America. The 13 countries required are: Argentina, Bolivia, Brazil, Guyana, Chile, Colombia, Ecuador, French Guinea, Paraguay, Peru, Surinam, Uruguay and Venezuela.

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Washington State Operating Achievement Award: The State of Washington and the Puget Sound Council of Amateur Radio Clubs are glad to sponsor this AWARD to publicize Washington State Amateur Radio Week proclaimed by the Governor to be September 1 to 7 inclusive. Any amateur outside the State of Washington may qualify by working ten Washington hams during the above mentioned week. Washington State amateurs must work twenty other Washington hams during this period to qualify. Send list of stations worked, their QTH, and the dates of the contacts to: The Puget Sound Council of Amateur Radio Clubs, Drawer A, McChord AFB, Washington 98438. Be sure to include your full name, call, address and zip code.

Notes

Sad to note the demise of the *CW County Hunter Newsletter* that had been doing a good job, also Dick Bentley, K2UFT and Rick Lobdell, K2VGR (Members of the South Shore Amateur Wireless Association, 116 Locust St., Valley Stream, N.Y. 11581) were running County Hunter Nets on week-

ends on 7055 and 14070 and they did a fine job of sponsoring the c.w. County Hunter QSO Party last year. Hope some active club will get in touch with Dick and pick up the pieces, at once.

When you hear that active call W5OB, remember that it is exW5BUK a County Hunter and all around active ham.

To repeat for NEW County Hunters, the *USA-CA Record Book* is available direct from *CQ* for \$1.25. These books are required as an application for the USA-CA-500 Award and you send your book direct to me.

Hope you all have wonderful vacations (holidays) but still find time to get in touch and let me know—How was your month?

73, Ed., W2GT.

Washington
State
Governors
Award.



SURPLUS sidelights

BY GORDON ELIOT WHITE*

IN these days of specialized electronic gear, it is far harder than after World War II to find surplus equipment that is useful to the amateur or experimenter simply by plugging it in to 117 volts a.c. The straightforward Command Sets have no 1969 counterpart. To find a useful surplus item, such as a top-quality receiver, you have to pay often *more* than the new price. The classic Collins R-390A receiver has been bought by the Defense Department at prices as low as \$985., but "new" surplus units have been advertised at \$1,700 each, and even decent used R-390A's sell today at \$750.

So it is a lucky break when you can find a cheap dog that can be turned into something useful. The time-division multiplex sets, used by all the services over the last ten years for long-haul communications, certainly qualify for the epithet "dog" — they were hard to keep running and are a pile of expensive junk to most surplus hounds.

But they offer this possibility: when higher amateur radio Teletype speeds are permitted, as a current petition to the Federal Communications Commission asks, time-division MUX systems may be made into speed converters. By selecting the appropriate "clock"

*5716 N. King's Hwy., Alexandria, Va. 22303.



Fig. 1 — CV-81/FGC-5 transmitting code converter. This multiplex component is basically a serial-to-parallel converter which fed signals to the following stages of the multiplex transmitter.

or frequency input, any speed RTTY may be "read in" and converted to another speed.

Although storage is not impossible, the current multiplex gear does not contain storage units, thus it will be practical only to read in slower speeds than are read out, but such an up-converter would allow the RTTY man to permanently gear his Model 14, 28, or 32 printer at 100 words per minute. The output of the up-converter could be permanently set to 100 w.p.m., and the speed of the input section made variable, to handle 60, 65, 75 or any other speed. Indeed, a variable "clock" could be used, to match the sending of an off-speed station, using a badly-adjusted governed motor. Matching 50 Baud European stations would be a snap, and regeneration in the up-converter would improve the quality of received copy slightly.

I first mentioned the MUX gear in this column in August, 1966, with a warning to stay away from it if you were looking for an RTTY converter. The AN/FGC-5, which I touched upon, has a number of drawers which are labeled "telegraph code converter," but which cannot be used to demodulate amateur RTTY signals. Likewise the AN/UGC-1, -2 and -3 sets are complex time division systems, not generally usable. The UGC type is the transistorized version of the FGC-5, slightly updated.

All of these MUX units take several channels of data signals and combine them for transmission over a single communications channel. They do this by a high-speed sampling technique which relies upon the fact that teleprinter pulses are relatively long. You need only sample a few microseconds to determine if it is "on" or "off." This works of course only on digital signals, not voice, Video, or other analog communications.

(*Frequency division* MUX, on the other hand, squeezes up to 18 different tones into a single channel. Separation at each end is done with audio filters. A much less complex system, such units may be converted into rudimentary amateur RTTY demodulators. See this column for April, and May, 1968.)

Figures 1 and 2 are photos of sections of the AN/FGC-5 time-division multiplex system. These may be picked up rather cheaply from Fair Radio in Ohio, among others.

I have seen them widely available in almost every part of the country, at prices which cover little more than the value of the meters in them. M.A.R.S. groups have been assigned some of the UGC equipment, although few

of them have the technicians to keep this sort of highly complex gear in operation. A prime reason it is surplus is that the military itself could not keep them consistently on line, according to my informants.

The multiplex technique involves first a shift register (a digital logic term which is part of the state of the art in current integrated circuit jargon) which "reads" the RTTY code. The signal is fed into the unit in *serial* form, *i.e.* start pulse followed by character pulse one, two, three, four, and five, and stop pulse.¹

The start pulse enters the circuit and triggers the "clock" which enables the first stage of the register to accept the first of the five character storage segments. If a "mark" is sent, let us say the first stage shows a plus voltage. If a "space" is sensed, a negative voltage is registered. The clocking signal, which is set to the same speed as the incoming signal, goes on to "enable" stage two, and so on, until the final or "stop" stage is triggered. At that moment, the RTTY code is set up *in parallel* in the shift register.

The character, is now represented on six wires instead of a single circuit. The parallel nature of the signal is shown on six neon indicator bulbs on the front of the FGC-5 unit. In the original multiplex application, complex timing circuits took over at this point to distribute the "bits" in the multiplex stream.

By connecting the six shift register stages directly to the output code converter of the multiplex set, without the intervening circuitry, you may convert that parallel signal back to a serial signal, to operate an ordinary Teletype printer.

Stage one of the input section attaches to stage one of the output unit, stage two to stage two, and so on.

At that point the *output* clock signal is triggered by reception of the parallel signal, and it "polls" the stages in turn, sending a "mark" or "space" whichever is present.

Fig. 3 is a graphic depiction of this process.

The *output* section may be set to *read out* the signal at any speed, once it gets the "information" from the input section. If the output operates more rapidly than the input, it sits idle while it waits for the input to "catch up". A 100 word per minute printer will tap out each character at that speed, then



Fig. 2—CV-94/FGC-5 receiving code converter. A parallel to serial converter, the CV-94 will put a parallel output signal back into shape to be used by a Teletype printer.

wait for the slower input to finish the next letter, in a "bit—bit—bit—" pattern quite unlike the usual 60 word a minute rhythm of RTTY.

Of course, if the input were *faster* than the output, you would get garble, since you would be putting in characters faster than you could get them out, and there would be no way to store the overrun. There are methods of storing RTTY characters. Mechanically, model FRXD and 28 R-T sets have been used to punch tape at one speed, then store the information in the form of a long loop of tape, which would provide slack if the transmitter-distributor at the other end of the machine ran more slowly than the perforator.

The mechanical storage units are bulky and noisy, and are being replaced by electronic storage equipment which does the

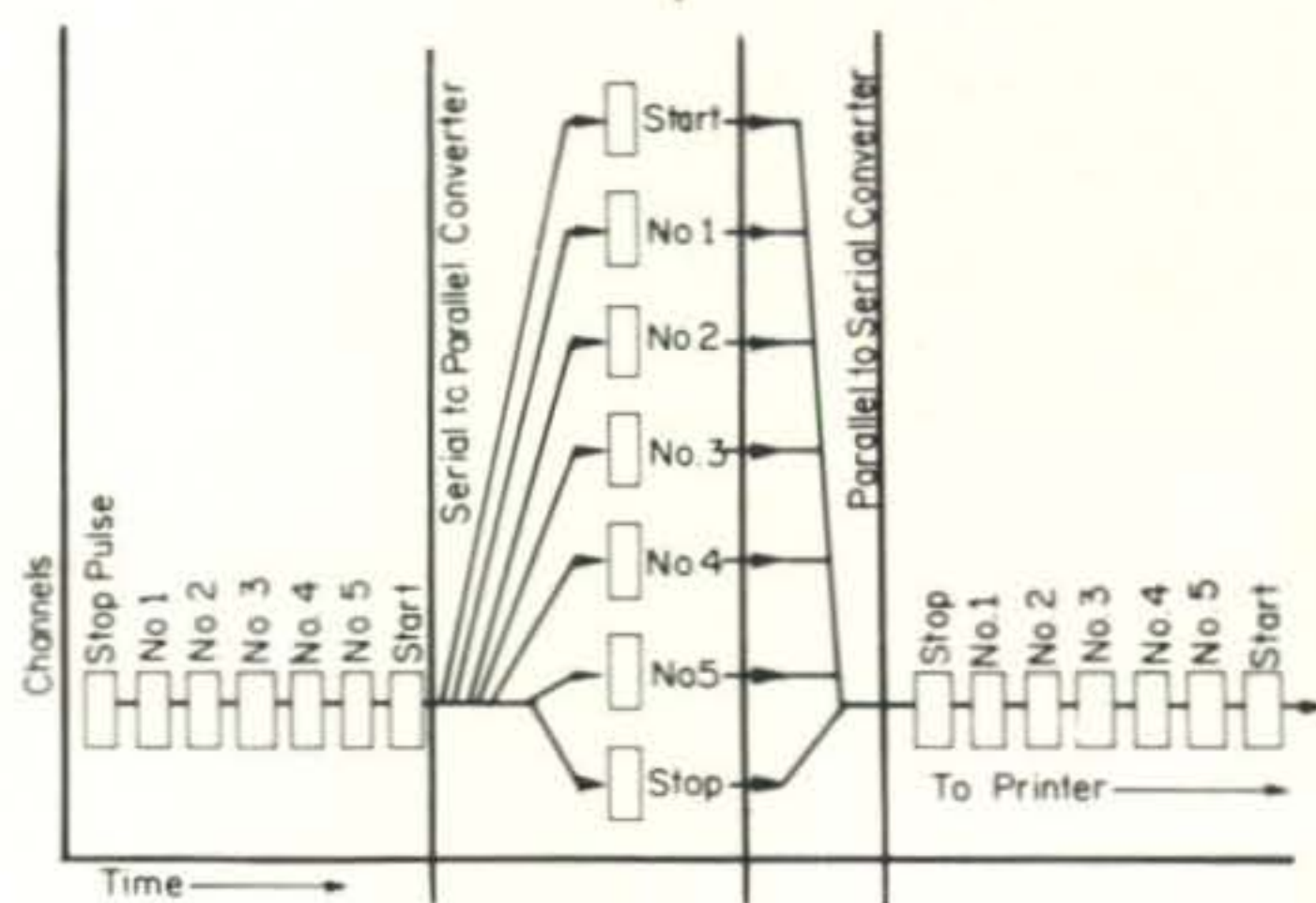


Fig. 3 — A schematic presentation of an RTTY character as it is changed from the common serial form to a seven-wire parallel signal, and then back to serial form. During the process, its speed may be readily changed.

¹See *RTTY Journal*, May and July, 1967, for an excellent description of serial-to-parallel logic.

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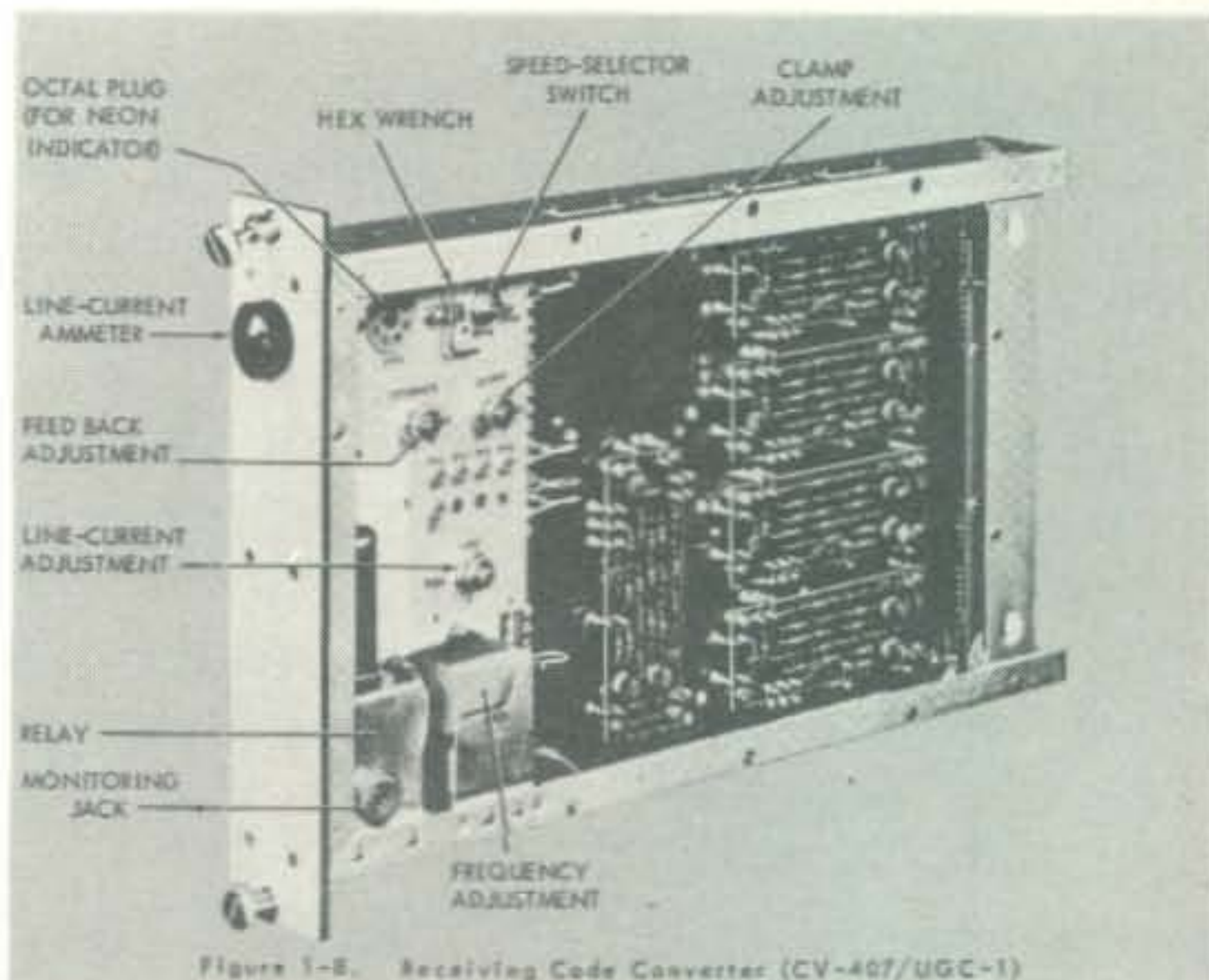


Figure 1-8. Receiving Code Converter (CV-407/UGC-1)

Fig. 4—The parallel-to-serial converter section of the transistorized AN/UGC-1 multiplex set. This small module does the same job as the larger CV-94/FGC-5. Since there is not space on the unit for six neon indicators, the indicator circuit may be plugged into the octal socket for maintenance purposes.

same job in much less space. The only surplus storage unit I have seen is the Frederick Electronics model 1300, which has a speed converter and 14,400 character storage capacity in the same package. The unit uses an acoustic delay line, with some very complex insertion and retrieval circuits. A more simple, though more bulky approach would be to use additional shift registers, one for each character to be stored. After the signal was read into the first parallel register, it could be read into register number two, then to number three, etc.

Leaving aside the additional complications of storage however, to use the multiplex sets for speed changing, you may simply hook the serial to parallel converter to the parallel to serial converter, and run the two units at whatever speed you like, as long as the input is not faster than the output.

In the AN/FGC-5 set, the serial to parallel unit is CV-81, and the parallel to serial section is CV-94. In the UGC-3, the input section would be CV-408 and the parallel to serial unit CV-407. Fig. 4 is a photo of the CV-407; the -408 is similar in appearance.

Details of the power supplies and the "clock" or timing signal frequencies are too lengthy to reproduce here with clarity. Anyone working on this project should have the pertinent military manuals. For the AN/FGC-5 the book is NavShips 91265A. For the UGC-1 the book is NavShips 93408 (FSC 0280-722-5000) this covers components of the UGC-3 as well. ■

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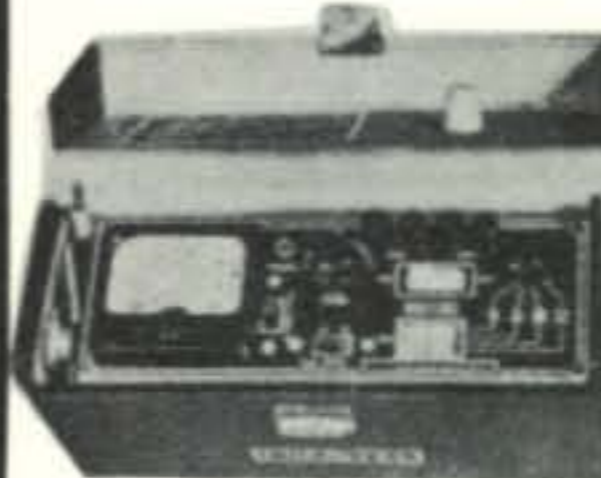
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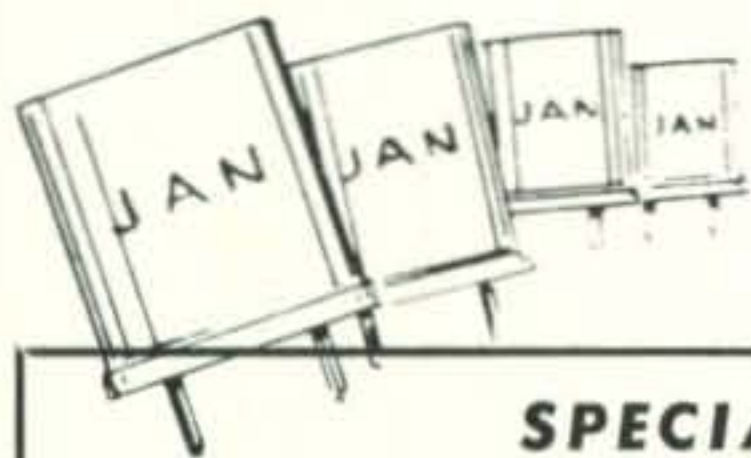
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Australis-OSCAR from page 24]

2. Call-sign and class of license if reporter is a radio amateur.

3. Latitude, longitude, altitude above sea level and other geographical details that might affect reception at observing station.

4. Brief description of v.h.f. and/or h.f. equipment used to observe the satellite, such as antenna type, gain, height, mounting and if rotatable, pre-amplifier, converter and receiver types, etc.

5. Brief description of the method used to decode the telemetry.¹

Reports from North and South America should be sent to AMSAT, P.O. Box 27, Washington, D.C. 20044; reports from Europe or Africa go to W. Browning, G2AOX, 47 Brampton Grove, Herdon, London N.W. 4, England. Reports from the rest of the world go directly to Project Australis (Telemetry) Union House, University of Melbourne, Parkville, Victoria, Australia, 3052.

Telemetry Decoding Data

Figures 2-5 contain telemetry decoding data for telemetry channels 1, 3, 5 and 7. For greater accuracy the following equations may be used:

CHANNEL 1: Battery current (ma) = $(f/9) - 63$
 f in c.p.s., linear to 1400 c.p.s.

CHANNEL 3: Battery voltage (v.) = $27.5 - .0125 f$
 f in c.p.s., linear to 1300 c.p.s.

CHANNEL 5: Internal Temp. (C°) = $.0642 f - 34.1$
 f in c.p.s., linear to 1200 c.p.s.

CHANNEL 7: Skin Temp. (C°) = $.0692 f - 36.9$
 f in c.p.s., linear to 1200 c.p.s.

Channels 2, 4 and 6 contain axis stabilization data. This is in binary form and no decoding will be required. The tones on these channels (2 - X axis; 4 - Y axis and 6 - Z axis) will change frequency as the satellite tumbles. The steadier the frequency, the smaller the spin rate. Changes every second or so will indicate relatively fast tumbling, while changes every four seconds or longer will indicate slow tumbling. The satellite is expected to tumble relatively fast its first few days in orbit, but slow down after the MASS takes over.¹

If this works as planned, observations on channels 2, 4 and 6 should confirm a reduced spin rate after the satellite has been in orbit for several days.

¹Jacobs, G., Australis-OSCAR; Amateur Radio's "Next Satellite in Space", CQ, Aug. 1969, p. 63.

Launch Date

A definite date *has not* yet been set for the piggy-back launch into space of the AUSTRALIS-OSCAR satellite. It *will not* be launched prior to October 15, 1969, but could be launched anytime from very soon after that date until early spring of next year, depending upon the status of the main satellite project with which the radio amateur satellite hopes to share a ride into space.

As soon as a launch date is approved, it will be announced on W1AW transmissions, members of AMSAT and Project OSCAR will receive by mail, and it will appear in *CQ*, along with detailed orbital data. ■

CQ Reviews: Heathkit SB-500

[from page 62]

hours. A v.t.v.m. and an r.f. probe are needed for alignment procedures, but if a probe is not available, parts and instructions are supplied with the kit for assembling an r.f. detector for use with a v.t.v.m.

Performance

Our unit was tested and operated using the HW-100 transceiver for the associated s.s.b. equipment. Performance-wise, the Transverter measured up to the specifications given earlier. Operationally, tuneup is easily conducted and transfer between v.h.f. and normal operation with the associated l.f. s.s.b. gear is conveniently made. Although instantaneous operation is available when the switch is made from v.h.f. to l.f., switching from l.f. to v.h.f. operation necessitates a slight delay to allow the SB-500 heaters to warm up.

When the associated s.s.b. equipment covers only a 2 mc range of 28-30 mc, as is the case with 3.5-30 mc amateur-band gear, or of 50-52 mc such as with the SB-110/110A, the v.h.f. range with the SB-500 is then limited to the lower 2 mc portion of the 144 mc band. If in such cases operation should be desired at a higher frequency in the 144 mc band, the heterodyning crystal would have to be changed accordingly. This would require lifting of the oscillator board and soldering the new crystal in place of the original one.

The unit is styled to match the SB-series of gear. It weighs 14½ lbs. and the cabinet is 6⅝" × 12¼" × 13" (H.W.D.).

The SB-500 2-Meter Transverter is priced at \$179.95 (kit). The producer is Heath Company, Benton Harbor, Michigan 49022.

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Q & A [from page 74]

Also described, is a video-remodulation accessory unit for refining picture quality. Another accessory is an adapter that makes possible the reception of pictures taken during nighttime darkness using the Direct Read-out Infrared Radiometer (DRIR) System.

Complete circuitry and component values are given along with a few constructional details; however, most of these must be left to the ingenuity of the builder. The video-electronics system and the accessory units are more involved than is the usual type of amateur gear and some understanding of the related circuitry on the part of the constructor may be desirable.

At any rate, there is a lot of helpful and interesting information for those desiring to get into this fascinating aspect of the Space Age.

The publication, the code number for which is NASA SP-5080, may be obtained at the price of \$3.00 from the Clearing House for Federal Scientific and Technical Information, Springfield, Virginia 22151.

73, Bill, W2AEF

VHF [from page 72]

getting the maximum output possible. At this point you are in business.

In the brief space of this column we have certainly not covered all aspects of making v.h.f. amplifiers "work". We have said nothing about problems involving, specifically, pushpull amplifiers; nor have we said anything about linearity. However, we have presented some basic techniques which we hope will stimulate the construction of a few additional amplifiers. In conclusion, we would like to stress that the secret of getting power out of a v.h.f.-u.h.f. amplifier is patience. If you keep playing with the thing, you are bound to succeed.

New 432 MC (Non Moonbounce) Record

At 1 A.M. July 16, 1969, WØDRL, Topeka, Kansas, worked K2CBA, Grafton, N.Y. (40 miles east of Albany) for a new 432 mc distance record in excess of 1,200 miles. This contact exceeds the previous record set on April 15, 1965 between W5LUU and WA4-KFW across the Gulf of Mexico by better than 50 miles.

Al, WØDRL runs 300 watts output into 1/2 inch heliax feeding a 44 element array of stacked yagis up 70 feet. He receives with a

DX [from page 66]

QSL application to Box 29, Tirana was returned marked "Addressee unknown."

de K2QBW: W6KG's record WAC reminded me of a WAC I made running only 160 watts to a dipole 10 feet above the ground. It went like this: 1023 GMT, UWØIH, Asia; 1031 GMT, VK3SR, Oceania; 1111 GMT, ZD7SA, Africa; 1138 GMT, DL6BP, Europe; 1200 GMT, W5ENH/mobile, North America; and 1212 GMT, YV1AB, South America. This was 1 hour and 49 minutes with a couple of other VK's thrown in.

QSL Information

CR6LF—Via W3HMK, P.O. Box 14, Norwood, Pa. 19074.
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CT1TZ—Via W3HMK.
CT1UD—To W3HMK.
CT1UE—c/o W3HMK.
EA6AR—To DL7FT.
EL2BI—Via W3HMK.
EL2R—c/o K4ZIZ, Route 4, Box 194, Bladenboro, N.C. 28320.
EP2KB—To W3HMK.
EP QSL Bureau—Amateur Radio Society of Iran, c/o EP2CB, P.O. Box 2000, USDAO, American Embassy, APO, New York, N.Y. 09205.
F9UC/FC—Via DL7FT.
FØBZ—c/o DL9XN, Siemensstr. 10, 7030 Boblingen, Germany.
GC5AGA—Via K4II, 1018 Woodburn Road, Spartanburg, S.C. 29302.
GC8HT—To W6UNP.
GW3DZJ—Via W3HMK.
HBØLL—To DL7FT.
HI8XRM—c/o WA2RSX.
JAIIVV—To W3HMK.
JA6BEE—c/o W3HMK.
KC6BY—Via WB9ALM, 302 E. Baker, Plymouth, Ind. 46563.

KL7EBK—To DL7FT.
KR6JT—c/o DL7FT.
KV4EY—To W3HMK.
KX6FN/KC6—Via W2GHK, P.O. Box 7388, Newark, N.J. 07107.
KZ5II—c/o WB4KZG, 1522 Shadylawn Drive, Burlington, N.C. 27215.
MP4BGR—c/o K9CSM, Rt. 1, Box 86, Monee, Ill. 60449.
MP4BGW—Via K9CSM.
MP4GBX—To K9CSM.
MP4TAF—Via DL6AA.
OX5BE—Bob Lannen, CMR, Box 1844, APO, New York, N.Y. 09023.
OY9LV (May 19, 1969 to date)—c/o W3HMK.
OY2A—c/o DL7FT.
PAØCOE—Via W3HMK.
PZ1CF—Via W3HMK.
SK6CF—c/o SM6CKU, Gullregnsvagen 45, S-434 00 Kungsbacka, Sweden.
SM5BUT—To W3HMK.
SMØBUT—c/o W3HMK.
SVØWM—To K9CSM, Route 1, Box 86, Monee, Ill. 60449. (New Address.)
TA2E—c/o VE3ABG, Box 35, Station "S", Toronto 382, Ontario, Canada.
TI2JCC—Via W3HMK.
TU2AY—To DL7FT.
TU2AZ (5/28/69 to date)—Via DL7FT.
VK9AM—To WB6AUH, 917 Carro Dr., #3, Sacramento, CA 95825.
VK9BS—To W3HMK.
VK9FH—c/o WB6TUH, 917 Carro Dr., #3, Sacramento, CA 95825.
VK9DH—Via WA6TVH, 13046 Paseo Verde, Whittier, Calif. 90601.
VP2VY (12/68 to date)—c/o W3HMK.
YBØAAD—c/o K9CSM, Rt. 1, Box 86, Monee, Ill. 60449.
YJ8JM—Via Radio Santo, Santo, New Hebrides.
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5A5TX (10/64-7/66)—c/o W3HMK.
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9K2CB—To K9CSM.
9K2CC—c/o K9CSM.
9U5CR—To ON5TO, Edward de Jansstraat 30, Sint-Andries, Belgium.
9U5RH—c/o ON5TO.
9V1OI—Via K9CSM, Rt. 1, Box 86, Monee, Ill. 60449.
9V1OX—To K9CSM.
9Y4VV—Via WA5WBK.

FR7ZL advises that although he is now behind on QSLs from his Tromelin trip, he is working on them and expects to catch up soon.

73, John, K4IIF



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Parks 432-2 converter and TIM 10 preamplifier fed into a Drake R4B.

Jud, K2CBA, runs 600 watts output from a 7213. His antenna is an array of 16 6 element yagis at a height of 80 feet and was described in this column several months ago. For receiving Jud uses a homebrew transistorized converter into a 51J4.

Al was alerted to the opening early in the evening by the reception of exceptionally strong signals from Ill. and Ohio—"but never expected anything like this!" Around 12 Midnight he heard VE3DKW and K2ACQ in Lockport, N.Y. coming through with good signal strength. He worked both of these stations a short time later along with W2CEH near Rochester, N.Y. Then he heard Jud, K2CBA coming through with an S-9 signal strength.

Jud came home from work at about 12 Midnight and threw his automatic keyer on to the West as usual. When he threw it off some 20 minutes later he was greatly surprised to hear W9WCD from Chicago calling him. After he finished with George, there was WØDRL calling him. Al's signals were so strong that Jud switched to phone to complete the QSO.

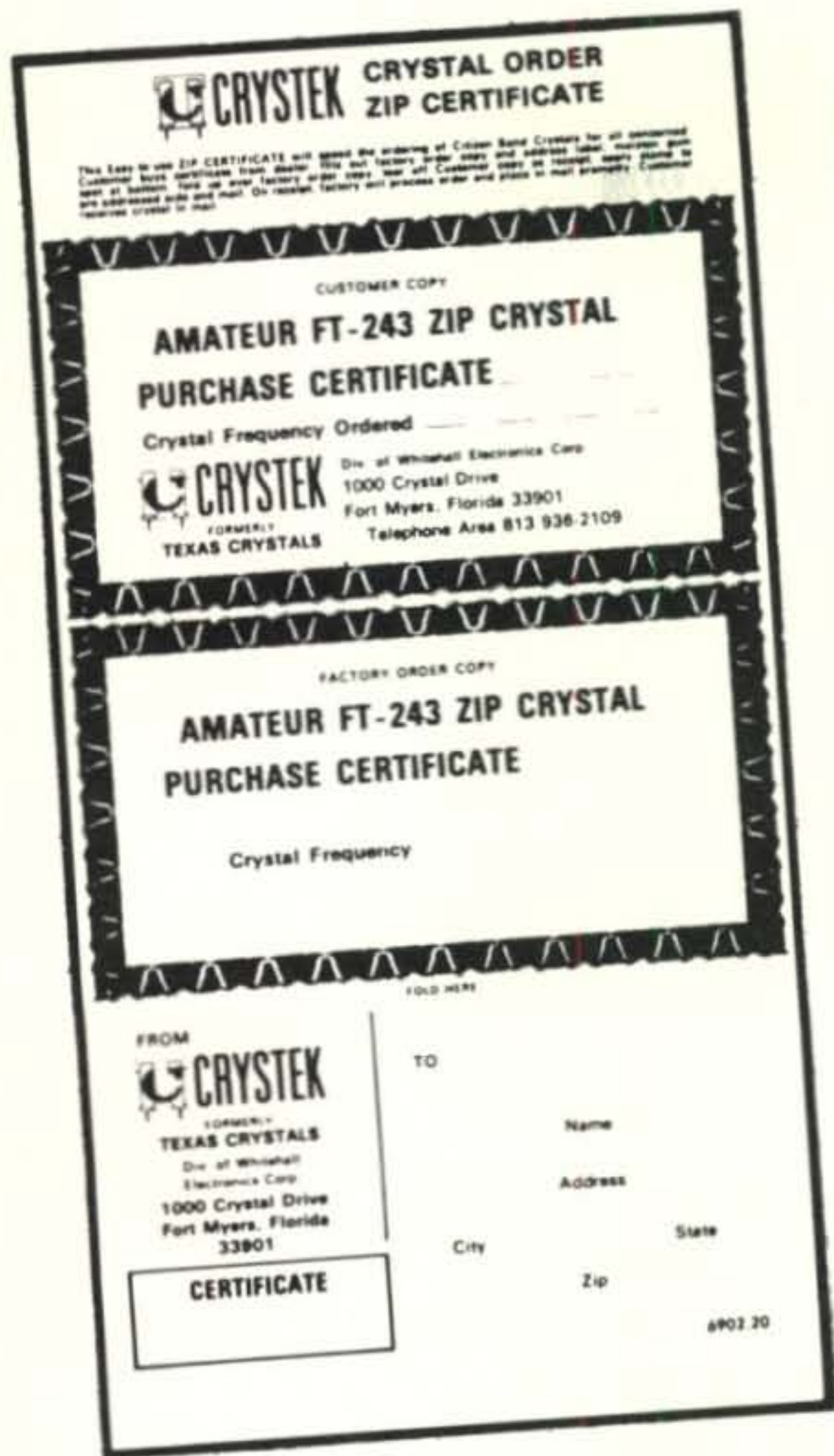
Conditions on 432 mc during this opening corresponded very closely to that of 144 mc. Many more states could have been worked on 432 mc had there been more activity on the band. Watch 2 meters and the u.h.f. TV channels for hints of 432 mc tropo openings. This opening leaves little question that during extended tropo conditions stations can be worked on 432 mc over equivalent distances to that provided by two meters.

73, Allen Katz—K2UYH

Paramp [from page 18]

fuse designers sure are making progress. Another advantage of the paramp is its immense gain, sufficiently high to mask the noise of almost any poor converter that follows it and finally, when used with a circulator, it is amazingly uncritical.

Although this article describes a 432 mc paramp, the same design will work well at 1296 mc and 2300 mc by using a quarter wave stripline transformer from 50 ohm down to the divide impedance of 10 ohms or so, and then using a length of line to resonate out the diode capacitance. The appropriate pump and idler cavity dimensions described in the January 1961 *QST* article by Troet-



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schel and Heurer can be used.⁵ The circulator for 1296 and 2300 mc range are also available in the less than S/100 class.⁶

Summary

The first rule, then, in building a paramp at 432, 1296 or 2300 mc is to use a circulator. The circulator, being a non-reciprocal network, couples the signal into the diode, say from port 1 or port 2, but directs the output signal to port 3. The inherent isolation between the input and output ports makes the amplifier stable for high (or changing) antenna and converted mismatches. The result is a stable, ultra low noise paramp that is infinitely easier to tune up. In closing, a word about noise generators at 432 mc. My home made 5722 temperature limited diode is not too reliable and I doubt that many are. The only method I have really had faith in is sun noise as received on my 15 foot dish. My 2N3399 transistor preamp that was measuring a 3 db n.f. yielded a 1 db noise rise off the sun. The paramp yields a 7 db noise rise. Other impressive. ■

⁶Melabs, 3300 Willview Avenue, Palo Alto, California 94304.

Back Issues

Back issues of *CQ* are available from our Circulation Department. Issues in the current year sell for face value (.75) and all others in stock are one dollar each, postpaid. If the issue is no longer in stock, photo copies of specific articles are available at one dollar each. Preferably, the entire issue will be sent.

 **signal/one**

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TX-62 VHF Xmtr 109	Speaker (A1, A2, A3) 9	Galaxy V Mk II 259	SR-150 Xcvr 289	JOHNSON	6900 Receiver \$149
621 VFO 39	KWM-2 Xcvr 689	Galaxy V Mk III 279	SR-160 Xcvr 169	Adventurer \$ 25	SBE
R-5 Receiver 39	351D-2 Mount 75	AC-35 AC Supply 65	SR-42 2m Xcvr 119	Valiant II 189	SB-33 Xcvr \$189
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Zeus VHF Xmtr 289	ELDICO	HALLICRAFTERS	SB-301 Receiver 249	400 Century DC 75	TV-2 2m Xverter 225
Interceptor Rec. 299	EE-3A Keyer \$ 39	SX-62A Receiver \$199	XC-2 2m Conv. 15	NATIONAL	TMC
Interceptor B Rec. 349		SX-100 Receiver 139	SBA-300-3 Conv. 15	NC-300 Receiver \$149	GPR-90 Receiver \$239
Allbander tuner 69		SX-101 Mk III 139	MT-1 Xmtr 29	NC-303 Receiver 239	TAPETONE
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752 DC Supply - kit	80 54	TD-2 40&80m Dipole	CR 50 35
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ND = New Display
CR = Customer Return (un-used)

AMATEUR ELECTRONIC SUPPLY

4828 W. Fond du Lac Ave., Milwaukee, Wis. 53216 - phone (414) 442-4200



WARNING

Please ignore the picture to the left - because it is of a standard Cygnet Model 260. The purpose of this ad is to tell you about the new Deluxe Cygnet Model 270, of which a photograph was not available to us at the time this ad was prepared. The new 270 will be similar to the 260, but with the following additional features:

SAVE \$50

Purchase any new Swan transceiver or linear at the regular price with no trade-in and you may take a \$50.00 Credit toward the purchase of any other merchandise.

C-F Networks Filter (same as is in 500C). 100kc crystal calibrator. Dial set control. S Meter and Transmit Metering. AGC and ALC. AF and RF gain controls. Sideband selector. Mic. gain and Carrier Balance panel controls. Mic. Jack on panel. Vox socket providing for plug-in of VX-2 accessory.

SWAN 250 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 500C 80-10m - Deluxe (\$50 Bonus)	565.00
SWAN 250C 6m Transceiver (\$50 Bonus)	450.00
NS-1 6m Noise Silencer	36.00
TV-2B 2m Transverter (specify 14 or 50 Mc i f)	350.00
Mark II 80-10m Linear - w/tubes (\$50 Bonus)	395.00
Mark 6B 6m Linear - w/tubes (\$50 Bonus)	395.00
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45 Swantenna - manual	65.00
55 Swantenna - remote control	95.00
Custom Contour Bumper Mount	24.95
Kwik-on Antenna Connector	3.25
Universal Mobile Mounting kit	12.00

The Amateur Net price of the 270 will be \$525, and the factory says that initial deliveries will begin in early September. Since Amateur Electronic Supply is one of Swan's largest distributors, as usual, we will be able to offer early deliveries. Order Now!...and be the first in your neighborhood to have one.

The improved 260, which now features increased (and variable) mic gain is normally in stock for immediate delivery. NOTE: After Oct. 1, mics will not be furnished with the 260.

The higher prices shown in this ad on the 500C, 250C, TV-2B, 510X and 508 were effective August 15, 1969.

NOTE: Above are listed the "Standard - Everyday" Swan Products — Below are listed some special purpose items:

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
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14-230 12v DC Supply w/230v Basic	140.00

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TB-1000-4 4-element 1000 watt continuous	\$159.00
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IC Keyer [from page 51]

circuit's immunity to spurious voltages such as induced r.f. voltages or poor line regulation.

The cost of DTL and TTL units is not significantly more than their RTL counterparts and there is the added advantage of there being a greater range of functions and function groupings available. A word of warning, DTL and TTL can be used together but RTL can be used with neither of them.

First the condition of certain parts of the circuit during a quiescent (non-keyed) period will be described. Normally Q and T on both DOT I and DASH I will be at "0" and S_D will be at '1.' The outputs of both DOT SET and DASH SET will both also be '1' and the inputs to both J terminals and DOT II and DASH II will be '0.' The Q terminals of both the latter flip flops will also be '1' and thus the output line will rest at '0.'

A dot or dash is generated by grouping (i.e. applying a '0' to) the S_D terminal of DOT I or DASH I respectively through an OR gate. Assuming the keying action has just commenced, this makes the Q of the particular flip flop change from '0' to a '1.' Considering for the present the generation of a dot only then the '0' on Q of DOT I will go to '1' and from the truth table (Table I) we see that the DOT SET output goes to a zero. This output change performs three functions; first the pulse generator is turned on, secondly, through DOT KEY the DOT II flip flop is actuated and on receipt of a '1' to '0' transition on T of DOT II the Q of that same flip flop changes state. This causes the output line to rise to '1' and the relay circuit is operated.

The third operation performed by the DOT SET going to '0' is to actuate the DOT RESET gate. This is best understood by referring to the timing diagram in fig. 4.

In fig. 4 the effect of the propagation delay through each gate has been exaggerated for the sake of clarity; in reality the delay of a gate is typically nanoseconds. Figure 4 shows how by putting a '0' on DOT RESET (input 1) the clock input (T) follows the output waveform and thus the DOT I flip flop is not reset until the output pulse is completed. When DOT I has been reset Q on DOT I returns to '0' thus allowing DOT I to be set again by grounding or the continued grounding of S_D . However, the propagation delay of the OR gate at S_D and the flip flop itself is sufficiently long that should the DASH I flip

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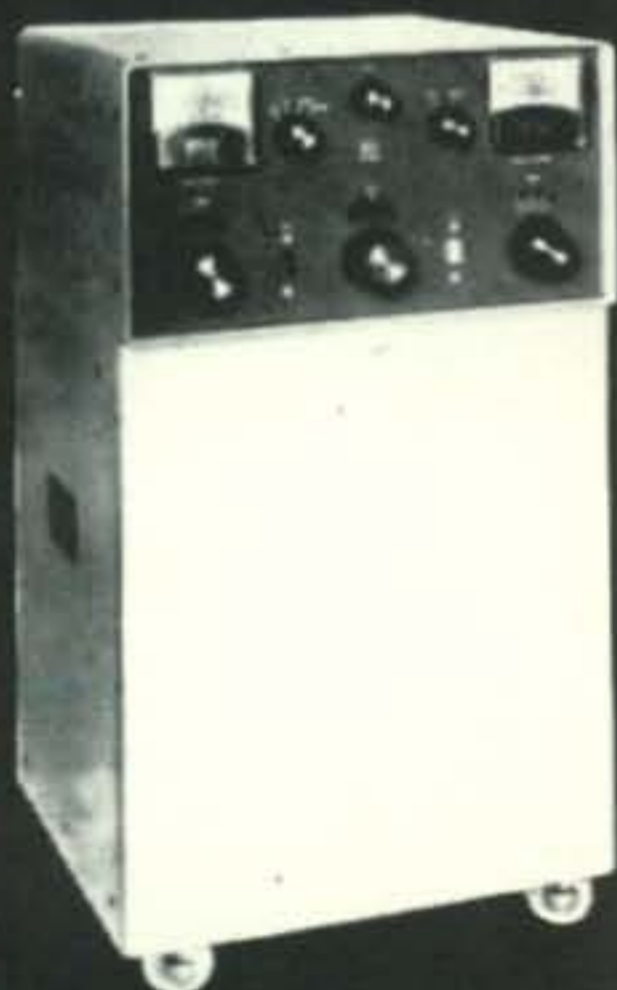
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flop have been set while the original dot was being formed then the transition of Q on DOT I from '1' to '0' will make the output of DOT SET change from '0' to '1.' This in turn allows the DASH SET output to drop to a '0' thus holding DOT SET off and actuating both the J input on DASH II as well as starting up the pulse generator.

A dash is formed by using the NAND gate to perform negative logic, *i.e.* act like a NOR gate. The reason for the inverter between the Q output of DOT II and the NAND gate is that the DOT II output must go to '0' before the DASH II flip flop can toggle. This produces a very short period (a few nanoseconds) during which the output drops to '0,' as shown in fig. 5, which due to the inertia of the relay should have no apparent ill-effects. If however, this short pulse were allowed to remain in the system, it would tend to reset the DASH I flip flop after the time required for a dot only. This is obviously undesirable and the inverter is introduced as a delay element only, giving the DASH II flip flop time to toggle and ensuring that the DASH I flip flop is reset at the end of a dash only.

Practical Considerations

The whole circuit is mounted on a piece of Vector board, type 126M76/032 measuring $5\frac{3}{8}'' \times 4''$. The 6.3 volt transformer was used for size reasons only and if a larger enclosure is used, a 12.6 volt transformer and a bridge rectifier would be a better choice than the 6.3 volt job with a voltage doubler.

The reed relay is a rather expensive P & B, type No. JF1045. It was chosen for its 10VA contact ratings, an insurance policy against abuse.

As long as the V_{CC} and ground connections are made correctly, to pins 14 and 7 respectively, the integrated circuits will prove very tolerant of miswiring—but not of excess volts; V_{CC} should never exceed the 5.5 volts maximum rating.

If NOR gates are available instead of the OR gates shown in fig. 3, then the circuit modification shown in fig. 6 will work equally well.

Conclusions

In designing the keyer every effort was made to minimize the total number of integrated circuits. Consideration of available integrated circuits suggests that the minimum number of integrated circuits has been used consistent with the requirements of the keyer.

CQ BOOK MART

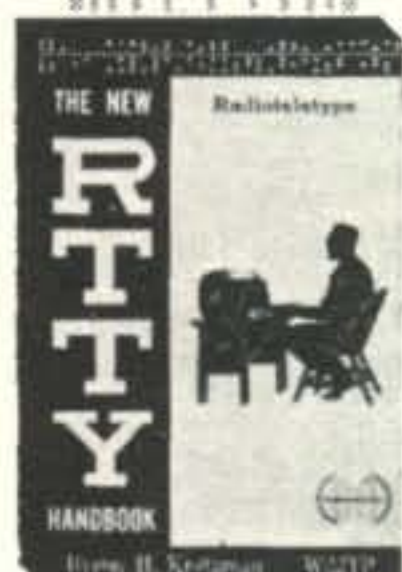


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CQ ANTHOLOGY I

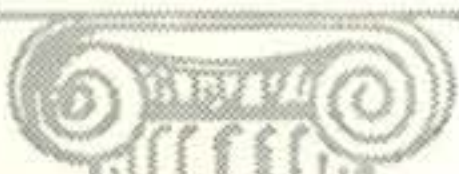


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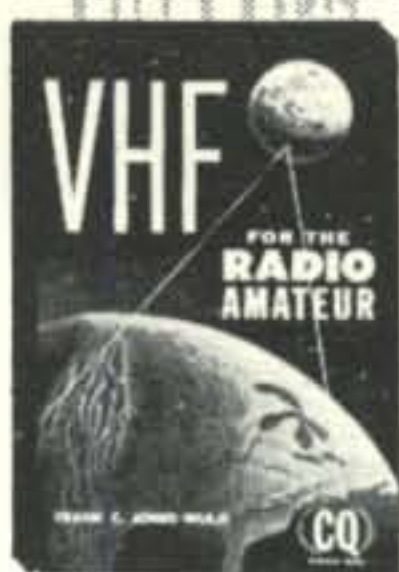
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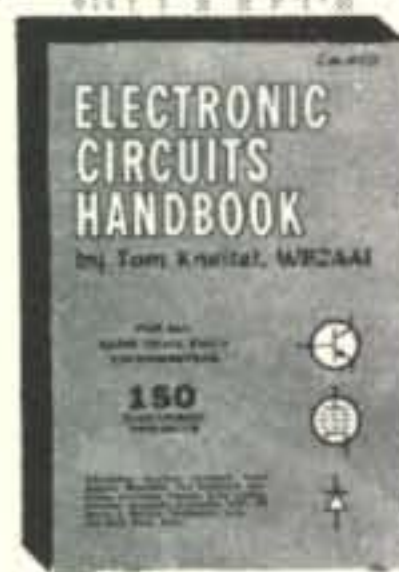
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Cat. #122. Contains 192 pages of conversion articles including the famous Command Set's plus a whole slew of the most popular military surplus gear including such gems as: EC-522, ART-13, BC603, BC659, ARC 1, ARC 3, etc. Actually, it covers almost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



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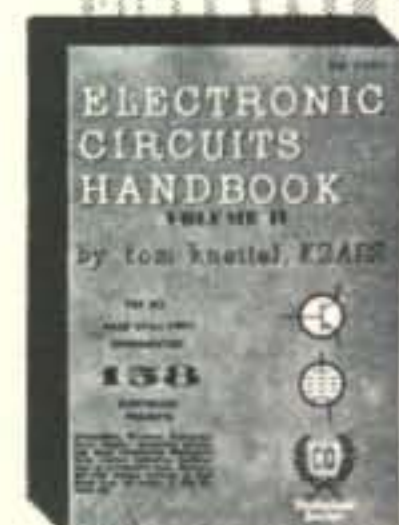
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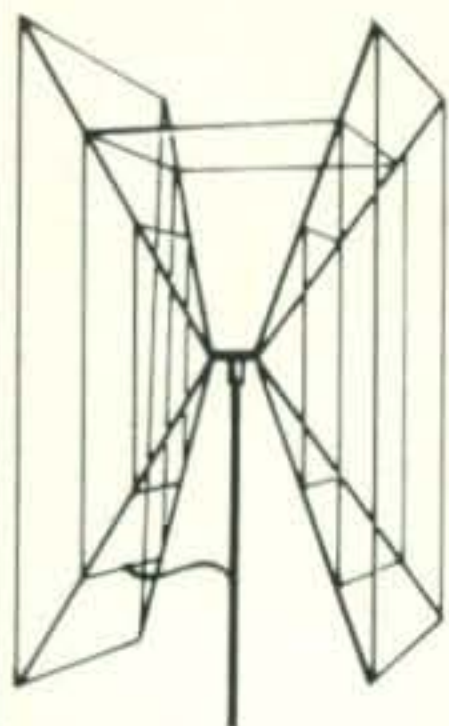
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Contest Calendar [from page 70]

had not seen in over 30 years. At St. Croix it was Herb, KV4FZ who picked us up and gave us a tour of the island. At our last port of call, St. Thomas, we finally got to meet "DX Hall of Fame" Dick Spenceley, KV-4AA and spent a couple of pleasant hours with Dick and his wife Anna. We stopped at the Post Office on our way back and got to see famous Box 403.

Nothing beats an "eye-ball" QSO with friends you have contacted over the years, and we hope to have more of them.

73 for now, Frank, W1WY

Announcements [from page 10]

mation from John Shafer, K0GZG, 303-443-5073.

Washington, D.C.

The annual hamfest for the Washington, D.C. metropolitan area sponsored by the Federation For Amateur Radio, will be at the Gaithersburg Fairgrounds in Gaithersburg, Maryland, on Sunday, September 21st, from 1000 until 1700 hours.

Andover, Mass.

The New England DXCC will hold their annual meeting Saturday, October 4, 1969 at Valle's Steak House, Route 93 at River Road, Andover, Mass. Dinner will be \$7.75 per person. For reservations contact (and make checks payable to): Robert A. Wallace, W1HH, Chairman, 146 Westford Street, Chelmsford, Mass. 01824.

Rome, Georgia

The Northwest Georgia Amateur Radio Club will hold the annual Rome Hamfest Sunday, October 5, 1969 at the Glen Hollow Youth Camp, Rome Georgia. Talk in on 3950, 146.94 f.m., or 146.34/.94 f.m. repeater. Good food; good fellowship; fine door prizes

Boy Scout Jamboree

The 12th Jamboree-on-the-Air will take place over the weekend of the 18th and 19th of October 1969. Starting time will be 0001 GMT on Saturday and will end 2359 GMT on Sunday. Full details next month.

MARCO Meeting [from page 32]

son, K8WYP, and to Bill Sprague, WA6-CRN, whose dream and perseverance made MARCO possible. The evening ended with a slide presentation by Orin Q. Flint, M.D., F.I.C.S., WA2WAU on an African safari he took with his family early in 1969.

Two final notes before we conclude this article. First, a note of recognition to Mr. Joseph J. Boris who extended my invitation and to the obviously long hours he puts in

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preparing the *MARCO Bulletin* and for making the meeting a success. The closing note is to urge all of those eligible for membership and who are interested in joining this organization to contact: William L. Sprague, M.D., WA6CRN, Secretary, MARCO, 433 North 4th Street, Montebello, California 90640. ■

6 Meter Station [from page 40]

signal levels and prevent over-driving of the circuitry or excessive volume level changes in the output. The stage presents no wiring problems and will not be tested until the converter is wired. A 12BA6 should be put in the socket, however.

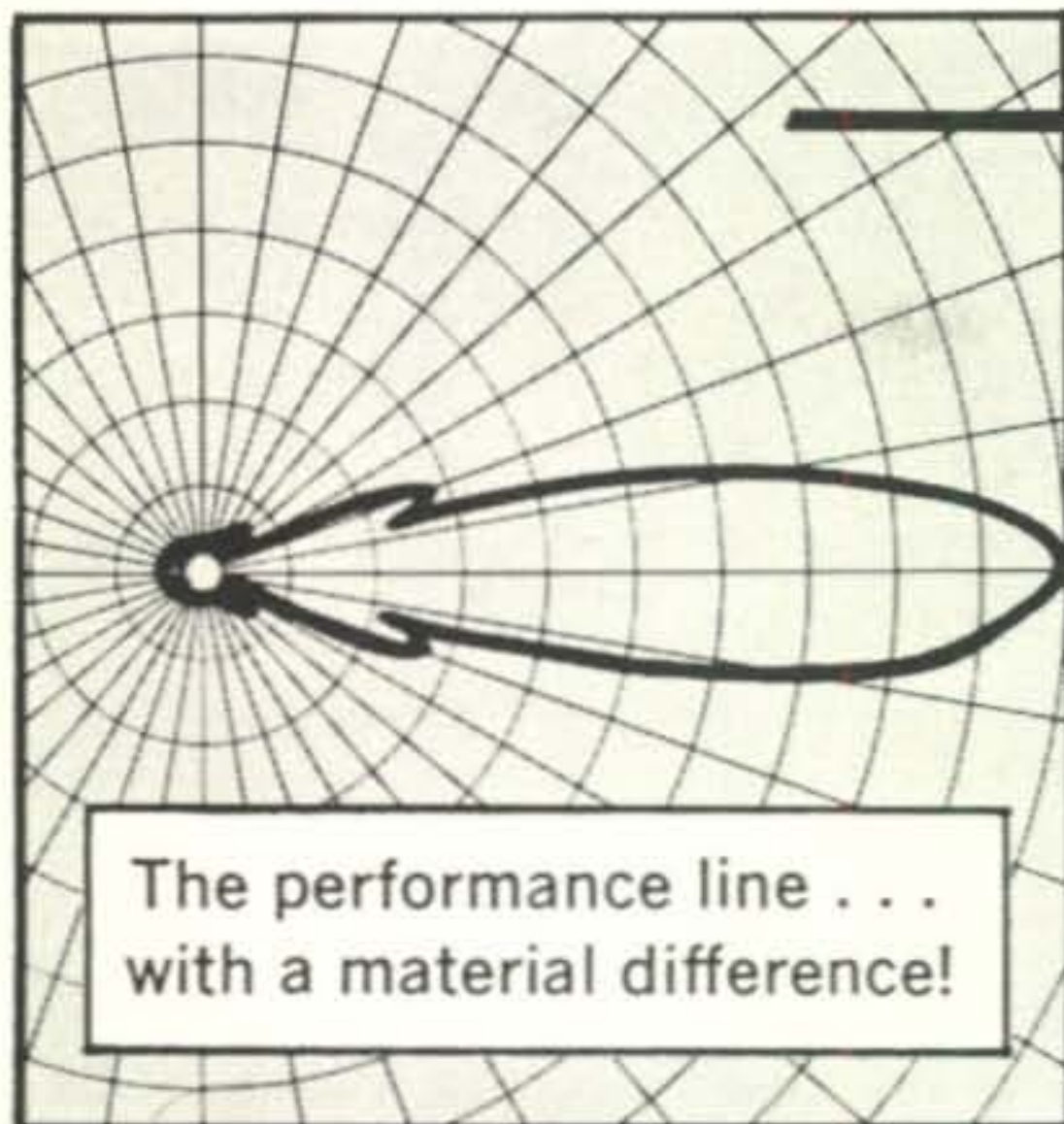
Stage V_3 is the converter. Its function is to convert incoming signals in the range of 550 to 1500 kc to 455 kc. This tube actually performs a dual function. Grids 1 and 2 and the cathode act as a triode oscillator with the frequency of oscillation being determined by C_{4B} and T_1 while the remainder of the tube acts as a mixer. Therefore, when the incoming signal is present on grid 3, it combines with the local oscillator signal, and the plate circuit produces the sum and difference of the two signals as well as each one independently. Since i.f. transformer T_2 is in series with the plate and since it is tuned to the difference frequency, only the difference frequency is fed to the i.f. amplifier.

This stage should be wired carefully observing the proper terminal connections, supplied by the manufacturer, for the oscillator coil and i.f. transformer. After the stage is wired and all tubes are in their proper sockets, the entire tunable portion of the receiver can be tested. Up to this point, we have constructed what is basically a broadcast band superheterodyne receiver with a few extra frills. Actual signals in the broadcast band will, therefore, be used for testing. To pick up these signals, attach a 12 inch piece of hookup wire to pin 7 of the 12BE6, apply power, and slowly tune the variable capacitor through its range. If everything has been properly wired, broadcast stations will be received and the receiver will be ready for its initial alignment.

In Part II we will cover the alignment of this portion of the receiver, the construction of the 6 meter front end and the complete transmitter.

[to be continued]

See page 110 for New Reader Service



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HP-24 Modifications [from page 55]

with the basic 0-10 ma meter results in an actual meter scale range of 0-1000 ma.

Construction

There is ample space for all of the components needed to modify the power supply within the original enclosure. The main problem is not actually finding space for the components but placing them so that they can properly dissipate the required wattage levels.

The photograph shows how an auxiliary piece of vectorboard was mounted next to the original board in order to install the components associated with the screen voltage circuit. Instead of a single 30K ohm resistor, three 10K ohm resistors of the IRC-PW-10 type were used in series. The individual resistors cost no more than a single 50 watt unit and allow for better heat dissipation by virtue of their separate mounting in the limited space available. Most of the components associated with the bias voltage regulator circuit are mounted on the same piece of vectorboard.

The components for the metering circuits, if used, can be mounted on the perforated cover of the power supply (using terminal strips), except for the 10 ohm, 10 watt resistor which is part of the plate/screen current measuring circuit and which should be mounted along with the power resistors. The multiplier resistors associated with the volt-

meter circuit should be especially well insulated from the chassis.

Summary

The HP-24 power supply, although designed for a specific application, actually can easily be used to power a number of different linear amplifier designs. In most cases, it can supply not only the necessary plate, screen and bias voltages but also the necessary filament voltages, such as if two 4 X 150 or 7094 tubes were wired in series to draw either 2.6 or 3.2 amperes filament current, respectively, at 12 volts. Perhaps most especially, the HP-24 power supply, modified as described, will prove uniquely useful for v.h.f. linears where the full benefits of careful bias and screen voltage regulation are most apparent. ■

Propagation [from page 78]

Central USA	06-08 (1)	05-06 (1)	09-14 (1)	18-20 (1)
	08-11 (2)	06-08 (2)	14-16 (2)	20-22 (2)
	11-14 (4)	08-10 (1)	16-18 (3)	22-01 (3)
	14-16 (2)	10-12 (2)	18-22 (4)	01-03 (2)
	16-17 (1)	12-14 (3)	22-00 (3)	03-04 (1)
		14-16 (4)	00-04 (2)	21-22 (1)*
	16-18 (3)	04-06 (3)	22-00 (2)*	
	18-20 (2)	06-09 (2)	00-02 (1)*	
	20-22 (1)			
Western USA	07-09 (1)	06-07 (1)	10-15 (2)	18-19 (1)
	09-11 (2)	07-09 (2)	15-17 (3)	19-20 (2)
	11-14 (4)	09-14 (3)	17-19 (4)	20-02 (4)
	14-16 (3)	14-17 (4)	19-00 (3)	02-04 (3)
	16-18 (2)	17-19 (3)	00-02 (2)	04-05 (2)
	18-19 (1)	19-22 (2)	02-04 (1)	05-06 (1)
		22-00 (1)	04-06 (2)	21-22 (1)*
			06-08 (4)	22-23 (2)*
			08-10 (3)	23-02 (3)*
				02-03 (2)*
				03-04 (1)*

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Eastern USA	18-20 (1)	16-18 (1)	14-16 (1)	08-12 (1)
	20-23 (2)	18-22 (2)	21-23 (1)	
	23-00 (1)	22-01 (3)	23-00 (2)	
		01-02 (2)	00-02 (3)	
		02-03 (1)	02-03 (2)	
		03-04 (1)		
Central USA	19-21 (1)	17-19 (1)	15-17 (1)	08-14 (1)
	21-00 (2)	19-22 (2)	21-23 (1)	
	00-02 (1)	22-00 (3)	23-00 (2)	
		00-02 (4)	00-04 (3)	
		02-03 (2)	04-05 (2)	
		03-04 (1)	05-07 (1)	
Western USA	20-22 (1)	18-21 (1)	16-18 (1)	08-11 (1)
	22-00 (2)	21-23 (2)	18-20 (3)	
	00-02 (3)	23-02 (4)	20-00 (2)	
	02-03 (2)	02-03 (3)	00-02 (3)	
	03-04 (1)	03-05 (2)	02-04 (4)	
		05-06 (1)	04-05 (3)	
			05-06 (2)	
			06-10 (1)	

‡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.



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FIRST \$100.00. takes Eico 753. With a/c P.S., D-104 mike. Excellent condition. A. Wyka, Splendora, Texas. 77372.

WRL's used gear has trial-terms-guarantee! KWMI—\$249.95; HW32—\$89.95; Swan 250—\$249.95; TR3—\$369.95; NCX3—\$169.95; SB34—\$299.95; Galaxy V—\$229.95; Galaxy Vmk2 —\$279.95; Ranger —\$99.95; HT32A—\$259.95; 100VO—\$259.95; Galaxy 2000 linear —\$329.95. Many more. Free "blue-book" list. WRL, Box 919, Council Bluffs, Iowa 51501.

CINCY STAG HAMFEST: The 32nd Annual Stag Hamfest will be held September 28, 1969 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.

PEORIA HAMFEST—September 15—Peoria, Illinois, same place as last year. For details, see Announcements, Sept. issue CQ. Advance registration: \$1.50, write: L. F. Lytle, W9DHE, 419 W. Stonegate Road, Peoria, Illinois. 61614.

RTTY gear for sale. List issued monthly. 88 or 44 Mhy torroids, uncased, five for \$2.00 postpaid. Elliott Buchanan and Associates, Inc., 1967 Mandana Blvd., Oakland, Calif. 94610.

FOR SALE: Swan 500, ps, and vox. \$450 or best offer. David Propper, 139 Thompson Ave., Oceanside, N.Y. 1572. Telephone: 516 RO 6-5793.

VHF-1 Heathkit Seneca 6 & 2 mtr. transmission, National HFS 28-250 mg., rotor cable, micro, relay, hygain relay, pwr supply. All in mint condition. WA9JMI, 1710 So. Maple, Marshfield, Wisc. 54449. Cheap \$300.00.

QSLs. Second to none. Same day service. Samples airmailed. 25¢. Ray, K7HLR, 25 South Terrace Drive, Clearfield, Utah. 84015.

SELL: S-240 rcvr \$70, Duo-Bander, A48A AC power supply \$25, Lafayette 460 6 meter xcvr all in excellent condition. W8UAB, J. G. Swanley, NSGA, Box 253, Ft. Meade 20755.

WANTED: Hammarlund HX-50 transmitter. W5BSU, 1210 So. 93 East, Tulsa, Okla. 74112.

SELL: All items in superb condition. Hallicrafters HA-2 Converter with power supply. Squires-Sanders Interceptor-B, Zeus, and all band converter. P & H 6-150 Transverter. Heath SB-110 6 meter Transceiver, modified to receive and transmit AM as well as SSB. Eldico 100-F SSB Transmitter. Best reasonable offers accepted. Write Dept. RA, c/o CQ Magazine, Port Washington, N.Y. 11050.

SELL: Collins 75A2 Receiver. Johnson Factory wired Valiant One. Gonset G-28 Transceiver G-28 Transceiver—separate Transmit, Receive tuning Dials, 6146 Final. All good condition. W8BLR, 29716 Briarbank, Southfield, Mich. 48075.

1-METER amateur band linear R.F. amplifiers for base or mobile use. Base units: "Hornet"—200 watts PEP output—\$104.95; "Raider"—400 watts PEP output—\$149.95; "Maverick"—2,000 watts PEP input—\$244.95. Mobile: "Scorpion"—200 watts PEP output—\$99.95; "Bandit II"—up to 500 watts PEP output—\$169.95. Electronic relay switching. All units designed for transceiver operation. State drive power when ordering. Dealer inquiries invited. D & A Manufacturing Co., 1217 Avenue C, Scottsbluff, Nebraska 69361.

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 Street, Sarasota, Florida 33577 or call 813-955-6922.

DXER's—R.F. Chokes wound with spun glass wire handle up to 5 KW W4GD, 3087 Carnes, Memphis, Tenn. 38111.

FOR SALE: Galaxy V, Remote VFO, AC and DC supply, CW monitor, rejector Webster Mob II, all like new, WAOKLC, 315 E. 20 Grand Island, Nebr. 66801, make offer.

SELL: Eico 753 W/AC, never got to working. Make offer. Wanted Candlestick or upright telephone. R. Carnes, 2678 Mulberry Street, Niles, Mi. 49120.

SELL: HT-37 Hallicrafter with Push-to-talk and break-in key. Manual. Make offer. W2EC, 8 Nathan Drive, Setauket, L.I., N.Y. 11785.

FOR SALE: Heath 10-21 scope. Excellent condition. Extras! \$37.50. Money order only. William Karl, 24 Mill Street, Cooperstown, N.Y. 13326.

WANTED: GSB amp., conversion info for Collins 51M-2 VHF rcvr. C. D. Trotman, W3BRX, Lincoln University, Lincoln University, Pa.

NEW Hammarlune HQ105TR, Transmit CB and 10m. Receive .55-30 mc. plus amateur bands. \$110. H. Greene, 211 Circuit, Hanover, Ma. 02339.

FOR SALE: Collins 75S3B Rec., 32S3 Xmitter, 516-F-2 P.S. & mike \$950, group only. Mint cond. L. Ahlstrom, 217 Kansas, Portales, New Mexico 88130.

SWAP: New 3CX100A5 tubes for 572B (1 for 1) or 6HF5 (1 for 2). Also have 4D32 tubes. W9TKR, 505 So. Elmwood, Waukegan, Illinois.

QST 1947-1966, 220 issues; CQ 1947-1964, CQ issues; Popular Electronics, 60 issues; all \$35 plus shipping. K8IKO, Box 222, Worthington, Ohio 43085.

Drake 2C and 2CQ \$195, Parks 50-1 meter converter (14 MHz IF) brand new \$28, DX-20 and Novice Xtals \$25, New Lafayette 455KHz mechanical filter \$10, 5-tube SWL receiver, Code records, and study manuals. For details, contact Jin Nestor, WB4CMS, 102 Denice Lane, Charlottesville, Va. 22901.

TRADE OR SELL: T150-A, G-76, 75A2, B&K picture tube Testor/rejuvenator. Want HA-6. Gerald Manning, Rt. 2, Rocky Face, Ga. 30740.

SELL: ARRL Handbook 200w. linear \$85 DX60B \$65, Lafayette HA700 \$60, all mint w/manuals. Kirby Kautz, WA2DZG.

D. C. DIFFERENTIAL AMPLIFIER, Solid State, 16 transistors, Video Instruments Corp., Model 71, Regulated power supply, Cost \$385.00, sell \$45.00. Fair condition. G. W. Ritchie, 643 Diamond Road, Salem, Va. 24153.

SELL: Drake 2-NT xmtr. perfect condx. I will ship. \$125. R. Davis, 3518 Indian Lane, Doraville, Ga. 30340.

FOR SALE: Heath MT-1, MR-1 and HP-10 mobile Xmtr, Rcvr, and Pwr supply. Good condx. All for \$110. Write WB2GDQ, 32 Wilshire Rd., Kenmore, N.Y. 14217.

IOWA. Swap 60 cc motorbike for gen cov rcvr. R. Wilson, 330 S. Capitol Street, Iowa City 52240.

OLD OLD TIMERS CLUB extend membership application to any amateur licensed for 40 years. Send your QSL card to Chas. W. Bowgel, Jr., W0CVU, 1500 Center Point Rd., N.E., Cedar Rapids, Iowa.

SELL: Linear, clars AB2 813 final w/ps in enclosed cabinet; pr 4-125A's; want DB-23, WE Carton, Box 1260, Lynchburg, Va. 24502.

TRADE Sixer with PTT for CB rig KLZGLK, 3 Barry Ave., Annapolis, Md. 21403.

TEKTRONIX SCOPES. Type 517 without power supply. Have several. Make offer. Joe Brand, K60JC, 1250 Val Vista Street, Pomona, Calif. 91766.

WANTED: RTTY Technical Manuals TM 11-352, 11-2222 and 11-2223. WA9EXZ, Draeger, 533 S. Spring Ave., La Grange, Ill. 60525.

OLD RADIO Schematics. 1928-1932. SASE for list. WN4KKM, 521 Woodlawn Ave., Calhoun, Ga. 30701.

SELL: DX-60 w/new tubes \$59, matching VFO HG-10 \$29, HR-10 rcvr w/speaker es xtal calibrator \$59, will ship, WA8YVR, 404 Sharon, Flushing, Mich. 48433.

FOR SALE: HA-350 rcvr. \$85 & AC-IT. (needs minor repair.) \$15, T. Blanton, 515 Granite Ave., Richmond, Va. 23226.

FOR SALE: Heath HR-10B rcvr & HRA-10-1 100 Khd calibrator: \$85, WRITE: David Rehrig, Box 135, Ashfield, Pa. 18212.

FOR SALE: HW-12-A, HP-13, Mike, Drake filter, \$125. HT32-A, \$250. 30L-1 (new), \$450. 312B-5 (new), \$310. J. W. Graig, W1FBG, 29 Sherburne Ave., Portsmouth, N.H. 03801.

NEED Schematic for Farnsworth M204-1 150-170 MH FM receiver. Leslie A. Folger, 8215 Water Street, Garrettsville, Ohio 44231.

SELL OR TRADE: Antique items Lab equip, Ham gear, servicing items. Samkofsky, 201 Eastern Parkway, N.Y. 11238.

SELL: Heath HX20 w/ac \$100 DX \$60 Tower \$35 all mint. So. Calif. only. K.C. Jones, 6172 Gumm Drive, Huntington Beach, Calif.

FOR SALE: Hammarlune HX-50 w/manual \$150.00. You pay shipping—Want Gonset 903A amplifier. S. C. Dible, K8JNP, Lot #172-4600 Britton Rd., Perry, Michigan 48872.

WANTED: Hand operated, coax antenna selector switch, kw all band tank coil, with switch, silver plated. Write WA6HYB, 624 First Ave., Chula Vista, Calif. 92010.

FOR SALE: 250th Transmitting tube in original box \$15 plus postage. Good condition. Heard S. Lowry, 915 Madison Street, Manchester, Tenn. 37355.

FOR SALE: Excellent condition—Drake T-4X, R-4A, MS-4, AC-4 \$750.00. plus shipping. WA1KZI, Dennis J. Burke, Meadowcrest Dr., RFD 5, Bedford, N.H. 03102.

THERMOFAX DRY COPIER \$30; electrostatic dry copier \$35; Motorola handy-talky \$10; Motorola 80D \$25; Motorola 41V NB \$45; 160-item list, SASA appreciated. WA9DYE, 114 Lakeview, Milwaukee, Wis. 53217.

DONATIONS WANTED for NSARC. Need old parts, receivers, transmitters, tubes, transistors, tech magazines, etc. Help get these people on the air. NSARC, c/o Carey Coggins, 7125 Hunters Branch Drive, Atlanta, Georgia 30328.

FOR SALE: DX-40 & HG-10 VFO \$50. Hallicrafters sky champion 550kc-44mc; RT-19/ARC-4 w/mt 230 MTG; BC-312N 1.5-18MC 12 VDC TG 7 TTY 3060MA. W001W, 1240 6th Street, Sheldon, Iowa. 51201.

SCIENCE FICTION FANS: 100 Scifi books in good condition will trade for equal number of books, Heathkit Tower, or \$25; Carey C. Coggins, 7125 Hunters Branch Drive, Atlanta, Georgia 30328.

51J3/R388 Collins All-wave Rx w/SSB Prod. Det. \$395; Drake 2B w/6 xtra xtals \$150; Panadaptor, list VHF/UHF. W4API, 1420 S. Randolph, Arlington, Va. 22204.

FOR SALE: Hallicrafters HT-32A, Johnson Thunderbolt linear, Collins 75A4 receiver. All mint condx. \$750.00. W3HQ0, 8005 Palmetto Ave., Phil., Pa. 19111.

RTTY INFORMATION for the Amateur interested in RTTY. F. DeMotte, P.O. Box 6047, Daytona Beach, Florida. 32022.

TOROIDS, 44 or 88 MHY. Center-tapped, not potted 5/\$2.00 postpaid. Model 14FRDX REPERF-TD combination, SYNC \$25. Complete model 15 with perforator and TD, table and covers \$110. Clegg 66'er new \$150. Stamp for list. Van W2DLT, 302X Passaic, Stirling, N.J. 07980.

COLLINS KWS-1/75A4. Guaranteed perfect. \$1000. Must sell. Bob, W0YVA/4, 4423 N. 17th Street, Arlington, Va.

SELL: DX-20, HQ-110 \$99 Globe Chief Deluxe \$29, surplus xtals 10¢ SASE for xtal list. 316 Donnell Rd., Lower Burrell, Pa. 15068.

SALE: Stancor Transformers. Pri 117V 60 Cy. Secs 125V 1/2 wave 50 Ma and 6.3 V 2A \$2.25. Trumbel, Lone Rock, Wis. 52556.

HE45B 6M 12V/110AC transceiver \$50, HE61 VFO for same \$10, Pr new 4CX300A w/SK700 sockets \$25. Art Ford, 6 Stoothoff Rd., East Northport, N.Y.

FOR SALE: Viking II xmtr 160-10 m \$50; HR-10 very good condx, 80-10 m \$70; by both get 40 & 15 m novice xtals free. David Wells, WA6EJX, 4145 Gregory Street, Oakland, Calif. 94619.

1200 W Linear amplifier. Self-contained solid state power supply. 8X11X10 inches. 700W output. Photo available. \$120 W9KYZ, 615 East Otjen Street, Milwaukee, Wisc. 53207.

SELL OR SWAP for receiver, Gonset II, 6 mtrs. Joseph Schwartz, 43-34 Union Street, Flushing, N.Y. 11355.

NEW: ASP 143 mount 7.50 PP. Trans. neg Vibrator 5.00 PP. W3MSN, 5400 Boulder, Oxon Hill, Md. 20021.

SELL: Hornet TB-1000-4 four element tri-band beam. Excellent condition with factory rebuilt traps. \$58. firm. W5AMK, Box 96, Temple, Tex. 76501.

SB-34 w/10 hours logged, W/SB-2 mic. Factory cartons will ship, all manuals \$260.00. W2WHW, Harry Lowenstein, 747 Valley Street, Maplewood, N.J. 07040.

SELL: Relay DOWKEY DK60B' nearly new \$8; Antenna HyGain 18HT, one cracked base insulator \$50 plus shipping. A. A. Wicks, Agoura, Calif. 91301.

WANTED: Old battery operated radios of the early 1920's. Need not be working condition. Also want early wireless gear—State your price. D. McKenzie, 1200 W. Euclid, Indianola, Oowa. 50125.

HAM TRANSFORMERS rewound, Using high temperature wire and insulation. Jess Price, W4CLJ, 411 Gunby Ave., Orlando, Fla. 32801.

SELL: Unused Harmon-Kardon MX-20 FM multiplex adaptor \$15, SR-400 xcvr, US postpaid. WA6BWB, 13241 Eton Pl., Santa Ana, Cal. 92705.

FOR SALE: KW Xmter Homebrew, 80-10 mhz. Many spare parts. BC348 rec & T-Type. Cannot ship, sorry. G. Ireland, 1073D Circle Drive, Dover, De. 19901.

SELL: HW-16 excellent \$90 or best offer. Pick up deal only—sri. Bert O'Connor, 16 Smithshire, Andover, Mass. 01810.

I NEED "QST" dated February & March 1922 to complete a 48 year collection. Reasonably priced offers, please, to A. Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England. 5Dow',,,,5P1 q \$8.

FOR SALE: 75A-4 Serial 3282 Vernier Knob 1.5 and 3.1 KC filters and matching speakers. \$350 FOB Peoria. Cliff Corne, K9EAB, 711 W. McClure Ave., Peoria, Ill. 61604.

SWAP: Old (but gud) Super-pro or CV-89A W/manual for HW-32A & pwr sup or ??? C. Bowers, Box 2000, USDAO, US Embassy, APO NY 09205.

HQ-170C with matching speaker. \$150 S. F. Bay area, K3BTT, J. N. Cuthbert, 1501 Canyonwood Ct., Walnut Creek, Calif.

WANTED: Drake DC-3 mobile power supply. Ron Nevers, K1VTM, 2438 Stanley Street, New Britain, Conn. 06053.

FOR SALE: HT-37 in A-1 shape, \$175. SBE-34, used than 50 hrs, \$275. Eico ST70 Stereo Ampin A1 shape, \$100. L. Kirschmann, Box 633, Regent, N. Dak. 58650.

SELL: Swan 350 (late) 410 remote VFO, Model 22 adapter, SWR. \$400.00, WB2YRU, Allan Rovol, 3538 Centerview Ave., Wantagh, N.Y. 11793.

FOR SALE: One model HQ-110C Hammarlund and receiver. One TR-6 transceiver. One Gonset 2 meter transceiver, One new Duo-Bander 84. Cheyenne (Heathkit) Model #MT-1 xmtr. A. L. Pulling, K1WQU, RFD #2, Rutland, Vermont. 05701.

FOR SALE: Collins 32S1, 75S1, plus Collins AC & DC pwr supplies, perfect condition. Asking \$800. Paul Hess, 800 Old Kensico Rd., Thornwood, N.Y. 10594.

DUMONT 304 rack mtg. scope—perfect \$65.00; BC 348 w/power supply and speaker—Mint \$60.00; RTTY M-15 table wired—excellent, Northern Radio AFSK tu (dual)—make offer; Rhon #6 tower 45' with all hardware and acces. \$50.00. WA4WIA, 1132 So. 18th Street, #9, B'ham, Ala. 35205.

SR-160 with AC supply \$200. DC supply \$60. Both \$235. J. Swank, 657 Willabar, Washington C.H., Ohio 43160.

SELLING a Johnson Viking II, Johnson VFO, Johnson Matchbox and Filter-In. Excellent condition—\$200.00. Walter Potas, 503 So. Main Street, Lombard, Ill. 60148.

FOR SALE: Knight Kit T-175 Linear amplifier for 6 & 10 meter. Near perfect condition. \$65. (206) VI 2-2738, Peter Thunem, Rt. 5, Box 5156, Bainbridge, Wash., 98110, WA7JBG.

TRADE OR SELL Teletype Model 10 Like new, \$150—W2GJJ, Vinson, 1796 Larkspur Street, Yorktown Hts., N.Y. 10598.

COLLINS 75A4 rcvr. Late serial No. 5276, Vernier Knob, vy clean, \$145. WA80NP, Al Schnorrenberg, 612 Jennings Ave., Salem, Ohio 44460.

FOR SALE: National N.C. 183D Rec. 54MHZ to 31MHZ plus 55MHZ (Instruction manual). WA2PLU, 9 Nancy Lane, Larchmont, N.Y. 10538. \$75.00.

WANTED: Good CE200V with 160M factory coils. State condition and price. W2CVW, 13 Robert Circle, S. Amboy, N.J. 08879.

SX100, HA12, CE 20 A, DX 40, 2 meter FM, much more. Send stamp for long list with low prices. W3WIY, 1705 Kaywin, Bethel, Pa. 18018.

WANTED: Control box for HAM-M Rotor, Jim Scalf, K4TKU, 10445 S.W. 70th Ave., Miami, Florida 33156.

B&W 5100 and 51SB, HE45B, Heath Tower Excellent, with manuals. WA5CMC, 2309 Bullington Street, Wichita Falls, Tx.

TWO, 2000 volt D.C. Power supplies on 21" wide x 17" deep chassis, \$45.00. Joe Brand, K6OJC, 1250 Val Vista, Pomona, Calif. 91766.

WANTED: CW Filter F455Q-5 for 75S1. Arthur Levesque, 173 Eastford Rd., Southbridge, Mass. 01550.

WHAT'S NEW?? 550 BIG WATTS!



The New Galaxy
Wattmeter/Antenna Selector

The Powerful New Galaxy
GT-550 TRANSCEIVER

The Beautiful, Matching
Galaxy Speaker Console

The GT-550 by Galaxy

*featured at New England's largest
Amateur Radio Distributor*

GRAHAM RADIO, INC.

"We sell satisfaction", and we know you will be satisfied with the New Galaxy GT-550 and all the fine new matching accessories. It comes with all new styling, 550 Big Watts, Receiver sensitivity second to none, the smoothest tuning, and many more fine features. "We know how it works", do you?

GT-550,	550 watt transceiver	\$475.00
AC-400,	AC Power Supply, 110/230 VAC, includes cables	\$ 89.95
G-1000,	DC Power Supply, 12/14 VDC, Neg. Ground	\$125.00
RV-550,	Standard Remote VFO provides dual frequency control for GT-550 only	\$ 75.00
RF-550,	3000/400 watt Wattmeter/Antenna Selector	\$ 69.00
SC-550,	Standard Speaker Console, 5 x 7 speaker 8 ohm, (AC-400 will mount inside)	\$ 25.00

call or write Bob Graham, W1KTJ

GRAHAM RADIO, INC.
505 Main Street
Reading, Mass. 01867
Phone: 617-944-4000

WANTED: TM 11-2205 and changes. Also, info on where to get TTY equip. Sam Cook, 310-3rd Ave., W., Oskalossa, Iowa. 52577.

NEED Sept. '68 issue HAM RADIO magazine. Will pay cash or trade other ham mags. Joe Wright, W5-AQN, Box 1316, Rockport, Tex. 78382.

BACK ISSUES: CQ and QST 1957-68. Almost all issues. Best offer. Robert David, Jr., 837 N. McKnight, St. Louis, Mo. 63132.

TRADE: My DX-100 for ur C.E. 10A exciter, or sell for \$80. WA6BWA, "BUD", 255 E. Blithdale, #4, Mill Valley, Calif. 94941.

SELL: Heath Marander HX10 and Chippewa KL-1 SSB Exciter & Lin Amp & Spare tube—\$300.00. Includes YFMRS for Lin. Supply. Model is RTTY. \$75.00. No shipping—W6ORS P.O. Box 416, Arcadia, Cal. 91006.

SOUTHERN CALIF. AREA. Hornet antenna for sale. Four element Tri Bander reasonable. WA6ZCQ, 1312 Micheltroena Street, Los Angeles, Calif.

FOR SALE: Viking Challenger transmitter 80 thru 6 \$42.00 and HT41 Linear with 2 extra rectifier tubes for \$185.00. or best offer. Write L. M. Carey, 238 Jenness Street, Lynn, Mass. 01904.

SELL: Waters Compreamp 359, \$23.00, Ameco Pre-amp model PCL-P, \$28.00; Hallicrafters S-120 \$40.00; Drake TR-100-LP filter, \$5.00; New 4-400A (never used), \$35.00. Will ship prepaid, money order or certified check. W4TYZ, Frank Ferris, 120 Williams Ter., Warner Robins, Ga. 31093.

FOR SALE: Used Eimac 3-400Z with SK 410 socket SK 416 chimney Retron fan. \$34.00. Postpaid via air P.P. W.R. Stangel, K6JB, P.O. Box 372, Lakeport, Calif. 95453.

WANTED: Dow key weatherproof coaxial relay, DK-72 etc. Mike Ludewicz, 143 Richmond Road, Ludlow, Massachusetts 01056.

FOR SALE: SX-140 rcvr. HT-40 xmtr new condition \$50.00. each. A. E. Wilson, East Brewster, Mass.

SALE: DX-100, \$64.00; HD-10 keyer, \$29.00; BC-221 Freq. meter \$44.00. L. Couch, K4GWQ, 1742 N.W. 3rd Place, Gainesville, Fla. 32601.

FOR SALE: Eddystone slide rule dial No. 893 new, \$12.00, VFO 80 meter described in Dec. 67 CQ \$15, Mobile CW 40 mtrs rig with pwr sup. \$25, W6BLZ, 528 Colima Street, La Jolla, Calif. 92037.

WANTED: Electric train for 1 7/8" to 3" wide track. Trade for electronics parts/equip or purchase. W6TDK, 872 Santa Rita Ave., Los Altos, Calif. 94022.

WANTED: 75A4 or 75A3 receiver. Tom Dornback, K9MKX, 19W167 21st Place, Lombard, Illinois 60148.

HV mica capacitors 800 uuf 5KVDC, 50 uuf 3.75 KVDC, Freq meter TS-33, and many others. List available. M. Bae, Box 9, Kingston, N.J.

C.E. 20-A SSB AM CW exciter with VFO and manual excellent condition. \$100. Grimmett, WB2AAS, 142 Wesley Ave., Cherry Hill, N.J.

WANTED TO PURCHASE: Capacitors 4 mfd. to 30 mfd. Also 3" Simpson & Triplett, M.A. & Volt meters. W4GD, J. R. Watson, 3087 Carnes Ave., Memphis, Tenn. 38111.

WANTED: Johnson Whiploaders, W4YOK, 2100 Scherm Rd., Ownesboro, Ky. 42301.

MICROPHONES — ASTATIC — 20D Dynamic P. T. T. Stand, (List \$60.00) \$28.00. D104 on Shore Stand, \$13.00. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805.

WANTED: Unuseable or not working C.B. sets for conversion to 10 meters, will buy or swap—send for list. E. A. Sjolander, Jr., 119 7th Street, W., Ashland, Wisc. 54806.

WANTED: Super pro receiver in unrepairable condition to be used in parts. E. A. Sjolander, Jr., 119 7th Street, W., Ashland, Wisc. 54896.

TRANSMITTER FOR SALE. Knight T-150A, 150 watts, AM-CW, 80-6 Meters, XTAL or built-in VFO, with manual J. S. Braund, Rte. 2, Salem, Ohio 44460.

DRAKE TR4 W MS4, Drake AC & DC supplies & mis \$500 or will swap for SB 101 & SB640. WA640. WA5JXC. 713-PA93985.

SELL: Dumont #208 scope \$40.00. Heath Cheyene xmtr, with spare tubes. \$35.00. W10DQ, 299 So. Main Street, Mansfield, Mass. 02048.

FOR SALE: 19" TV pix tube. Type 19 copy. Gud for test CRT. \$15.00 plus shipping. S. Spares, WN6BJP, 325 Bloom Drive, Monterey Park, California. 91754.

DRAKE TR-3 transceiver with AC-3 power supply. Excellent condition. \$395.00. Harold McGilvray, P.O. Box 77, Lano, Tex. 78643.

GALAXIE GT-550 with AC-sply. \$475.00. Dr. Trade on Collins S line or KWM2—wanted 312B4, F. E. Coble, 251 Collier Ave., Nashville, Tenn. 37211.

FOR SALE: Pierson KE 93 all band Ham receiver original carton & manual. First \$100 takes. Steve Rukavina, W9DDB, 422 Park Crest Dr., Thiensville, Wis. 53092.

SELL: Globe Scout, 90W, AM-CW 10-6m. \$35 or best offer. WA7DOK, R. Harker, 934 Washington-4, Eugene, Or. 97401.

TRADE: Have good cond. HW-12 W/xtal cal. Want 32A or HW32 w/cal. G. Meyer, WB6DXB, 3340 Stauss Ave., Oroville, Cal. 95965.

66-67-68 CQ and QST. 11 copies 73. 2 Ham Radio. W3MSN. Make offer.

WANTED: MORROW RECEIVER TO BUY W6DVN, P.O.B. 532, Atascadero, Calif. 93422.

G.E. 50/W F.M. Transceiver Pre-Prog W/T power, W/control & cables, very clean. \$50. W. J. Davis, 4434 Josie Avenue, Lakewood, Calif. 90713.

TR108 and V107; 2 meter transceiver. Best offer—perfect condition. Homebrew, 6 meter gear also. Siegel, 234 Lancaster Drive, Lake Hiawatha, N.J. 07034.

FOR SALE: DX-100, JT-30 mike, and Dow-Key Relay DK60-G2C. Best offer. Want good SB-200 and SB-610. Dennis Quinn, 88 Woodrow Court, Sharon, Pa. 16146.

SELL: LM 13 Freq. Meter, 110 VAC p/s with manual. \$35. W. Staudenmaier, 1229 Chanteloup, Hendersonville, N.C. 28739.

TOWER GUY WIRE: A-1 Galv. 1/4" made up with insulators. Turnbuckles, etc. Complete 18¢ per foot. Govt. surplus. Details Fred WA1ECV, RD 1, W. Redding, Conn. 06896.

FOR SALE: DX 100 \$60.00. Will deliver MD area. Hallicrafters SK 43 \$50.00. Cn 50W 2000. CN 144W W/ACPS \$25.00. HG-10B new \$25.00. Coan, W3CPN, 1513 Farlow Crufton, Md. 21113.

FOR SALE OR SWAP: NC303 with AMECO 6 meter Converter, Finco 6 & 2 Antenna, 20' Tower, Make offer. W3SNM, Chet Angstadt, R.D. #3, Box 450, Fleetwood, Pa. 19522.

ROTATOR, CDR AR 22 with control, Box Ex Condx. \$22.00. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805.

FOR SALE: Heath HR-10, DX-60B, HG-10b excl. condx. \$150. WB4GLN, T. S. McCulloch, 516 Shanks Street, Salem, Va. 24153.

WANTED: Loop ant. for Radiola 28, also, old style switch points and arms. Joe Horvath, 522 Third Street, San Rafael, Cal. 94901.

CANADIAN: Complete amateur equipment service, fully equipped., gov't licensed technician, VE6TW, Bob Fransen, Box 197, Sherwood Park, Alberta.

Transistor Checker [from page 30]

any available enclosure. A simple screw type wire joiner strip was used for the test connection points, although one could probably devise some better looking terminals. The good lamp was simply painted green to indicate its function.

No line switch or pilot light was included in the unit. Essentially, no current is drawn until a transistor is actually tested. If one doubts that the unit is working, various transistor test terminals can be shorted to confirm the indicator lamp action. In fact, the unit provides a sort of self-fault indication since if the lamps light without a transistor being tested, it indicates that some of the diodes are shorted.

The transformer used need only have a current rating of 500 ma or even less since the lamps and 390 ohm resistors limit any short circuit current flow to approximately the lamp's current rating. Certain shorts might cause greater current flow but it is assumed that one doesn't leave a transistor that is indicated as being bad connected for very long. Other transformer/lamp combinations can be used if desired such as a 12 volt center tapped transformer and 6.3 volt 40 ma lamps. However, one probably shouldn't use larger than a 12 volt transformer since this will limit the transistors that can be tested to those capable of handling a collector to base voltage of 12 volts or more.

Operation

Aside from the voltage precaution just mentioned, the tester can be used on all but the very lowest power (less than 50 mw dissipation) audio or r.f. transistors to large power type transistors. Generally, with small signal transistors, the lamp indications will be quite definite and distinctive when the transistor is either good or bad. On larger power transistors, the leakage within these transistors sometimes will cause the SHORT lamp to glow a bit although the transistor is good. Some practice with transistors of this type will quickly allow one to discern the difference between good and bad units.

Aside from those situations where exact gain or noise measurements on a transistor are necessary to determine performance in a critical circuit, this little unit should be able to serve the needs of almost any amateur for a transistor test unit. The permission of Bob Haavind of Electronic Design to reproduce the basic circuit is much appreciated. ■

See page 110 for New Reader Service

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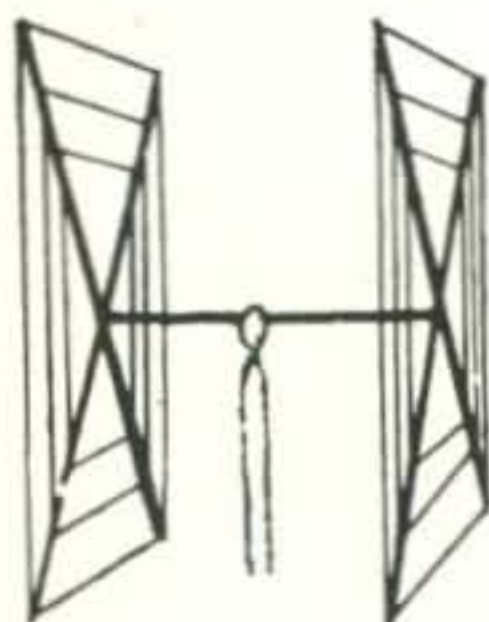
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 SWR: 1.05:1 at resonance
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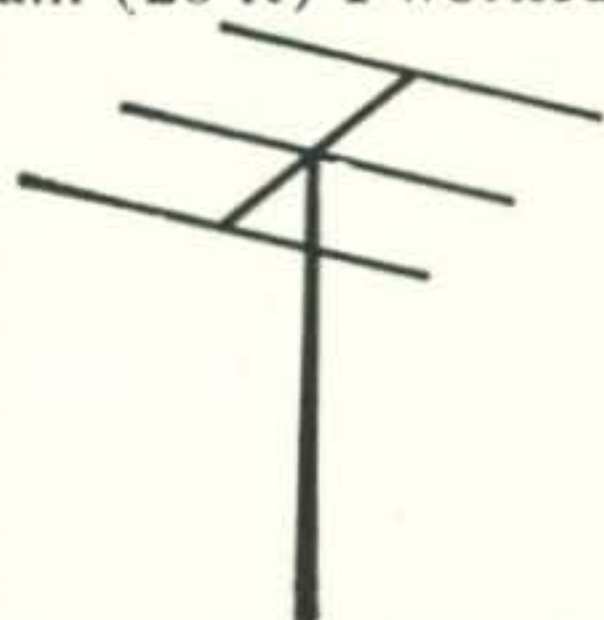
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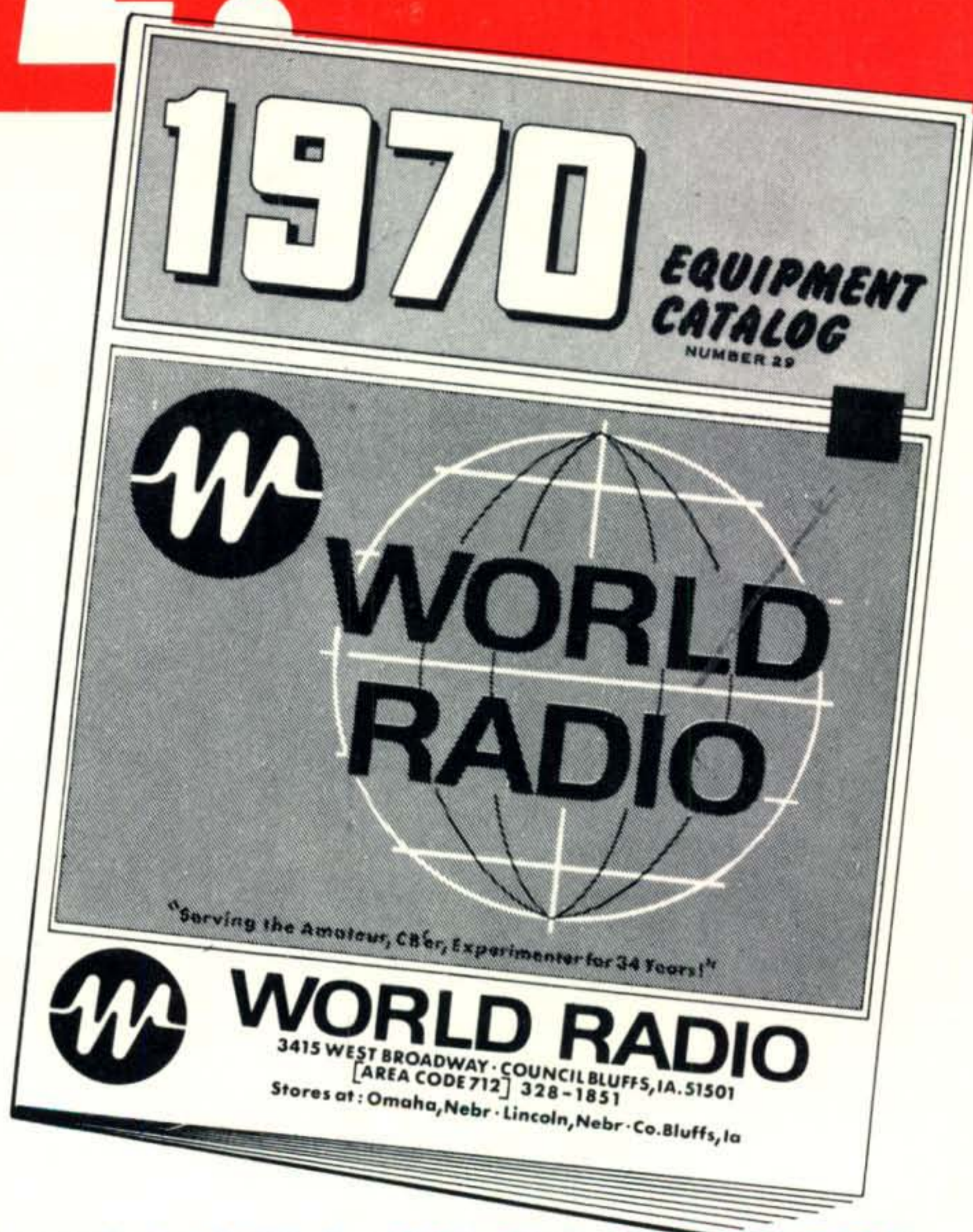
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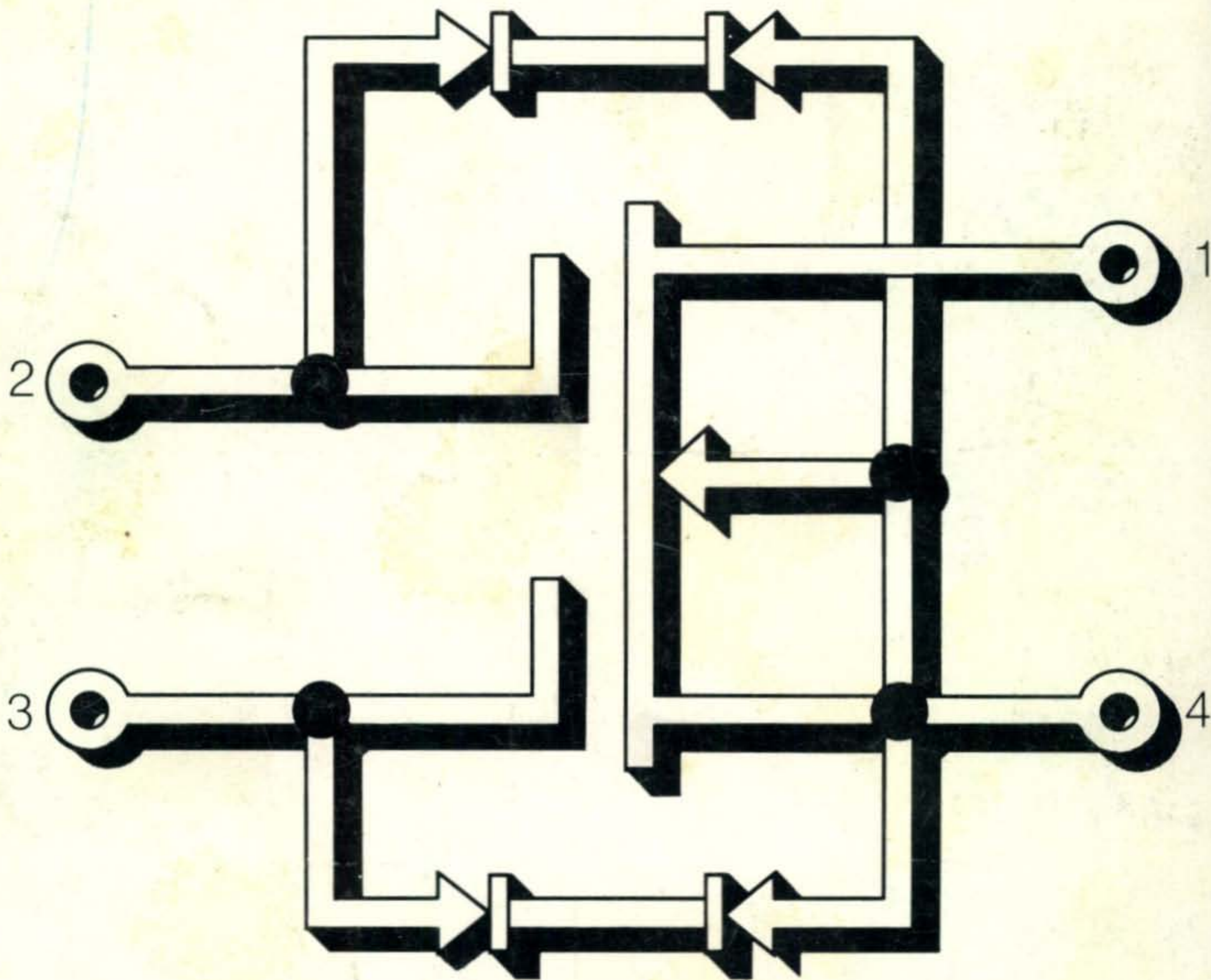
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