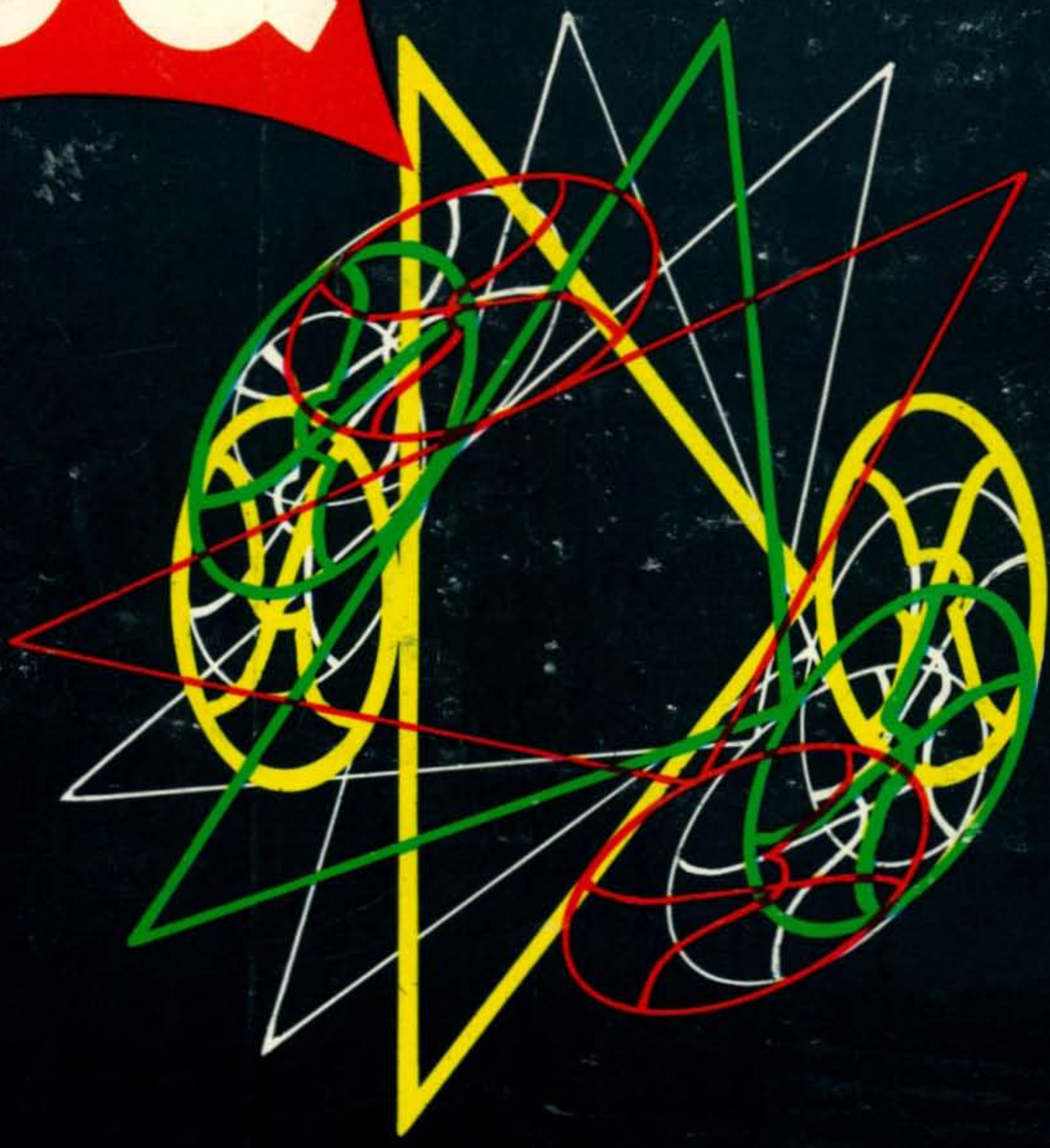
April 1970
75¢

CQ

ICD

FCC PROPOSES 80% FEE HIKE FOR AMATEUR LICENSES

See page 5.



Stable Broadband VHF R.F. Amplifier

"The VHF Quadrature Phase Amplifier"

CQ REVIEWS THE TEN-TEC TRANSCEIVER

The Radio Amateur's Journal

introducing

the NEW

Heathkit® SB-102...

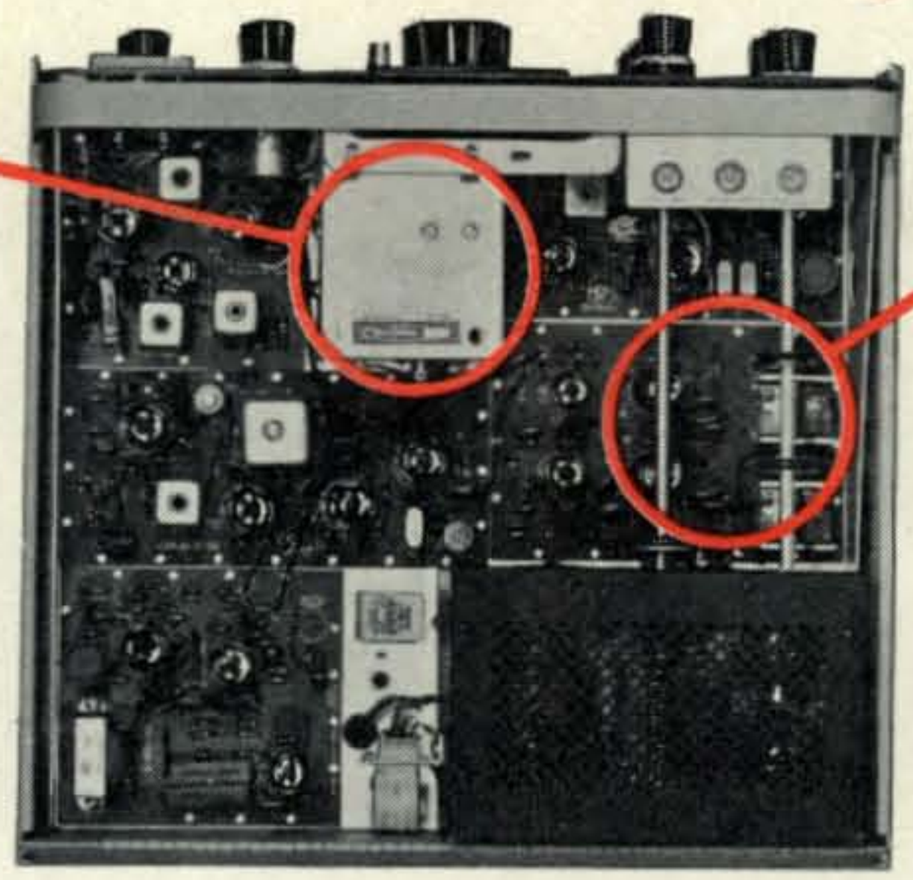
now the world's best rig

(the SB-101) is even better

Heathkit SB-102 . . . the new standard of performance & value

NEW Solid-State Linear Master Oscillator

provides improved frequency stability, better linearity and shorter warm-up



NEW Receiver Circuitry

for increased sensitivity . . . now 0.35 uV for 10 dB S+N/N

The New Heathkit SB-102 . . . proud descendant of the rigs that put many thousands of hams on the air — the famous "100" and "101". With a heritage like this, you expect top performance, reliability and value . . . and you get it.

We improved the already excellent frequency stability and dial linearity of the "101" by using an all solid-state LMO . . . the result is a rig that stabilizes in half the time and tracks more accurately than ever before.

The receiver portion of the "102" is even hotter than the "101" . . . sensitivity is now less than 0.35 uV for 10 dB S+N/N ratio . . . an increase that gives you solid copy longer when the band is on the way out.

The new "102" . . . all the flexibility and performance that made the "101" the world's most popular transceiver plus important new features. When you get ready to buy a new transceiver, check out the new "102" . . . the world's best made even better. From the Hams at Heath, of course.

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

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

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

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Describes these and over 300 kits for stereo/hi-fi, color TV, amateur radio, shortwave, test, CB, marine, educational, home and hobby. Save up to 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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the only complete station that is truly portable!

A total amateur radio station in one, compact, powerful package. The Swan 270 includes AC and DC power supply, and loudspeaker. Just hook up the antenna, plug into a power source, and you're on the air.

Portable enough to be used in your camper, motel room, on your vacation or business trip. We even have a handy carrying case for it. . . . Also an instant mobile kit for installation in rental cars. That's about as portable as you can get.

SWAN DELUXE *Cygnet* 270

SSB TRANSCEIVER—5 BANDS, 260 WATTS P.E.P.

- Power input: 260 watts P.E.P., 180 watts CW.
- Full coverage of 10, 15, 20, 40, and 80 meter bands.
- Selectivity: 2.7 kc bandwidth with shape factor of 1.7 and ultimate rejection of more than 100 db.
- Sensitivity: Less than 1/2 microvolt at 50 ohms for S + N to N ratio of 10 db.
- Unwanted sideband suppression: 50 db. Carrier suppression: 60 db. Third order distortion down approx. 30 db.
- The well known Swan audio, flat within 3 db from 300 to 3000 cycles.
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- 100 kc calibrator.
- Sideband selection • S-meter • AGC and ALC.
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- Voltage input: 117 volts AC or 12-14 volts DC.

$525

Standard Model 260 Cygnet . . $435

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APRIL, 1970 VOL. 26, No. 4

The Radio Amateur's Journal

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DEPARTMENTS

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

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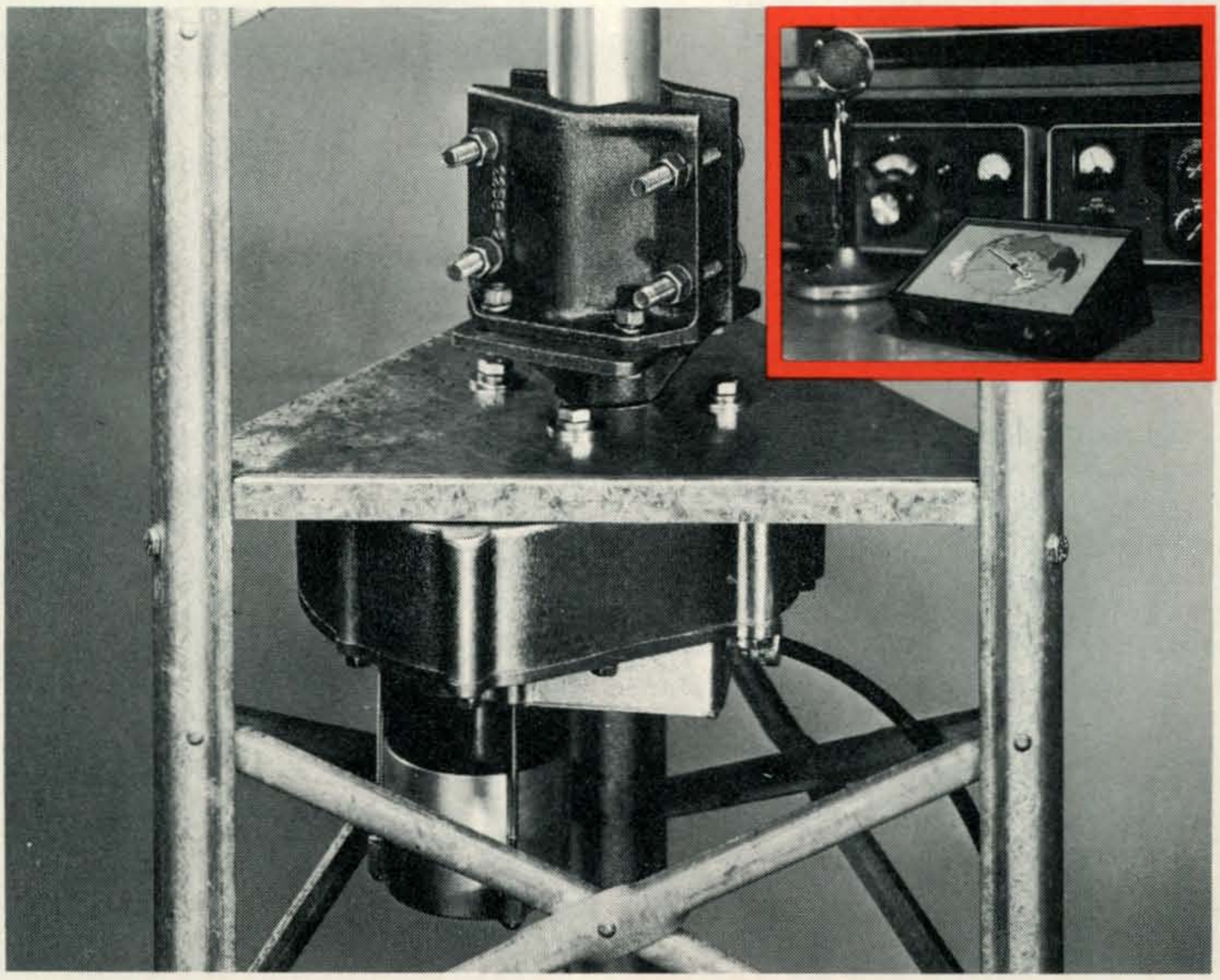

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Handles Large Beams And Stacked Arrays With Ease!

Up to 10 times the mechanical and braking capability of any rotator on the market!

The ROTO-BRAKE delivers over 4,000 IN/LBS of starting and rotating torque. Brake slips at 5,000 IN/LBS to prevent damage to parts. Motor and gear train are protected by husky cast aluminum housing.

Handsome control unit features sweep pointer over choice of great circle map or compass rose. Select desired position and capacitor-start rotator (operating off 110VAC 60 cycle power source through five-conductor cable) moves until null seeking circuit brings into position. No blind spots. As a matter of fact, rotator will move 380°, giving you a generous overlap. And, if antenna should move during severe environmental conditions, it will automatically return to original position when control is activated. All circuitry is highly reliable—no troublesome selsyns used.

Heavy duty mast clamp takes up to 3" O.D. mast. Mounts to standard tower plate with minimum of 10" tower leg spacing. Mounting kits available for poles and small towers; universal tower mount available for towers without a plate.

There's just nothing like the ROTO-BRAKE for performance. Buy one from the best distributor under the sun—the one who stocks Hy-Gain.

Model No. 400 Suggested Retail Price $189.95.

HY-GAIN ELECTRONICS CORPORATION

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ZERO BIAS

The Federal Communications Commission spent a busy month of February, it appears, as documented by a major Proposed Rule Making, Docket 18802, affecting amateur radio. The rule making arrived at CQ too late to be printed in its entirety, as is our policy with significant FCC releases, but we are able to at least describe the docket so that comments by readers may be filed before the early FCC filing deadlines. In addition, the general scope of Docket 18802 is so broad that only a small portion is of specific amateur interest.

Docket 18802 is entitled "Ammendment of Subpart G of Part I of the Commission's Rules relating to the schedule of fees," which translates as, "We propose to raise radio license fees for nearly all services, and there's not much that can be done to stop us." We don't mean to sound bitter, but in these days of tight money, the mere mention of rising costs picking our pockets for a few bucks more brings on a mild state of apoplexy.

FCC has not undertaken to propose fee increases solely of its own volition. On the contrary, the Commission has been under increasing Congressional pressure to raise its fees to cover, as nearly as possible, its annual budget appropriation. The newly proposed fee schedule has been carefully determined taking into consideration "value to the recipient" and "public interest served." Thus, commercial stations are to be tapped to the tune of up to $45,000 as a "Grant Fee" for the issuance of a new station license to a VHF TV installation; this after a $5,000 filing fee.

We mention such high fees in an effort to put the newly proposed amateur fee schedule into perspective. Specifically the proposed amateur fees are:

"Initial License, renewal and new class operator licenses $9
Modification of License without renewal $4
Modification of License with renewal $9
Special Call Sign (Plus other applicable fee) $25"

Additionally, no fee will be required for Novice class licenses, amateur stations under military auspices, and RACES applications.

Comparatively speaking, we stand to be only slightly inconvenienced by the proposed fee structure, but the degree of inconvenience should not deter us from putting up as much resistance as possible to the approval of the new schedule. It was a gray-enough day for the amateur service when fees for licenses became a reality six years ago. To allow a new precedent to be established - uncontested - which sets the stage for future arbitrary fee hikes would be tragic.

We therefore urge you to file comment with the FCC that the fee hikes for amateur licenses described in paragraph 1.1115 not be enacted. The deadline for filing comments is "on or before April 20, 1970." Remember, however, that 14 copies of your comments are required.

73 Dick, K2MGA

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OUR READERS SAY

New Extra Class Concept

Editor, *CQ:*

I was quite interested to read "A New Concept for the Amateur Extra Class License" in your January issue, as it parallels much of my own thinking on the matter. A while back I sent a letter off to an ARRL Director and did not even receive the courtesy of a short reply; again I take typewriter in hand, this time in hopes of reaching a more responsive audience.

I agree that there should be two paths toward an advanced class of license, however, I feel that such procedures could be even better defined than in the aforesaid article. Operating is just as important as technical knowhow, in an emergency, it can be even more so. How many times have we read a RACES report wherein the net control tells of a lid with a kilowatt who completely, and with all the good will in the world, makes a shambles of net procedures? It would seem that even if you can build a transceiver from empty tuna fish cans and old toothbrushes, it matters little unless you know how to use the darn thing.

I would propose that the FCC institute a new testing procedure based on the aspiring licensee's knowledge of net procedure, rules of operating and the like. The written part of the test could contain such questions as matching "Q" signals to their meanings and explaining how a piece of traffic might flow from one coast to the other. There are all sorts of involved questions which could be asked on Operating Theory. Further, it is possible that the FCC could also put each individual into a "real-life" situation. This would require little more than a mock-up version of a typical Amateur station within each testing facility. The FCC examiner would conduct a net (over the mock-up station) and grade testees on their actual performance passing traffic.

Yet another reason this would be a viable method of licensing is simply that it is needed by more people than Technical Theory might be. My own case might be explanatory. I am a college student and a professional fiction writer. Between the two (and one helps pay for the other) I cannot afford the time to study something I will likely never need. I know that, for me, operating procedure is something I will use, that I am already using. Why should I, and thousands like me, be forced to learn something which is highly unlikely to be of any value at all?

Operating theory and electronics—you can't have just one on the ham bands, yet the FCC has granted one the highest of priorities and has seemed to ignore the other.

Neil Shapiro, WB2KQI
Rochester, N.Y.

A.F. Regs Crimp DXing

Editor, *CQ:*

Just a short note to inform you of a regulation that will impair the efforts of any avid DX'ers who are serving in or working for the United States Air Force. Their security regula-

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tion AFR205-57 states that "all contact with persons in communist held or controlled countries must be reported to the individual's immediate supervisor or commander" and these people in turn must notify the OSI about the matter.

You can clearly see that this could restrict the Air Force troops' DXing—one report of a violation of this regulation brings all types of comments from all levels. It is interesting to note that no other service has a similar regulation.

I am trying to work for a change in the regulation, but my "level of command" is quite low. Any help (suggestions?) you can give will be greatly appreciated.

Name withheld by request

Japanese Radio Row

Editor, *CQ:*

I was very pleased in reading the article by W4UW, *Radio Row Japanese Style.* I had the good fortune in 1967 to visit Japan on a ham's vacation. OM Genaille's article brought back many memories about Akihabara. However, no mention was made about any ham supply shops there. The only one that I found there was Rocket Radio Supply and this was the only place in Akihabara that catered solely to hams. I recall that if one, a Westerner, shopped there for a while, one could meet more JA's and JH's than in a 20 meter pileup.

Author Genaille should also have warned the prospective buyer to insure that the TV or f.m. set he purchases should be marked "for use in USA." Otherwise, he will not only have to contend with voltage and current values, but also TV's that cover channels 1-12 and f.m. that covers 78 mc.

Bob Migliorino, K2YFE/ø
Kirksville, Mo. 63501

Reciprocal Operating with Japan

Editor, *CQ:*

I would like to bring to the attention of the American amateurs the following problem: presently there is no Reciprocal Operating Agreement between the United States and Japan, despite the fact that many Japanese amateurs could benefit from such an agreement.

If my information is correct, American hams can operate in Japan but Japanese hams cannot operate here in the U.S. We already have such agreements with 42 countries, some of them with very few amateurs, so there are very few beneficiaries from "the other side." It seems to me that these agreements are signed mostly when we will benefit from it. For example, more American amateurs will go to Sierra Leone, Monaco, Luxemburg or Guyana, than amateurs from those countries will come here.

Because U.S. personnel can operate in Japan anyway, (see KA listing in *Callbook)* there is not too much interest from our government to sign a Reciprocal Operating Agreement with Japan, no matter how many Japanese amateurs are living and working in this country.

Personally, I know a few of them: Takeshiko,

[*Continued on page 99*]

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Announcements

Columbus, Georgia

The annual Columbus, Georgia hamfest will be held on April 5th at the Fine Arts Building behind the Muncipal Auditorium at the Fairgrounds. For information, contact John Laney, 1905 Iris Drive, Columbus, Georgia 31906.

Euclid, Ohio

The second annual old time hamfest sponsored by the Indian Hills Radio Club will be held all Sunday, May 10, at the Slovenian Social Home, 20713 Recher Ave., Euclid, Ohio 44119. Plenty of activities all day with a buffet dinner at 6:00 P.M.

Fresno, California

The 1970 A.R.R.L. Pacific-Southwestern Division Convention will be held on May 15, 16, and 17th at the Travel Host Motel, Fresno, California. For complete details write to: George P. Simon, WB6ETR, 5401 E. Sussex Way, Fresno, California 93727.

Somerville, Mass.

The Somerville Mass. Amateur Radio Club (WA1MHN) will be operating from the summit of Mt. Washington, N.H., the highest point in the northwest, the weekend of May 23-24, 1970. Operation will be from 1800-2000 GMT both days according to the following schedule: s.s.b.—21.375, 28.650, a.m.—50.274, 145.470. There will be an f.m. station operating on 449.050. Any station establishing two-way communication with WA1MHN on two different bands will be eligible for a special certificate upon request for it and 25¢ to cover printing and mailing. For more information write to: Paul Graveline, K1YUB, 19 Cambria St., Somerville, Mass. 02143.

Birmingham, Alabama

The Birminghamfest this year will be on May 3 at the Armory on Oporto Ave. (just off U.S. 78 East—near Eastwood Mall). For entertainment, prizes, contests, net meetings, eyeball QSO's and fun for the entire family, plan to attend. For further information contact the Birmingham Amateur Radio Club, W4CUE, P.O. Box 603, Birmingham, Alabama 35201.

Royal Signals A.R.C.

Membership of the Royal Signals Amateur Radio Society is now open to past and present members of the United States Army Signal Corps who have, in the past, been attached to, or worked in close liason with, Royal Signals. Full details from: General Secretary, R.S.A.R.S., 15 Valley Road, Blandford Camp, Blandford Forum, Dorset, England.

Plains, Kansas

Hi Plains ARC Annual Hamfest will be held on May 17th at the Grade School Auditorium.

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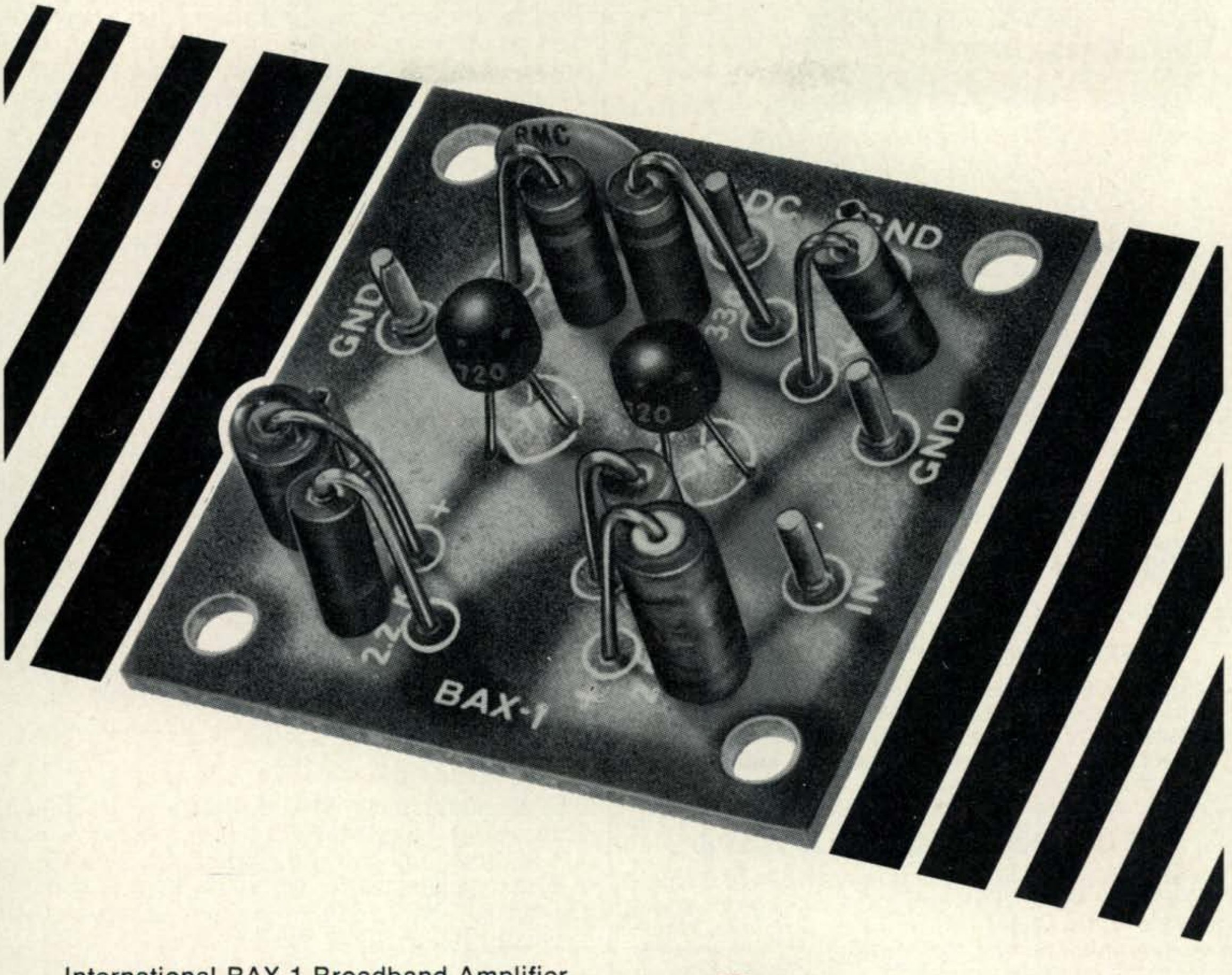

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International BAX-1 Broadband Amplifier is a general purpose unit which may be used as a tuned or untuned amplifier in RF and audio application. For example: when used as untuned RF pre-amplifier connect between antenna and receiver antenna posts. Ideal for SWL, Experimenter or Amateur applications. Easy to build. Complete Kit.....**$3.75**

SPECIFICATIONS:

1. Power	9 to 15 volts dc @ 10 ma
2. Frequency Range	20 Hz to 150 MHz
3. Gain at 1 MHz	30 db
Gain at 150 MHz	6 db
4. Response ref 1 mhz	down 6 db at 50 hz , ±3 db 100 hz to 10 mhz down 15 db at 100 mhz down 24 db at 150 mhz
5. Operational Impedance	50 to 500 ohms
6. Noise	less than 10 microvolts rf across 50 ohms; audio less than .0005 volts
7. Maximum Input Level	.01 volts ac
8. Output at Maximum Input	50 ohms — .1 volt
(at 1 mhz)	500 ohms — .5 volt
Size inches	1½" x 1½" x 1"
Mounting	4 holes with spacers

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See page 102 for Reader Service

Basket dinner at noon. Bring your own table service. Drinks will be furnished. Large swap table, bring your trading gear. Registration $2.00 at the door. For further info write: WØNIO, Plains, Kansas 67869.

Stirling, New Jersey

The Keyklickers of Stirling, New Jersey, present their third annual auction on Friday, April 3, 1970 at 8 P.M. It will be held at the Central School Auditorium, Central Ave., Stirling, New Jersey. There will be door prizes, refreshments and two auctioneers working continuously. For further details phone 201-647-3325 after 10 P.M.

Johnson City, New York

The eleventh annual New York State Southern Tier Hamfest sponsored by the IBM Amateur Radio Club, QCWA, AREC, and Binghampton Amateur Radio Club will be on April 18, 1970 at St. John's Memorial Center in Johnson City, N.Y., starting at 2 P.M. Adult tickets $4.75, student tickets $2.50. Advance sale only. Closing date on ticket sale is April 15. Full particulars may be obtained from Frank Gyidik, K2CWD, 509 Torrance Ave., Vestal, N.Y. 13850. Phone 785-6220.

St. Petersburg, Florida

The St. Petersburg ARC will hold their annual Hamfest at Lake Maggiore Park, entrance gate at 9th Street and 38th Ave. South, St. Petersburg, Florida, Sunday, May 17, 1970. Plenty of parking space. No charge to enter the park. All cordially invited.

Dixon, Illinois

The Fourth Rock River Hamvention will be presented by the Rock River Radio Club of Dixon, Illinois, on May 17, 1970, from 9 A.M. to 5 P.M. at the Lee County 4H Center, Ambey, Illinois, located at the intersection of Highway 52 and 30. Advance ticket sale is $1.00; at the door $1.50. For tickets and complete details write to: Carl Karlson, W9ECF, Nachusa, Illinois 61057.

Orlando, Florida

The Orlando ARC will hold their annual Hamfest at the Hilton Inn, 3200 W. Colonial Drive, Orlando, Florida on May 23-24, 1970. This is one of the largest Hamfests in the southeastern U.S. Admission tickets $2.00. Room reservations and other information can be had by writing: Hal Shea, W4BKC, 736 Alfred Drive, Orlando, Florida 32810.

Dayton, Ohio

The Dayton Amateur Radio Association is once again sponsoring The Dayton Hamvention on Saturday, April 5, 1970. It will be held at the Dayton Hara Arena and Exhibition Center. There are technical sessions, women's activities awards, exhibits, flea market, and a banquet scheduled. For complete detailed information write to: The Dayton Amateur Radio Association, Department C, Box 44, Dayton, Ohio 45401.

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SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Being the good frend I being, I having another idea on how you can improving your Hon. Mag. It's not that good-old Seek-You are that bad, but it can stand some improving, you not thinking? You having to keep up with the times.

I reeding and reeding and never seeing anything on Astrology. Hon. Ed., how can you making such an oversite? How amchoors going to knowing if there sines are rite for them if they not being able to reed there Hon. Horrorscope? Relax, not worrying, good old Scratchi has come to the rescue—here's a 1970 horrorscope for amchoors:

CAPRICORN, Dec. 21 to Jan. 19—You cats born-under this sine love things shiny and gaudy and pretty. Your shack reeks of plexiglas and chrome-plated stuff. One needs sunglasses to look at your rig.

1970 can be trubblesome yeer for you if you do things on the spur-of-the moment. Plan ahead for everything. It being good yeer to be competitive, plan to be in big dee-x contest. But not desiding at last minute, or something happening like your Hon. Mother-in-Law coming for visit and throwing all your plans in cockatoo hat.

AQUARIUS, Jan. 20 to Feb. 18—You are the intellectual tipe—liking the finer things

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LARGE ANTENNA LOAD

BUILT FOR WIND

THE TRI-EX FREESTANDING LM 470

(70 FEET HIGH)

This advanced state of the art tower is aerodynamically designed to reduce tower wind drag. This means you can carry more antenna than ever before. Tri-Ex engineers have made this possible by using high-strength, solid-steel rod bracing. Only at Tri-Ex do you get "W" type continuous truss bracing. Developer of the freestanding, crank-up tower, Tri-Ex prides itself on the quality of its products. More Tri-Ex crank-up towers are in use today than all other crank-up towers combined. Find out why the LM 470 tower is such an outstanding success. Write today for free literature.

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Tri-Ex TOWER CORPORATION 7182 Rasmussen Ave., Visalia, Calif. 93277

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of life. You only work rare dee-x and rarely call seek-you.

This will be exciting yeer for you. You'll be very popular and you'll make many new frends. You'll have so much charm you could even talk the FCC out of giving you a pink ticket. Live it up.

PISCES, Feb. 19 to March 20—The sensitive tipe. If anybuddy told you your fist was lousy, you'd probably give them a diddledy bump-de-bump in a flash.

The yeer 1970 will be a yeer of change for you. New venshures are indicated. Because you like to bild things by hand, try bilding a new shack, or a new tower, or a new eleventeen transister reseever. It'll work peechie.

ARIES, March 21 To April 20—You guys are the wheelers and deelers, the adventurshun, the daring. You like too see how close you can operate to the edge of the band without going out.

The stars say you are in for a big romantic yeer—but they also say you should guard your money. If you figyour your way around that, let me know how you did it, post hasty.

TARUS, April 21 to May 20—Amchoors born under this sine are a bundle of energy—always on the go. But are you fussy—boy oh boys yes. A place for everything and everything in its place.

Money will be tite in '70 for you, but it's a grate yeer for polishing the Hon. Apple. Play up to your local ham equipment supplier—maybe he'll sell you stuff at cost.

GEMINI, May 21 to June 20—Jack-of-a!l-trades, master of none, that's what you are. The yeer 1970 will be so good for you. In factly, it'll be downrite miserable for amchoor radioing. Have you ever considered stamp collecting?

CANCER, June 21 to July 21—The sentimental hams. Most of you probably have your first QSL card pasted in an album, and your first rig stored in a box somewhere—or maybe you're still using it.

In 1970 you'll never keep your rig working rite, partly because you're absent-minded, partly because you ought to have stayed in bed. Forget it.

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[*Continued on page 89*]

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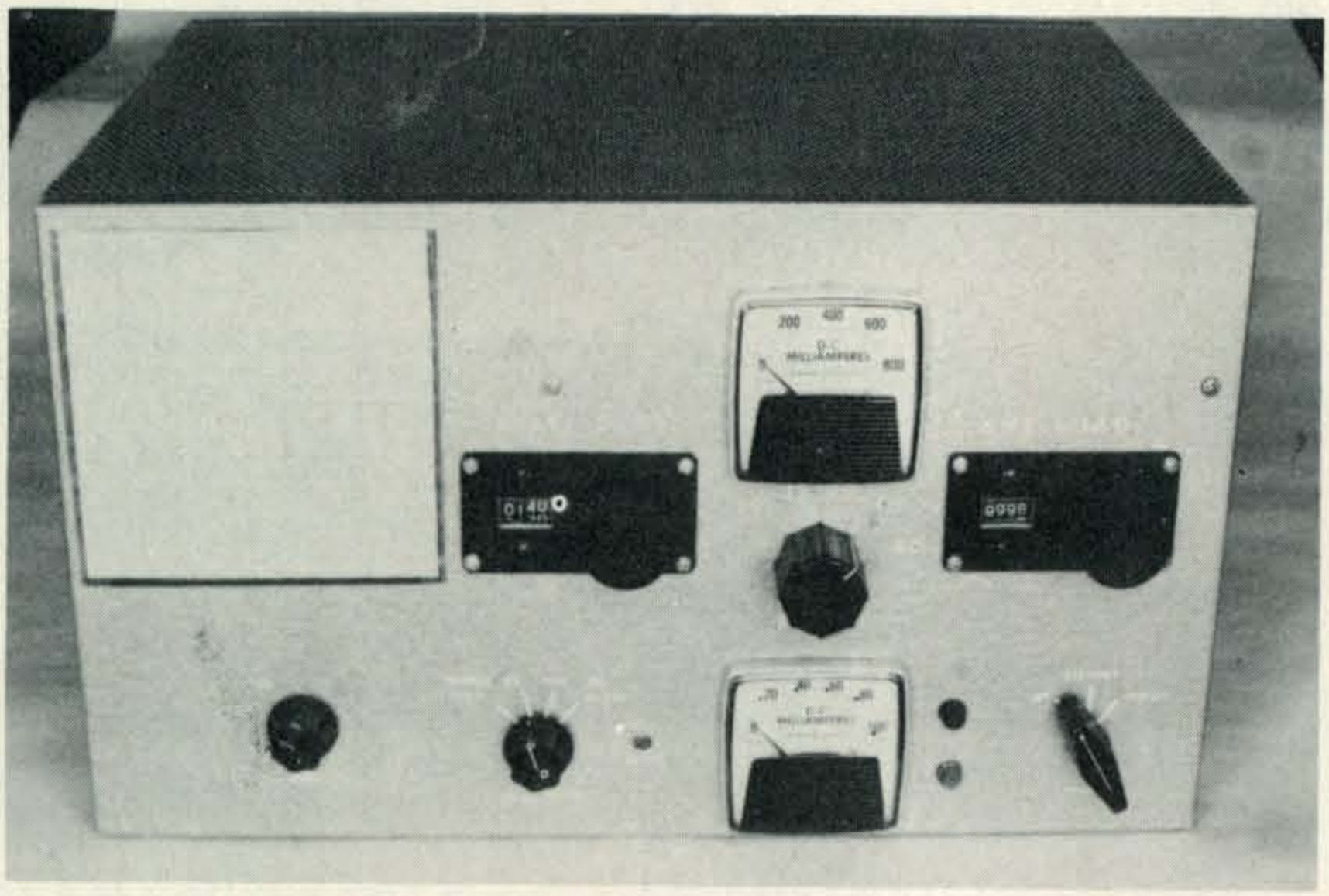

Front view of the final showing the arrangement of the controls. The tuning chart lists settings for easy band change. The cabinet is a California Chassis Co. model LTC 472 and measures 9½" × 16¼" × 11³⁄₁₆" deep.

AN ALL BAND 4CX1000A SUPER CATHODE DRIVEN AMPLIFIER

BY DEL CROWELL,* W7GVL

UNTIL recent years tetrode tubes were rarely used in grounded grid or cathode driven application. As single sideband continues to take over the bands, however, more modern methods are being developed to convert input power to output power. One way, of course, to improve the conversion efficiency of the final amplifier is to run the tube or tubes in cathode driven service. More recently an article[1] was published describing a unique method of obtaining better linearity and improving performance for the cathode driven amplifier. This amplifier uses the super cathode drive circuit,[1] in class AB¹ with excellent efficiency and linearity. Not a trace of flat topping shows even when the amplifier is driven far beyond the maximum legal limit, and requires no a.l.c. control.

Review Of Amplifiers

A review of the basic concept is in order before describing the performance of the modified super cathode driven amplifier. A basic grid driven amplifier is shown in fig. 1. The class of operation is determined by the value of bias voltage. The amount of driving power required is determined by the class of operation. Class A or AB¹ will use only the power needed to make up circuit losses. Classes AB² and B will draw some grid current and thus require more power while Class C will need a large power input because of the greater grid current.

In fig. 2 we see a cathode driven amplifier better known, perhaps, as the grounded grid configuration. Note that the drive is fed completely to the cathode and as far as signal is concerned the control grid is grounded. The grid bias still determines the class of operation and for linear performance class AB¹ is usually used.

The cathode driven circuit behaves con-

*434 S. Ridge, Mesa, Arizona 85201.

[1]Orr, W. I. and Sayer, W. H., "Semi- and Super-Cathode-Driven Amplifiers," *QST*, July 1967, p. 34.

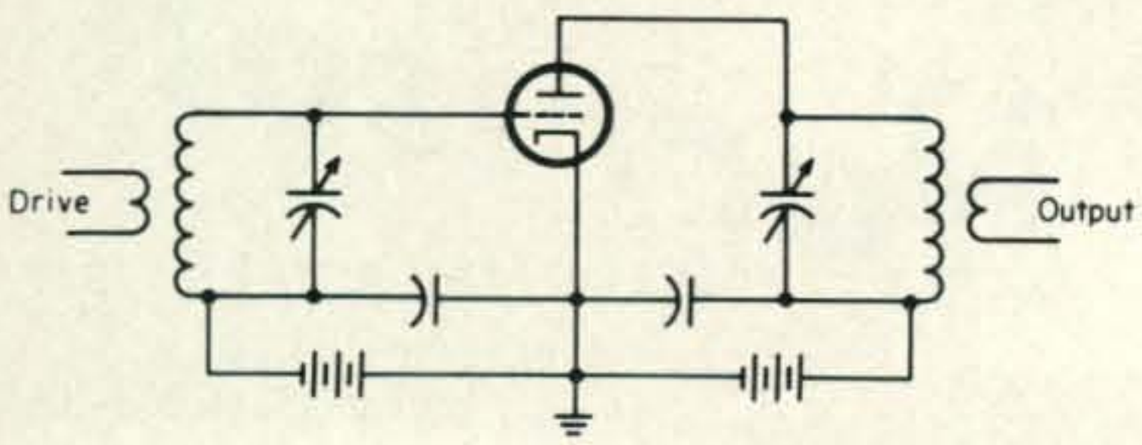

Fig. 1—Basic circuit of a grid driven amplifier.

See page 102 for New Reader Service

siderably different from the grid driven circuit in several ways. First, the input signal becomes part of the output with the drive signal adding to the power output. The part of the input to appear as output is called the *converted drive power*. It raises the effective plate voltage by the r.m.s. value of the drive voltage. The total drive power needed is the sum of the grid circuit losses, the grid drive power and the *converted power*. It can be seen then that cathode drive requires more input power by the amount of the converted power.

Secondly, because of negative feedback the stage gain is reduced. This loss is countered by a reduction in intermodulation distortion due to the feedback.

The third change in performance results from the reduction of capacitive coupling between input and output diminishing the need for neutralization until the higher frequencies are reached.

Figure 3 shows a compromise or combination of grid and cathode drive called semi-cathode drive. By moving the tap on L^1 to one extreme end (A), full cathode drive is attained; end (B) provides full grid drive. This setting of this tap will vary the converted drive power (maximum at A), stage gain (Minimum at A) and total drive power required (maximum at A). This arrangement can be used to match the required drive to that available from the exciter.

The super cathode driven circuit shown in fig. 4 shows how the grid and cathode are driven in phase. The result is a reduction in stage gain and an increase in drive power. The full output of the driver may be absorbed and converted to output power.

General Description

Several years ago the author constructed a 4CX1000A 2 kw p.e.p. final using the passive grid, grounded cathode method. Reading the article on super cathode drive methods,[1] the

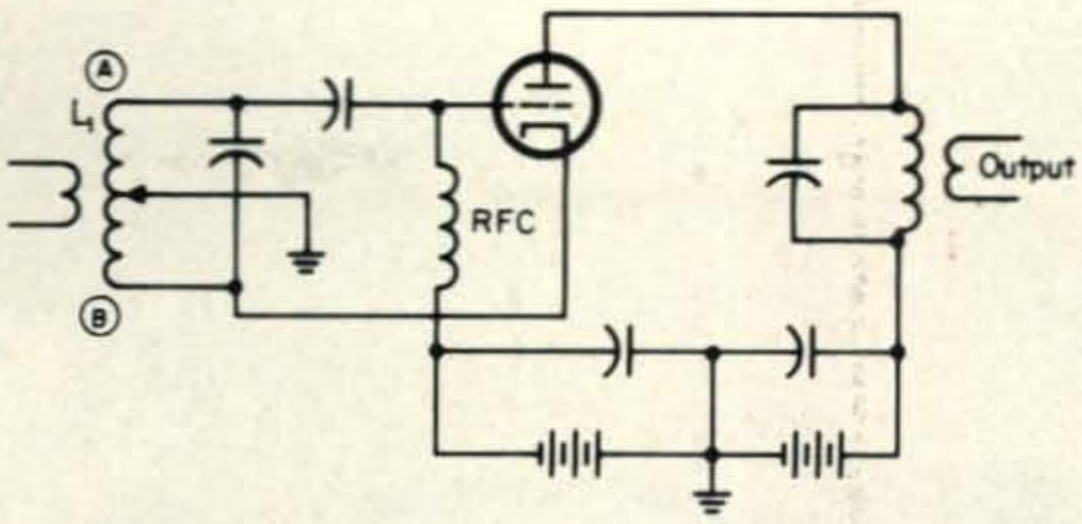

Fig. 3—Typical circuit for a semi-cathode-driven amplifier.

basic concept looked quite interesting and converting the input circuit of the original 4CX1000A final into this driving scheme was considered. Several configurations of driving and biasing methods were tried, and, after much experimenting and testing the method to be described was chosen. The tube was operated in class B and AB[1] using both the standard cathode drive and super cathode drive techniques. The AB[1] super cathode drive method proved to be best over all. It was discovered that the tube required the minimum driving power that most exciters could deliver, which was in the 130 to 180 watt class.

Conventional Cathode Drive, Class AB[1]

The tube in standard cathode drive service (fig. 5) was very critical as to maximum drive level. As grid current was approached, flat topping occurred with a sharp rise in grid current as in grid driven service. Driving power required was approximately 40 to 70 watts.

Conventional Cathode Drive, Class B

Characteristics in Class B cathode drive were even worse since it was necessary to tune and load the amplifier at the level which it would peak, or the linearity would suffer greatly. Again, the amplifier was very sensitive to grid current and flat topping.

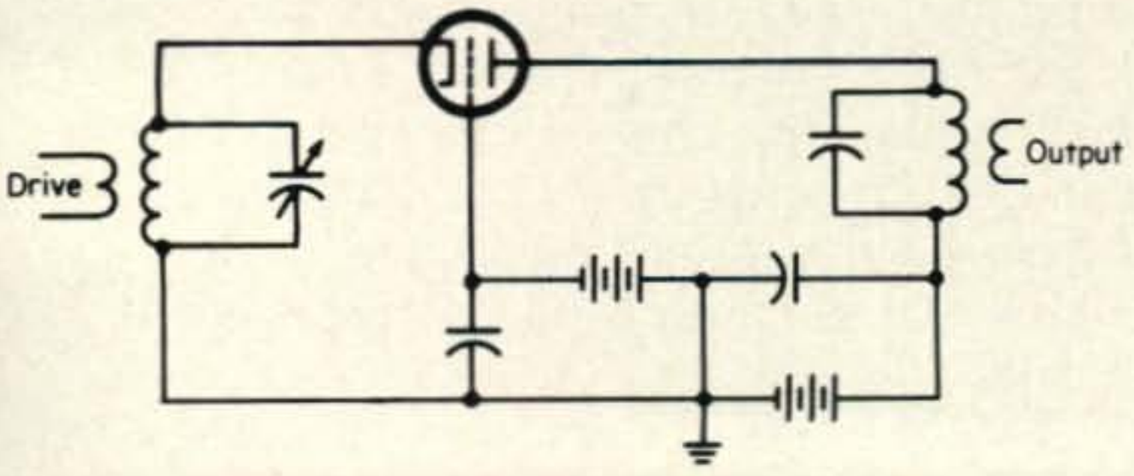

Fig. 2—Cathode driven (grounded grid) amplifier.

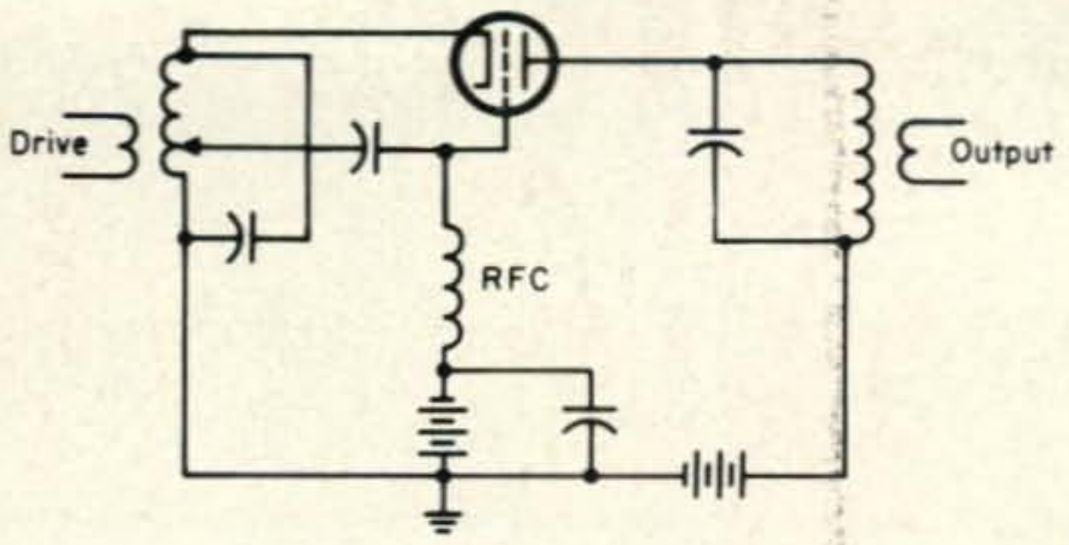

Fig. 4—The basic super cathode driven amplifier circuit.

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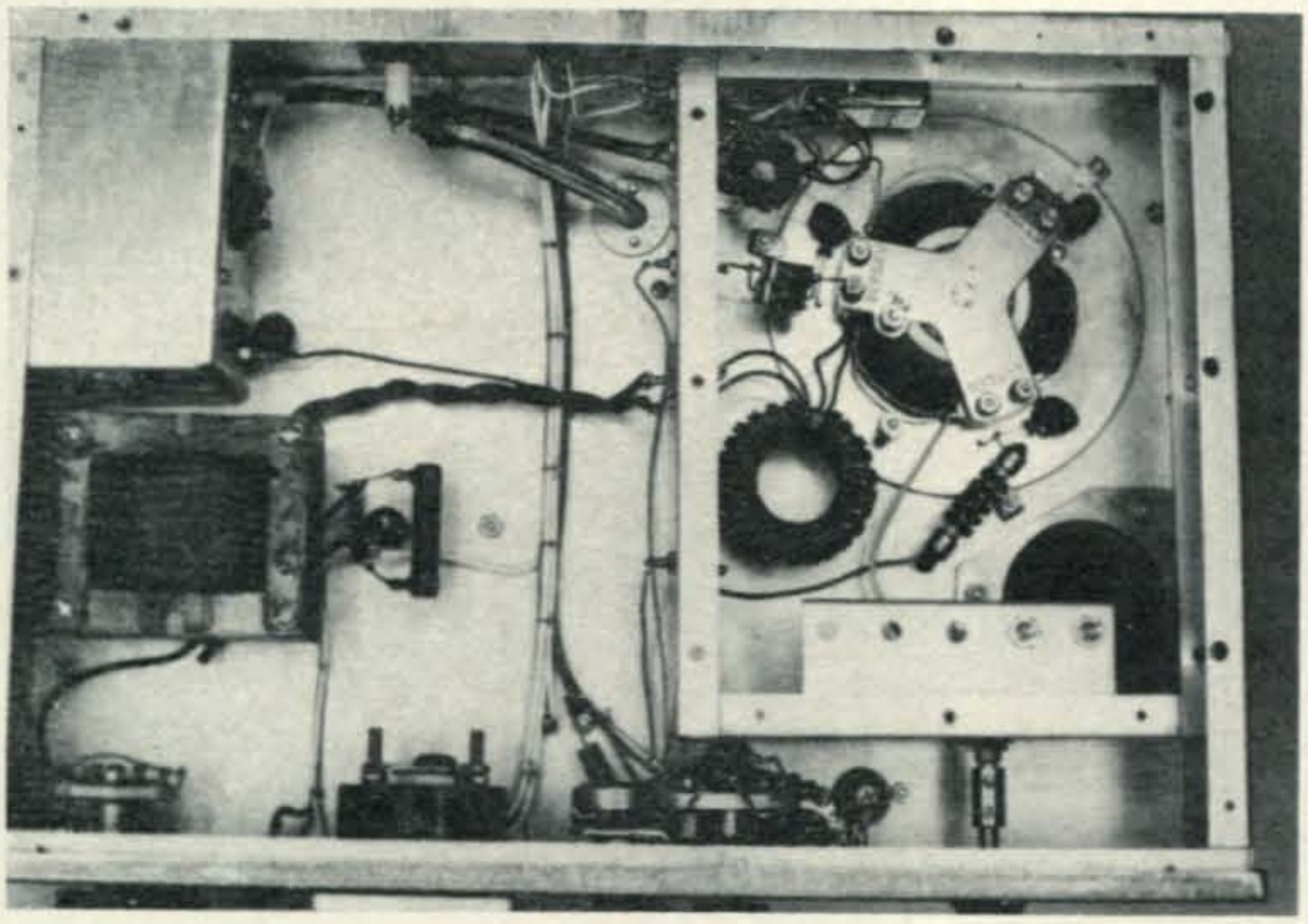

Bottom view of the 80-10 meter amplifier showing the general layout and the wiring. The resistor next to the filament transformer drops the filament voltage to less than 6 volts. Inductors L_1 and L_2 are mounted on the bracket in the front of the input compartment.

Super Cathode Drive, Class B

Using the tube in super cathode drive service, Class B, (fig. 6) improved the linearity. Also, no grid current could be indicated. Due to the large amount of negative feedback, drive power required was more than 200 watts for the 2 kw p.e.p. level. Tuning was critical and hard to adjust at the maximum level of operation for best performance.

Super Cathode Drive, Class AB^1

The best approach by far was class AB^1, shown in fig. 7. This method gave very good results; with 175 watts of drive power the peak input power obtained fell just at the 2 kw p.e.p. limit. Output power measured over 1350 watts, and plate efficiency was near 70%. With both control grid and cathode at the same r.f. potential no grid current flows. (Metering is not necessary.) Tuning and loading proved much simpler in class AB^1. Since screen and bias voltages are applied, plate reactance changes much less with operating level than in Class B. Looking at the Class B method fig. 6, screen voltage must be developed by rectification of the driving signal which in turn varies the plate reactance and makes tuning more critical. Up to 75% plate efficiency was recorded running the tube in B. As previously stated, however, the AB^1 class was chosen for easier tuning, smoother operation and reduced drive requirements. Distortion products appeared to be lowest and the amplifier showed best overall operating characteristic. Of course, this requires bias and screen voltages, but it still is worth it for a good clean signal. A comparison of the results is shown graphically in fig. 8.

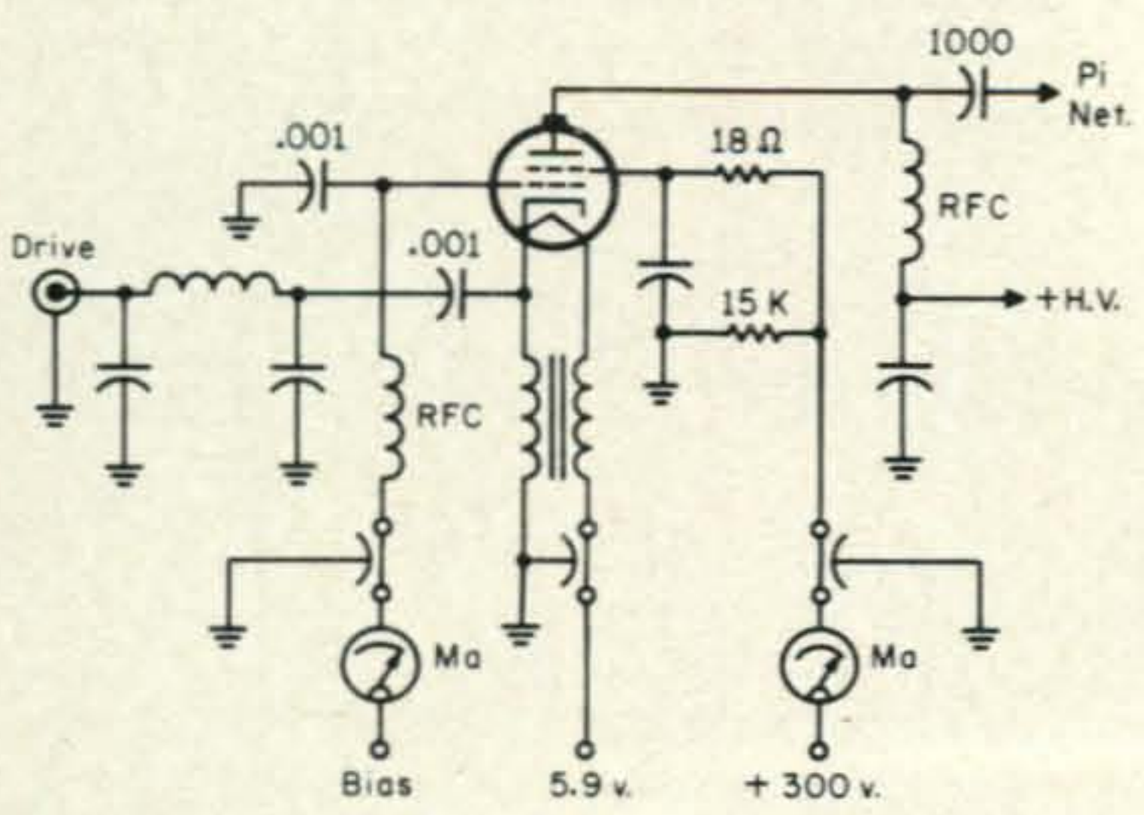

Fig. 5—Conventional class AB1 cathode driven amplifier using 4CX1000A.

Circuit Description

Cathode and Grid Circuits

Changing from grid driven to cathode driven service (fig. 9) required a new socket (SK800A or B) and the input circuits had to be rewired.

A standard aluminum chassis and cover was used to enclose the lower portion of the tube and socket, all voltages were routed with feed through capacitors into the sealed box. A bifilar filament choke was constructed by winding 26 turns of #12 e. wire on a large MicroMetals toroid core. The balun kit[2] which is available in parts stores would do nicely.

Several input circuits were considered but

[2]Amiron Assoc., Torrid Cores, 12033 Ostego Streeet, North Hollywood, California 91607.

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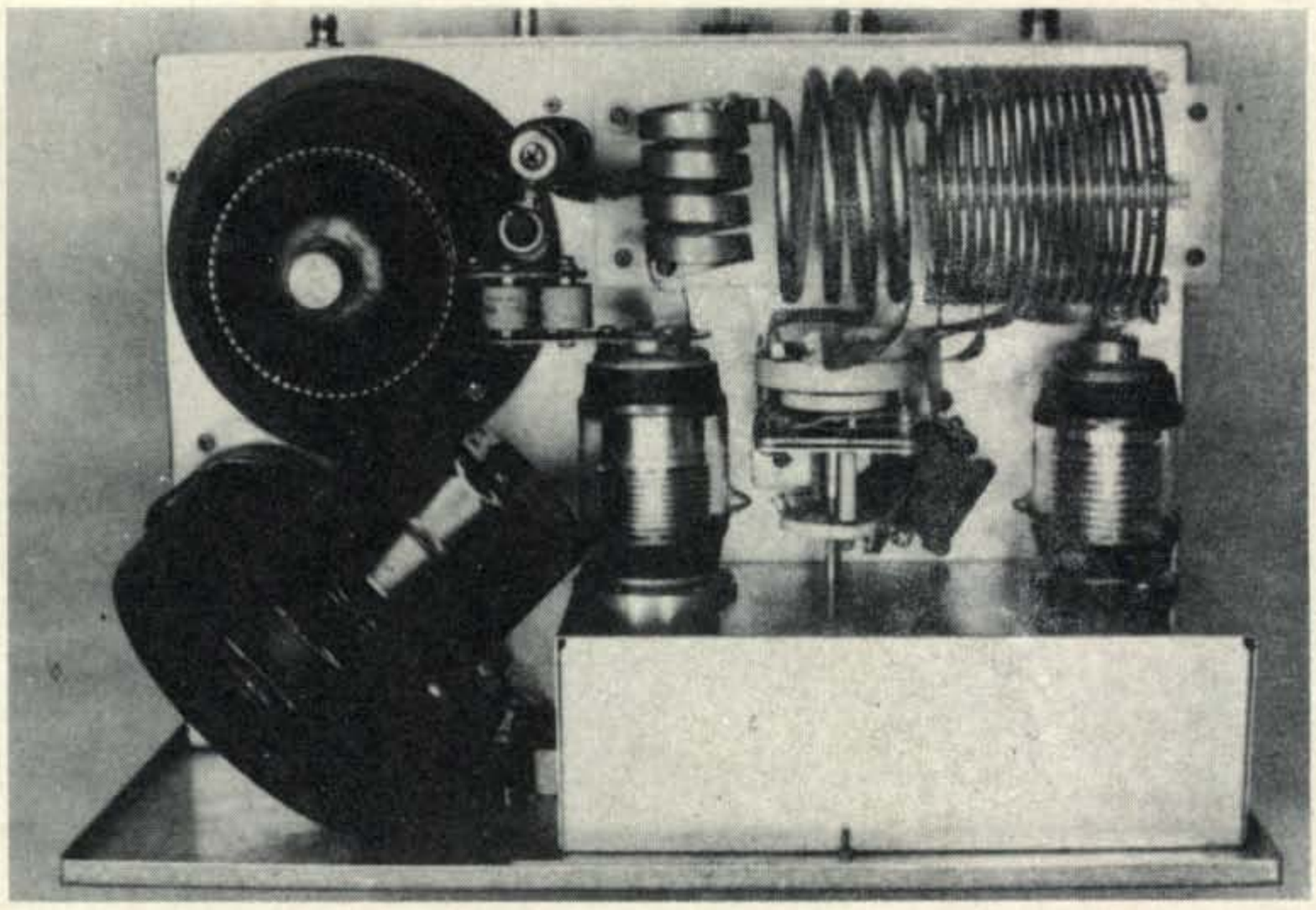

Top view of the amplifier shows the bandswitch with the extra wafer used for the loading capacitors. Plate connection is made with a large clamp around the anode. Note the two vacuum variables and the Air Dux pi-net coil.

an untuned broad band balun was wound on a ferrite torroid core[3] which worked quite well up through 20 meters. Peaking coils were later wound and installed to tune out the large amount of tube and socket capacitance at 10 and 15 meters. The combined input capacitance was about 120 mmf with the SK800A socket contributing a large portion of this total.

An improved input network would be more desirable using individual pi-networks pre-tuned for each band. The calculated values are listed in fig. 10 for those interested. The input impedance is approximately 225 ohms which works out OK for a 1:4 broad band balun.[3] Since the cathode and control grid are at different d.c. voltages, capacitors must be used to isolate these potentials. A 1000 mmf capacitor is connected between each of the three grid and cathode terminals; one side of the filament is connected to the cathode within the tube.

Plate Circuit

Very few changes were made in the plate circuit which used a conventional pi-net output, vacuum variable capacitors, and vacuum relay in the antenna switching network. The band change switch used was removed from a BC375 tuning unit, an extra wafer was added to select fixed mica capacitors in parallel with the loading capacitor for the lower frequency bands. Turns counting dials were used to make band changing and tuning easy. Once the settings are established it's only necessary to preset the controls to settings previously listed on a chart.

[3]Indiana General Corp., Ferrite Materials, Keasbey, New Jersey.

Construction Hints

Most builders prefer to use their own choice of chassis and material for projects, so construction details will be limited to hints and suggestions for using the 4CX1000A in this type of circuit. This method of drive can be used with many tubes and actual circuits will, of course, have to be modified to fit their particular requirements. The 4CX1500 can be used with very little change (only screen and bias voltages).

Be sure to enclose and filter all wiring to the tube socket, and provide plenty of air for cooling.

The convenience of high or low power switching was incorporated using two relays for bypassing the final in low power mode. By studying the photos one can see most of the assembly in the cathode-grid compartment.

A meter is provided for the monitoring of

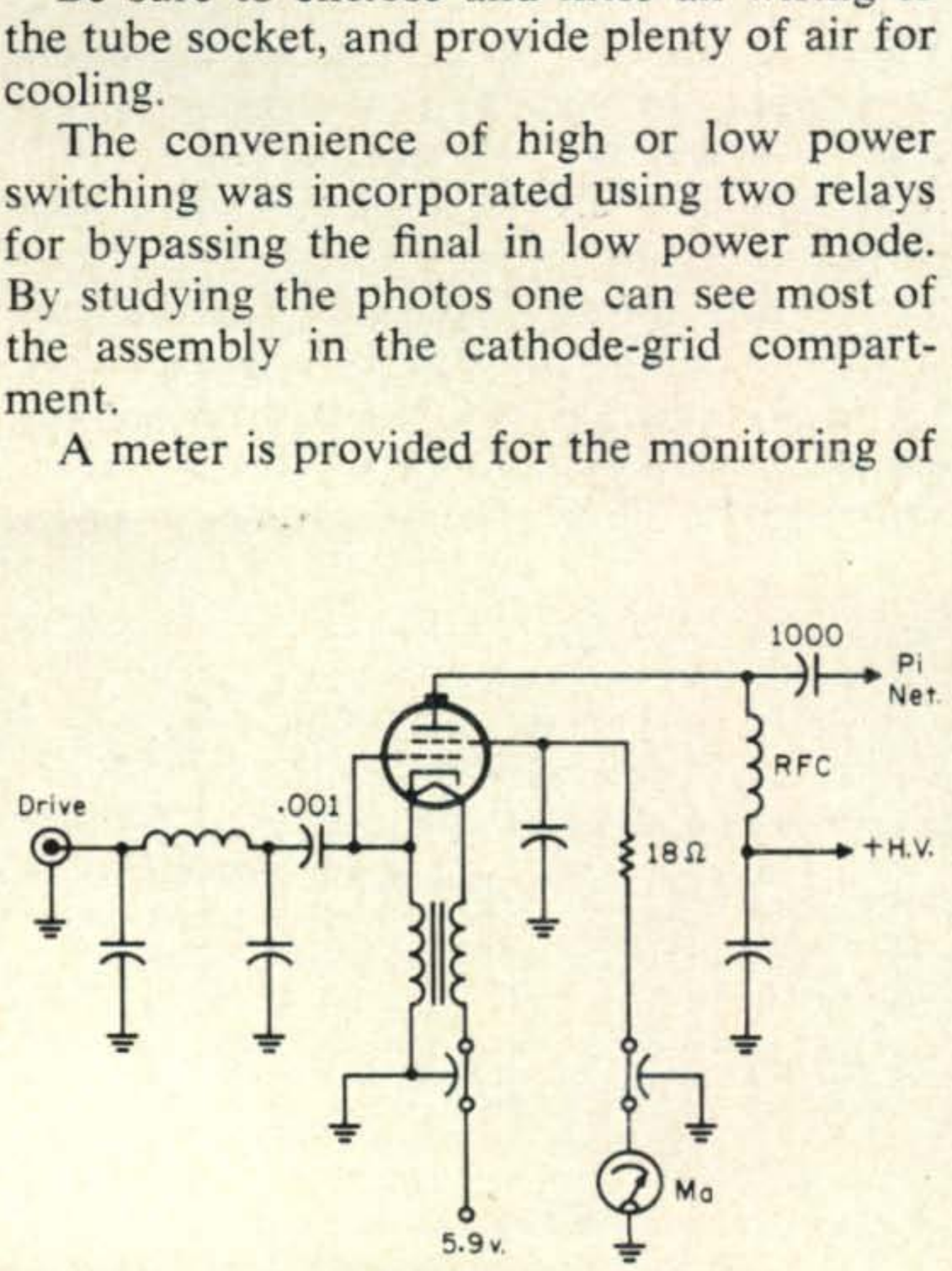

Fig. 6—The circuit of fig. 5 altered to operate as a class B super cathode driven amplifier.

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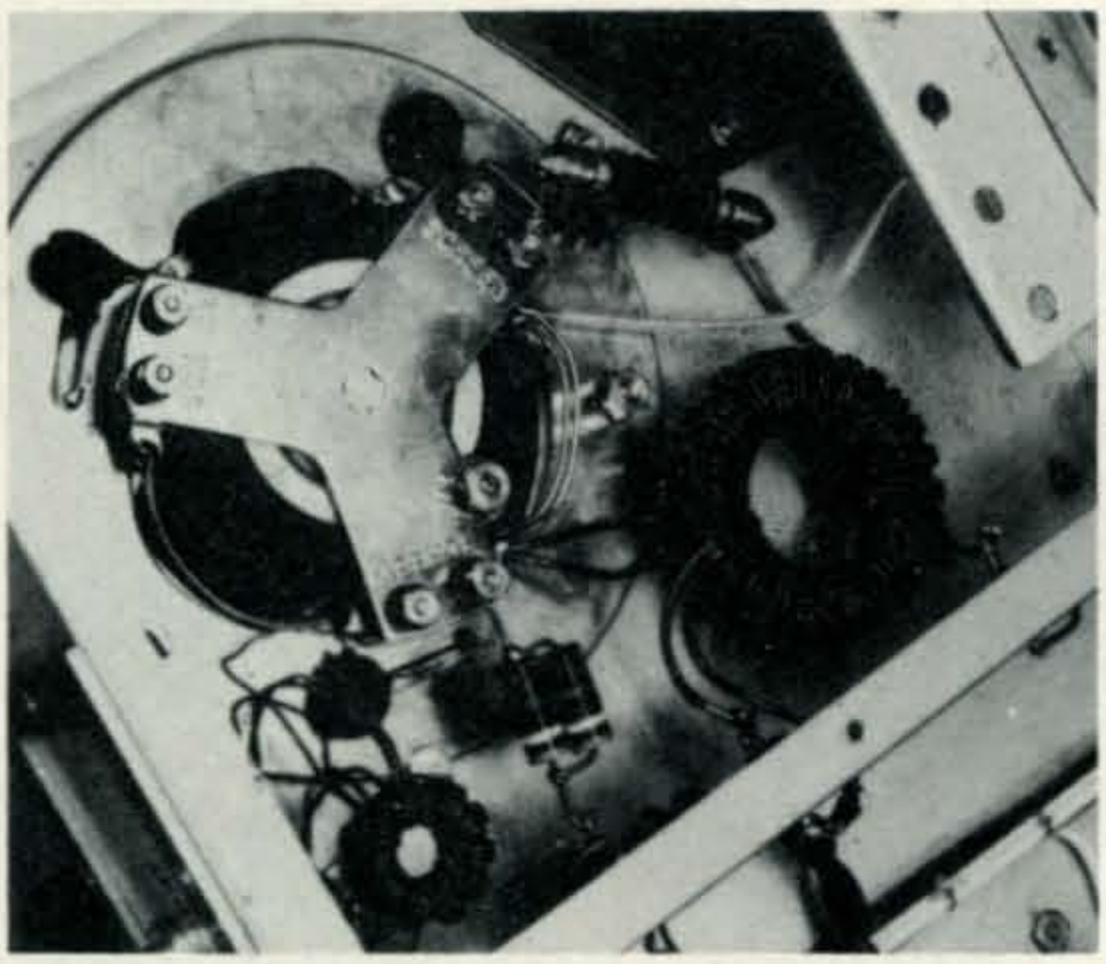

Close up view of the input compartment shows the filament choke (large) and the bifilar balun.

grid current, screen current, screen voltage and relative r.f. output. Each circuit is selected with a 4 position pole switch. A 0-800 ma meter continuously monitors plate current.

Power supplies are not shown since most any style of power supply will usually work OK. A separate supply with two VR150 regulators provide a screen voltage of +300 volts at 35 ma; the dropping resistor was selected to provide 35 to 40 ma of current thru the VR150 tubes. This gives automatic limiting to prevent the screen from dissipating excessive power. A 180 second time delay relay was also provided along with a high current relay to control the plate and screen transformer primary voltages. The filament voltage should be adjusted for approximately 5.7 to 5.9 volts, or reduced until the power output shows a slight drop; 5.8 volts was used and reduced the tube temperature considerable; no loss of performance was noted and the reduced voltage greatly increases tube life.

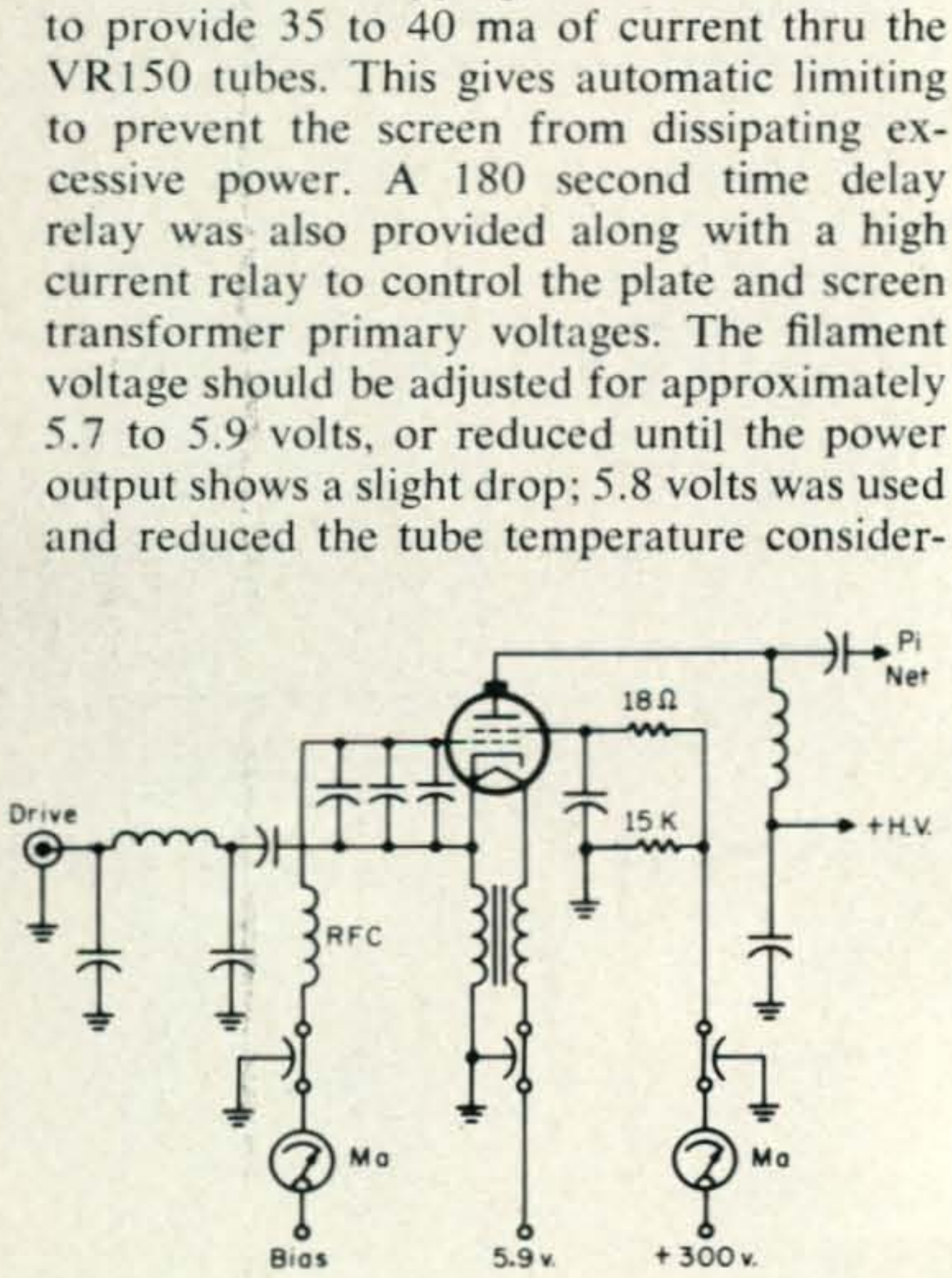

Fig. 7—The 4CX1000A as a class AB1 super cathode driven amplifier.

Operation

This amplifier using the super cathode drive method has been used for more than a year with excellent results. The amplifier is very easy to tune; the main indicators used are screen current, plate and r.f. output. No precise tuning with a monitor scope or two tone generator is required. Loading is adjusted a 1 kw steady carrier for approximately −15 to −20 ma of screen current. On voice peaks the screen current should not exceed +5 ma. (A zero center scale meter should be used.) No grid current is ever indicated on maximum peaks; a test was conducted using a Swan 500 transceiver putting out over 360 watts peak. The amplifier was adjusted as described and driven to over 2500 watts p.e.p. into a 50 ohm dummy load and still no grid current indication. The final simply continued to draw more plate current and deliver more output power. As in most finals this amplifier does not show a flat topping condition when driven with more than the normal required power. Different test results are shown in

[*Continued on page 85*]

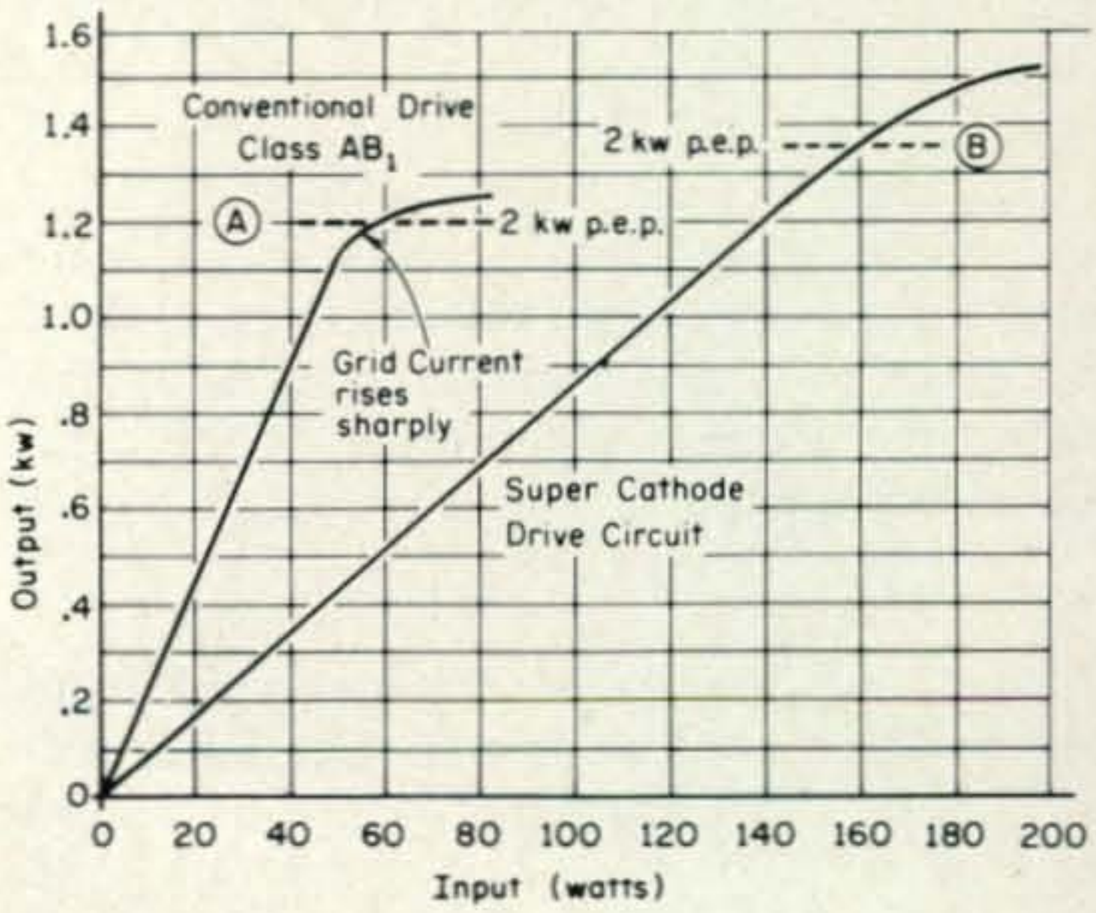

Fig. 8—The above curves show the relationship between drive power and output for (A) conventional drive, Class AB_1, and for (B) super cathode drive, Class AB_1. The slight bend in curve (B) is caused by the need for a higher screen voltage. Because of the legal output limit, however, the screen voltage should be held to plus 325 volts as *recommended by the tube* specs. Linearity is still good beyond the 2 kw p.e.p. level. Curve (A) shows the distortion occurring very rapidly as grid current is approached.

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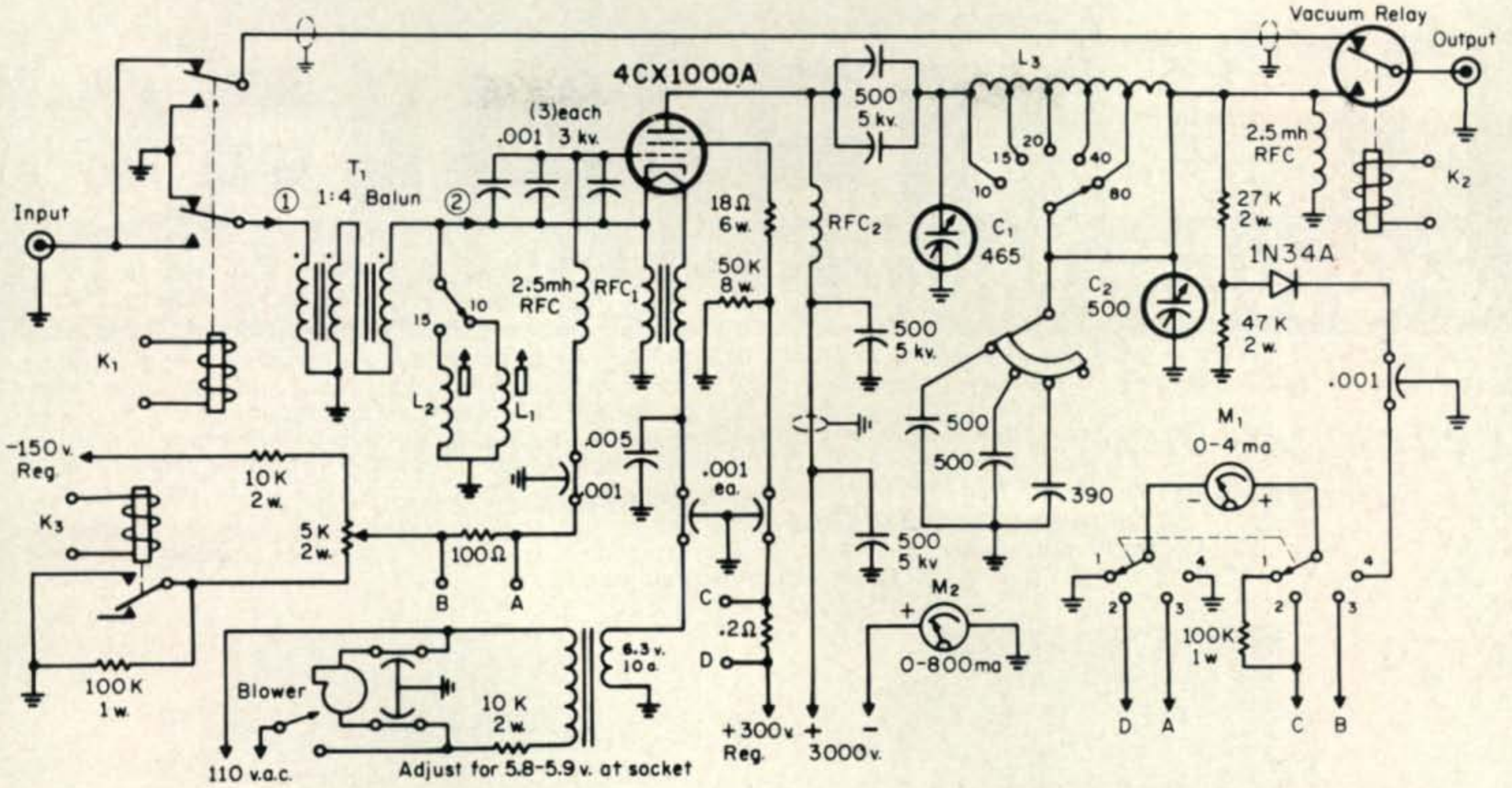

Fig. 9—Practical circuit of the 4CX1000A super cathode driven amplifier. Relays K_1, K_2 and K_3 are wired to operate together from a single switch to give instant switching from straight-through exciter operation to high power operation. K_3 reduces grid bias from cutoff to operating level in high power operation. Decimal value capacitors are in mf; all others in mmf.

C_1—Jennings UCSL 465 mmf vacuum variable capacitor, 2—5 kv.

C_2—Jennings UCSL 500 mmf vacuum variable capacitor, 2—5 kv.

K_1—D.p.d.t. relay with contacts and insulation suitable for exciter power. Coil voltage compatible with K_2 and K_3.

K_2—Jennings s.p.d.t. vacuum relay.

K_3—S.p.d.t. light duty contacts and insulation. Coil voltage same as K_1 and K_2.

L_1—10 m. peaking coil 4 t. #16 e. spaced 4-times wire dia. on 3/8" dia. slug tuned form.

L_2—15 m. peaking coil. 6 t. #16 e. spaced 2-times wire dia. on 3/8" dia. slug tuned form.

L_3—Air-Dux #195-2 kw Pi-network inductor. Taps from flat-wound end: 10 m.—6½ t., 15 m.—7½ t., 20 m.—8½ t., 40 m.—11½ t., 80 m.—15½ t.

RFC_1—26 t. #14 e., bifilar wound on Micro Metals T200-2 toroidal ferrite core.[2]

RFC_2—800 ma transmitting-type r.f. choke. Raypar.

T_1—1:4 balun. 11 t. each winding #20 e. trifilar wound on two toroidal ferrite cores stacked together. Windings interconnected as shown (dot indicates start of winding). Cores: One each Indiana General Co. CF111Q1 and CF111Q2.

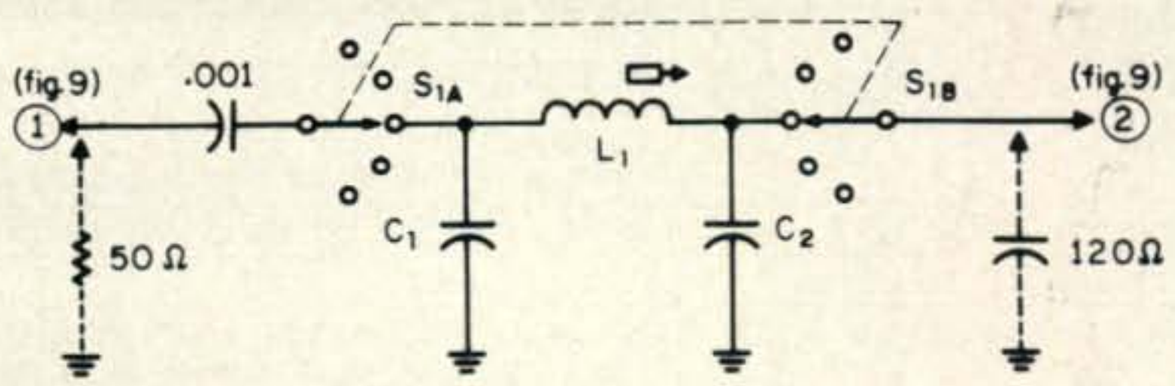

Fig. 10—Recommended pi-network input to replace T_1 in fig 9. Inductor L_1 is wound on a 3/8" slug tuned form. To adjust the coil terminate the network in a 120 mmf capacitance and connect a 50 ohm resistor as shown above. Then grid dip the coil adjusting it for the center frequency of the range. The compartment values for each band are shown in the chart and are calculated on the basis of a 50 ohm input, a 225 ohm output and a Q of 6. Points marked 1 and 2 above connect to similarly marked points in fig. 9.

Band (mc)	C_1 (mmf)	L_1 (μh)	C_2 (mmf)
3.75	2100	2.30	1080
7.20	1200	1.20	470
14.20	600	.61	180
21.25	390	.40	70
28.50	220	.22	0

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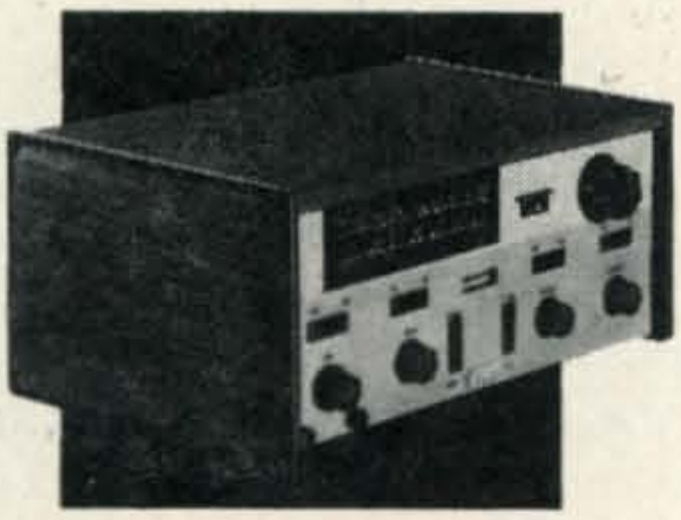

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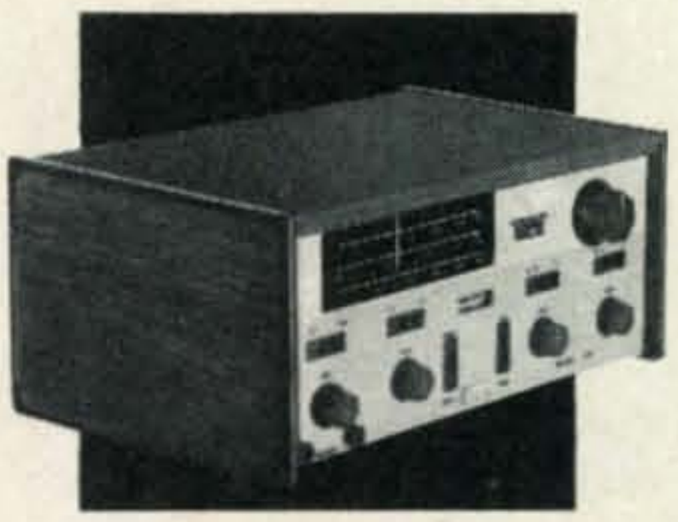

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Finish	Baked enamel. End panels, walnut wood grain.	(same)
Power Required	12 volts DC 30 ma. to receive 450 ma. to transmit	12 V. DC. 20 ma. to receive 200 ma. to transmit
Semi-conductor Devices	1 dual-gate MOSFET, 1 integrated circuit, 8 silicon transistors	1 dual-gate MOSFET, 1 integrated circuit, 4 silicon transistors
Types of Reception	CW-SSB-AM	CW-SSB-AM
Selectivity	2 KHz at 6 db down points	(same)
Sensitivity	Less than 1 uv	(same)
Antenna output impendence	PI Network	50-75 ohms. Fixed Link
Audio	Output impendence 1000 ohms. Frequency response ± 3 db 200-2500 Hz	(same)
Frequency Stability	Less than 100 Hz drift. No warm up	(same)
Power Input	Approximately 5 watts	Approximately 2 watts.
Front panel controls	On-off, 40-20 band switches (3), transmit-receive, volume, receiver peak, tune-operate, tune, load. Metered amplifier. Head phone tip jacks.	On-off, 40-80 band switches (3), transmit-receive, volume, VFO/crystal, receiver peak, oscillator tuning and amplifier tuning. Metered amplifier. Head phone tip jacks.
Tuning	Slide-rule dial. Flywheel tuning	(same)
Size	HWD 4½", 10⅜", 6⅝"	(same)
Shipping weight	3 pounds	2¾ pounds

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A SIMPLE D.C. TO D.C. CONVERTER

BY ROBERT J. MURPHY,* K4PZW

If you would like to construct a mobile power supply for one of the popular "Hot Water" series or other transceivers having approximately the same power supply requirements, and want to spend fifteen dollars or less, then this is for you.

Basically all you need is a flyback transformer and a filter choke from a junked TV set, a few tubular electrolytic capacitors, diode rectifiers and a few resistors. All of these items can be purchased from bargain houses, and for that matter the wire for the transformer can be purchased from surplus lists. Chances are that if you have been in the radio "Business" any length of time, you have most of the items on hand.

Don't shy away because winding a transformer is mentioned, because if you have ever "wound up" a ball of kite string, you have the technique. Aside from the time required for the epoxy cement to set, the entire transformer can be constructed in a couple of hours.

The layout of parts is not at all critical, and you can change the positioning to suit your requirements. The transistor heat sinks used were from a surplus unit, but several of the handbooks show how "nested" channels bent from sheet aluminum can serve the purpose. Heat sinks for the 2N174 transistors

*7103 Wendy Circle, Jacksonville, Fl. 32211.

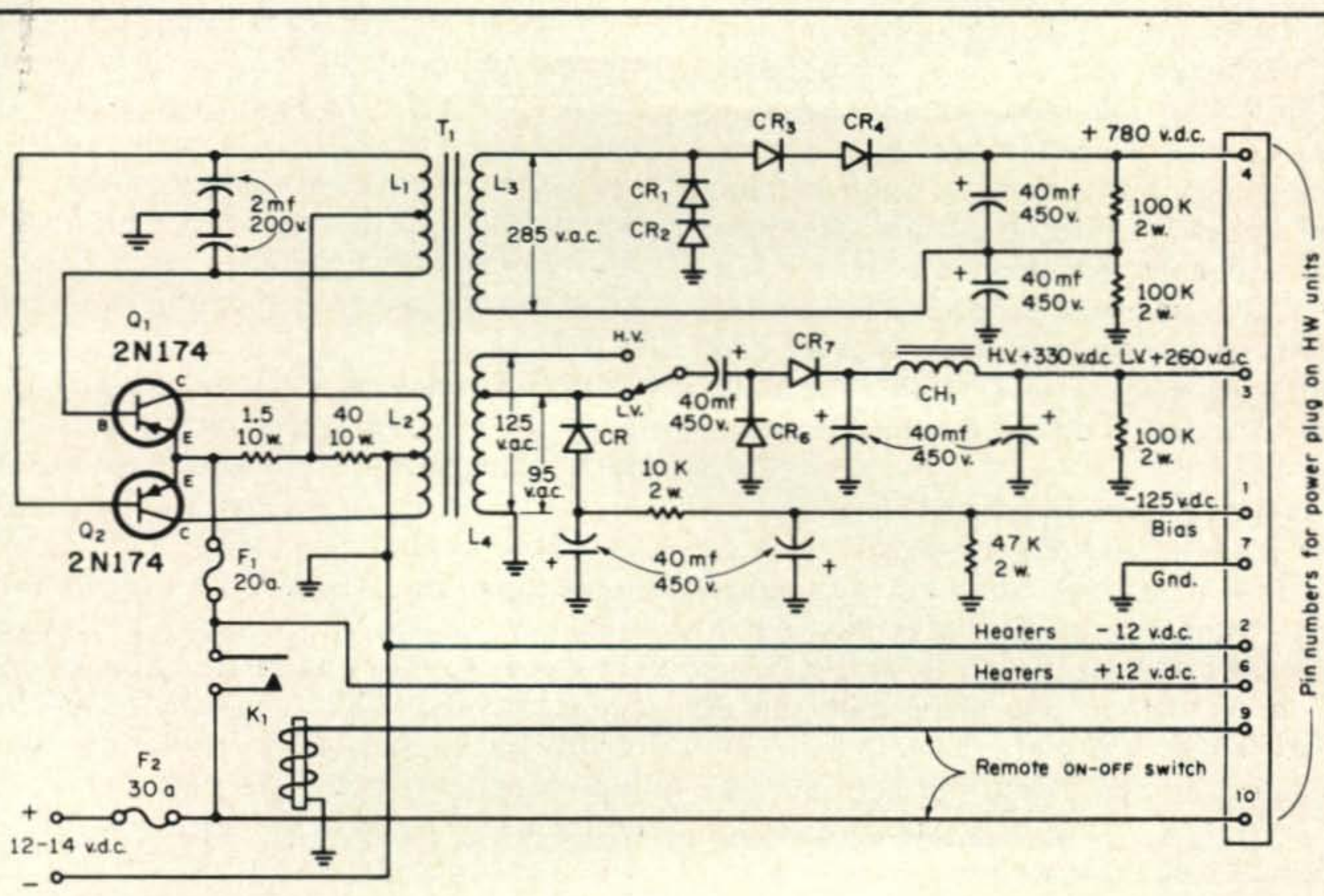

Fig. 1—Circuit of a d.c. to d.c. converter suitable for operating the HW series or similar transceivers. The construction of transformer T_1 is covered in the text. Diodes CR_1 and CR_7 are rated at 1 ampere, 600 p.i.v. Capacitor C_1 must be insulated from the chassis and must be sleeved or taped as it is above ground by 390 volts. Choke CH_1 has a 50 ohm winding resistance and comes from a scrapped TV set. Relay K_1 contacts should be rated for 30 amps. All voltages listed are for light loads.

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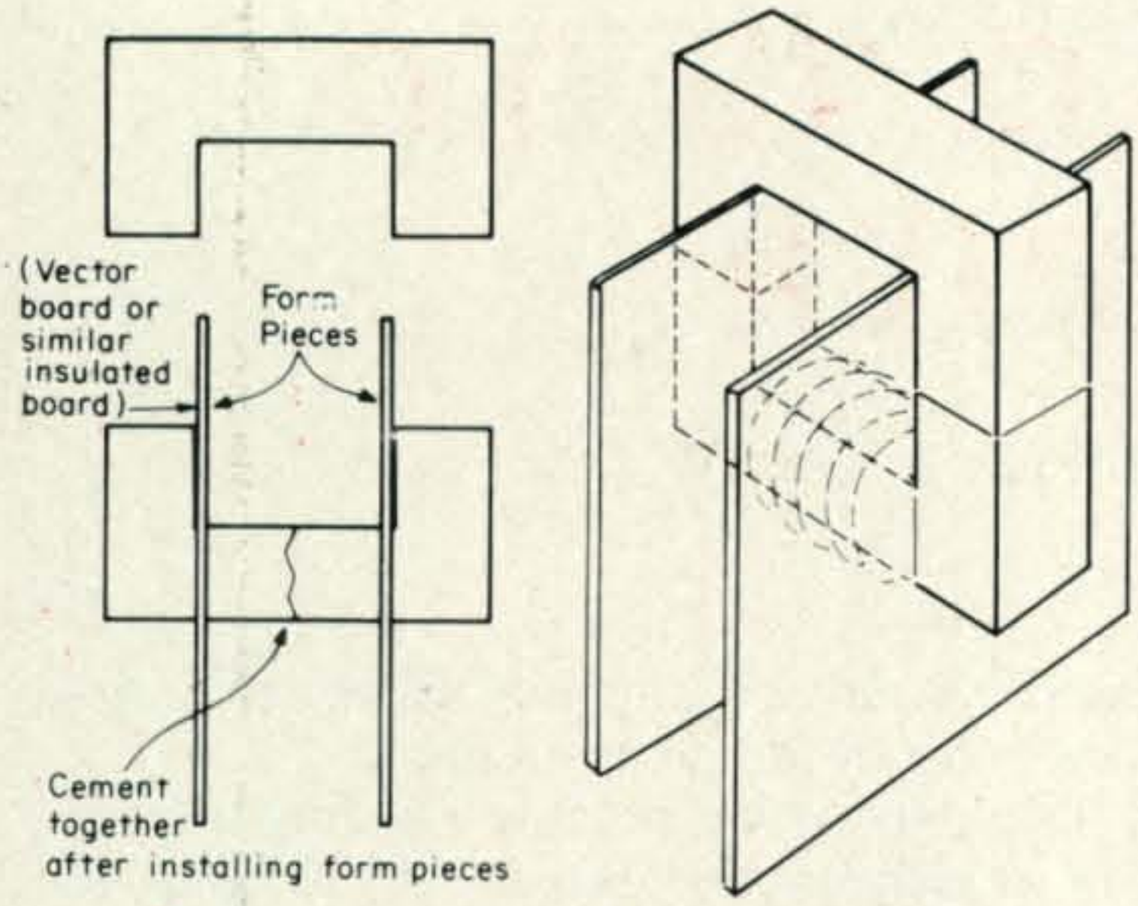

Fig. 2—Side view of the d.c. to d.c. converter transformer core with forms, ready for windings. The two C halves of the core are cemented together with an epoxy after the windings are completed.

should be about three by five inches with a minimum of six fins one inch high. Be sure the fins will be in a vertical position when the power supply is finally mounted. This allows for maximum circulation of air. Silicone grease should be placed on both sides of the mica insulators to assure maximum transfer for the transistor to the sink. Power leads should be heavy and as short as possible.

In connecting the feedback (L_1) winding (see fig. 1) leads to the transistor bases, be sure you apply power to see if the oscillator takes off before you trim the leads. You have a fifty-fifty chance that they may be reversed. The oscillator operates at about 3400 cycles; this is why the 40 mf capacitors provide adequate filtering. In fact, several times as much filter was added with little effect on the output.

The tapped L_4 winding provides an option of either 250 or 300 volts for the low voltage supply. Both of the B+ supplies use voltage doublers, while the bias supply uses a half wave rectifier. The HW series transceivers have a "BIAS ADJUST" pot in the unit, but of course if you need an adjustable bias in the power supply, a 10K 2 watt pot between two 10K 2 watt resistors can be substituted for the 47K bias bleeder shown on the schematic.

Detailed instructions for constructing the power transformer follow, and although the transformer is the "heart" of the supply it is quite easy to construct.

Construction Of The Transformer

The core of the transformer was taken from an old television flyback (horizontal output) transformer. Discarded flybacks are available for the asking at most television repair shops. From our observation the cores fall into two general sizes. The smaller core has a cross-section of about 3/8" by 3/8" with a center opening approximately one and a quarter inches square. The larger core, and the one you should use for rewinding, will have a cross-section of about one half inch by one half inch (some are square, some hexagonal and some round) and have a larger center opening of about 1.5 inches on a side. The size or age of the TV set seems to have little to do with the size of the flyback core. Some of the smaller sets which were junked had the largest cores.

After removing the surrounding frame, terminals and wires from the flyback transformer, place the core in a vise carefully and with a hacksaw cut through the old windings down to the core itself. The old windings can then easily be removed. Wash or otherwise clean the core. (Some of these can become quite dirty and gummy over the years). You will note that the core is in two halves which have been cemented together to form the ring. Place the junction of the halves on the edge of the workbench and, while holding one half down on the flat surface, apply a sharp blow with the heel of the hand to the over-hanging half. The cement will "pop" and you now have two identical halves. If by chance the core is cracked or broken when you remove it from the set, don't despair as it can be cemented together and will work just as well.

It is necessary to break one of the halves to insert the "Vector board" which will serve as the winding form. To do this place one of the "C" sections in the vise with half of the "C" above the jaws and again apply a sharp blow to the top of the exposed half. It will probably break evenly, but if it does not, save all of the pieces so they can be fitted back together and cemented. Cut two squares of Vector board or similar thin insulating material approximately three and a half inches square. Drill and file holes in the center of the boards which will fit snugly over the broken "C" of the core. With epoxy (do not use other type), cement the insulating "form" boards on the broken pieces of the "C" and then cement the "C" back together. Overnight setting of cement will produce the completed half of the core with the winding forms as shown in fig. 2.

Apply two layers of plastic electrical tape

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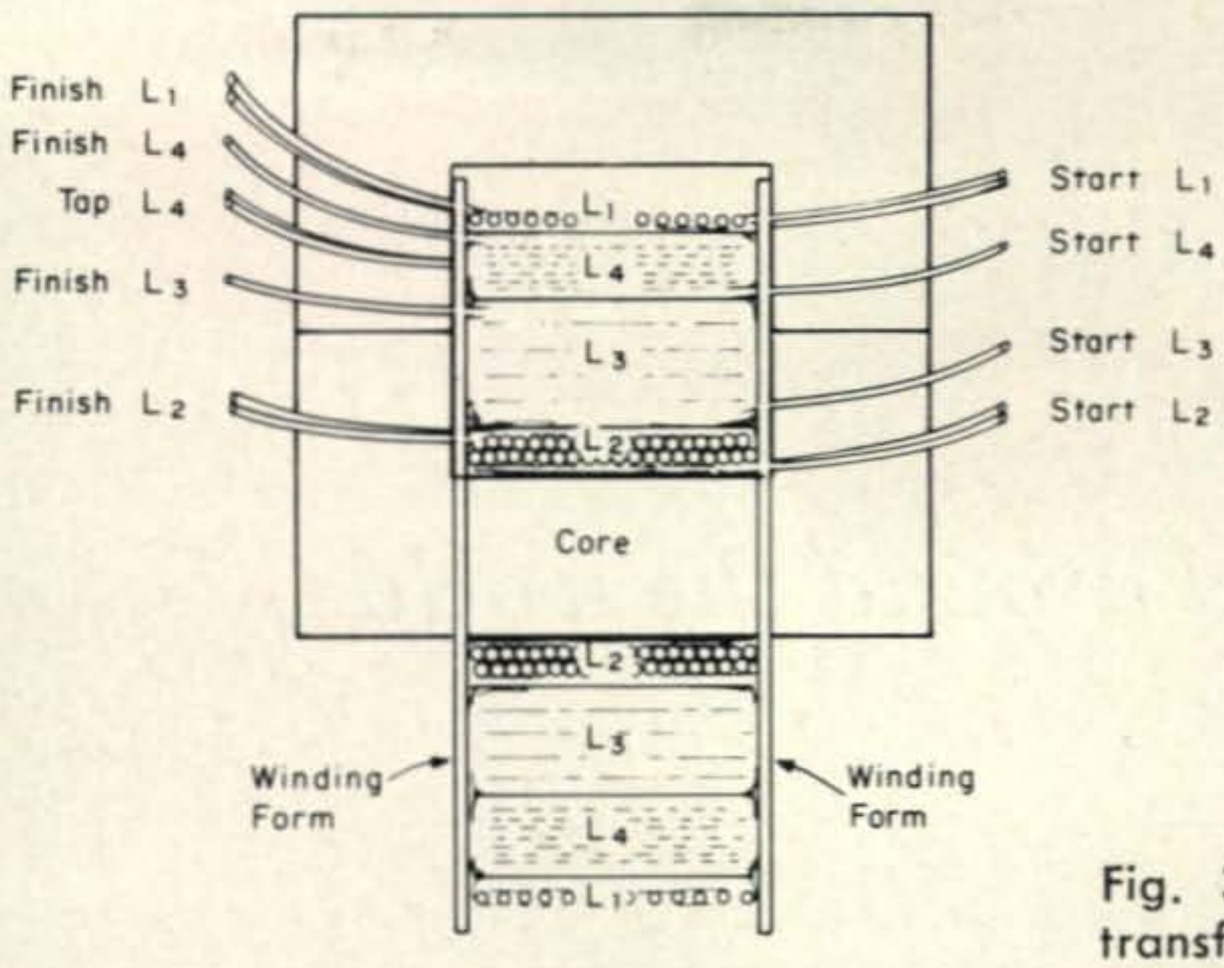
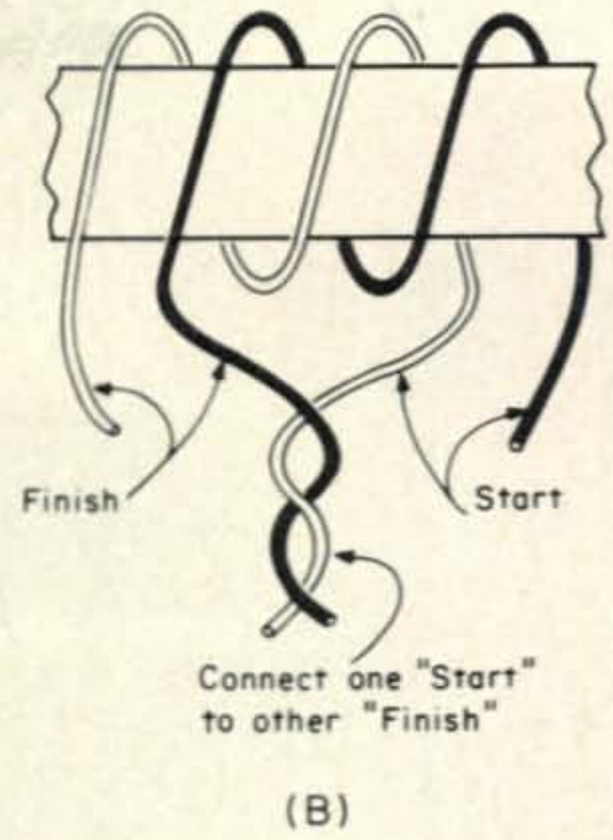


(A)



(B)

Fig. 3(A)—Cross-section view of the finished transformer showing the winding locations. (B)—Method of connecting L_1 and L_2 windings to provide the center tap and bifilar configuration.

over the core material between the form boards and you are now ready to wind the primary (L_2).

Use Mylar or other well insulated wire for all of the windings. No insulation is used between the layers of the same winding, but heavy brown paper is used between each winding. When a winding is completed a generous amount of orange shellac is brushed on to cement the turns in place. After the shellac is applied a band of heavy brown paper is placed over the completed winding, shellaced and the next winding started.

Windings

Measure two pieces of #11 or #12 Mylar insulated wire about nine feet long. One end of the two wires *(start* ends) are passed together from the inside of the winding form through a hole next to the core. With about six inches of the two wires extending outside the form, wind twenty double turns (two wires together) about the core as tightly as possible. On the cores used here, this amounted to about three layers. Drill a hole or use a hole in the Vector board, and pass the *finish* ends out the other side of the form piece. Shellac the winding, apply brown paper and the L_2 winding is completed.

Now start the high voltage winding (L_3). A two inch length of sleeving is used over the *start* end of the #21 wire, again passed through a hole in the form just above the primary winding from the inside out. Extend about six inches of the *start* end through the form and wind 570 turns. Place a two inch piece of sleeving on the *finish* end of L_3, pass it through a hole in the form, shellac, place paper band and wind L_4 in a similar manner. When the 187th turn is reached simply double the wire, place the sleeving through a hole in the form and continue to wind the remaining 58 turns. Place sleeving through a hole in the form as before, shellac and place the paper band.

The last winding to be placed is the feedback winding. This was done in case is was necessary to change the number of turns to assure oscillation. It is a bifilar winding as was the primary. Measure two pieces of #18

[*Continued on page 89*]

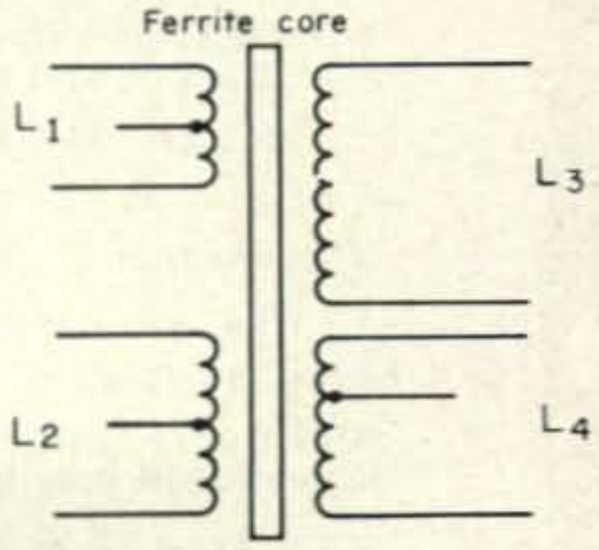


Fig. 4—Summary of the transformer. The windings are as follows:
L_1—Feedback; 12 t. #18 Mylar, center tapped, bifilar wound.
L_2—Primary; 40 t. #12 Mylar, center tapped, bifilar wound.
L_3—H.v. secondary; 570 t. #21 Mylar.
L_4—L.v. secondary; 245 t. #21 Mylar, tapped 187 turns.

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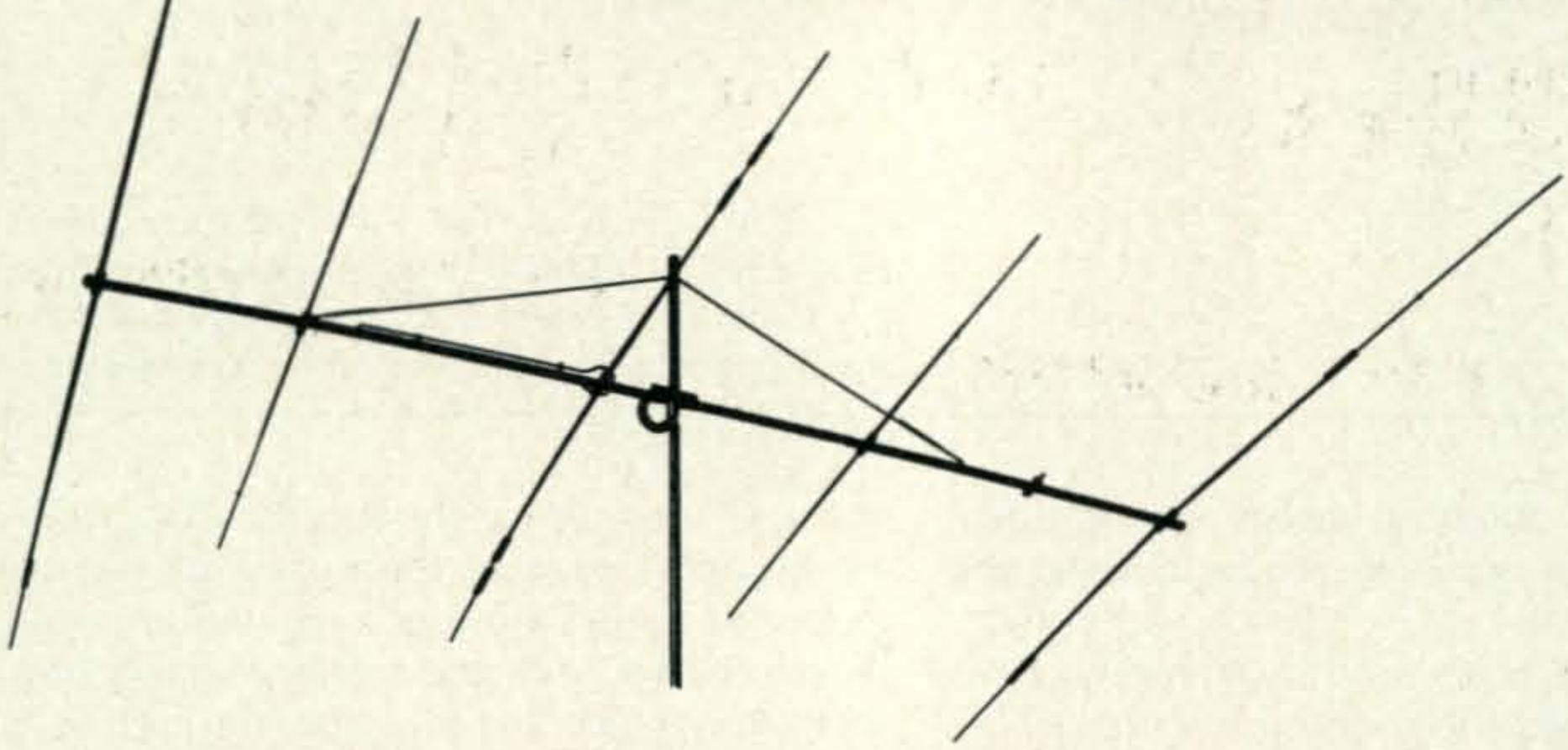
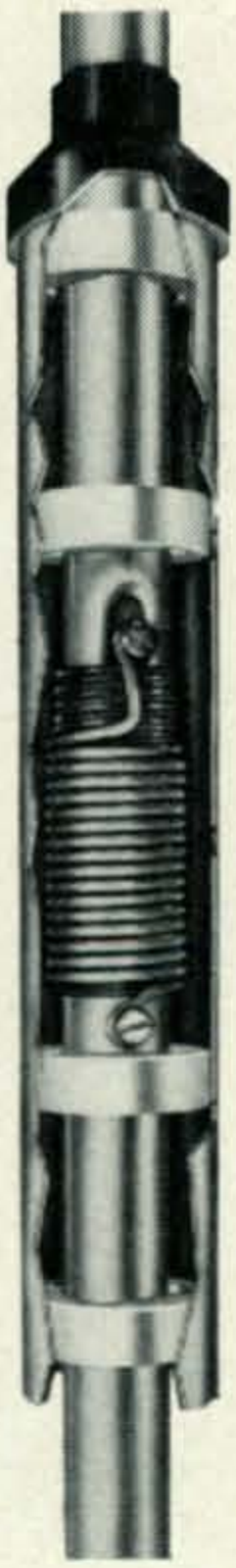
The voice of

HY-GAIN'S THUNDERBIRD 10-15-20

is heard around the world



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



- **Thunderbird's "Hy-Q" traps** provide separate traps for each band. "Hy-Q" traps are electronically tuned at the factory to perform better at any frequency in the band—either phone or CW. **And** you can tune "Hy-Q" traps, using charts supplied in the manual, to **substantially** outperform any other traps made.
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NOTES ON TRANSISTORIZED TRANSCEIVER CONSTRUCTION

BY LARRY WALROD,* VE7BRK

ALTHOUGH this is not a construction article, it is designed to gather together a number of facts that will be of interest to any person who wishes to become involved in building a completely transistorized s.s.b. transceiver with reasonably good output. Some photographs are shown of just such a unit which is in actual service and concerning which there will be a report later on in this article.

Until recently, the r.f. power output transistor has been the greatest problem in any project such as this. Just a few years ago, the entertaining amateur was hard pressed to find an r.f. transistor with any reasonable amount of power output, with a usable power gain and at a price which he could afford. More complications arose if his interests were in linear r.f. output stages, until recently, the most popular transistors had their collectors attached to the transistor cases. This presented heat sink problems because, in linear service, popular circuits operate with grounded emitters. The requirement for some forward bias in the interest of linearity made it necessary for the bias to be stiff and this ruled out the use of a stabilizing emitter resistor which would tend to alter the amount of base bias in proportion to the amount of drive the stage was being supplied with at any particular instant. Without emitter degeneration, thermal runaway was a risk and so circuit design had to be very conservative.

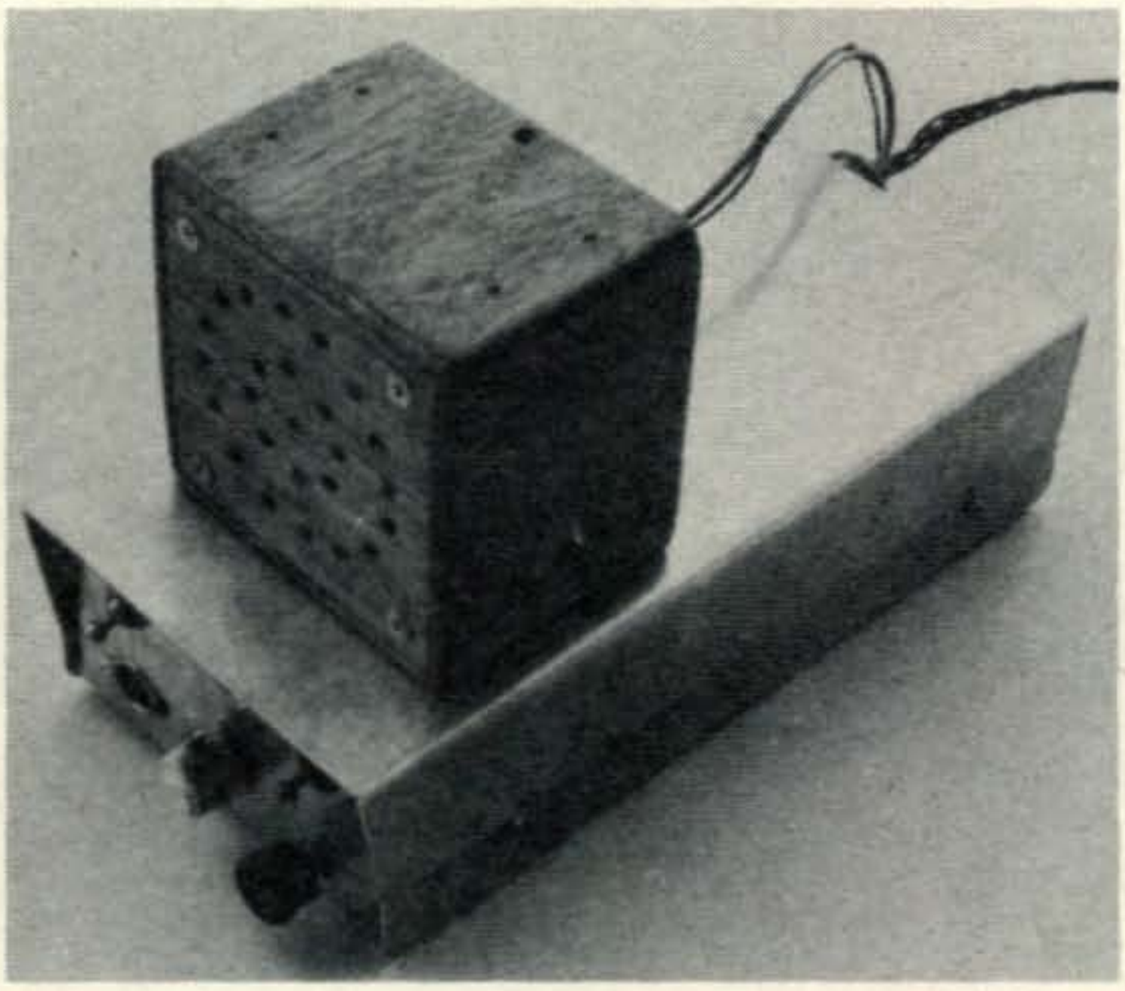
Improved R.F. Transistors

Within recent times transistors have come on the market which appear to have been designed to overcome many of the above mentioned shortcomings. For about thirty dollars (in single lots) r.f. transistors can be bought rated at 70 watts dissipation. Some have guaranteed outputs of 50 watts at 50 mc. In some emitters are already grounded to the cases to assist with the heat sink problem.

Emitter design has been improved to decrease the emitter lead inductance for v.h.f. use and to minimize the temperature differential between the junction and the heat sink. With such a transistor, good isolation between the input and output circuits can be achieved by running the transistor base lead through the chassis near the transistor and installing the input circuit behind or below the chassis.

The 2N5070 and the 2N3950 are samples of such units; no doubt others are available. These transistors have enough power gain so that, if you require only reasonable amount of output, just one driver stage is needed following a transistorized exciter. Of the various driver transistors we were able to try, the Fairchild SE8010 (at $1.60) was the most satisfactory.

One peculiar feature of r.f. power transistors is that the impedance presented to the output network varies with the amount of output the stage is delivering. This makes it necessary to decide what power level your



Completed s.s.b. transceiver using transistors only is housed in a 5" × 3" × 11" case. The speaker is housed in a mahogany case to improve tone as explained in the text.

*Box 2270, Manila, Philippines.

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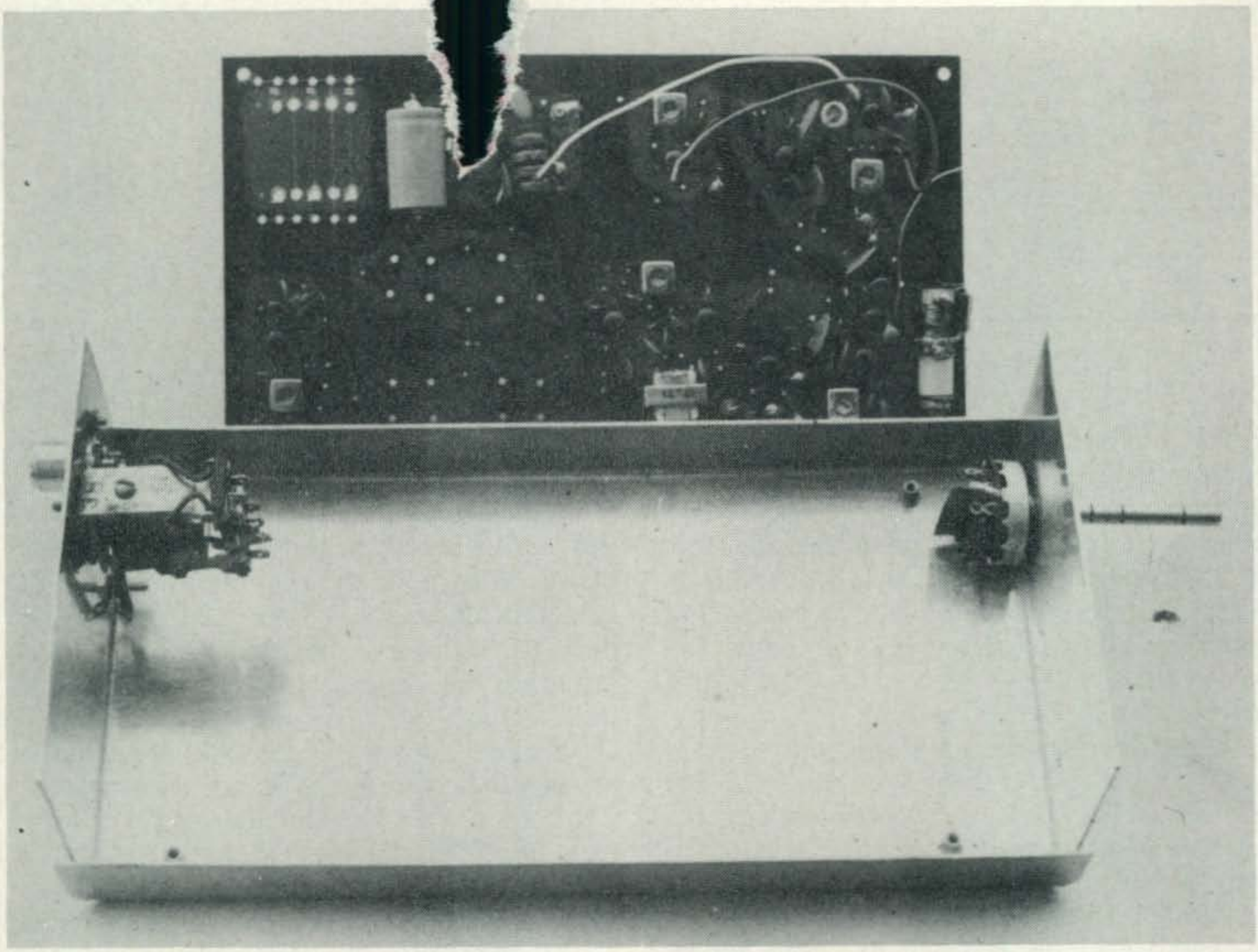

View of the transceiver exciter chassis partly constructed.

combination is going to be operated at and then tune up your output network for those conditions. Until recently it was a matter of cut and try until everything was optimized. Now some manufacturers are printing information that will assist in deciding the approximate impedance that will be required in your output matching network. In some cases graphs are supplied which show the output capacitance the transistor presents to the network at various drive levels and various supply voltages. This raises an interesting possibility. By selecting your supply voltage, your frequency and your p.e.p. output for linear service, you can refer to the graphs and see the specific reactance the transistor presents under these conditions. Your network, in some circuits at least, can be tuned up without the transistor by substituting the indicated reactance and feeding the network with a signal generator and a proper load, of course, being connected to the network.

One profitable idea for experimenters with r.f. transistors is to install a spring return foot switch in series with the collector supply current. Spurious oscillators in the output stage can destroy the transistor if they are permitted to continue for any length of time so it might save you money to be in a position to disconnect the supply voltage instantly.

When first tuning up your output transistor swamp the drive with a 5 ohm 1 watt carbon resistor. The size of this resistor can be progressively increased to 50 ohms when you are certain no difficulties are showing up.

The first time your antenna is connected is also a time for caution as it almost certainly will not present the same load that your dummy did. Apply limited amounts of drive at first. At this stage of the game, it is an advantage to use a tuned field strength meter so that only fundamental frequency outputs will be registered. It's a little dangerous to try tuning up on a harmonic.

Printed Material

There are a number of publications available which will be of assistance to any person interested in this subject. A few are listed at the end of this article. Comprehensive treatment of the subject appears in the RCA Silicon Power Circuits Manual, pages 249-335.

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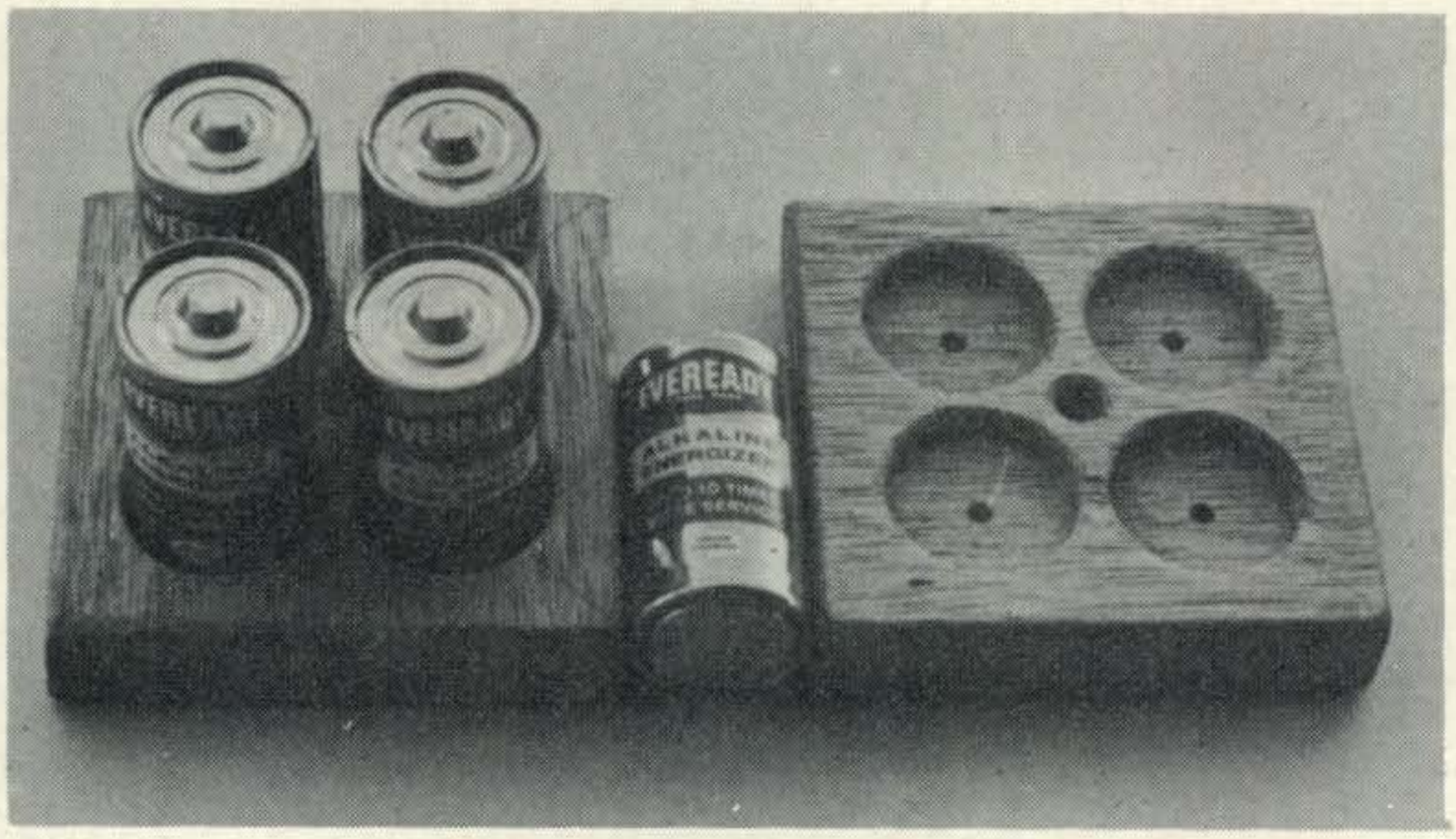

Construction of the battery pack used to power the s.s.b. transceiver. Twenty size D Alkaline Energizers are mounted in this assembly. Series strings of cells are rolled in heavy paper and a 3/8" threaded rod is inserted in the center holes and drawn up with a wing nut. Connection is made to the battery terminals by bolts inserted in the small holes shown.

The specifications sheets on the 2N3950 and the 2N5070 transistors are worth more than their weight in gold so you would be wise to secure them.

Design And Circuit Tips

This transceiver project was initiated with the purpose in mind of producing the most reliable portable s.s.b. signal with the least possible expense. Convenience of operation and battery maintenance were also major considerations. We have built about two dozen s.s.b. units for portable use but with vacuum tube linears. These are working well but require 12 volt storage batteries and power converters. For a number of years we thought that it might be possible to put up a usably strong s.s.b. signal with flashlight batteries and now we know it is practical. In the type of work we are in it is a real headache to be dragging 60 pound batteries back and forth from the base to power the transceivers. The storage batteries also present a fire and acid damage risk in the light planes we must use for transportation. Modern transistors work most effectively with supply voltages of 28 or 30 volts and while this is impractical with storage batteries, it is no problem at all when flashlight batteries are being used. At 28 volts both maximum driving requirements can be utilized.

A number of very low powered solid state transceivers have been described in amateur publications so we feel it is unnecessary to repeat this information here. However, the planning behind this linear might be of interest to some even though we are not including complete circuit data. Any constructor would be wise to refer to all available literature on the subject before initiating a project of this nature. The Motorola 2N3297 specifications sheet gives a circuit for a driver stage which we have used successfully. The base of our output stage is driven from a two turn link around the driver transformer toroidal output core. We use a pi-network for output matching with a variable loading capacitor. The transistor is matched to the output network by tapping it down on the output tank (pi-network tank).

Anyone working on transistor linears should keep in mind that they are potential harmonic generators. Some tips to help in overcoming this difficulty can be found in an article in *QST*.[1]

Forward bias for the driver and output stages can be secured by employing a separate power supply of two flashlight batteries A 2.4 volt zener diode can be used to regulate the output. About 50 ma of current should be drawn through the dividing networks. If resistances of too high a value are used in these dividing networks, the drive will affect the bias to an excessive degree. To assist in stage isolation, separate zeners and separate dividing networks are used for each stage. Even with low resistance values, full drive will tend to reduce the bias on the final stage by a couple tenths of a volt. A 1/3 ohm emitter resistor might assist in stabilizing this situation but we haven't tried it.

We planned in advance to limit our final stage input to 30 watts p.e.p. By so doing we were able to use just one string of 20 D cells. Our battery cases are designed so that we can insert a double string but up until this time the sets we have in service are using just one. Someone will likely say, "Why use a transistor with 70 watt dissipation for only 30 watt

[1]Taylor, R. S., "A Direct-Conversion S.S.B. Receiver," *QST*, September 1969, p. 11.

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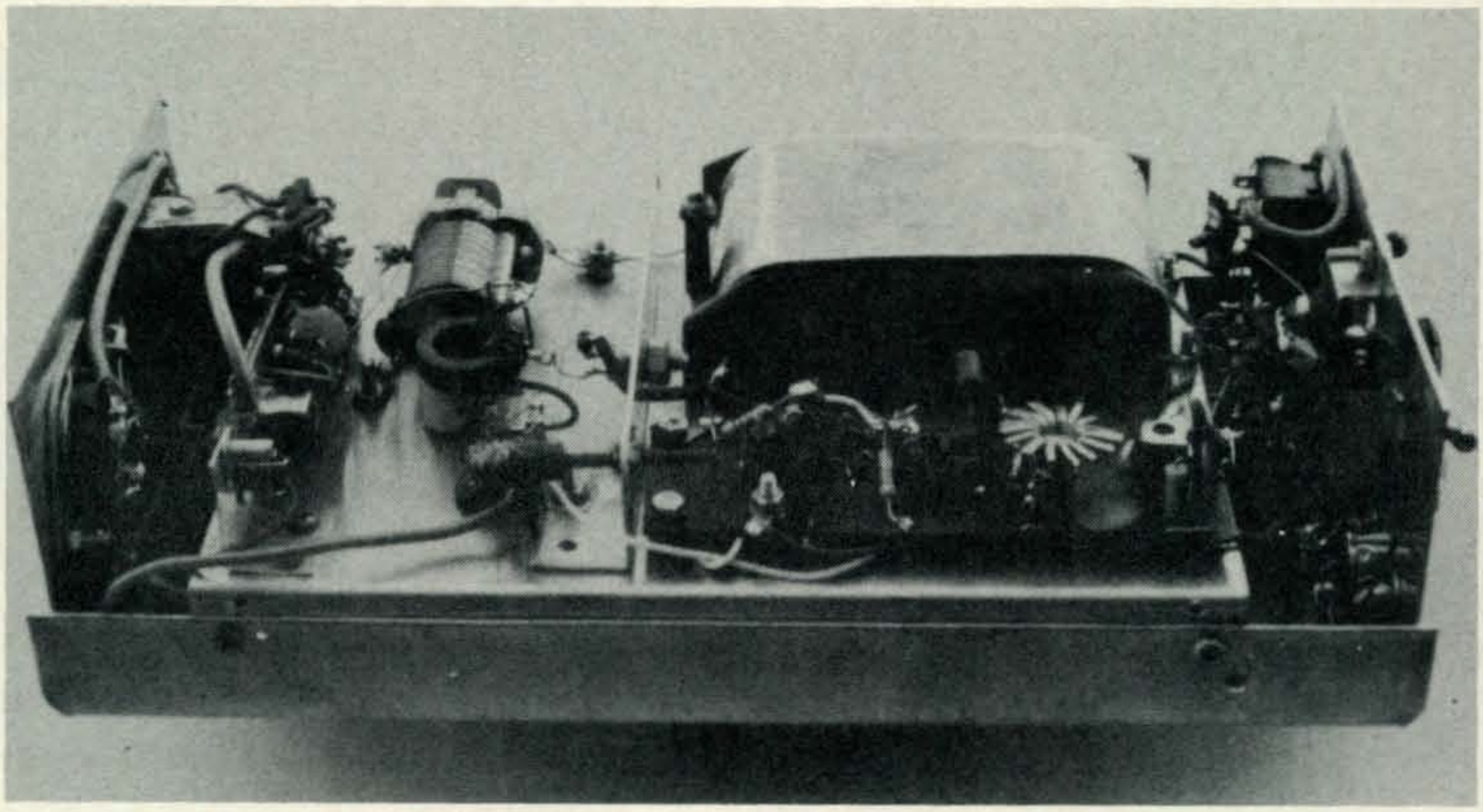

View of the transistorized s.s.b. transceiver with the cover removed. A 2N3950 is mounted on the metal dividing panel. An SE8010 is located at the right with a fan shaped heat sink. The metal bracket at the rear houses 3 size D cells used for the bias supply.

p.e.p. input?". Our answer is that we required the maximum reliability possible even under such adverse circumstances as a disconnected antenna along with above average drive which might be applied if an inexperienced operator were using the set. It's not very good economy to have to fly a plane a hundred miles or so to find out what happened to a fellow who blew a power transistor.

Antenna Change Over Relay

It is difficult to get along without an antenna change over relay even though every possibility should be considered for minimizing current drain in a unit to be run from batteries. We have been able to reduce relay coil drain to 50 ma by running a 24 volt relay on 12 volts. The contacts need to be readjusted for closer spacing and the armature return must be replaced with a softer but much longer spring. The off end of this replacement spring may be mounted on the chassis by using an ordinary solder lug. A fine hole may be drilled in the relay armature near the contacts to accept the other end of the spring. Modified in this manner the relay works satisfactorily down to 10 volts even though it draws only 50 ma.

Ferrite R.F. Transformer Cores

The use of ferrite cores in the r.f. transformers might be considered in any transistor final stage for the following reasons: (1) Reduction of size. (2) Reduction of wire losses since the necessary inductance can be secured with only a small percentage of the wire that would be needed for air wound coils. (3) Virtual elimination of external r.f. fields surrounding the coil. This factor is of major importance since, in the confined spaces that transistor amplifiers are usually constructed, it is important to minimize any tendency towards interaction between stages. (4) Increased coupling between various elements of the transformer. (5) Simplified mounting techniques. A torroidal transformer can be mounted right on the chassis by inserting a bolt through the center.

We purchase our torroids from Indiana General Corporation, Keasby, New Jersey. They have a large variety of sizes and several types of ferramic materials for different applications.

Ferrite Beads

The ferrite beads which have recently come on the market are a fine addition to any experimenter's kit of parts. When we first saw the diminutive size of these beads we had a difficult time believing that they could be very effective. In one instance, however, we affixed three of them in series on the base of a power transistor and were quite surprised that the drive to this base was reduced by

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some 50% by the action of the beads. This was at 7 mc. We therefore conclude that just one bead is effective in reduction of any tendency towards parasitics.

Ferrite beads are available from Amitron Associates, 12033 Otsego St., North Hollywood, California.

External Speaker

The smaller the size of a transceiver a person attempts to build, the more likely he will end up having to use a very small speaker if it be mounted inside. Even a larger speaker mounted in an external metal box is likely to sound tinny. We therefore used a mahogany plywood case for the speaker in which we also mounted our receiver audio strip.

Linearity Testing

Anyone interested in doing an effective job of checking the linearity of this type of output stage (or any other linear for that matter) would be well advised to buy, borrow, steal or build an r.f. spectrum analyzer of 50 cycle resolution or better. With this instrument distortion is very easily observed and the results of any corrective measures can be easily assessed.[2]

On The Air

We have been using two of these units for several months over 150 mile circuits on 7 mc and with just ordinary dipole antennas. Even through interference, it is very rare that we cannot copy them successfully. Doubtless, the erection of directional antennas on each end of such a circuit, would extend the consistent range of these units to 500 miles.

Even with buying an expensive output transistor, a net channel transceiver can be built of a design similar to ours for less than one hundred dollars. Anyone seriously interested in QRP work might be interested in having one or more of these units. ■

Available Data

Below is a partial list of material available on r.f. power transistors and associated subjects.

Technical bulletins, Engineering reports and Applications notes.

1–Motorola Semiconductor Products, Inc., "Application Note Index."

2–AN-150 (Motorola) Getting Transistors into Single Sideband Amplifiers.

3–AN-137-R1.

4–AN-192 (Motorola) Interpreting Designer's Data Sheets for Silicon Transistors.

5–AN-172 (Motorola) A Solid State Transmitter with 50 Watts Output at 50 Mc.

6–AN-166 Using Linvill Techniques for R.F. Amplifiers (Motorola).

7–(Motorola) Report No. 99–A 50 Mc Transmitter Using the 2N2947.

8–(Motorola) Applications Engineering Report No. 100–2 Watt Output at 160 Mc using the 2N2832.

9–AN-156 (Motorola) A Marine Band Transmitter Using the New Motorola 2N2950.

11–AN-115 (Motorola) Pi-Network Matching with the 2N1561 Transistor.

12–AN-100 (Motorola) Achieving Stable High-Frequency Design with the Mesa Transistor.

13–AN-114 (Motorola) Modulation of Driver Stage to Increase Power Output of A.M. Transmitter.

14–(RCA) SMA-36 Design of Large-Signal VHF Transistor Power Amplifier.

15–(RCA) SMA-14 Design Considerations for the RCA 2N2102 in Low-to-High Level, and DC-to-RF Applications.

16–(RCA) SMA-10 Design of an Amplitude Modulated VHF Transmitter Using the RCA TA2267.

Partial List of Transistor Specification Sheets of Interest.

1–(RCA) File #268 Silicon NPN "overlay" Transistor 2N5070.

2–(Motorola) DS5190–The RF Line–2N3950.

3–(RCA) File #32 Silicon NPN Planar Transistors 2N2631, 2N2876.

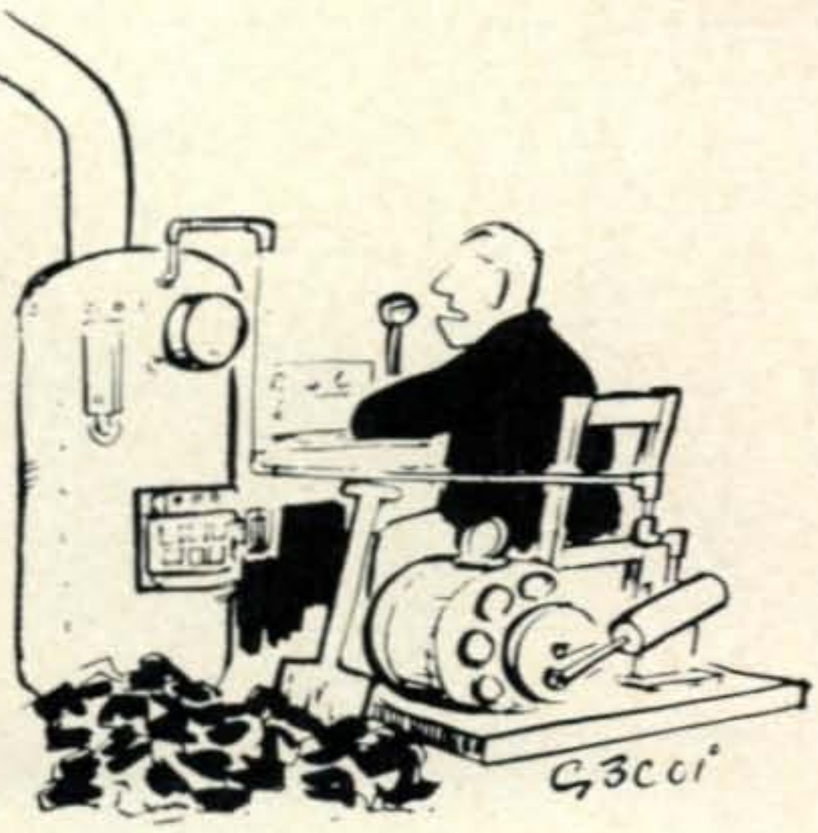
4–(RCA) File #92 Silicon NPN "overlay" Transistors 2N3632, 2N3553, 2N3375.

5–(Motorola) DS5072 2N3296.

6–(Motorola) DS5071 2N3295.

7–(Motorola) DS5073 2N3297.

8–(Motorola) DS5040-R1 2N2947, 2N2948.



"Heard you there so I fired up the rig and gave you a call..."

[2]The author built an acceptable spectrum analyzer from a series of articles in *CQ*. Rand, S.; Whitmore, C., "Basic Spectrum Analysis," *CQ*, Part I, August 1961, p. 34; Part II, September 1961, p. 32; Part II, October 1961, p. 24.

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A GOOD RTTY CONTROL LAYOUT

BY L. A. STAPPS,* WØPHY

THIS station consists of a pretty good set-up for 5 band operation on s.s.b., a.m., c.w. and RTTY. Considerable time and effort has gone into a good control system for RTTY. It has been worked over and over. Until now something was always missing in the final result.

A list of requirements were drawn up, the system built and the results have been gratifying. The requirements were:

1—Convenience: All controls (reduced to lowest possible number) right at the RTTY operating position.

2—Single control, receive to transmit and local copy at all times.

3—A "Take-over" key for correcting conditions of upper case, end of line, overlining, *etc.*

4—Be able to practice, cut tape, *etc.*, without turning on the transmitter or receiver.

5—A *mark* hold, if that feature was not incorporated in the TU.

The diagram of fig. 1 shows what was worked out on paper and after being built, has worked out very well. Taking the items one at a time.

1—Once the transmitter and receiver are set on frequency, all operations are carried on from the RTTY position. The three switchboard type keys are mounted in a small box located just under the table top at the left hand side of the RTTY.

2—A single 4 pole, double throw key makes the change from receive to transmit.

3—If the machine starts writing in upper case or piling up at the end of the line or overlining, momentarilly operate the "Take-over" key, punch the proper correcting keys on the keyboard, release the take-over key and get good copy.

4—To practice, punch tape or let visitors get the feel of RTTY, just turn on the TU (the 2 tone oscillator comes on), turn on the machine, operate the take-over key and you are in business.

You will notice that in the TRANSMIT position, the 2 tone oscillator output is fed into the mike jack of the transmitter. This operates the VOX, putting the transmitter on the air. Returning the key to normal restores things to receive. Single key control is achieved, copy is obtained on the machine in both transmit and receive conditions.

Perhaps this arrangement will simplify your RTTY operations. ■

*2903 Ash, Hays, Kansas 67601.

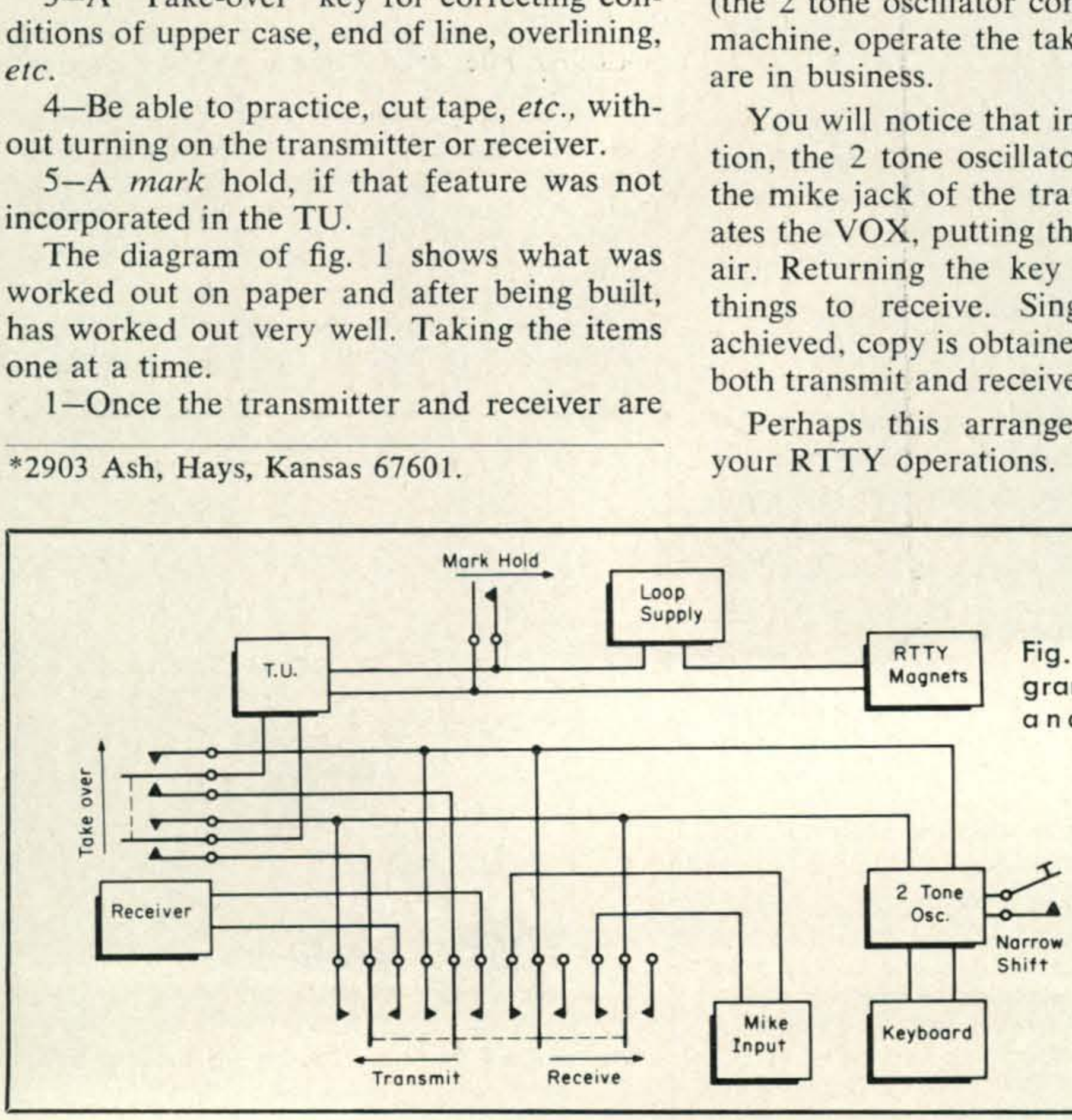

Fig. 1—Switching diagram for a complete and simple RTTY layout.

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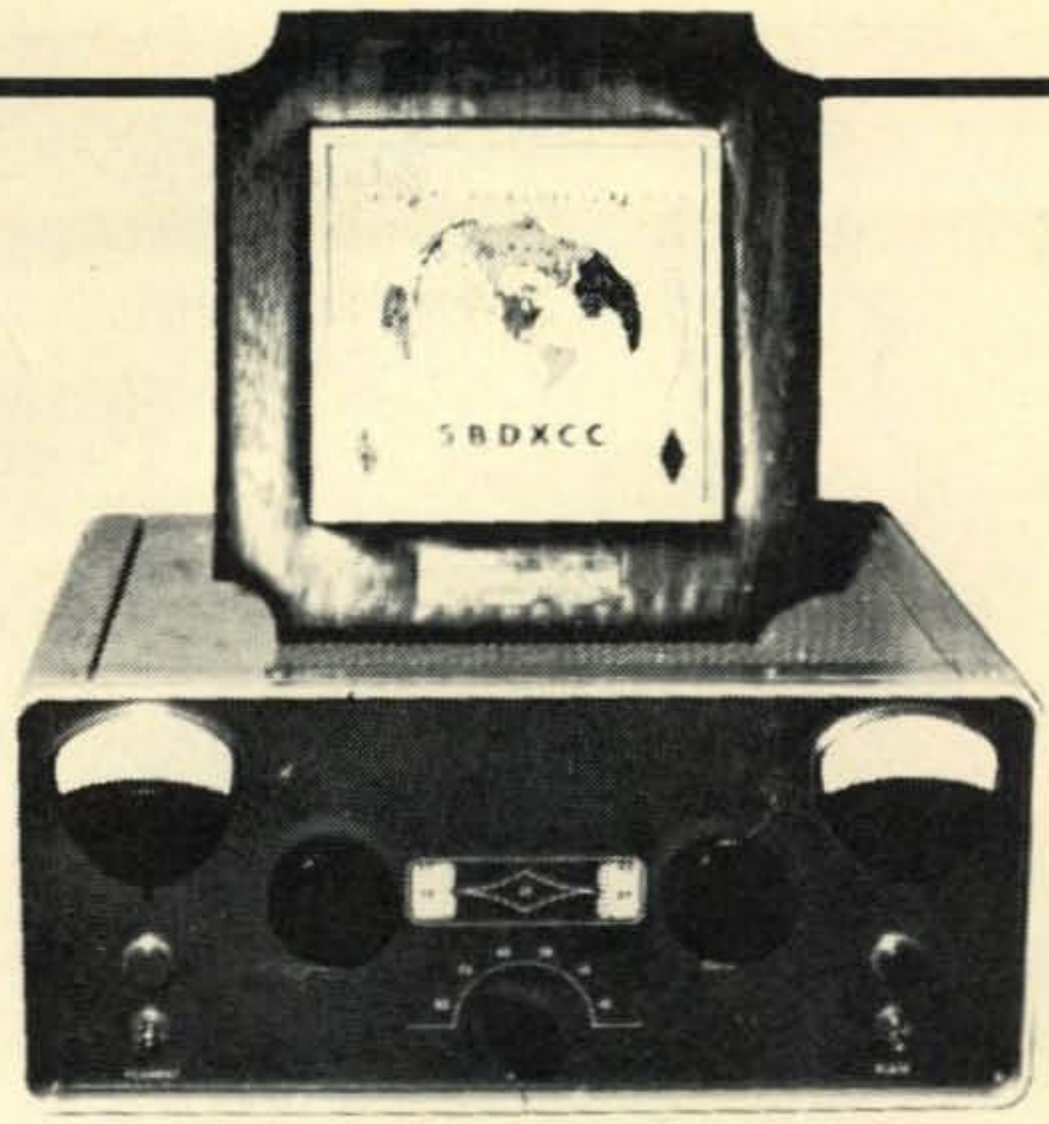

Bob Eshleman, W4QCW, earns top Five Band DXCC Award and his "trusty" 2-K amplifier was with him all the way!

Most amateurs dream of being number ONE. Few have the opportunity. W4QCW was ready. Bob had the skill, the patience and he had the fine equipment he needed. At Henry Radio we are proud the 2-K helped W4QCW win this unique honor.

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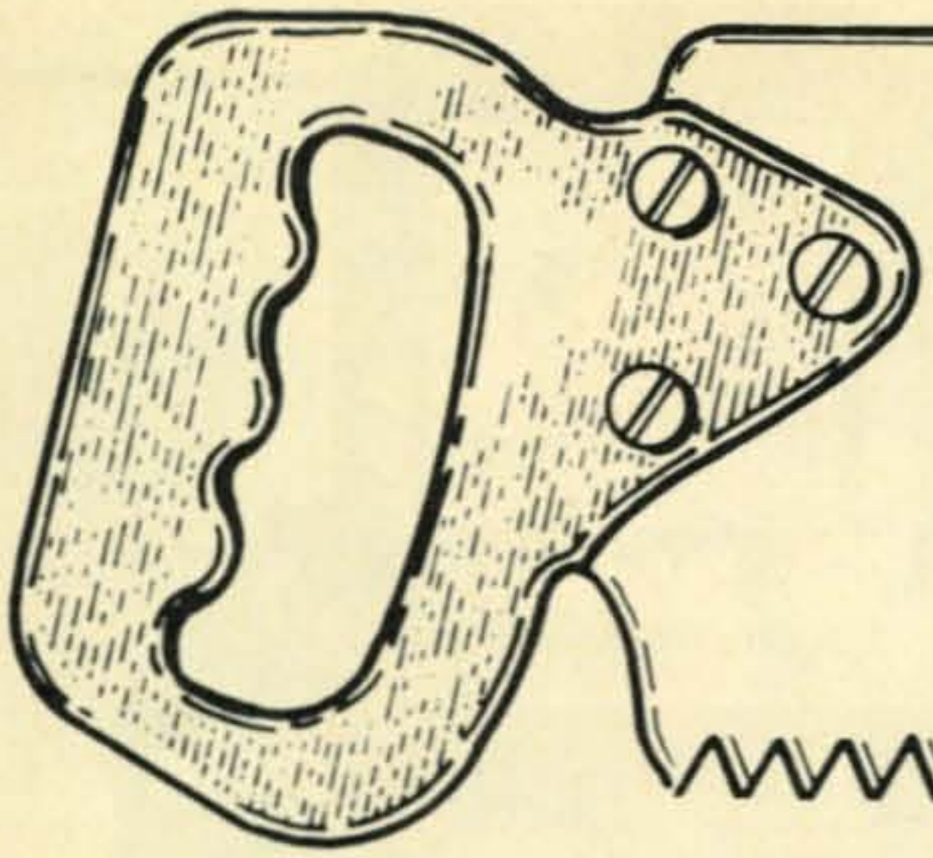

A CHEAP AND CLEAN SCOPE CART

BY JIM ASHE*

IF you are using a large oscilloscope in your work, or even a small one, you may gain up to three additional feet of effective bench space by putting your scope on a cart. The scope cart described here is easily assembled from materials precut by your lumber company, and is better suited to many applications than the expensive commercial variety. You can get the wood cut on a Saturday morning and have a finished cart by your bench the same evening.

Most designers of scope carts seem to think the sides of the cart will usually be inaccessible. If we drop that idea, we can replace the two blank sides by a single sheet of material in the center, add about four shelves, and get a cart assembly with practically zero waste space. Not only will the cart hold your scope, but it will provide a convenient place to store several plug-in units or other test gear.

General Design, And Purchasing

The cart described here is made of half-inch plywood, assembled with small nails and good quality casein glue. It can be finished with shellac or paint, but a good polyurethane varnish is recommended. Since the cart is mounted on casters it can be wheeled easily around the lab or shop. Rubber casters are suggested to avoid a too free-wheeling investment.

Before you go to the lumber company to get the wood cut, match up the wood parts in Table I with the drawings in figs. 1 & 2. This elementary print-reading exercise will help you get through the assembly job with minimum confusion.

At the wood-cutting shop, explain that the parts you are ordering are for furniture-type construction. The cutting must be accurate, and the corners square. A quick check for squareness appears in fig. 3.

Assembling The Scope Cart

The first step in assembly is a good sanding of plywood pieces. Sand all pieces of wood lightly, with a special attention to rough edges to get the splinters off.

Next, pick out the bottom piece and the four casters. Decide which side of the bottom will face the floor. Using one of the caster assemblies as a template, trace its outline a half inch in from the edge at each corner, remembering to mark the mounting screw holes.

Then draw a line down the center to indicate where you will drive the five nails attaching the bottom to the central vertical sheet. Finally, drill sixteen tiny holes as guides for the short woodscrews that will mount the caster assemblies. Do not install the casters.

The most challenging part of the assembly process is assembling the bottom and center sheets into a T-shaped structure. Once you have the back in place the developing scope cart becomes quite rigid but at this stage it seems to take five hands and a foreman. See fig. 4.

Here, the center piece is resting on the floor, a thin line or glue has applied to its edge, and the bottom piece has been laid upon it. The pencil marks serve to indicate the side of the bottom that will face down upon completion is now facing up. Using the previously drawn line as a marker, the two pieces are oriented so nails driven down through the line will pass into the center of the vertical piece.

Tip the T-shaped assembly over so its back

*P.O. Box 253, Cambridge, Mass. 02138.

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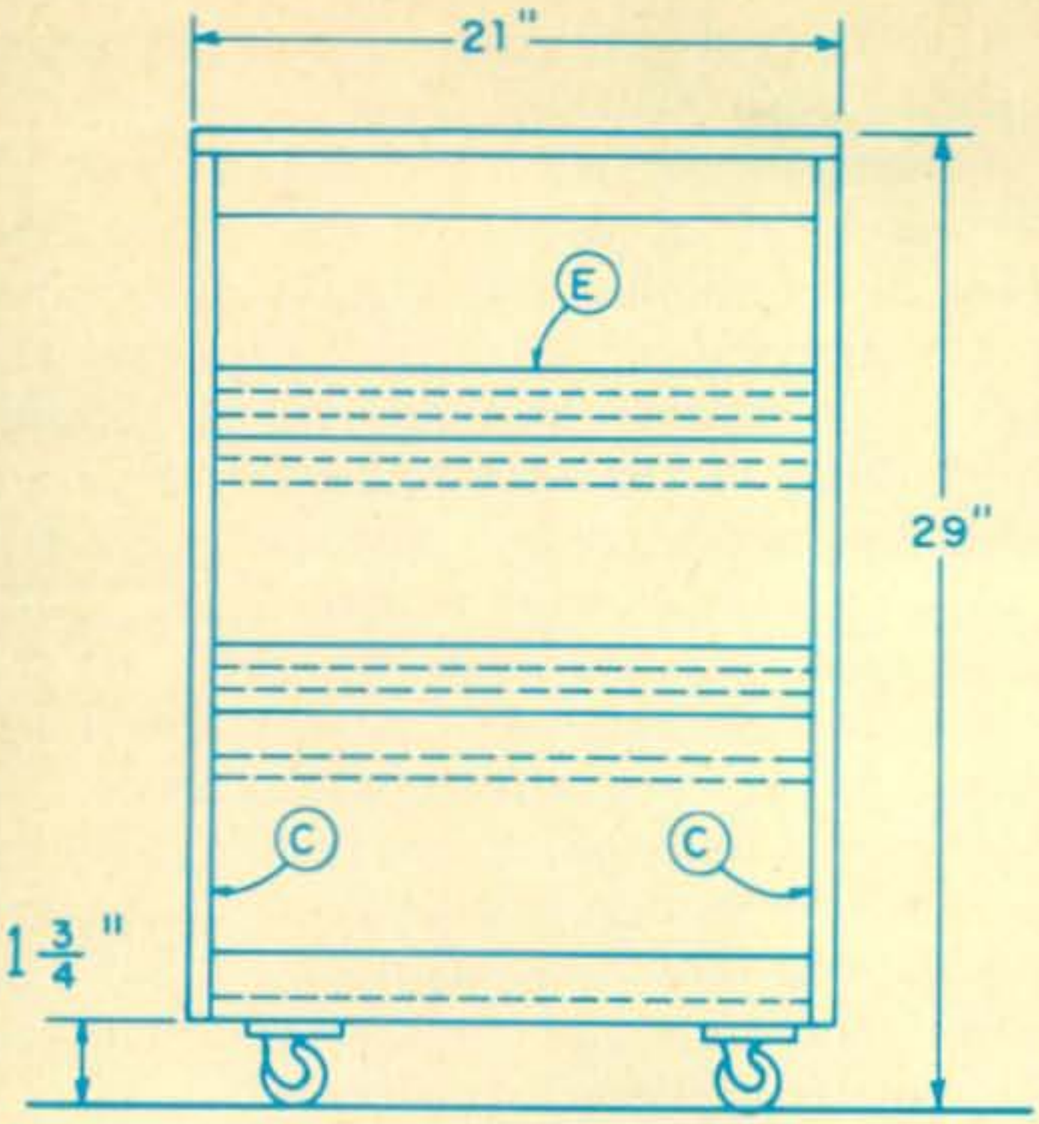

Fig. 1. Left Hand Side

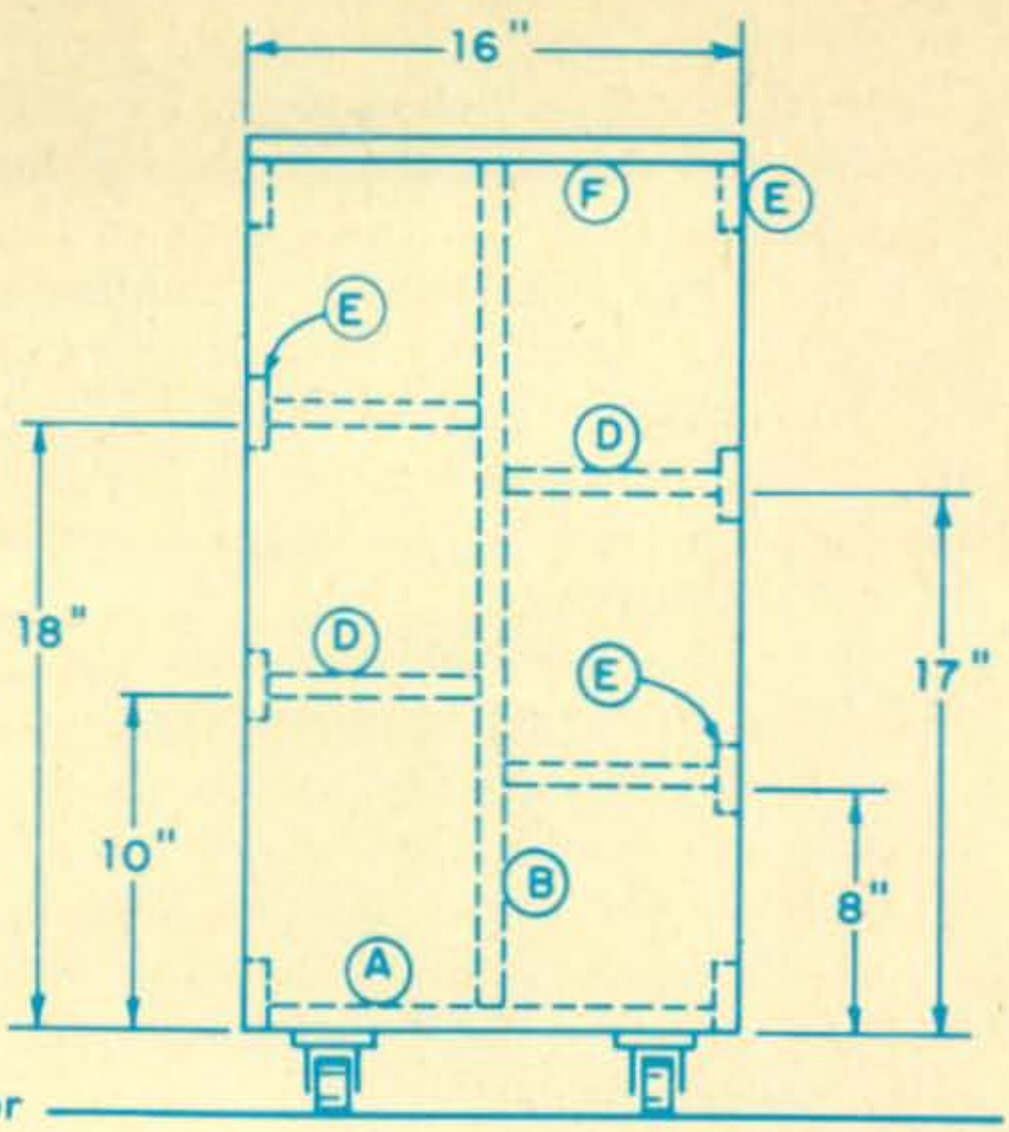

Fig. 2. Front View

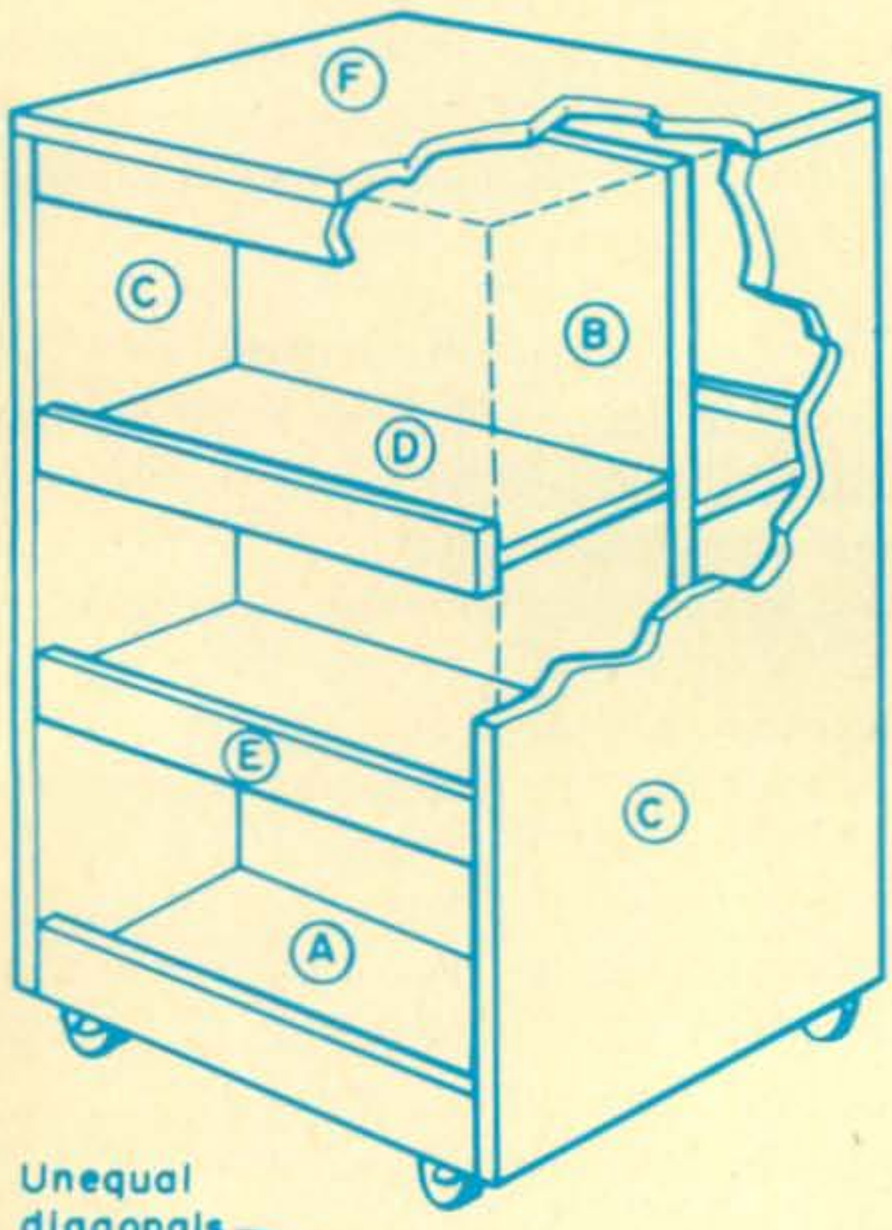

Table I List of Wood Parts

All plywood grade AD, good on one side, $\frac{1}{2}$" Thick

(A) —	1 pc.	15" x 20"	bottom
(B) —	1 pc.	20" x 26$\frac{1}{4}$"	center divider
(C) —	2 pcs.	16" x 26$\frac{3}{4}$"	front and back
(D) —	4 pcs.	7$\frac{1}{4}$" x 20"	shelves
(E) —	8 pcs.	1$\frac{1}{2}$" x 20"	reinforcing bars
(F) —	1 pc.	16" x 21"	top

Figures 1 through 5 are explained in the text. The unequal diagonals shown in Fig. 3, depict a board with unsquared corners. The entire project can be put together with simple tools and patience.

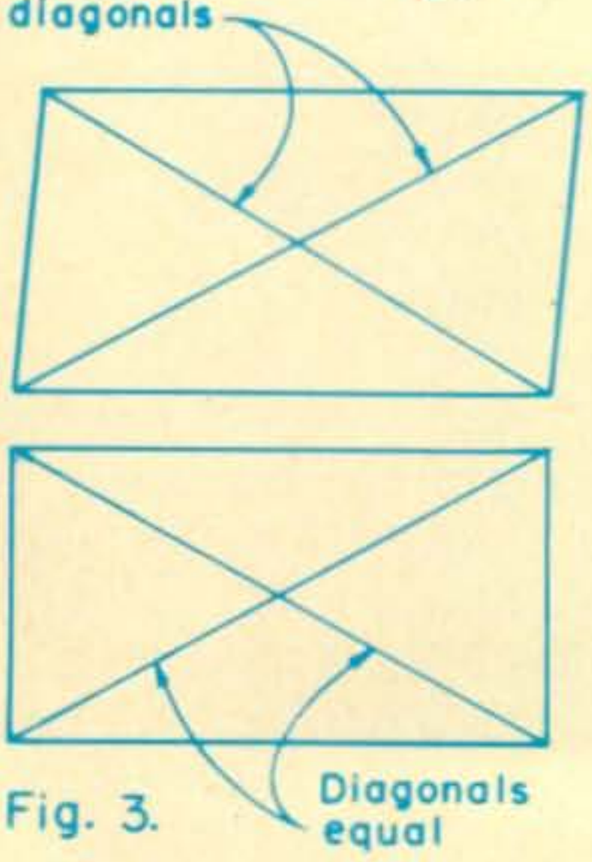

Fig. 3.

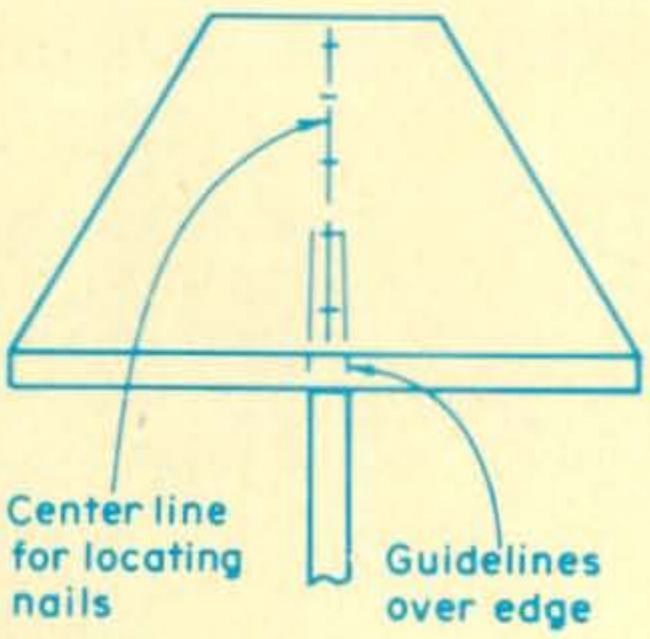

Fig. 4.

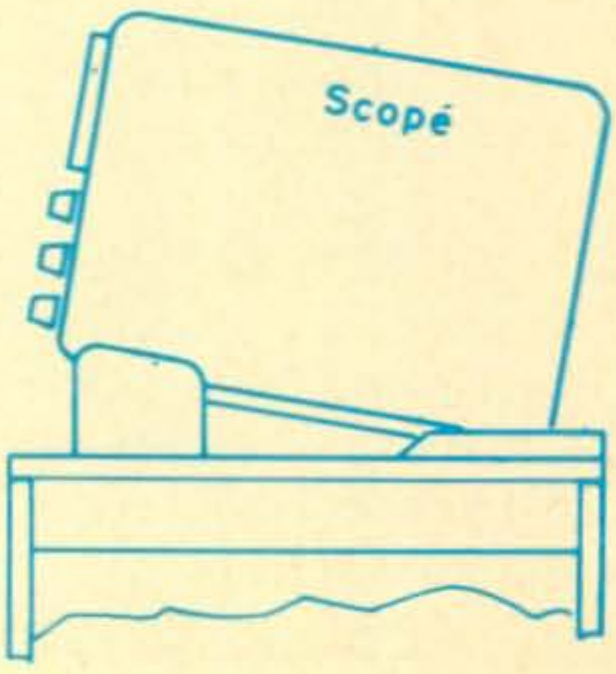

Fig. 5.

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faces up and it rests firmly on the floor. Apply glue to the two appropriate edges, gently place the back piece (plywood good side out) upon it, and nail it down. Three nails go in about two inches from the three ends of the T, and four or five additional nails complete this part of the assembly. The developing scope cart is now quite easy to handle.

Now decide just where the shelves will go, and mark in a few pencil guide marks for the shelves, and on the opposite sides, some guide lines for the nails. One shelf at a time, apply glue to mating edges, set in place, nail ends, then centers. At this point you see the shelves are staggered so inside edges of all shelves can be nailed to the center divider. Two or three pieces of wood laid on the floor will support the shelves during nailing, since they are not as wide as the cart.

Next we add six of the eight reinforcing bars, two to the bottom piece and one each per shelf. These bars double over as safety pieces that prevent anything from sliding or rolling off a shelf when the cart is moved. After these, the front panel goes on in about the same way as the rear panel, but here the four shelves require nailing too.

After this the two stiffeners on the *LH* and *RH* sides of the top are assembled to the top. They can be rested on the floor, glue added, and the top laid on them for nailing. Three or five nails will be adequate. Then this is fitted and nailed into the cart and the assembly of wood parts is complete. Top and bottom are clearly distinguished by the caster tracings and mounting holes already drilled in the bottom.

Now the cart is inverted and the four casters installed, using the short woodscrews in place of the three-quarter inch screws that came with the casters. Alternatively, four quarter-inch pieces of plywood can be glued in place to build up the bottom thickness. In this case the cart height may require adjustment which is best performed about the time the wood materials are cut.

Finishing The Scope Cart

At this stage any objectionable pencil lines or smudges can be sanded off with fine paper and the sanding block. If there is some wet glue visible wipe it off, and wait a half hour before the next step.

After dusting once more, read the instructions on your shellac, polyurethane varnish, or whatever. Good gray floor paint can do an excellent job here, but shellac dries quickest and polyurethane varnish provides a durable coat. The polyurethane varnish is recommended.

Invert the cart, casters up, and apply the varnish to all upward-facing surfaces. Soak some of it into all corners, and work an inch or two upward on all vertical surfaces. This will be the cart bottom, four shelf bottoms, the bottom of the scope shelf, and several miscellaneous edges and surfaces

Then set the cart on its casters and, working downward, varnish its top, all inside surfaces, and the tops of the shelves. There should be no wood surface left uncovered.

The polyurethane varnish really does dry hard in four hours. It smells awful, too, and this is real encouragement to follow the manufacturer's recommendations about ventilation. He suggests lots of ventilation.

Once the surfaces are dry, sand the outside and shelves with block and fine paper, but do not use a lot of pressure. The purpose here is to remove a slight residual roughness, but not the finish. Then apply a second coat, let that dry four hours, and you are ready to mount the scope.

Scope Mounting

The cart described here has no provision for adjustable tilting of the scope. Experience with a similar cart that has been in use for several years suggests none is required, since the scope is set at a convenient angle and it stays there. A simple blocking-up system will be adequate, but there ought to be some attention applied to assuring the scope cannot possibly slide off the cart.

A bar across the back of the cart solves this problem as shown in fig. 5. This can be wood or angle aluminum. The wood looks better, and each piece is held by two woodscrews or bolts.

Using The Cart

A collection of plug-in units or other gear will soon accumulate on the shelves. If any of this gear is liable to undesirable dust collection a few pieces of cloth will minimize this. Dime stores sell skirt-weighting strips, and your wife or best girl can sew some of this material around a piece of soft denim about twice the length and width of the unit that is to be covered. This is nicer than plastic bags.

The finished cart is a simple, solid structure with no moving parts. It is about as inexpensive as a scope cart can be, yet it will serve for many years in your lab. ■

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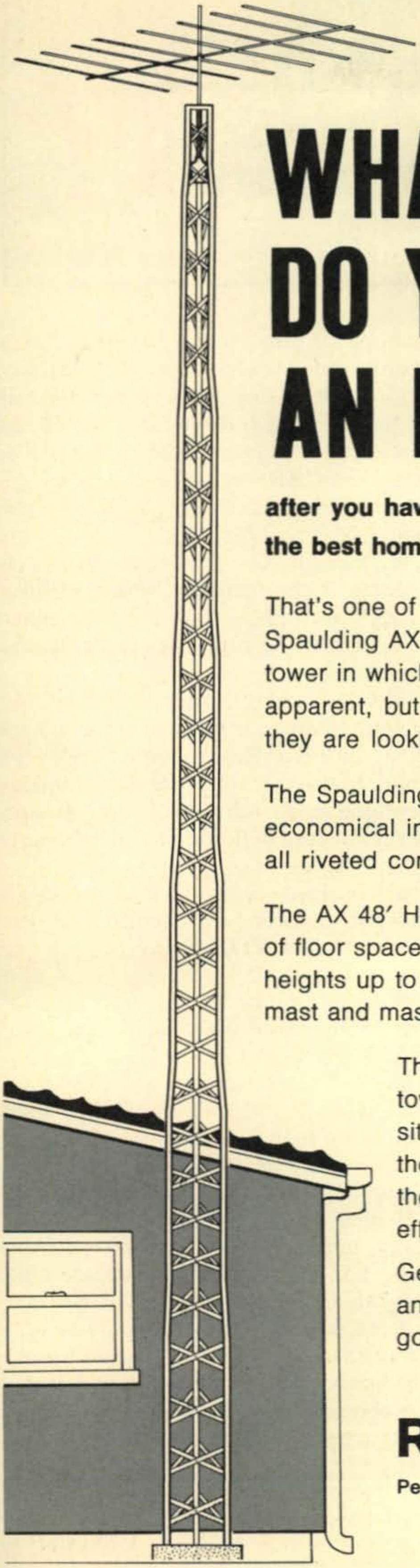

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See page 102 for New Reader Service

Instant Service Nets
WCARS—MWARS—ECARS

BY ED GRIBI,* WB6IZF

BIGGEST news in this hacienda is THE MOVE. This professional geologist and radio amateur plus XYL, Betty, and Dan, Sharon, Jim, and Mark will be traveling to the Far East for a two-year stint not long after this column appears. Don't know just where "home" will be but my job will be conducting oil exploration on the island of Ceram in eastern Indonesia for Gulf & Western Industries. I'll certainly be operating the best station I can manage from 8F6(IZF?) and I'll be looking for all of you. I'm going to try to keep the column going with the aid of what I hope is fairly rapid Air Mail service plus on-the-air contacts. By the way, Marv, W9WWE, calls it "TRANSCARS" during those great times when 40 is in long skip but I'll be looking for "WORLDCARS" myself wherever and whenever it might be.

Out Of Sight Line Of Sight

This column was initiated because of the achievements of the several public service amateur groups on 40 meters. However, the real purpose of this column is to recognize any amateur efforts in the public service field and to promote further efforts regardless of the band or mode. One of the biggest potential contributors to amateur public service is the growing group of v.h.f. repeaters scattered throughout the U.S. and Canada (and I note now in Australia!). A lot of response to this column has mentioned this phenomenon, so we'll devote some of this and subsequent columns to v.h.f. (and u.h.f.?) public service applications.

A letter from Jerry Swank, W8HXR, hopes wet will "see the blossoming of thousands of 2 meter f.m. stations and emergency nets. This is the only thing that would ever make thousands of hams get this equipment in areas where there are no repeaters and where you need a helping hand the most. It could be done on 6 or 10 but 2 seems the most likely bet. An emergency setup will never be of any value until 2 meter f.m. units sprout like CB sets, so the hams can have their far flung emergency base . . . How about MCARS, WCARS, and ECARS having 2 meter f.m. receivers sitting alongside their rig made from kits or such?"

K6GWE, north San Francisco Bay area a.m. repeater, is conducting a "Project Highway Safety" to utilize the many 2 meter mobiles for reporting highway accidents and hazards.

WB6OPG, 2 meter f.m. repeater of the Tulare County Amateur Radio Club, blankets the entire southern San Joaquin Valley in California. It was recently the communications keystone in search and rescue mission exercises conducted with the Sheriff's Department.

My pair of Twoers have worked through the WB6OQS 2 meter a.m. repeater of the Santa Clara Valley VHF Relay Society for years (we now have 450 f.m. in and out also but I'm still old fashioned). I've used it several times in conjunction with 7255 for local relays and alerting and I'm sold on the concept. I had a Twoer listening on Christmas day, 1969, when WB6UOO mobile activated OQS requesting help in reporting a 3 car accident with injuries near San Jose. WA6VXF picked it up and reported it immediately.

Bud Henley, WAØPZV, the chief peddler for Galaxy, tells me that on a recent trip to Florida he had a ball working repeaters all the way with the Galaxy FM-210. He says this 2 meter f.m. transceiver is going like hotcakes. It looks like it should be a winner looking at the specs. In fact, all the new 2 meter f.m. transceivers, domestic and imported, on the market appear to be compact, lightweight, and reasonably priced.

A very interesting map of the U.S. showing all known coverage by v.h.f. repeaters has been compiled by Ken Sessions, K6MVH. It

*229 Vivian St., King City, Calif. 93930.

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appears on pp. 138 and 139 of *Communications Handbook*, 1970 published by *Popular Electronics*.

Fred, K6AEH, a WCARS Director, has gotten the f.m. bug. His flights of fancy envision operating 2 meter mobile going in on 2 and out on a 7255 base station. The mind boggles at the thought but stranger things have already been accomplished during my short period of watching amateur radio technology.

On And In The Air

I recently managed to get my Private Pilot's license without bending any airplanes. My first instructor started me out by saying "this is a microphone—this is what buffaloes most beginning students." His look of disbelief was the best part of that day's instruction after I had picked up the mike and called the tower with the same ease as calling WCARS. On the other side of the coin, I've learned a lot about brevity of communications listening to those marvelous FAA people who have just *got* to be some of the best radio operators in the world. Incidentally, have you noticed the large number of FAA people who participate in WCARS-MWARS-ECARS?

ECARS News (from ECARS Monitor)

Lots of discussion in Monitor No. 5 regarding East Coast Amateur Service proposed organization and operation but very little regarding services performed. The only way people can learn the value of your service is by passing the details of these incidents along to the Monitor.

The "short talkers" of ECARS get together on 3903 or 3904 each night after six. It is definitely informal and shouldn't be considered a part of ECARS but perhaps it is a start.

W4CEM, W2QKA, WB2YGW, WB2KLJ, and WA3KSH were involved in the reporting of a couple of highway accidents and handling some priority messages in late 1969 on 7255, ECARS monitored frequency.

For information on joining ECARS send an SASE to the Secretary, Jim Lightfoot, WA1KRN, Station WBZ, Boston, Massachusetts 02134.

MWARS News (from Radio Watch)

Midwest Amateur Radio Service is trying to start a c.w. section on 7100 as a monitored alternate to 7258. Any takers?

W∅WYJ, ace monitor control, uses a map of MIDCARS country with a plastic overlay. He notes weather, driving conditions, and the like with a grease pencil and thus has a continuing picture of potentially hazardous conditions.

For information on joining MWARS send an SASE to Marv Cook, W9WWE, Box 82, Seaton, Illinois 61476.

WCARS News (from The Sentinel)

K6VDL, Walt, who has been the hero of several incidents utilizing 7255 from his remote Pine Mountain, California, location was in an automobile accident in late 1969. A passing motorist saw the car, stopped Walt's bleeding, and, with Walt's instructions, called for help on 7255, WCARS monitored frequency, on Walt's rig. WCARS control, WB6-OAO, and others were able to dispatch an ambulance and its arrival was reported by the motorist. Walt is now back on the air and doing nicely.

W6SBR/∅ was stuck in a snowstorm in Colorado. K6KZI, K6OAM,, K7LXR, VE7-FW, WA6CWF, W∅WYJ, W5IJQ, and W5-UD/∅ were involved directly in effecting the rescue 18 hours later.

A request for AB negative blood put on 7255 at 2:35 P.M. resulted in 2 donors having reported to the hospital by 4:30 P.M.

WA6TPN came on an accident in the Mojave Desert area with serious injuries. Utilizing 7255 and the help of K6KZI, W6-FCS, W7BDU, and W6IVS ambulances arrived on the scene within 30 minutes.

XE2MMK called in on 7255 from a remote Baja, California locality requesting a phone patch to a veterinary in San Diego regarding a sick dog. WA6CWF and WB6RED helped accomplish this. Animal lovers will recognize the priority nature of this situation.

Other accidents and highway hazards were handled on 7255 by WA6MRS, K6AEH, WB6OAO, K6OWU, K6KZI, K6MVF, WA-6TKE, WB6LLB, W1WEX/6, WA6SNE, and WB6IZF.

Some of the WCARS gang are talking about a CW alternate frequency. 7155 has been suggested since it's accessible to all including Novices. It may be a fact by the time this appears.

For information regarding WCARS send a card to Wayne Nail, WB6CBW, 4924 Omar, Fremont, California 94538.

[*Continued on page 90*]

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SAPS...A Submerged Antenna Propagation System For Enhancing DX

BY PROF. JERZY OSTERMOND-TOR,* (ex-YM4XB)

ON his return from Greece last year, after receiving the Distinguished Order for Scientific Effort (D.O.S.E.), the author (ex-radio amateur YM4XB) was invited to visit the French radio propagation laboratory of Dr. Simon Ducandre, a fellow D.O.S.E. recipient. In this exclusive article Prof. Ostermond-Tor describes the results of a Submerged Antenna-Propagation System (SAPS) developed by Dr. Ducandre, which enhances considerably the propagation of radio waves through water. Such systems may have considerable application to amateur radio.

DEAR readers of *CQ*, I know you are well aware that high frequency radio signals travel great distances because they are reflected by the ionosphere.[1] But what about v.h.f. signals? Well, except for some sporadic-*E* propagation or unusual weather conditions, v.h.f. signals are generally limited to distances not too much greater than line-of-sight. Even with high gain directional antennas at very great heights, using maximum legal power and with unobstructed terrain, it is difficult for radio amateur v.h.f. signals to propagate much beyond 150 or 200 miles on a regular basis.

Well, I am very happy to report that my good friend Dr. Simon Ducandre is one fellow who is doing something about extending the range of v.h.f. signals. Dr. Ducandre received his Distinguished Order for Scientific Effort at the same time I did.[2] After the ceremony, he invited me to visit his laboratory in the south of France to see first-hand the spectacular results he has achieved with v.h.f. propagation through sea water using submerged antenna-propagation systems, or SAPS.

Narbonne Laboratory

Dr. Ducandre is a young man in his mid-forties, and, as a graduate of the famous *Ecole Polytechnique,* stands among an elite group of scientists and engineers in France.

Dr. Ducandre has devoted more than twenty-five years to the study of radio propagation over and within sea water. Achieving fame during the war when he devised an underwater communication system which made it possible to transmit secret messages from the resistance movement in France to Allied Headquarters across the Channel in

Interior view of well equipped laboratory at Narbonne, France where Dr. Ducandre conducts underwater propagation experiments in the amateur v.h.f. bands.

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

[1]See the Propagation Special issue of *CQ*, November, 1969.

[2]Heisseluft, E., "D.O.S.E. Awarded To Prof. Ostermond-Tor (ex-YM4XB)," *CQ*, April, 1969, p. 61.

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England. He is considered to be one of the world's foremost experts in the field of underwater communications. Today, he conducts most of his research from a small, well-equipped laboratory located on the beach at the edge of the Mediterranean Sea near the twon of Narbonne, in southern France.

I arrived at Marseille airport on a bright spring day, where Dr. Ducandre was waiting to drive me to his laboratory 150 miles to the west. Narbonne is a small, quaint village still bearing much of the medieval look. The laboratory is located on the beach a short distance out of town in a small, well-built two story white stucco building, bristling with a maze of antennas on its roof.

Before setting foot in his laboratory we lunched at the nearby Neptune hotel where he introduced me to a local *bouillabaisse*, seasoned with a white wine of marvelous bouquet, pressed from locally grown grapes. As we ate on the flower-bedecked patio of the hotel's restaurant, our attention was easily attracted to the bikini-clad young women enjoying the warm sunshine.

But I did not undertake this article for *CQ* to tell you, dear readers, about the flora and fauna of southern France, so back to the subject of submerged antenna-propagation systems.

Signal Reflection

Dr. Ducandre's SAP systems are based upon a fundamental law of optics and wave propagation which states that at some critical angle a ray of light or a radio wave will be reflected completely, without loss of energy, from a boundry formed by two substances of considerable different densities. This can be shown mathematically as

$$(1)\ \text{sine}\ i > \frac{n\,1}{n\,2}$$

where i is the angle of incidence for total reflection

n 1 is the index of reflection of one substance

n 2 is the index of reflection of the other substance

In air, $n1/n2$ is approximately 1. Since the sine of an angle can never be greater than one, it is impossible to have total reflection of a radio wave in air, and this is the reason why v.h.f. signals *are not* reflected over great distances in the earth's atmosphere.

But what about a boundary between water and air thought Dr. Ducandre? Air has an index of reflection of 1, while the index for water is 4/3. Mathematically:

$$\frac{n \text{ for air}}{n \text{ for water}} = 3/4$$

from (1) therefore, sine $i = 3/4 = 0.75$

or angle $i = 48°$

In other words, if a radio wave can strike a boundary formed by air and water at an angle *greater than* 48°, it should be reflected completed at the surface, theoretically without the loss of energy. In this way a radio wave could travel over consideragle distances by multi-hop reflections in much the same manner as h.f. radio waves are reflected from the ionosphere. In this case, of course, the surface of the water acts like the ionosphere. Here, Dr. Ducandre theorized, was the key to long distanct v.h.f. propagation.

Operational System

With the theory mathematically established Dr. Ducandre next set out to develop working equipment.

From fig. 1 it can be seen that for a radio wave to strike the surface between water and air at an angle greater than 48°, it must be launched from beneath the water surface at an elevation of firing angle *less* than 42°.

In air the elevation angle of an antenna is controlled by its height above ground. For a horizontally polarized antenna maximum radiation occurs at angles less than 42° when the antenna is at least a half wavelength above ground. Why not the same in water?

In the first experiments, Dr. Ducandre used a 50 watt transmitter operating in the amateur two meter band. The transmitter was placed upon a table on the beach at the water's edge, and was connected to a 9 element horizontally polarized Yagi antenna which was submerged about three feet below the surface of the Mediterranean Sea. In order to prevent a

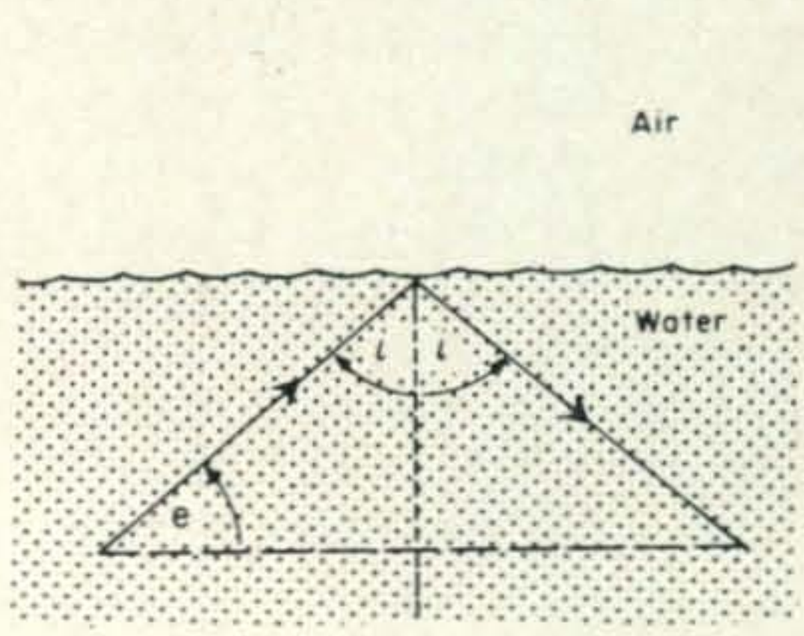

Fig. 1—Reflection of a v.h.f. radio wave emitted from an underwater antenna. For total reflection, angle i must be greater than 48°, and angle e, the antenna's radiation angle, must be less than 42°

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short-circuit, he encased the entire antenna in plastic. The result—a feeble signal a few hundred yards away, then nothing. Something had gone wrong!

Hydro-Magnetic Coupling

After initial failures that Dr. Ducandre traced to poor signal radiation and exceptionally high s.w.r.s, he concluded that the antenna was not coupling properly to the propagation medium. Something had to be devised that would permit efficient coupling of the electro-magnetic radiation to the fluidity of the sea water. This led to what is probably Dr. Ducandre's greatest contribution to science, the *hydro-magnetic*, or HM coupler.

Since the HM coupler is not yet protected by patent and royalty law, it is only possible to describe it here in very general terms. Basically an HM coupler consists of radiating elements of an antenna system, through which sea water is permitted to flow at a constant rate. The flow of water *must be parallel* to the direction of maximum radiation for maximum coupling to take place. In this way, the radiation is directly coupled to the water in much the same way that two coils are coupled in a conventional circuit.

The HM coupler shown in fig. 2 consists of a multi-element Yagi radiating system, where the water flows through hollow insulated tubes at right angles to the elements, and passing through them. A small pump keeps the water circulating through the tubing at a constant flow. HM couplers can take a variety of other forms, providing that this parallel relationship between the directions of water flow and radiation is maintained.

SAPS

The developement of the HM coupler made it possible for Dr. Ducandre to complete his submerged antenna-propagation system. Basically, a SAP system consists of a transmitter and receiver (or a transceiver) at each end of the circuit connected to a submerged antenna of conventional design, a hydro-magnetic coupler, and a small pump. Naturally, all submerged components must be protected from short-circuits by proper insulation.

The entire underwater system, once assembled, is lowered into the sea to a depth of at least a half wavelength, but never greater than five wavelengths. This is to assure maximum radiation at elevation angles less than the critical value of 42°.

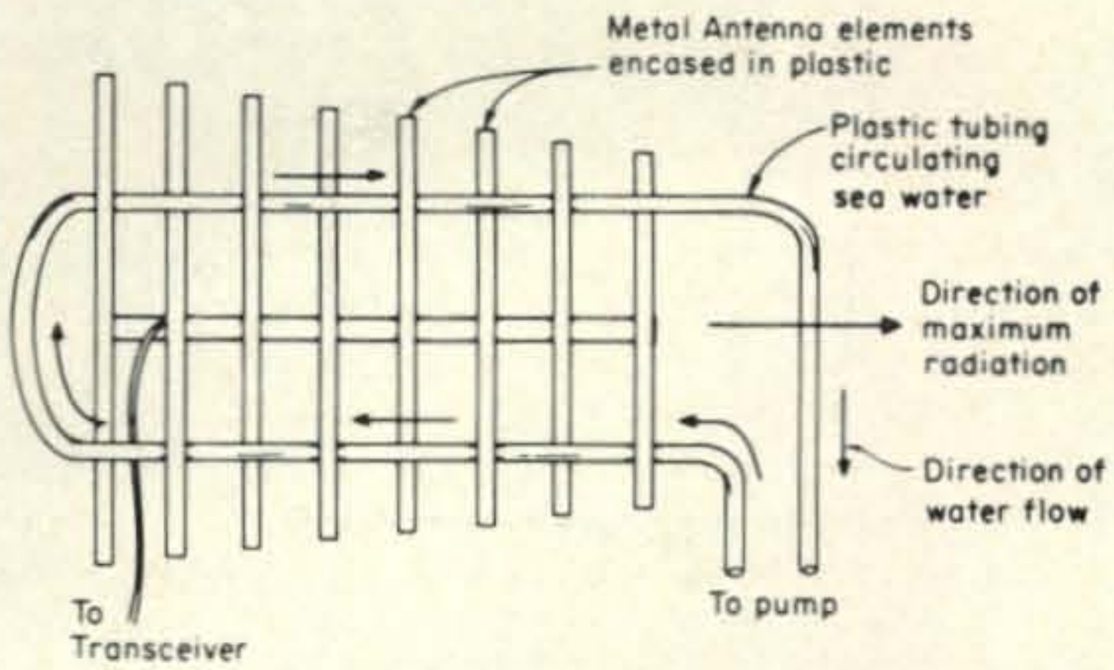

Fig. 2—A typical hydro-magnetic coupler of the type developed by Dr. Simon Ducandre. It is absolutely essential that the flow of sea water be parallel to the direction of maximum radiation, if maximum coupling is to be achieved.

SAPS developed by Dr. Ducandre have *measured* s.w.r.s of 1.2 or less at their properly submerged level, and radiation efficiencies as high or higher than similar antenna systems operating in air.

On-The-Air Results

About two years ago, Dr. Ducandre conducted his first experiments with a complete SAP system. Using a 50 watt 2 meter transceiver on the beach at Narbonne, connected to a 9 element Yagi antenna and an HM coupler submerged about ten feet below the surface of the Mediterranean, he ran test transmissions with a similarly equipped station located at Toulon, 150 miles to the east. For comparison purposes, the transceivers also operated into similar Yagi antennas ten feet above the ground.

The signal received in Toulon from Narbonne via atmospheric propagation varied between R-S 44 and R-S 57, with considerable fading. The signal received via SAPS varied between R-S 58 and R-S 59, with very little fading. A few weeks later similar tests were conducted between Narbonne and Menton, near Monaco, over a distance of 200 miles with some intervening land. While normal propagation through the atmosphere was not possible on this path, successful communication was established using SAPS, with signals peaking 57, and never lower than 55!

The results of these initial experiments have been reported previously in the technical press.[3] More recently, Dr. Ducandre has conducted successful test transmissions on

[*Continued on page 88*]

[3]Ducandre, S. "Possibilities De Liaisons THF En Grand DX Par Propagation Sous Marine", *Radio REF*, April, 1969 p. 257.

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SAFE & SOUND

TOWER INSTALLATION

Last month's installment of "Tower Installation" described locating the tower base, and designing and pouring the massive concrete footing needed to support a 54' tower. Part I left off with the conclusion of the "Transit Mix" concrete pour. Part II, below, tells what to do while the concrete cures, and how, finally, to erect the tower-beam combination.

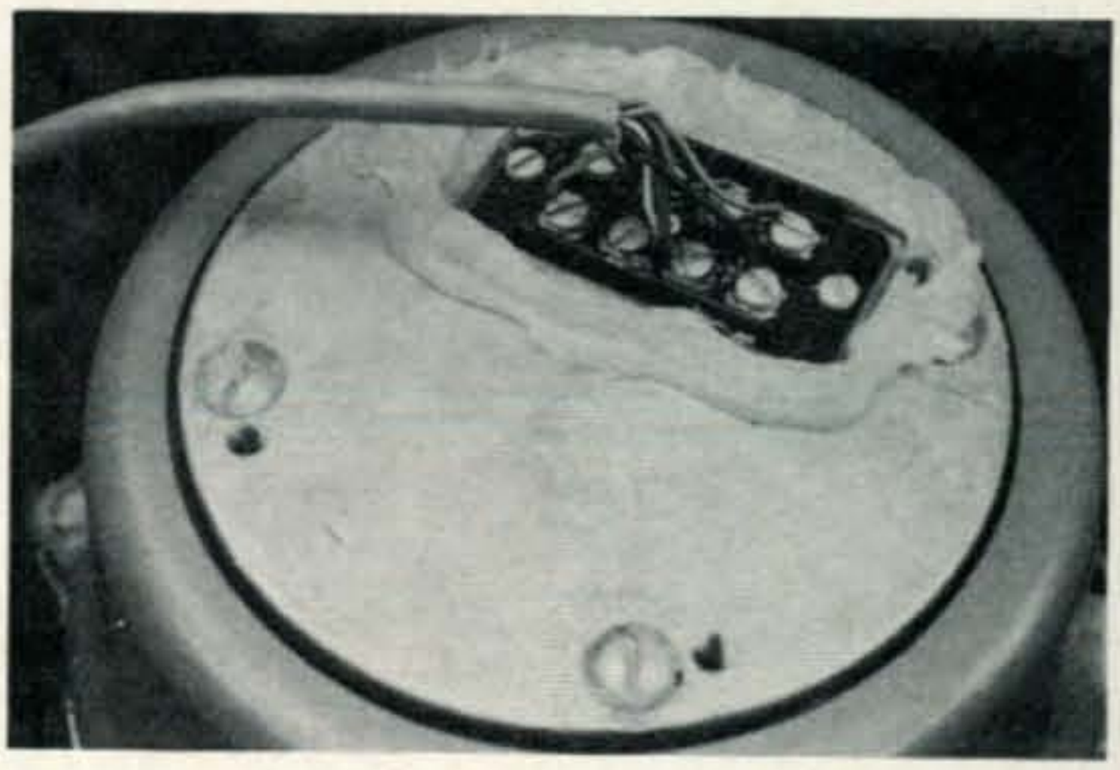
Part II

BY MORT WATERS,* W2NZ

WHILE the concrete was setting, as described last month, work proceeded elsewhere. First came the mounting of the rotator—the old standby, a Ham-M. Like many towers, this one had a platform below the peak that was predrilled for the Ham-M. In mounting it, I decided that I didn't like the idea of leaving exposed the terminal block on the bottom of the rotor, because of the inevitable corrosion. It would be open to weather in two ways—through the small gap between the rotor base and the tower plate, and through the opening in the tower plate through which the cable dropped down.

There's a rubbery stuff called Silicone Seal sold in tubes in any hardware store. It's weatherproof, very tough and stays permanently pliable—an ideal gasketing material. A bead of this sticky stuff was squeezed out around the terminal block and allowed to dry. When the rotor mounting screws were tightened, they compressed the sealant tightly, closing the gap around the terminal block. The other end of the cable had been fed through the opening in the tower plate. Then, strips of tape were criss-crossed around the cable over the opening, overlapping its edges a bit to provide a foundation for more sealant, which was then applied generously over the tape and beyond its edges, so that it would adhere directly to the metal instead of relying on the tape for bonding to the plate. This too was allowed to dry, while the big thrust bearing was bolted to the top of the tower.

The Ham-M is designed for a mast of 2 1/16" diameter. The 10-footer I received with the tower measured only 2 inches, to match the thrust bearing. For proper centering, two shims of 1/32-inch stainless steel were placed in the vee of the rotor's mast mount, one on each leg of the vee. If you ignore this, there



Terminals on base of rotor required sealing to prevent corrosion. Silicon sealant was used in a 1/4" thick bead around block and allowed to dry. Holes for bolts which fastened rotor to tower must be kept free of the sealant, as at the right edge of the block. Screws, like one in foreground, were given coat of silicon to lock them into place.

*82 Boston Ave., Massapequa, L.I., N.Y. 11758.

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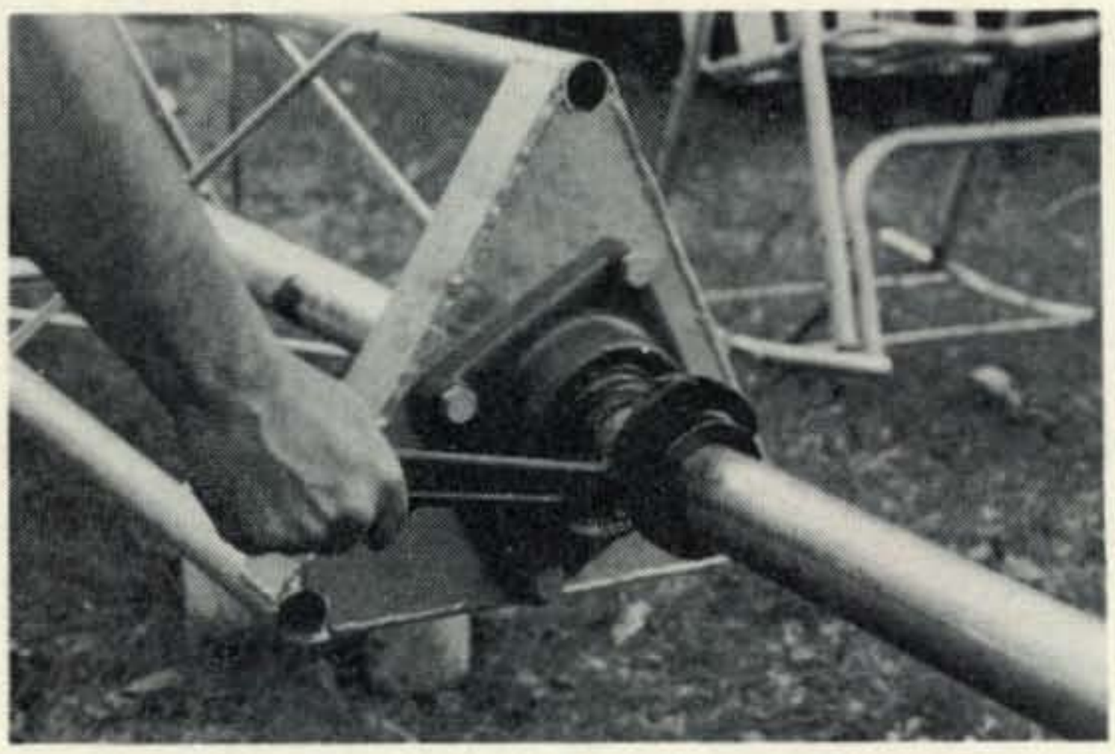
will be a severe strain on the rotor every time you turn your beam. When correctly installed, and with the thrust bearing taking the entire vertical load, the rotor supplies turning force only and should last until there's no more DX to be worked.

A separate part of the bearing—a heavy steel collar—fits over the mast and is locked to it with a large Allen head setscrew. Then, as the mast is seated in the rotor clamps, the collar fits on a race and becomes part of the thrust bearing. The two pieces are locked together with a special tool (see photo) called a pin spanner. I bought one just for this photo, but you can do the job by driving the collar tight with a punch and a hammer.



A pin spanner, which is what this odd-looking tool is, is a hard tool to locate. It fits around the thrust collar and jams it home on the thrust bearing atop the tower.

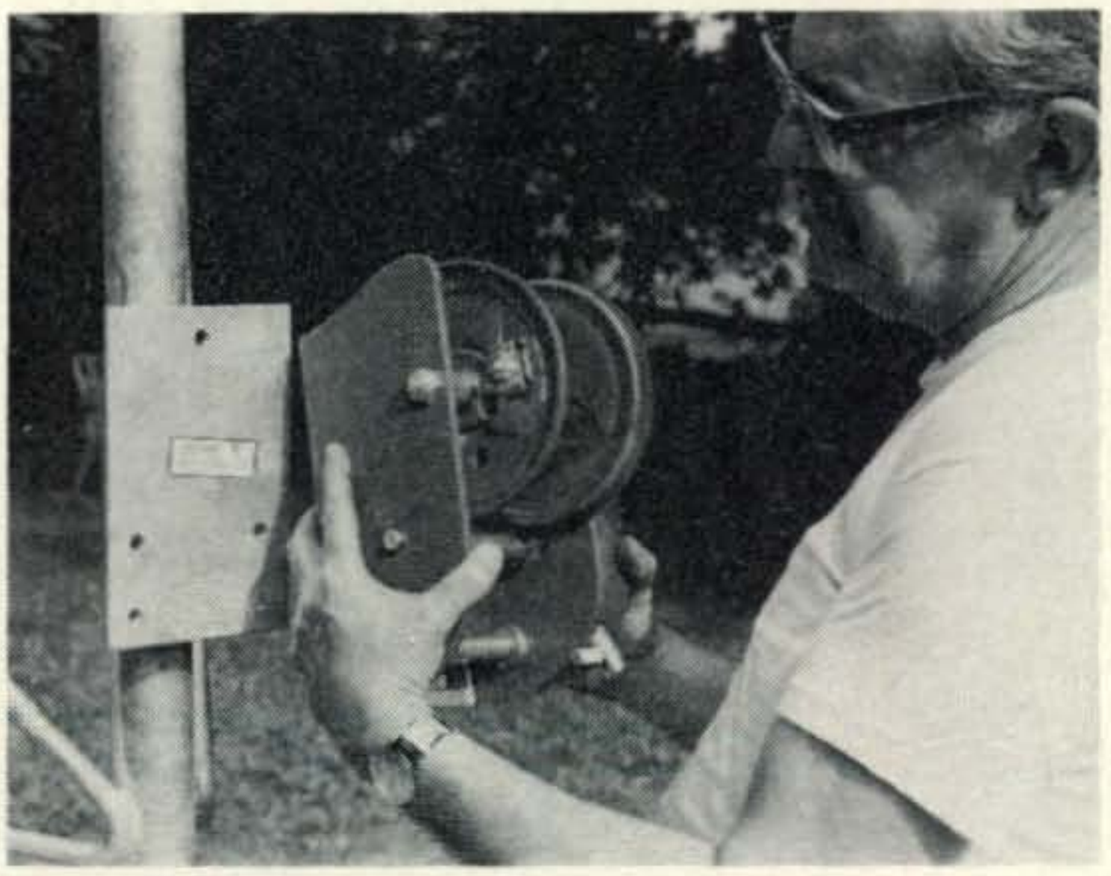
Erecting The Tower

What I thought would be the most difficult part of the project was really one of the easiest. This tower is heavy—it weighs about 520 pounds without rotor or mast, and the base is 205 lbs. more. Getting it off the truck and into the backyard took a lot of hands and plenty of groaning. I thought getting it into position against the tower would be just as hard. The tower had been deposited about 10 feet away from the base and was lying on the wrong side of the triangle, so it had to be moved closer and rotated 120° on its longitudinal axis before it could be hoisted erect.

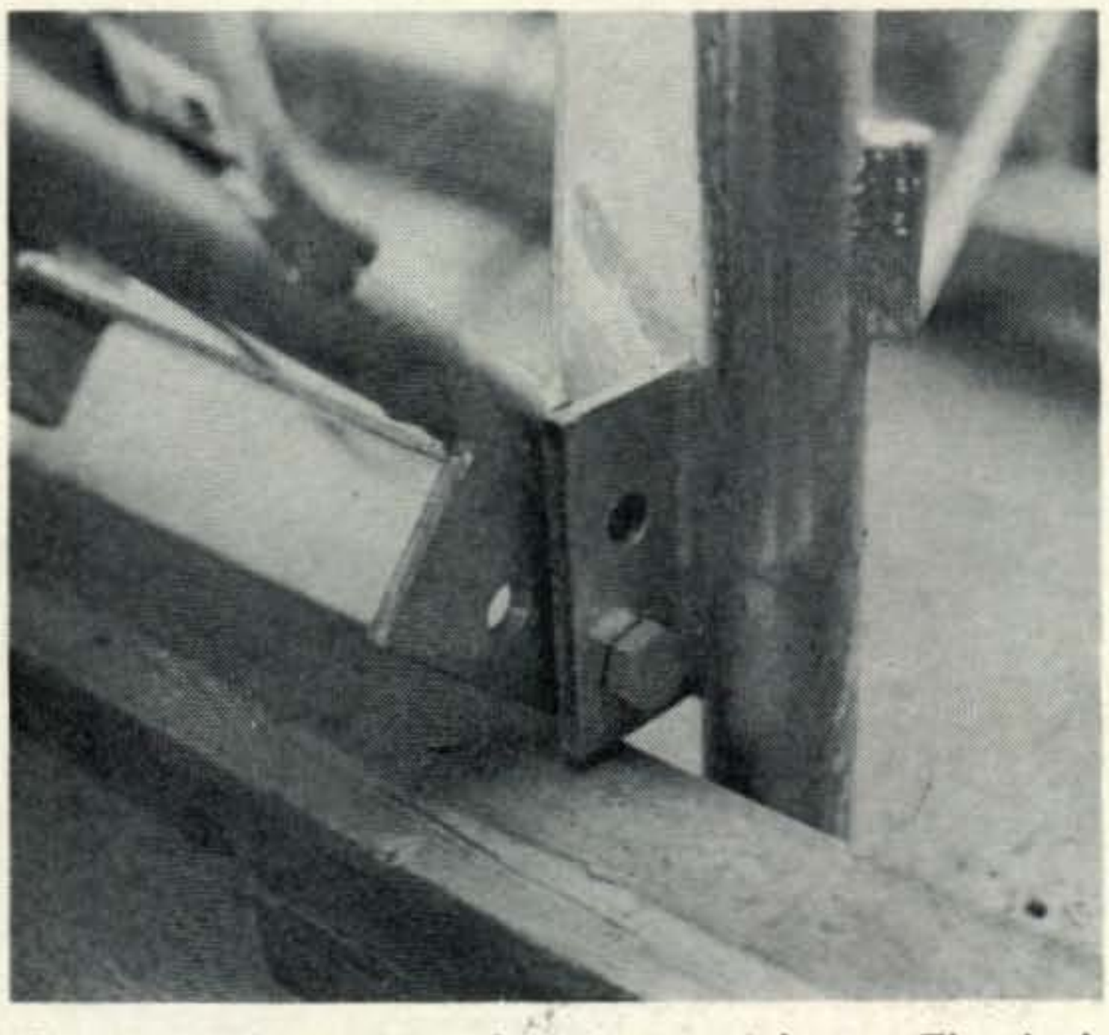
To prepare for this heavy task, I had asked some of the locals to drop by the following Saturday for a lifting party, but the previous evening I looked at it again and got an inspiration. If the erection winch was powerful enough to pull the thing upright, why couldn't it horse the tower into position? Only trouble was I didn't want the far end to drag on the patio where it rested—not that I was worried about the patio, but I didn't want to scratch up my shiny new tower!

It took a few moments to jack up the far end, and slip a dolly under it. Then the winch cable was run through the top pulley, shackled to the tower, and I began cranking. The tower moved smoothly over to the base. Eureka!

Now I just had to rotate it so that the desired side was facing down. Removing the cable shackle, I refastened it to one of the other legs which, when hoisted far enough, I could see, would cause the tower to turn as I wanted it to. The top end, however, would twist over on the patio with a crash unless I cushioned it, so I placed a piece of scrap plywood alongside the top where it would fall.



Small in size but big in capability, is the winch that erects and tilts the tower. The author is shown here about to install it on the mounting plate at the point on the vee, on the base. Tower was hauled into position by this little winch.



Closeup of mating of tower and base. The bolt heads are 1 inch across, just to put the whole thing in scale.

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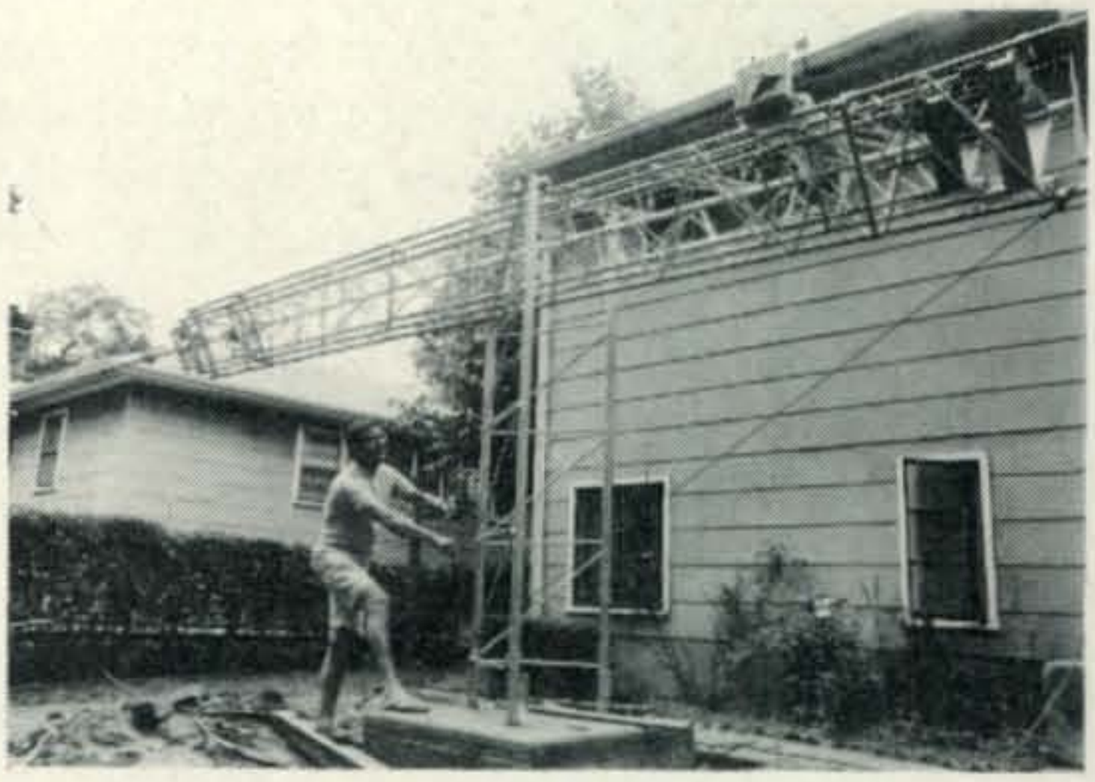
Matching ears at bottom are bolted together and winch is cranked. Tower comes erect smoothly. Tree in background interfered at this point and a couple of branches had to be removed.

Once again, I began hoisting. The part of the tower near the base lifted slowly, up and up, but showed no sign of turning. I continued cranking. Little by little the tower began to twist in the direction I wanted. Suddenly, the force I was applying through the winch overcame the tower's inertia, and with a loud thud it turned over. A quick examination showed that there was no damage. I don't recommend this method unless you're as impulsive as me or can't get any help—but I proved it can be done by one man in just a few minutes.

The rest of the job was even easier. Again using the winch, I hoisted the tower until the ears at the very bottom came up level with those on the base and mated. Then the first pair of bolts were slipped in, as previously explained. The cable was unshackled and moved into erecting position, as shown in the photo. Cranking the winch began, and the tower came erect slowly but surely. This winch has a 12 to 1 gear train, each turn of the drum reeling in perhaps six or seven inches of cable. With that much mechanical



The tower has gone through the vertical position and is now pivoted in the opposite direction. First bolts have been removed, and tower is swinging on bolts at very top of base. Notice that same winch is now doing the work, but the cable has been rerouted through a second pulley at bottom. That's W2MUM on the winch handle.

advantage, it really doesn't require a lot of effort to do the work.

Antenna Assembly and Installation

According to the instruction manual, there are three suggested ways of installing the TH6DXX. None of them would work for me because all involved at least partial assembly on the ground, and there simply wasn't room in my backyard to attach even one of the large elements to the boom. Here's where the tower's tilt feature proved its value in yet another way. The boom is in four pieces which bolt together. I could put it together right on the mast and attach the elements as I progressed.

To begin, I assembled the boom on the ground. There was room for that. Then I assembled the element clamps loosely and slid them into their approximate positions on the boom. With the help of the dimensions given in the manual, the distance between elements was carefully measured and marked with strips of masking tape around the boom. Each was identified by marking with pencil right on the tape. The beta match parts were attached to the boom also. The boom was then disassembled and stored.

The elements were then laid out on the ground and assembled with much checking and double checking of the measurements. Each element consists of two halves, one for each side of the boom. Each half is made up of two or more pieces of tubing and/or traps, and assorted clamps. To assure the

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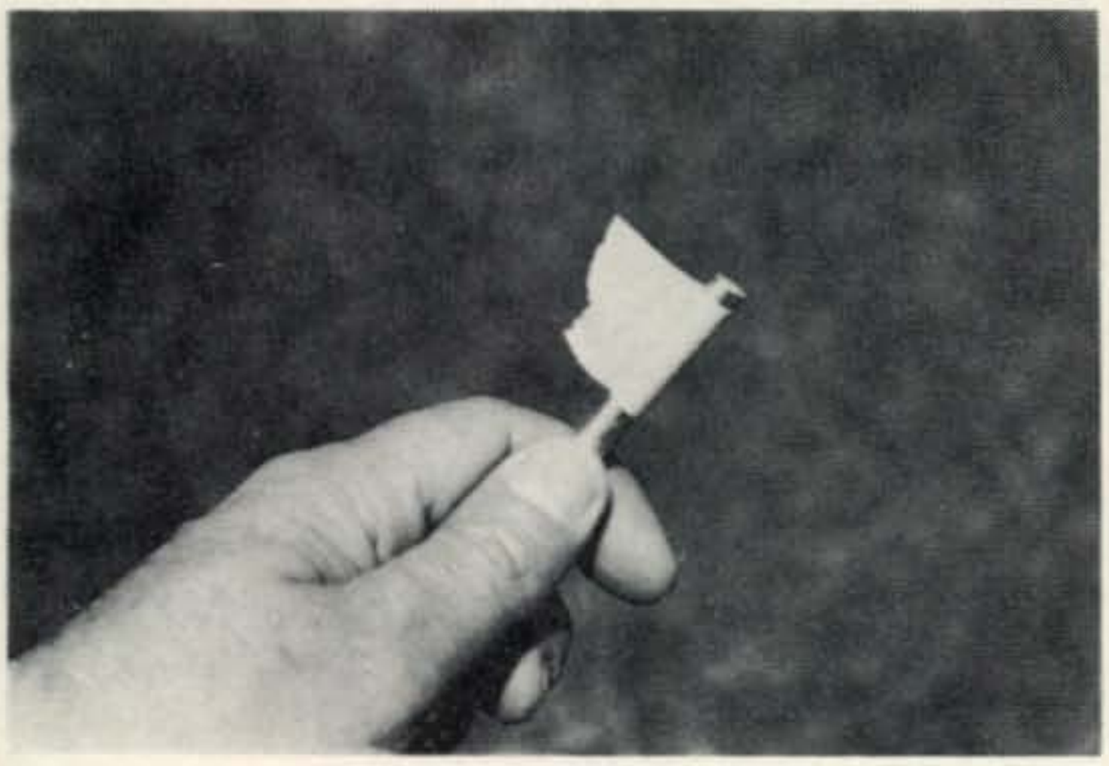
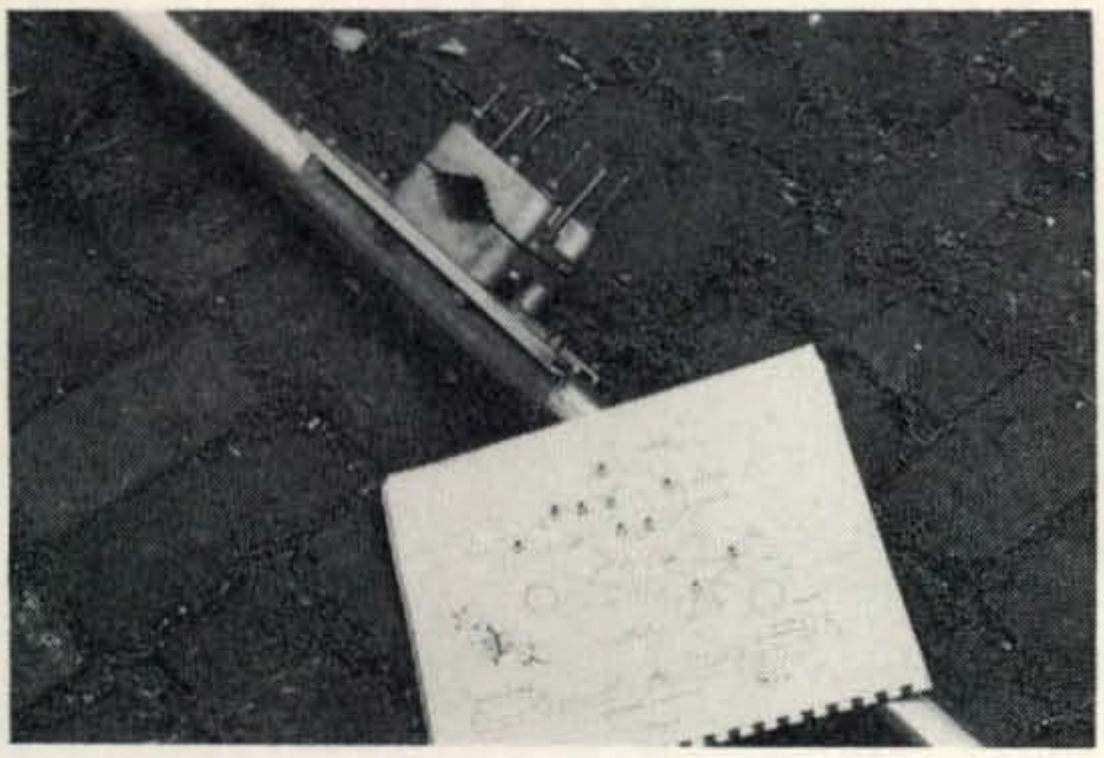


The elements of the 2 meter antenna have to be cut to length. The aluminum rod is easy to work with a hacksaw, but you might try this little trick to make cuts more accurately. The element was measured and masking tape rolled onto it to indicate cutting line.



Massive boom clamp and two central sections of boom of TH6DXX are assembled on the ground, then attached to mast. The instruction manual shows how with clear diagrams.

Mac attaches the guy wires which run from a fitting 3 feet above the boom to support the TH6DXX. Guys are clamped securely at both ends. Hy-Gain BN-86 balun already mounted here had to be moved later to shorten the leads from it to the driven element. It's the little box right below the boom clamp.

best electrical connection between elements, I went beyond the instructions, steel-wooling the surfaces where they would join, then coating them liberally with Penetrox A, a conductive grease especially formulated for aluminum. The clamps were then tightened. Don't get overambitious when you tighten yours, as I did. The heads of the first two clamps crews twisted right off because of the excessive pressure I applied with a pair of Vise-Grip pliers. Putting the elements together took nearly a day. When through, they were stored indoors to keep them dry. In assembling the elements, keep all drain holes oriented in the same direction, and remember to clamp them to the boom later so that the drains will face down.

My antenna plans also included an 8 element job for 2 meters, the Hygain Model 28. It was so easy to assemble it took only about a half-hour, so I won't go into that here. Worth mentioning, though, is that this antenna's boom clamp requires a thinner mast than the one I had, so I fitted a stub of smaller diameter to the top of the big mast and bolted them together in wo places.

The two meter antenna would be on top of everything and relatively inaccessible because of the much longer boom of the TH6DXX, so it was installed first. The coax was then attached and taped to the boom and mast.

At this time, I also provided for a 7 and 3.5 mc antenna to be hung from the top of the tower. A piece of 1½-inch thickwalled aluminum pipe about 4 feet long was

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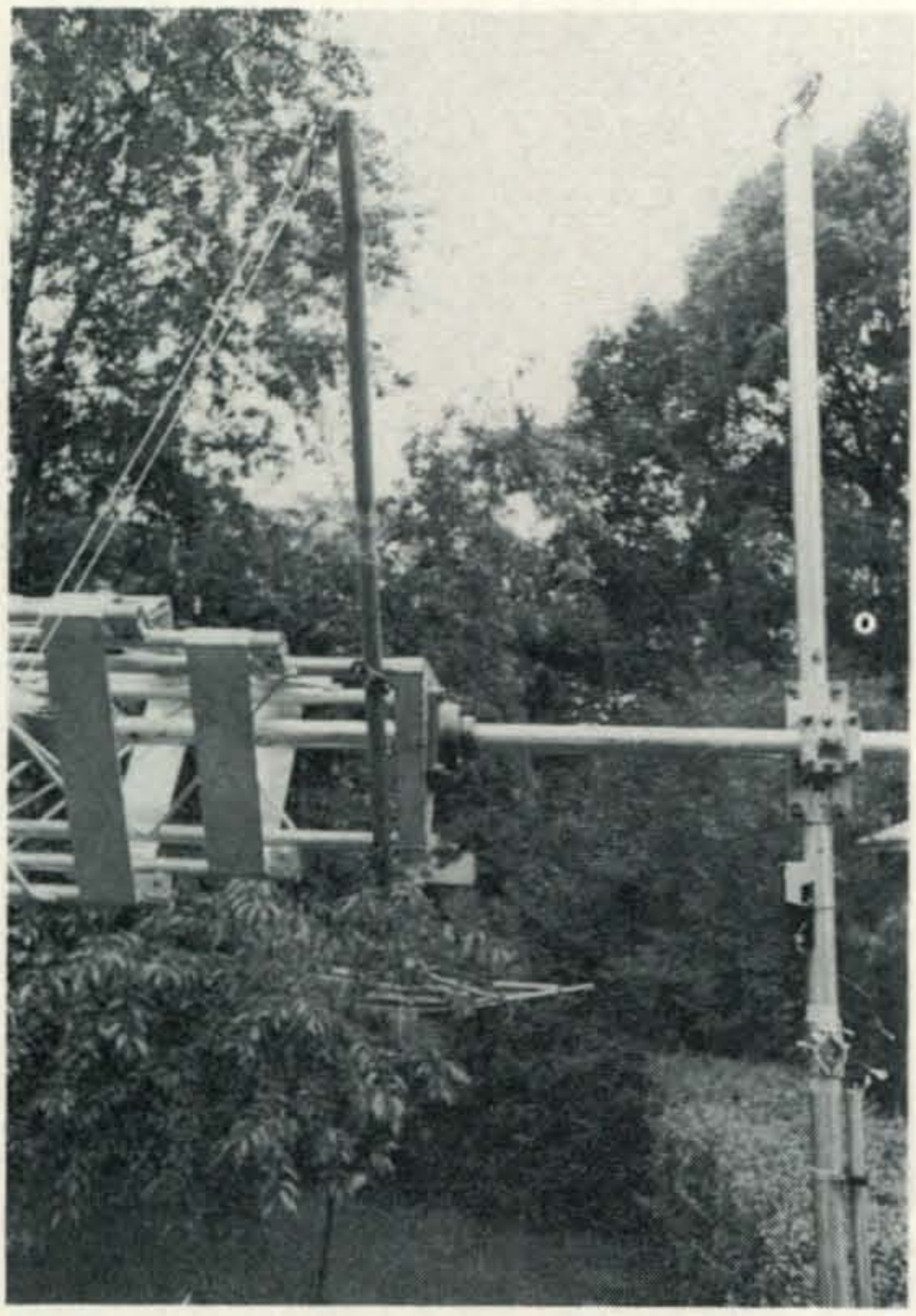
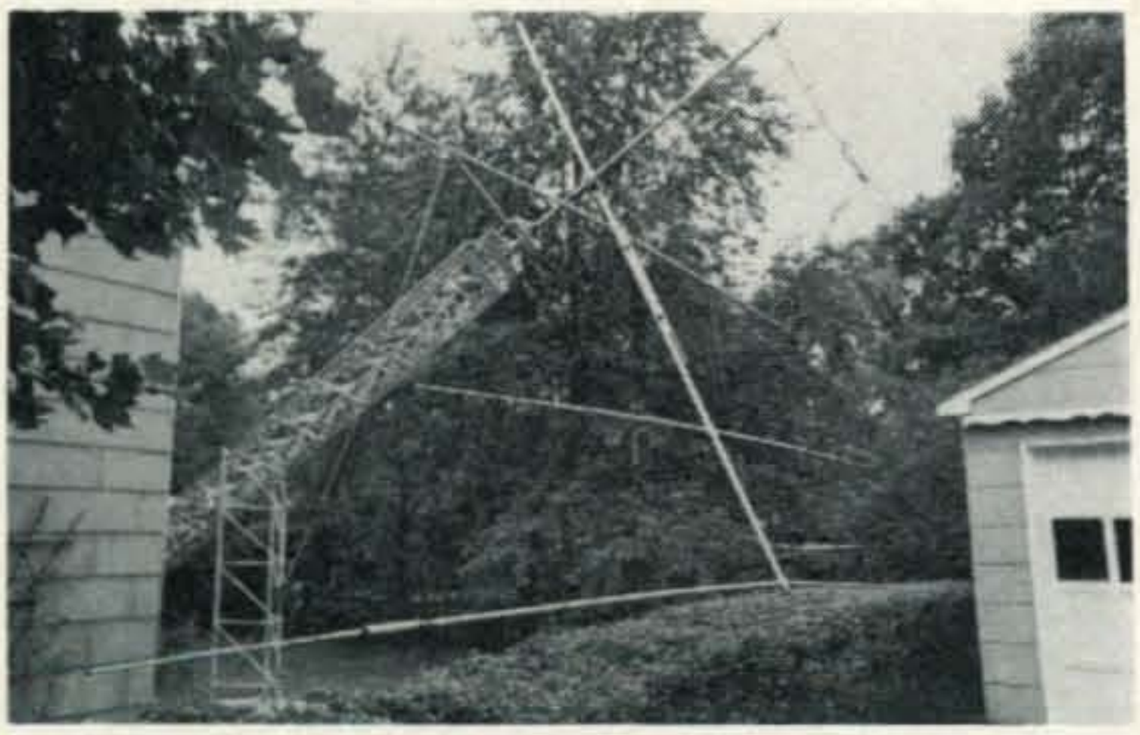


The 4-foot piece of pipe clamped to the end of the tower will support a 40 and 80 meter inverted vee antenna. Pully and lanyard for hoisting that antenna up and down are already affixed.



This photo taken from neighbor's yard shows how half the big beam looks now that it's ready to be hoisted up. The hedge is inside my property line.

With all work completed, the antenna is on its way, all the way up. I rented a huge industrial 3/4-inch electric drill, chucked it right on to the winch handle and pulled the switch—and up she went! Beats hand-cranking by a mile. That 40 to 1 reduction on the winch means perhaps 1200 to 1500 spins of the crank—now you know why I want to motorize it.

The balun was loosened and moved over, jammed against the driven element bracket. As a result, the connecting wires were shortened at least 3 inches each. Further tests of the antenna after this change indicated proper operation.

clamped horizontally to two legs of the top section of the tower right below the platform that carried the thrust bearing. To this was attached a pulley and a lanyard long enough to reach the ground with the tower fully extended. Later, when everything else had been done, I hung a balun from the lanyard and tied the antenna to it.

Now, came the big beam's turn. The massive cast aluminum main clamp was pinned to the mast and two pieces of boom were

[*Continued on page 87*]

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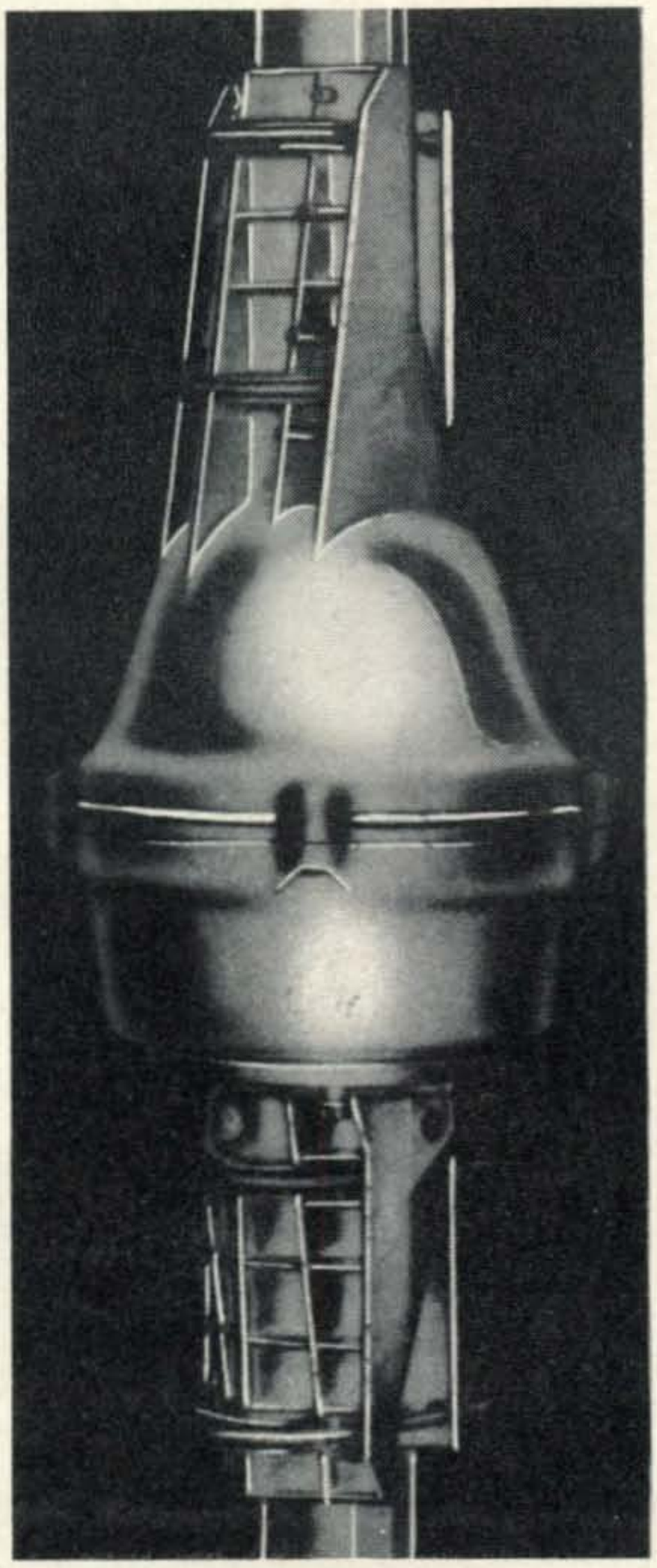

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CQ Reviews:
The Ten-Tec Power-Mite Solid-State C.W. Transceivers

BY WILFRED M. SCHERER,* W2AEF

CURRENTLY so many radio amateurs are "power-hungry" and equipment manufacturers are upping the power ratings of their transmitting products either to satisfy this power craze or to meet competition.

In contrast to this, Ten-Tec, Inc., has come up with a line of unique low-power solid-state c.w. transceivers with a transmitter input of only 2 watts. If you've never had the thrill of c.w. QSO's or of working DX using low power, joining the ranks of the QRP enthusiasts is easy with the Ten-Tec units. Furthermore, these jobs are small in size, lightweight and battery-operated with a maximum current drain of only 300 ma from a 12 v.d.c. source. They are thus ideally suited for low-power portable operation. In addition, excellent s.s.b. or a.m. reception is possible, making them handy for bedside or sunchair eavesdropping on the phone bands.

The transceiver made available to us for evaluation was the Model PM2. It covers the full range of the 80 and 40 meter amateur bands on receive and provides crystal-controlled or v.f.o. operation with c.w. on transmit. It is thus suited for Novice or higher-class use. The transmitter is also arranged for 15-meter band operation using crystal-control only. An accessary converter, the Model AC-3, is required for 15-meter reception.

The a.f. output is designed for headphone use only. External battery power is required (such as "D" cells or lantern battery). The size of the unit is 4" × 10⅛" × 7½" (H.W.-D.) and it weighs 3¼ lbs.

Technical Details

From a technical viewpoint probably the most interesting feature of the Ten-Tec unit is the utter simplicity of its setup. The whole transceiver employs only five transistors, two diodes and one integrated circuit.

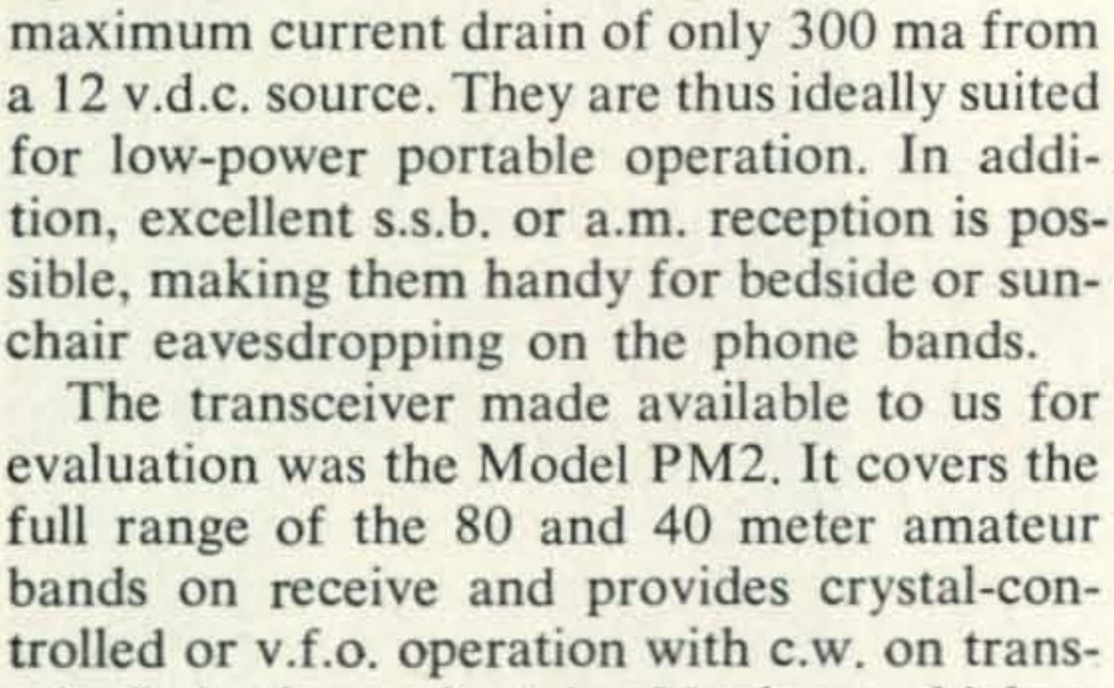
The simplicity is primarily made possible by the use of a unique receiving system. This method converts the r.f. input signal directly to an audio frequency by means of a synchrodyne converter/detector. Although it is not a new idea,[1] it is the first application of it we've run across in manufactured amateur gear. The principle of operation is as follows:

Referring to the block diagram at fig. 1,

*Technical Director, *CQ*.

[1]D.G. Tucker, "The Synchrodyne—A New Type of Receiver for A.M. Signals," *Electronic Engineering*, March 1947, page 75.

"Synchrodyne Receiver," *Radiotron Designer's Handbook*, Fourth Edition, page 1226. Additional references will be found thereat.



The Ten-Tec Power-Mite Model PM2 Solid-State C.W. Transceiver.

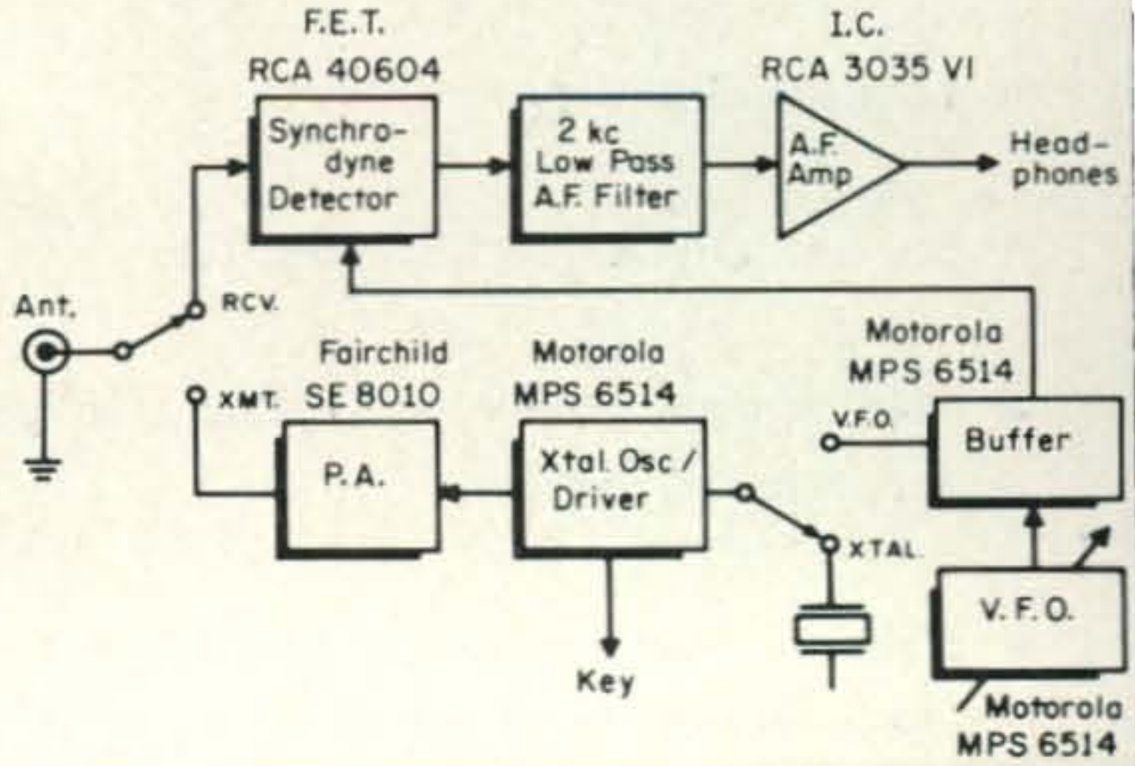


Fig. 1—Block diagram for the setup used in the Ten-Tec Model PM2 Power-Mite. Details are given in the text.

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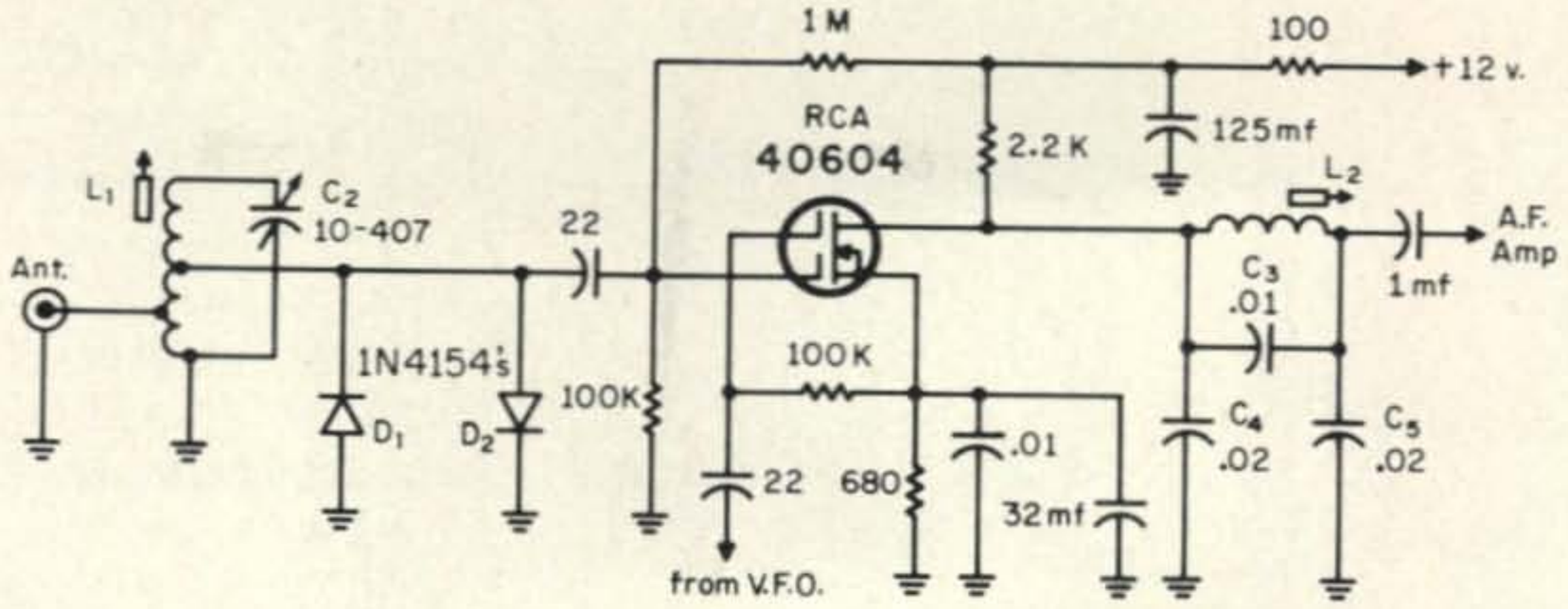

Fig. 2—Circuitry of the r. f. / synchrodyne-detector section used in the receiver for the PM 2. L_1-C_1 tune both the 80 and 40 meter bands, eliminating bandswitching.

the r.f. input signal (in this case c.w.) is heterodyned in a mixer (the synchrodyne detector) with a v.f.o. signal the frequency of which is the signal frequency plus or minus an amount that will produce an a.f. beat note at the detector output.

For example: with an r.f. input signal of 3525 kc and a v.f.o. signal of 3526 kc, the a.f. output from the detector will be 1 kc or 1000 c.p.s. (3526−3525 kc=1 kc).

The principle is the same as that whereby an a.f.-output tone is obtained with a receiver b.f.o. used to convert the i.f. signal.

The a.f. output from the detector is then passed on to a high-gain a.f. amplifier to bring the a.f. signal up to a usable headphone level.

A low-pass filter between the detector and the a.f. amplifier limits the a.f. passband and thus determines the selectivity of the receiver, which in the Power-Mite is set for 2 kc at 6 db down. However, just as with the usual receiver b.f.o., an audio image also may be experienced.

For example: for the case in point above, an r.f.-input signal of 3527 kc also will produce a 1 kc a.f. beat with the v.f.o. signal of 3526 kc (3527−3526 kc=1 kc). Therefore, in the presence of certain adjacent-channel signals, the overall selectivity could be reduced to 4 kc.

The term "synchrodyne" was denoted in the references, inasmuch as for an a.m. signal the heterodyning oscillator has to be synchronized or at zero beat with the carrier for proper demodulation of the sidebands. A similar situation exists with s.s.b. signals. The synchrodyne detector in the Power-Mite units is a linear device and is equivalent to a product detector.

Circuit Details

Referring to fig. 2, the synchrodyne detector for the PM2 is a dual-gate MOSFET (RCA 40604) with the r.f. signal applied to one gate, the v.f.o. signal to the other gate. Diodes D_1-D_2 are shunted across the signal-input gate for overload protection of the f.e.t. against damage from strong r.f. signals. The low-pass filter is comprised of C_3-C_5 and L_2. The audio amplifier consists of a single integrated circuit (RCA CA 3035 V1) and has a gain of approximately 70 db.

The v.f.o. section employs two silicon transistors (Motorola MPS 6514) one of which functions as the oscillator in a modified Colpitts circuit, while the other is an isolation/buffer stage operating as an emitter follower.

The transmitter section is comprised of a silicon transistor (Motorola MPS 6514) in a conventional setup with a tuned-collector circuit. This stage drives the base of the p.a. transistor which is also a silicon job. The p.a. tank (at the collector) is link-coupled to the antenna circuit for matching to a low-impedance transmission line.

The transmitter is keyed at the emitter of the crystal-oscillator stage. A socket is provided on the panel for quickly and conveniently changing crystals.

V.f.o. operation of the transmitter also may be had by pushing a switch that then applies the receiver-v.f.o. signal to the base of the transmitter-oscillator stage which then functions as an amplifier.

Transmit-receive changeover is handled by a d.p.d.t. switch that transfers the antenna between the receiver and transmitter and that also grounds the receiver input on transmit. The transmitter is activated simply by closing the c.w. key. A panel meter provides proper transmitter-tuneup indications according to the current drawn by the unit.

Construction

The PM2 is modular-constructed using four different printed-circuit boards. These are the receiver r.f. section, the a.f. amplifier, the v.f.o. and the transmitter section. Small slide switches on the panel set up operation

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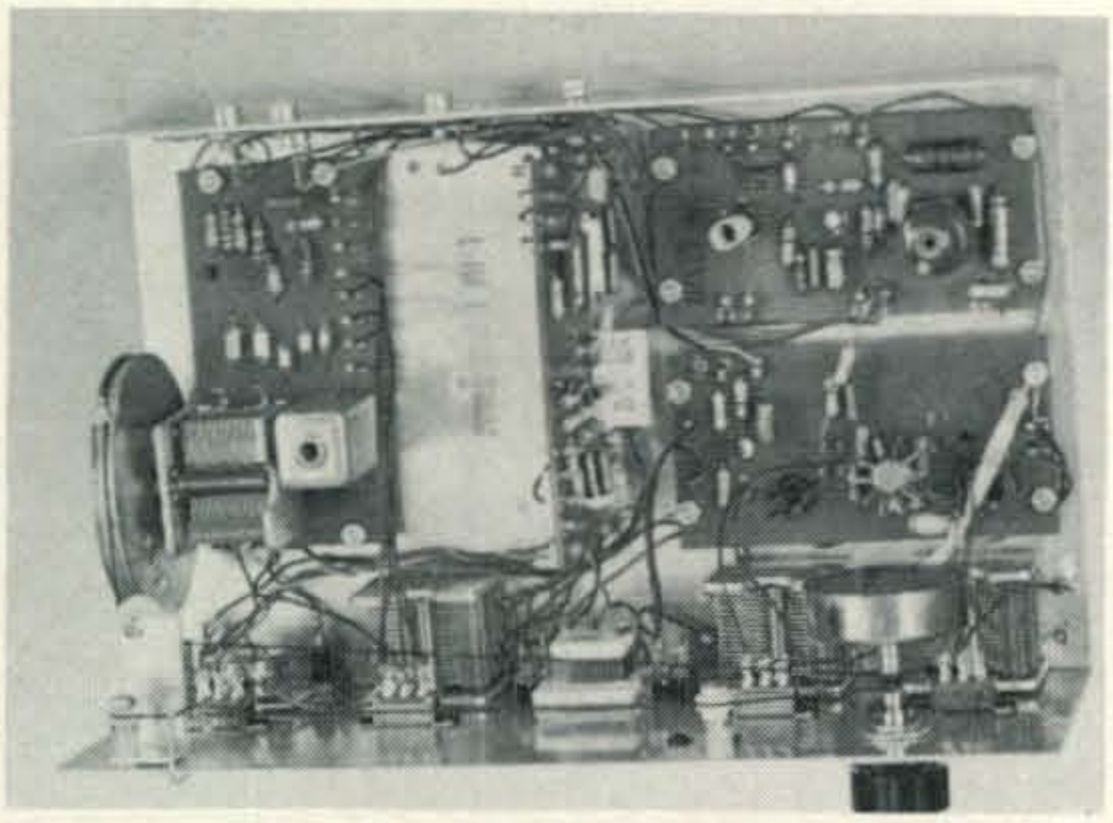

Interior view of the PM2. The various portions of the transceiver are assembled on individual printed-circuit boards. At upper left—transmitter, at lower left—receiver r.f. section with the synchrodyne detector, at center (mounted vertically)—a.f. amplifier, at right—v.f.o.

for the various bands, crystal—or v.f.o.-control and XMT-RCV transfer.

A slide-rule dial has separate scales calibrated for the 80 and 40 meter bands. When the 15-meter r.f. converter is used for receiving, the receiver functions as a tunable 3.5-4.0 mc i.f. and a third scale is accordingly calibrated for the 15-meter band. Tuning is accomplished by a string drive with a flywheel control

The circuit boards are installed on a U-shaped aluminum frame that serves as the bottom half of the equipment cabinet, the top of which is a similar type. Both halves are held together by plastic end pieces that have a wood-grain finish. The top half of the cabinet has a glossy cream-colored finish.

Operation and Performance

XMT-RCV transfer must be conducted manually by a panel switch. Tuneup requires adjustment of the oscillator control for maximum meter current and adjustment of the p.a. control for a current dip at resonance. Since the output is designed for nominal loads of 50 ohms, an antenna-matching coupler would be required for maximum efficiency with more widely divergent loads.

With crystal control, the unit tested in the *CQ* Lab put out 1.75 watts on 80 meters and 1.5 watts on 40. With v.f.o. operation the output was 1.5 and 1 watts respectively for 80 and 40.

Clean and crisp keying was obtained with crystal controlled operation. Keying with v.f.o. operation also was excellent. During keying with the v.f.o., a nominal change in loading on the oscillator shifts its frequency slightly downward. This provides the equivalent of frequency-offset as usually provided in s.s.b. transceivers when used for c.w., in order that when the receiver is tuned for a beat note on the received signal, the transmitter output will be on the received signal's frequency without necessitating resetting of the v.f.o.

The receiver sensitivity measured 1 μv for 3 db S+N/N. The selectivity, either side of zero beat, was 2 kc at 6 db down, 2.25 kc at 10 db, 2.8 kc at 30 db, a notch of 36 db at 3.1 kc and 8.5 kc at 40 db. The LP filter inductor, L_2, is adjustable, making it possible to lower the filter cutoff frequency somewhat and thus slightly narrow the selectivity. Outside of the audio image, no other spurious responses were experienced.

With input signal levels above 1500 μv, a.m. signals could be weakly detected, regardless of the v.f.o. tuning, when the r.f. input circuit is tuned to the a.m.-signal frequency. This is most likely to occur with shortwave-broadcast signals outside of the amateur bands (particularly those on 6 mc), and thus normally would not be of concern, since the r.f. circuit is then tuned to the amateur band for such operation. The effect evidently is due to rectification in the f.e.t.

Although an unwanted sideband is not rejected by the receiver, because of the audio image, the unwanted-sideband attenuation of an s.s.b. signal usually is sufficient to permit exceptionally clean sounding s.s.b. signals. This is enhanced by the fact that the converter detector functions at a very low signal level. A.m. signals, of course, are tuned in at zero beat as would be the case with conventional receivers using product detectors.

There is no r.f. gain or a.g.c., but in the presence of exceptionally strong signals, overload may be prevented by detuning the r.f. input.

The frequency stability of the unit was also excellent. We've listened to s.s.b. signals over periods of an hour or more without finding the need for retuning; as a matter of fact, by leaving the receiver tuned to the 3999 kc s.s.b. boys at night and turning the receiver on the next morning, it still was tuned right on the button. Bench tests indicated adherence to the manufacturer's specification of 100 c.p.s. drift from turn on.

Battery operation was found best. Operation from an a.c. source required a very low-

[*Continued on page 86*]

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See page 102 for New Reader Service

A GREAT BUY FROM ARROW—

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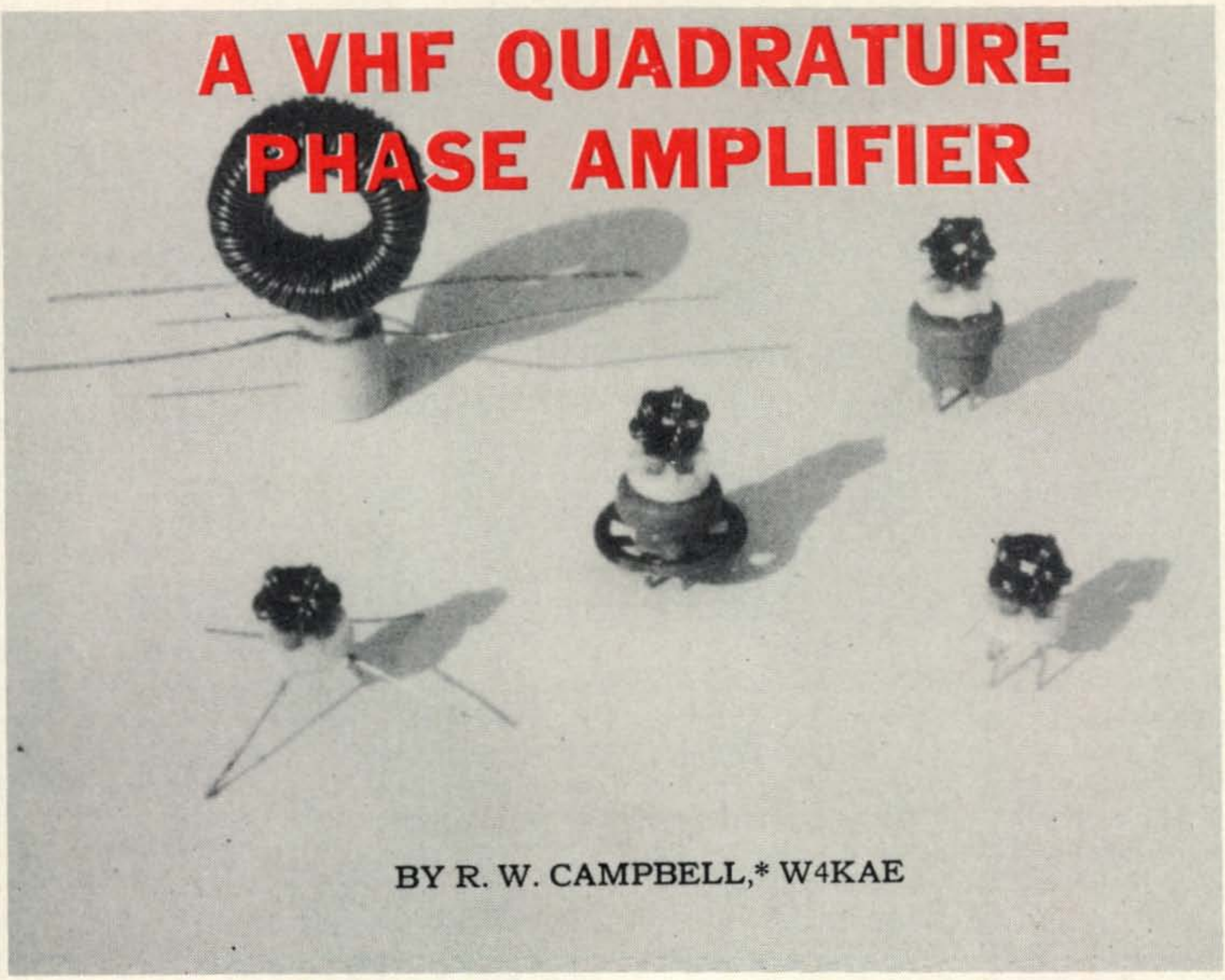
A VHF QUADRATURE PHASE AMPLIFIER



BY R. W. CAMPBELL,* W4KAE

View of several quadrature couplers that can be made with ordinary high frequency ferrite toroid cores. The left rear unit is for high frequencies and is wound on a Carbonyl SF core and is useful for 3 to 30 ms. The two couplers in transistor sockets are for u.h.f. and are wound on Amidon Associates 1/4" toriods using 24 e. Beldsol wire. The other two are the type used for the v.h.f. quadrature amplifier depicted in fig 1 and are wound on Permacor #57-6075 IRN-9 material.

THIS article describes how to build and wire a stable, low-noise transistor amplifier, using toroidal coils, that can be used as a v.h.f. preamplifier or h.f. amplifier for an i.f. strip. The idea for this circuit was the result of a stimulating report of a "$75.00 Quadrature Coupler, Packed in Plastic," offered to the public in *Microwaves Magazine*.[1] In this report it is said that octave bandwidth frequencies can be amplified with great stability by use of quadrature couplers, but the price drove us to making our own out of Permacor #57-6075 toroids for a fraction of the cost.

Using these IRN-9 cores and #24 Beldsol wire broadbanded and mean *low noise* amplification was achieved consistently. The octave frequencies that our experimentation proved most practical were from 80 through 160 mc. U.h.f. ranges could well cover 1¼ meters through 432 mc, if you make this kind of amplifier, or, the entire u.h.f. TV band could be covered from 470 to over 890 mc. Using 3/4 inch Carbonyl SF cores, wound bifilar, it is possible to bring these octave frequencies (similar to harmonic multiples of 2) down to h.f. Baluns are not obsoleted with the quadrature coupler, even though the coupler is a 90° coaxial hybrid. You can liken this device to a quarter-wave Q section with the exception that it is non-selective throughout its bandwidth.

Theory of Operation

The theory of the quadrature coupler is very simple from a practical standpoint. First, we have two lengths of number 24 enamel wire, wound bifilar. Then there is an

*316 Mariemont Dr., Lexington, Ky. 40505.

[1] "$75 Quadarature Coupler Packaged in Plastic," *Microwaves*, June 1968, p. 108.

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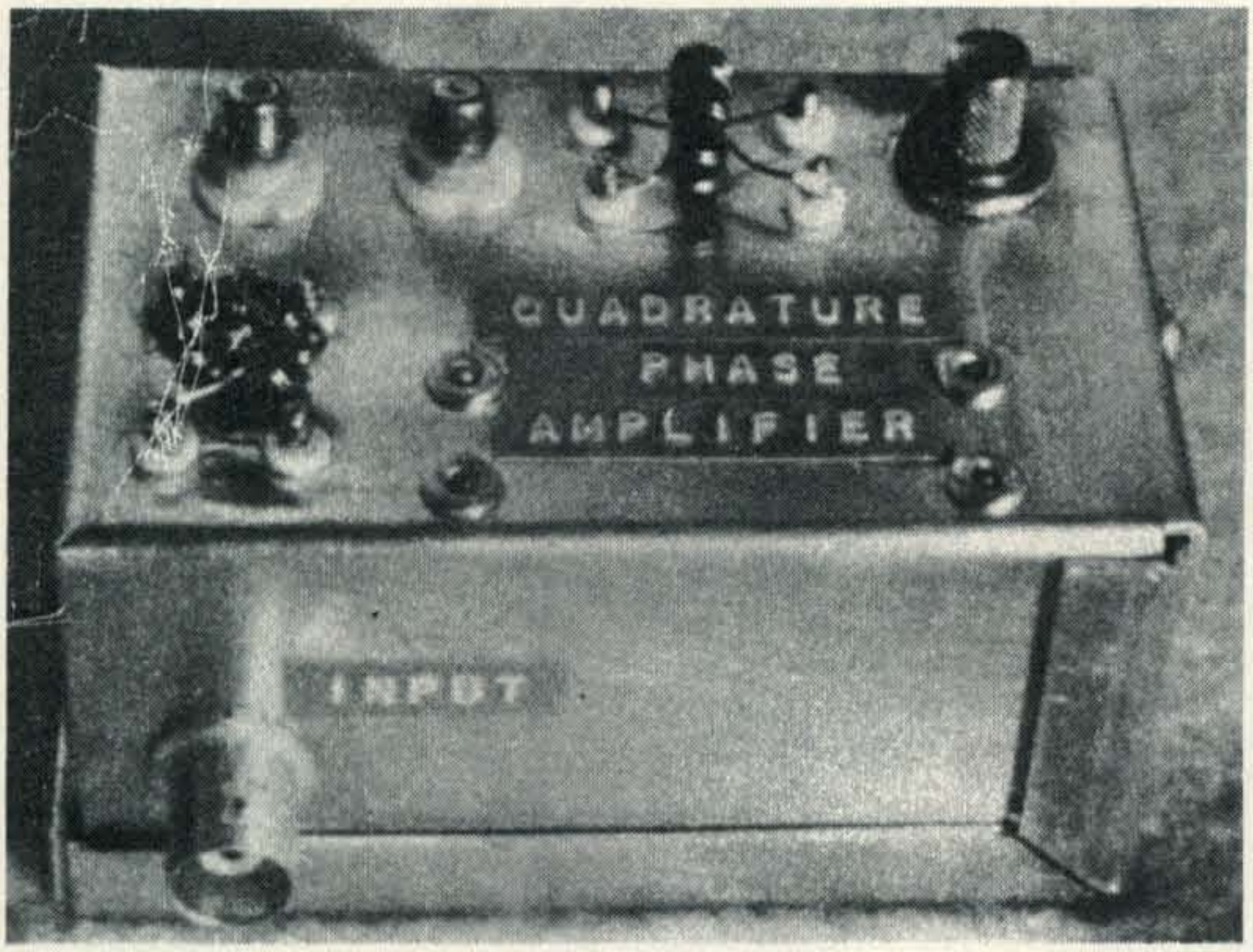

View of the complete v.h.f. amplifier. The two AF-239 transistors, the two quadrature coils and the on-off switch are clearly visible.

electrical criss-cross in the connections, from input phase to output phase. This is identical to "winding-up" a Q section and transposing the connections.

The goal is to amplify signals and yet prevent feedback, because of 90° phasing. This is achieved because an inverted phase-shift of this number of degrees is in the exact opposite quadrant of the input signal; hence, is is self-cancelling. Note that there can still be feedback, however, if the gain is so high as to "overcancel" the input signal with the higher level output. This property would depend upon the feedback capacitance of the transistors and associated wiring, but use of toroidal cores to keep the fields within them prevents this possibility with a single stage of amplification.

If this unit is used on a continuous basis it is recommended that the reader build a full-wave voltage doubler circuit for the d.c. power supply using a 6.3 v.a.c. filament transformer as the power source. Preferred components might be HEP-154 Surmetic rectifiers and Mallory MTA electrolytic capacitors rated at 200 mf 25 v. Possibly, 1000 mmf feedthrough capacitors would be a convenience way of passing the transformer secondary leads through the Minibox (or LMB Flangelock box channels) with large ferrite beads to provide magnetic shielding, being slipped over the feedthrough capacitors.

Circuit

Figure 1 shows the schematic. AF-239's were chosen for our experiments since they were the cheapest Motorola Mesas with the best noise specs and cost. The input and output coupling capacitor values were chosen such that resonant-lead effects would give optimum coupling for the impedance present. The AF-239 common-base input admittance parameters are easily found in Motorola's 1968 "Semiconductor Data Book". All that is necessary is to check the chart of conductance and susceptance values at the frequencies in question. A single curved ellipse is used as the quadrature coupler symbol; there is no connection between wires. Only a 90° magnetic coupling 'link' exists through the toroidal cores. This diagram approaches long-tail biasing with a single battery.

Construction Suggestions

Pop rivets were used to secure the battery holder to the interior of the LMB Flangelock case. A small rotary switch (Arrow-Hart-3/8") was used in preference to a toggle switch to save space. Teflon sockets of the press fit variety are used for the AF-239 transistors. Semiconductors lead conversion/mounting pads separate the transistor leads from the TO-72 for lower wiring capacity.

The quadrature coils are wound on Permacor #57-6075 toroid cores.[2] Using two lengths of #23 e. Beldsol wire, a 5 turn bifilar winding is placed on the core. The leads are transposed as described earlier and shown in fig. 1. The connections for the coils are made to Johnson press-fit feedthrough terminals. The input and output toroids are mounted at right angles to reduce coupling.

Since the amplifier is broadband some preselection might be desired. If so, use a larger box to accomodate the tuned circuits. The packaging of the unit can be tight because there is no feedback problem.

[2]Permacor Division of Radio Cores, 9540 S. Tulley Avenue, Oak Lawn, Illinois. Samples can be obtained if requested on letterhead.

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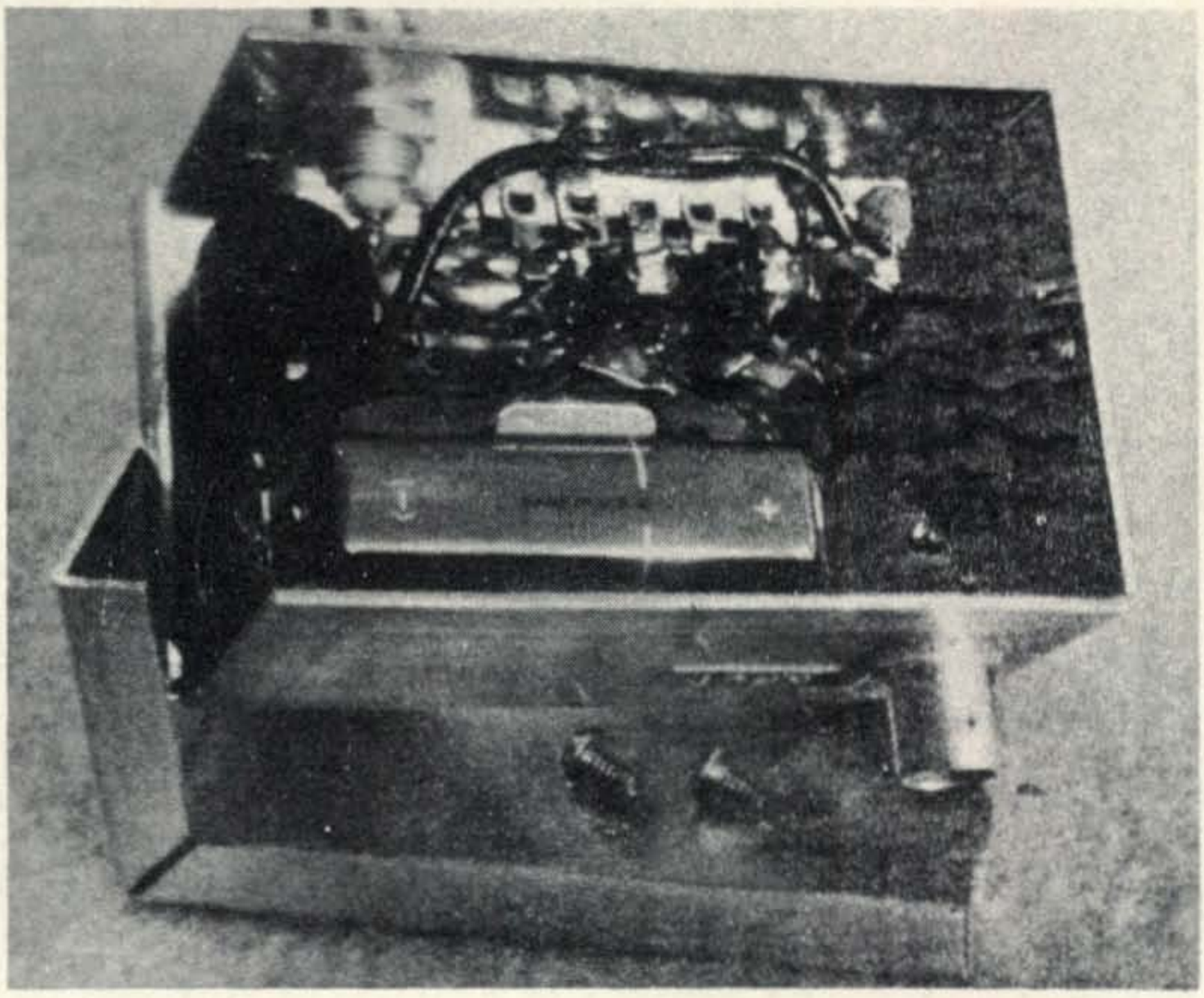

Interior view of the v.h.f. quadrature amplifier. The 22 1/2 volt battery permits a quick source of power for experimenting but a permanent power supply as described in the text is preferred.

At my station, the v.h.f. quadrature-phase amplifier provided a voltage gain of over 3 S units or about 12 db power gain. Noise was less than a single AF-239 and, I think, better than two in cascade. There was somewhat less gain than I expected using two transistors, but much more stability with lowered noise. If a tuned input is preferred, anyone can design such a network using *The Radio Data Reference Book*.[3] At one time I blamed these transistors for overloading from the professional communications band operators, but found out later on my Parks converter had wandered "out-of optimum" adjustment.

Except for the possibility of overload, this amplifier solves most common dissatisfactions, especially oscillation and noise. We have told you about a radically new circuit for wideband voltage amplifiers, researched from professional literature, for the amateur. I hope to have "spread-the-word" that a simple, reliable, solid-state circuitry is available for applications including possibly wideband integrated circuits for a few cents per core! The transistors can cost just a few cents more. ■

[3]Jessop, G. R., "Radio Data Reference Book," *RSGB Publication*, December 1966, pp. 36-37.

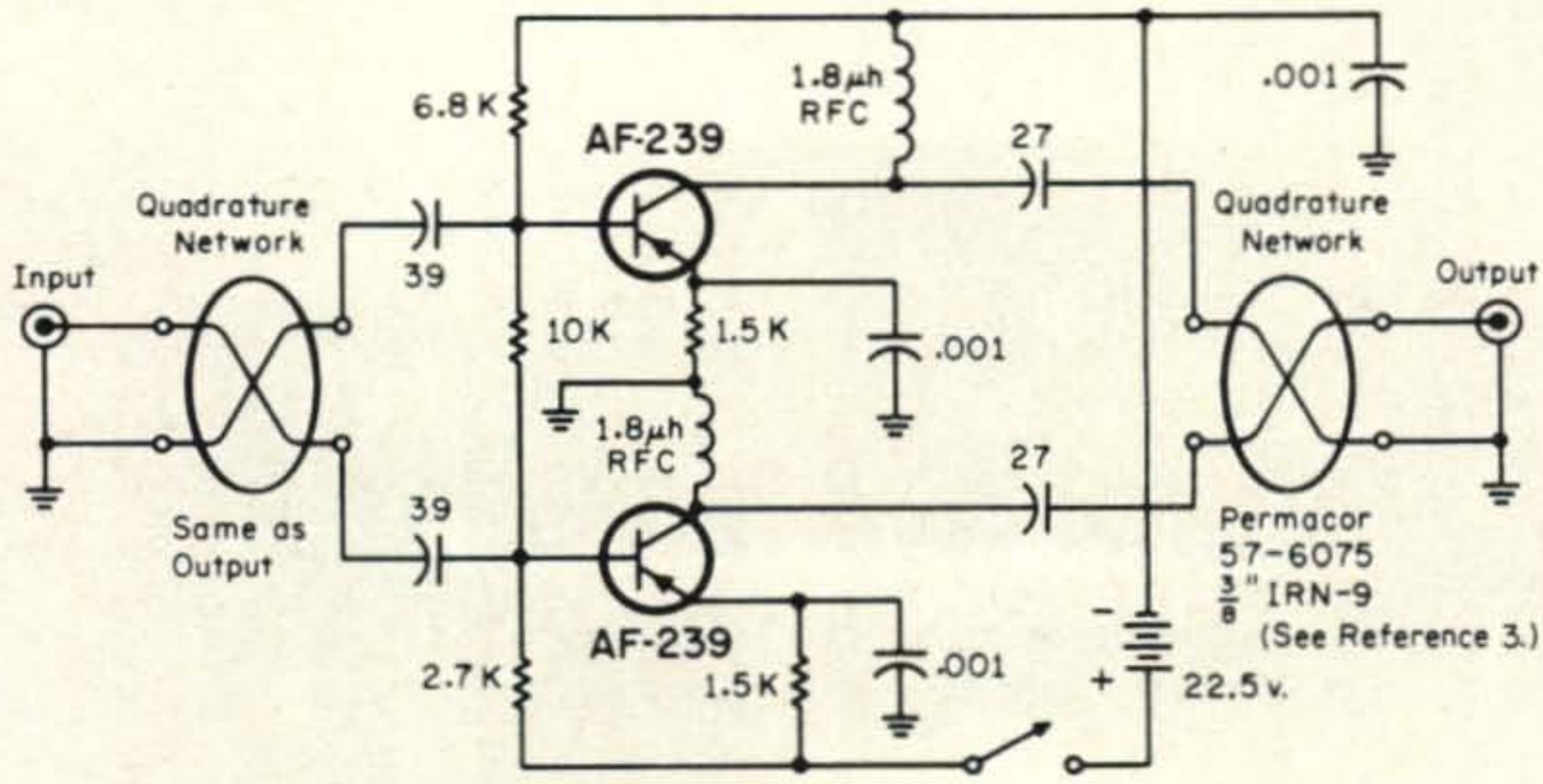

Fig. 1—Circuit of the v.h.f. quadrature amplifier using toroid input and output coils. Note that there is no connection between the bifilar wires but only a magnetic 90° coupling. The two radio frequency chokes are 1.8 microhenry ferrite cored inductances. All resistors are 1/2 watt. Capacitors are disc ceramics; those with values greater than one are mmf and those less than one in value are in mf.

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Late OSCAR News

BY GEORGE JACOBS,* W3ASK

LAUNCHED at 1131 GMT on January 23, the AUSTRALIS-OSCAR 5 radio amateur satellite continues to orbit the earth every 115 minutes as this is being written, during the last days of February. The 2 meter beacon on 144.050 mc, however, has ceased transmitting and the 10 meter beacon is becoming slowly but progressively weaker on 29.450 mc.

Reception of the satellite's 2 meter beacon was last reported at 1945 GMT on Saturday, February 14, during orbit number 280. Anyone hearing the 2 meter signal after this time is urged to send reports immediately to AMSAT headquarters.[1]

The 10 meter signal, operated by ground control during weekends, was placed into continuous operation after the 2 meter transmitter ceased operating. The 10 meter transmitter is expected to remain in operation at least through February, and perhaps into early March.

The AO-5 satellite is considered to be an outstanding success. Except for trouble with the 10 meter telemetry modulation, every thing functioned as planned. The proper orbit was achieved, both transmitters operated for approximately their predicted life spans, the magnetic attitude stabilization system (MASS) stabilized the satellite as planned, and the 10 meter transmitter was successfully controlled from the ground.

AO-5 Reports

Thousands of tracking and reception reports have been received and forwarded to the AUSTRALIS-OSCAR computer center at the University of Melbourne, Australia. The computerized data will form the basis for an official report which will be submitted to NASA and which will be made available to radio amateurs and scientists throughout the world. The report will summarize tracking, telemetry and radio propagation observations of interest.

While a large number of reports received are single observations submitted for the special AO-5 QSL card, many are voluminous and detailed. For example, K9LCR, K2SS, K1HTV and W6RP are but a few of the many radio amateurs in the United States

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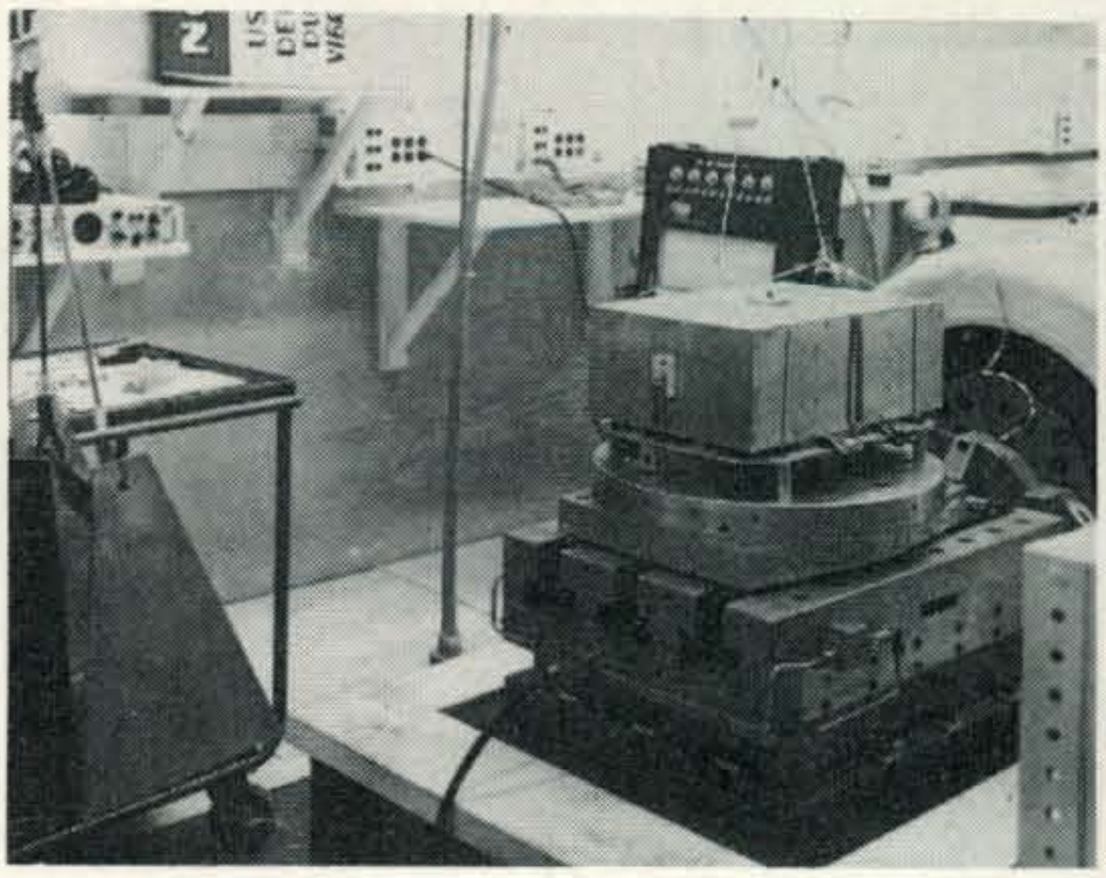
*Space Communications Editor, *CQ*. 11307 Clara Street, Silver Spring, Md. 20902.

[1]AMSAT, P.O. Box 27, Washington, D.C. 20044.

AMSET officers gather around the AUSTRALIS-OSCAR satellite at an official sendoff earlier this year at AMSAT's East Coast headquarters. From left are Jim Puglise, W3CBJ; George Kinal, K2MBU; "Cap" Petry, W3AWN; Chuck Dorian, W3JPT; Bill Tynan, W3KMV; Jan King, K8VTR; and Perry Klein, K3JTE, AMSAT's President.



Before delivery to launching officials, the AUSTRALIS-OSCAR satellite underwent final environmental tests. Here the satellite is shown withstanding severe vibrational testing.

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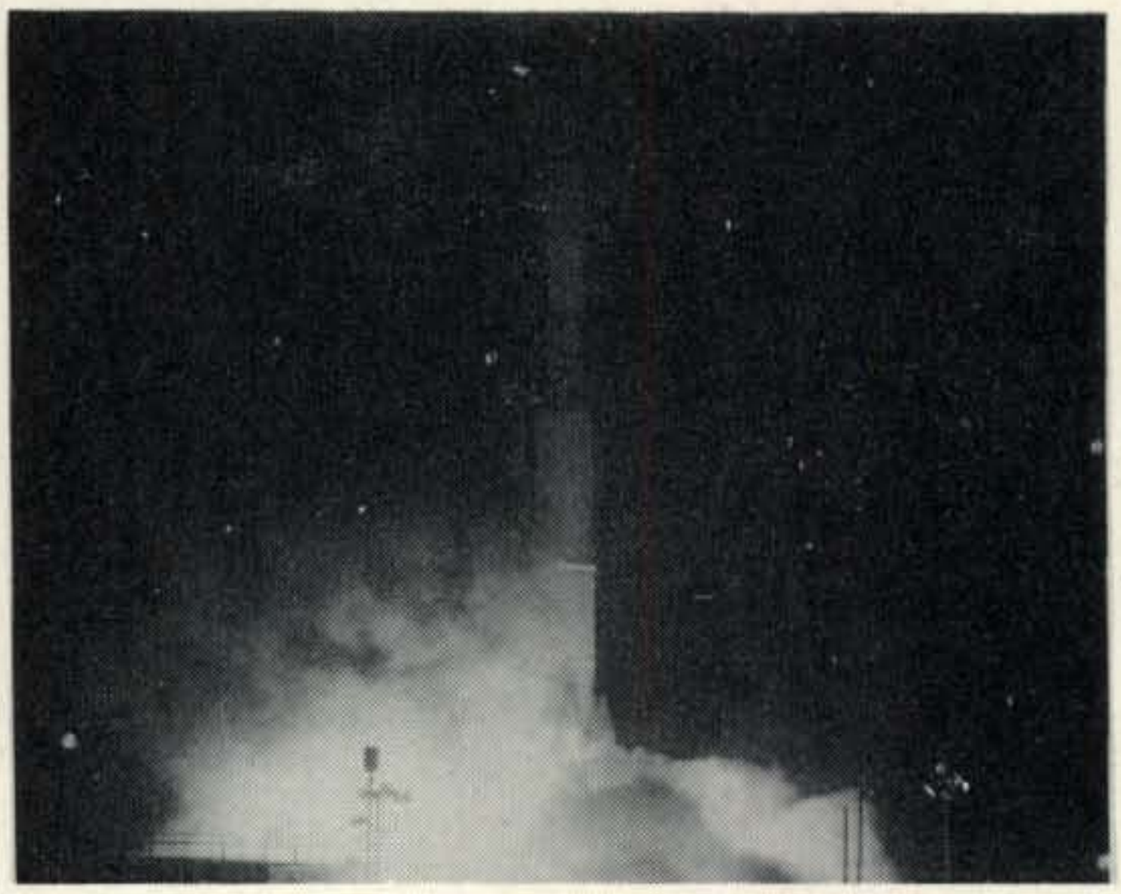
After arrival at the Western Test Range near Lompac, California, the radio amateur satellite is "weighed-in" before being mounted on Delta launch vehicle. *(NASA Photo)*.



BLAST OFF!! At exactly 1131 GMT on January 23, 1970, Delta #76 rises gently off its pad carrying the OSCAR satellite on its way into space. *(NASA Photo)*.

who copied AO-5 on its first orbit, and continued to copy orbit after orbit as the satellite passed in and out of range.

K2SS, K1HTV and WA4JID were among the first to report antipodal propagation or long distance skip reception of the satellite's 10 meter signal. Antipodal propagation is the sudden reappearance of the signal as the satellite passes over a point approximately at the opposite side of the earth from the receiving station. Here's an entry in WA4JID's log which describes skip propagation of the 10 meter signal. His QTH is Plantation, Florida.

"I could hear every 10 meter pass south of 60 degrees south latitude, near the south pole. On orbit 181/182 I could hear the 10 meter signal just about all the way around the world. I heeard it for 95 of the 115 minute orbit, from very faint to fairly strong signal strengths."

WA2KSB was among the few who caught the first successful ground controlled shut-off of the 10 meter transmitter. He reported the signal going out suddnly at exactly 08:16:30 GMT on January 28, during orbit number 61. This was right on the button!

[*Continued on page 87*]

Jan King gently passes satellite to launch technicians who will mount it into Delta's framework. *(NASA Photo)*

Members of the Goddard Radio Club (Greenbelt, Md.), tracking the OSCAR-5 satellite during its early passes.

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IMPROVING THE SX-101A FOR DX PERFORMANCE

BY MAURICE HAUSER,* W7VW

To modify or not to modify has been the amateur's dilemma down through the years. I have always been very conservative in changing a manufacturer's product unless it is a factory recommendation.

The modification of this receiver was prompted by the entry of newer receivers and the completion of DX; "If you can't hear them you can't work them".

The first things that come to mind with a receiver are the signal-to-noise ratio, selectivity, stability, and the a.m. and s.s.b. reception compatibility. Another important thing is the receiver's capability of not overloading on strong signals.

*6077 Shasta Way, Klamath Falls, Ore. 97601.

With my particular receiver, selectivity and stability are very good. Also, there is no overload problem, even with the strongest local stations. However, signal-to-noise ratio has been extremely poor and a.m. reception has left much to be desired. This receiver, otherwise, is rugged and there are many of this type still around and available.

It is the purpose of this article to describe several changes the writer has made to improve this receiver. I would like to say that since making the modification, I would not care to trade this receiver for any one on the market today for use at the home station.

R.F. Modification

First, I replaced the 6DC6 r.f. tube with a frame grid tube, the 6EH7. (Before and after schematics are shown in fig. 1.) As can be seen, very little change was necessary. The screen voltage was lowered and the 1 megohm carbon grid resistor was replaced with a 1 megohm metal-film type for lower noise. The transconductance of the 6EH7 is about 12,500 *gm* with a plate voltage of 200 volts and a screen voltage of 90 volts. This is a little over twice that of the 6DC6. It can be seen that the 6EH7 is one of the best available tubes for use as a gain-controlled r.f. amplifier when the criterion is for the highest *gm*-to *C*gp ratio.

It was found that realignment of the front end was not required after these modifications. The ten meter band showed small change.

Step by step changes are as follows:

1. Remove and label all leads from the 6DC6 socket.
2. Drill out rivets so that socket may be removed.
3. Use socket punch to enlarge hole for new ceramic 9 pin miniature socket.
4. Place new socket in position so that the grid lead connection will be short. (Keyway to the rear as shown in fig. 2.)
5. Drill holes for new socket and install.
6. Remove the control grid wire from the

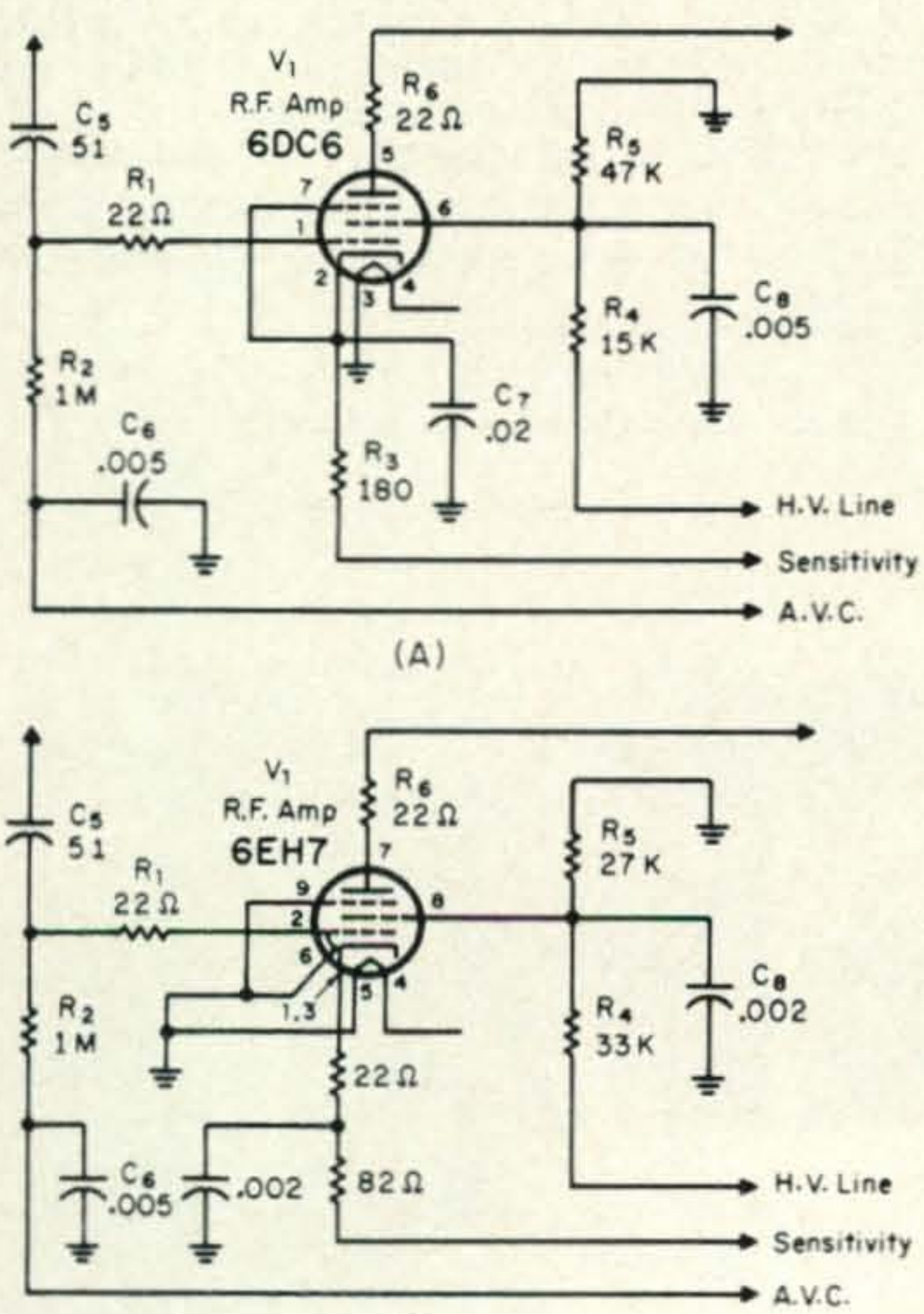

Fig. 1(A)—Original circuit of the SX101A r.f. amplifier. (B) Modified circuit of the r.f. amplifier using the 6EH7, a frame grid type tube.

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tie strip next to the socket. (It will be noted that this grid wire terminal is next to he high voltage terminal lug on strip. In this modification, the grid wire is routed as directly as possible to the 6EH7 socket pin 2.)

7. Replace the original grid resistor, R_2, with a 1 megohm metal-film esistor.

8. Remove original screen bypass capacitor, C_8, from circuit.

9. Replace resistors R_4 and R_5. (See fig. 1; also in manual schematic. This is to lower screen voltage. Two watt resistors are used here.)

10. Install new screen bypass 0.002 disc type capacitor near the socket and common ground. *This is important.*

11. Remove original cathode capacitor, C_7, from circuit.

12. Add 22 ohm, and 82 ohm, 1/2 watt cathode resistors.

13. Bypass the 82 ohm resistor with a 0.002 disc-type capacitor close to the socket. The 22 ohm resistor is left unbypassed.

I.F. Modification

The second modification is made in the 50 kc i.f. section. A 6C4 is added. (Before and after schematics are shown in fig. 3.) A close look at the SX 101 Mark 3 and the SX 101A schematics shows that the 6C4 was not used in the latter.

It was first thought that adding this 6C4 might overload the product detector, but this

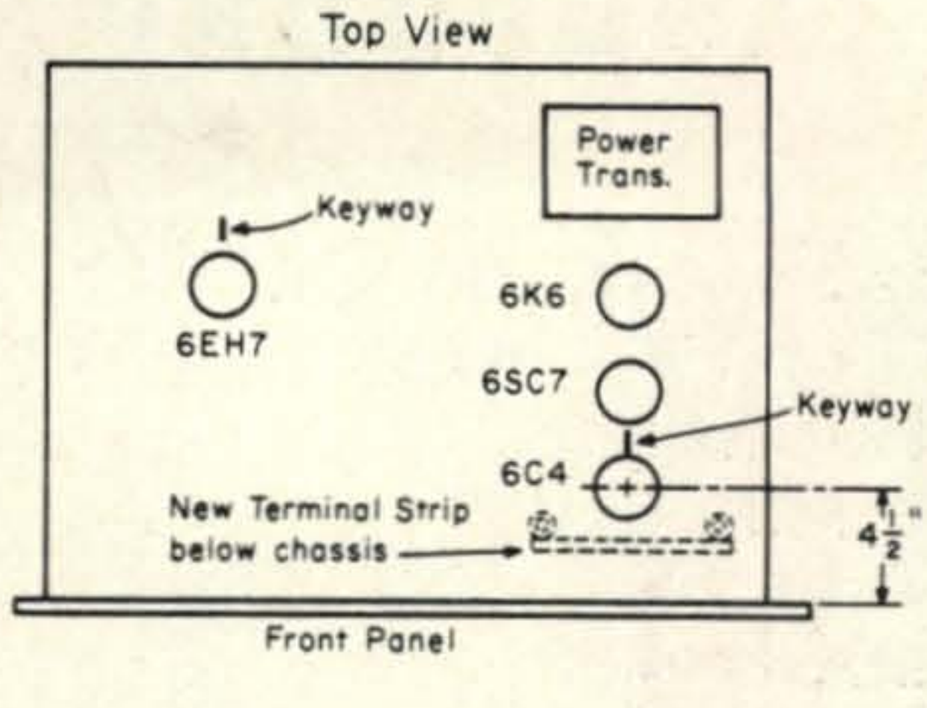

Fig. 2—Top view of the receiver showing the location of the r.f. amplifier (6EH7) and the added 6C4 50 kc i.f. amplifier.

was not the case. There was even some added gain. This addition certainly improved the a.m. reception and gave a little extra punch to s.s.b. reception. Selectivity was not changed in any way and realignment was not required.

Step by step changes are as follows:

1. Determine the point to make pilot hole for socket punch for a miniature 7 pin socket. (Be certain that wiring below is in the clear. Look at the chassis from the top and view the layout for the socket as shown in fig. 2.)

2. Place socket in position with keyway to the rear. (See fig. 2)

3. Drill holes for anchor bolts and install socket.

4. A 7 pin terminal strip (two outside pins

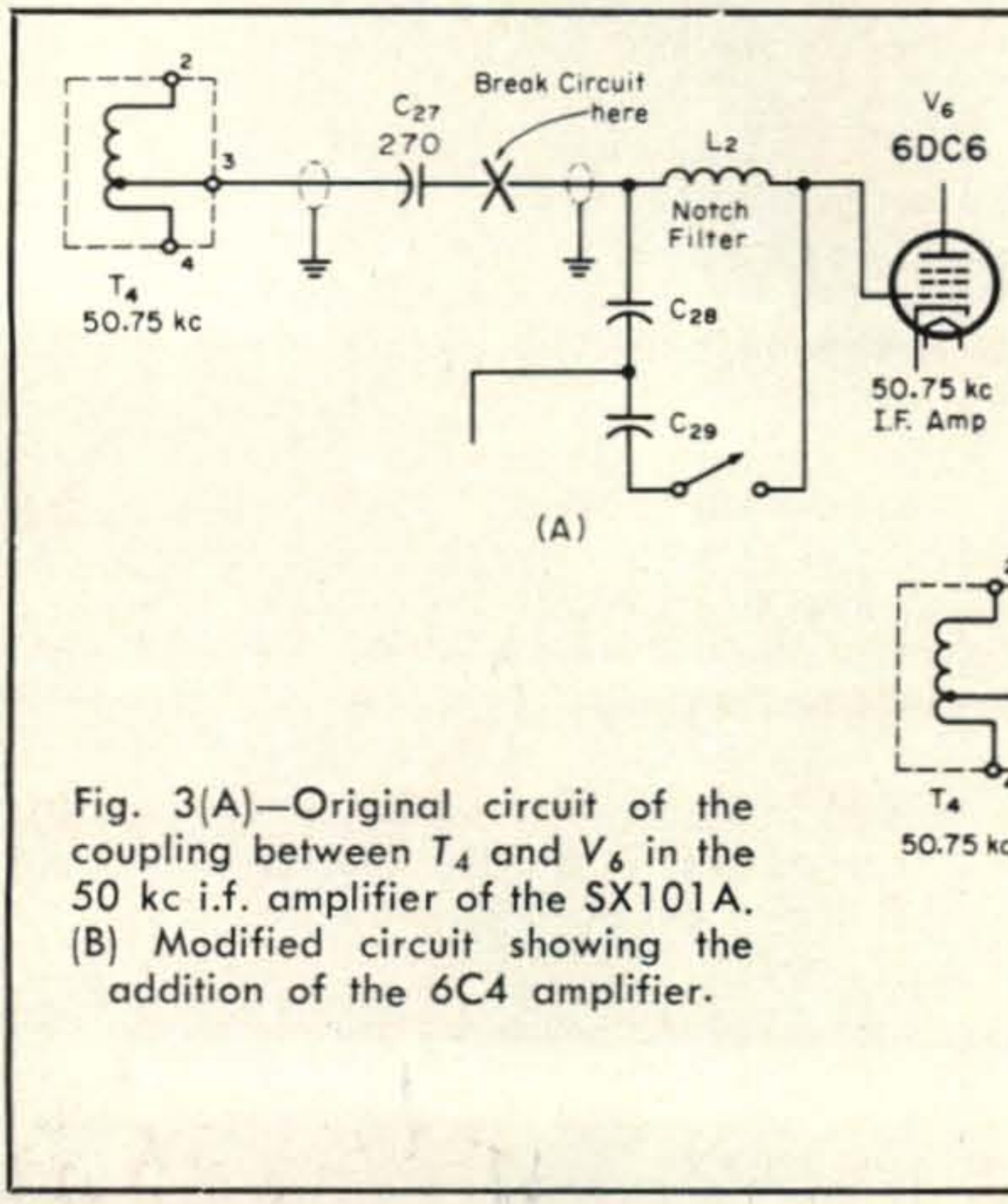

Fig. 3(A)—Original circuit of the coupling between T_4 and V_6 in the 50 kc i.f. amplifier of the SX101A. (B) Modified circuit showing the addition of the 6C4 amplifier.

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grounded) should be installed alongside bottom of socket for the 6C4 as shown in fig. 2.

5. Make use of terminal strip to mount the various components in fig. 3. This is also to terminate the input and output coax. All initial wiring of the 6C4 can be completed and then this section can be wired into the original receiver circuit.

(a) B+ for the 6C4 is connected to pin 4 octal socket 6K6 audio tube.

(b) Filament of 6C4 is connected to pin 8 octal 6SC7 audio and b.f.o. tube.

(c) Locate capacitor C_{27} (SX 101A receiver schematic) and related C_{28} and L_2 notch filter. The circuit is broken at this point. This capacitor will be located on a terminal strip near center of chassis. Small size coax from the i.f. transformer, T_4, is routed to $C27$. Leave capacitor and this lead as they are. (See fig. 3.)

6. Remove small coax from side of C_{27} which is cabled together with other wiring. Re-route this coax to new terminal strip. This will be the output of 6C4.

7. Complete this wiring to the socket itself.

8. Install another piece of small type coax which is to replace the coax just removed from C_{27}, and route this to the new terminal strip. This will be the input of the new 6C4.

9. Complete this wiring to the socket itself.

Testing

All wiring should be double checked for errors. Connect speaker and then receiver can be turned on so that operation can be checked.

Suggested operating practice with this receiver is as follows:

1. Turn R.F. CONTROL to between 5 and 8. In this area, a point will be found where noise will begin to appear on the "S" meter. My own meter reads 1½ "S" units of noise at this position. (I have an extremely noisy location.) With the R.F. CONTROL in this position on 80 meters, the local signals are hitting around 40 db over 9.

2. AUDIO control is generally at position 3 and SELECTIVITY control is at the 3 kc position.

It is a pleasure to operate this receiver and hear the DX on the different bands. Stations are there, and the signal-to-noise ratio is the very best.

This modified receiver has been compared with several other brands of receivers of the latest vintage, and I have yet to see one that can beat it. ■

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DX

BY JOHN A. ATTAWAY,* K4IIF

THE big news this month for all you prefix chasers is the *CQ* World Wide WPX S.S.B. Contest which comes up the weekend of April 11-12. See Frank's CONTEST CALENDAR in the February issue, p. 78, for complete rules.

For last year's contest the Ministry of Communications of Brazil allowed the PY gang to use a special array of prefixes. They could only be used during the contest and haven't been heard since. Included were PU2, PQ2, PR2, PU7, PU4, PT1, PT2, PU1, PS4, PS7, and many, many others. Maybe they will be on again, we don't know. Brazil surprised us last year, who will it be this year? Portugal with the CS and CU series maybe?

Despite the fact that propagation conditions were exceedingly poor for the 1969 contest, many stations racked up impressive prefix totals. For example, single operator stations W3MSK and LAØAD worked 335 and 305 different prefixes during the contest. Multi-operator, single transmitter station G3SSO worked 320, and multi-operator, multi-transmitter station CE6CA worked 340 prefixes. Whether interest is the WPX Honor Roll or just some more certificate endorsements, don't miss this one.

Incidently, a new wrinkle in this year's contest is double QSO points for contacts on 160, 80, and 40 meters. This should pep up activity on the lower bands.

Pacific North West DX Convention

The annual Pacific North West DX Convention will be sponsored this year by the British Columbia DX Club, and will be held in Vancouver, British Columbia on August 1 and 2. All DXers are welcome. Further information can be obtained from the committee chairman, VE7SV.

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

Geneva Diploma

The Geneva Section of USKA (Union Suisse des Amateurs sur Ondes Courtes) has announced the inauguration of the "Diplome de Geneve" for making specified numbers of contacts with amateurs in the Canton of Geneva. Complete rules may be obtained by writing USKA, P.O. Box 524, Geneva 3, Switzerland.

De Extra

De Extra welcomes H. R. Cowling, VE3-WT, of the Canadian DX Association as guest columinist this month. He originally wrote this article for his local club bulletin, and it was subsequently picked up by *Long Skip*, the Canadian DX Association Bulletin.

Country Status by VE3WT

"O.K., you worked 300 countries. So what! What's so difficult about that? Well, its not as easy as you may think. Although there are 321 valid countries on the DXCC list, 4 of them are banned, and for political reasons there are 15 other countries which do not permit amateur operation even by their own people. The breakdown that follows is interesting. Although the status of countries changes from time to time and I may be open for argument in some cases, I think that the following summary is reasonably accurate.

"The first group of 20 countries consists of islands with no inhabitants and no active stations. They are the most difficult to work as the only way they can be activated is by a bonafide DXpedition costing someone a pile of money. In this group are:

Col. John Cody, W4FUM, of Tice, Florida. The Colonel recently passed the 200 mark in s.s.b. countries and seems bound for the Honor Roll.

See page 102 for New Reader Service

Harvey, W2MLO, sent us this nice photo of Anatol Repin, UVØIA, who is QRV from Zone 19. Anatoly is a radio operator for the Russian airline *Aeroflot*. His wife is also an amateur and is requently active from Club Station UAØKIQ, also in Zone 19.

CEØX–San Felix
FO8M–Maria Theresa
HKØ–BajaNuevo
HKØ–Malpelo
HKØ–San Andres
KC4–Navassa
KP6–Palmyra
KS4B–Serrana Bank
PYØ–Trindade
PYØ–St. Peter & Paul Rocks
TI9–Cocos Island
VKØ–Heard Island
VP8–South Sandwich
VQ8–Blenheim Reef
VQ8–Geyser Reef
XF4–Revilla Gigedo
YVØ–Aves Island
1M–Minerva Reef
1S–Spratly Island
3Y–Bouvet Island

"The second most difficult group contains 50 countries which are inhabited and some of which list amateurs. However, at the present time there are no active stations. To work them you must depend on DXpeditions, visitors, or the odd government employee with a station. Many of these countries do not permit amateur operation.

AC3–Sikkim
AC4–Tibet
AC5–Bhutan
BY–China
CEØZ–Juan Fernandez
EAØ–Spanish Guinea
FR7–Europa
FB8–Crozet
FO8–Clipperton
FR7G–Glorioso
HBØ–Liechtenstein
JY–Jordan
KS4–Swan
MP4Q–Qatar
OHØ–Aaland
PYØ–Fernando
ST2–Sudan
SVØ–Dodecanese
TY–Dahomey
TZ–Mali
VKØ–Lord Howe
5H1–Zanzibar
VQ8–Agalega
VQ8–Rodriguez
VQ9–Aldabra
VQ9–Chagos
VQ9–Desroches
VQ9–Farquhar
VR1–British Phoenix
VS9–Aden
VS9–Kamaran
VU–Andaman
VU–Laccadives
XU–Cambodia
XZ2–Burma
YI–Iraq
ZA–Albania
ZK1–Cook Is.
ZK1–Manihiki
ZK2–Niue
ZL–Cambell
Z7–Tokelaus
3V8–Tunisia
3X–Guinea
4W–Yemen
5X5–Uganda
8Z4–Neutral Zone
9A1–San Marino
9K3–Neutral Zone
9X5–Rwanda

"The third group consists of countries inhabited with an average of one semi-active amateur. He may be a native or government official from an other country. These boys usually have a close group of friends or talk to their friends back home. Very few will get involved in a pileup, and most will not accept breakers. This is a frustrating and difficult group of countries to work:

AP–E. Pakistan
AP–W. Pakistan
BV–Formosa
CEØA–Easter Is.
CR3–Port. Guinea
CR4–Cape Verde Is.
CR5–Sao Thome
CR8–Port. Timor
CR9–Macao
C32–Andorra
CT3–Madeira Is.
EA6–Balearic Is.
EA9–Rio de Oro
EA9–Spanish Morocco
FB8–Ansterdam & St. Paul
FB8–Kerguelen Is.
FC–Corsica
FG7–Guadeloupe
FH8–Comoro Is.
FK8–New Caladonia
FL–Fr. Somaliland
FM7–Martinique
FR7–Reunion
FR7–Tromelin
FS7–St. Martin
FW8–Wallis
FY7–Fr.Guiana
HC8–Galapagos
HZ–Saudi Arabia
KH6–Kure Is.
KS6–Am. Samoa
MP4–Trucial Oman
MP4–Muscat & Oman
OY–Faeroes Is.
JT–Mongolia
TJ–Cameroun
TL–Cen. Af. Rep.
TN–Congo Rep.
TR–Gabon Rep.
TT–Chad Rep.
VK4–Willis
VK9–Christmas
VK9–Cocos Is.
VK9–Nauru
VK9–Norfolk
VKØ–Macquarie
VR1–Ocean Is.
VR3–Christmas Is.

The WAZ Program

S.S.B. WAZ

758.....W3UJ
759.....JA1DFQ
760.....HR1KAS
761.....HK3WO
762.....ZE1JE
763.....VE3CTX
764.....VE3BAP

Phone WAZ

435.....K6TXR
436.....W6KG
437.....W9JJB

C.W.—Phone WAZ

2839.....W6DR
2840.....K4TWJ
2841.....F8GB
2842.....YU3PO
2843.....WA4QBX
2844.....W6VD
2845.....DJ4VU
2846.....DL8UP
2847.....DJ7OM
2848.....JA8MS
2849.....K2BW
2850.....5A1TY
2851.....WB2RBG
2852.....W3CRE
2853.....UB5WK
2854.....UT5HP
2855.....UA4KWP
2856.....JAØAWF
2857.....K7AHO
2858.....K8DBW
2859.....DJ1BV

Complete rules and an application blank for WAZ may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

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VR4–Soloman Is.
VR5–Tonga
VR6–Pitcairn
VS5–Brunei
XW8–Laos
XT2–Voltaic
YJ–New Hebrides
ZD9–Tristan de Cunha
ZL–Chatham Is.
ZL–Kermadec Is.
ZS2–Marion Is.
3A–Monaco
3W8–Vietnam
4U–ITU Building
5B4–Cyprus
5T5–Mauritania
5V4–Togo Rep.
7X–Algeria
9H1–Malta
9L1–Sierra Leone
9N1–Nepal
9U5–Burundi
9Q5–Rep. of the Congo

The following countries have 2-5 active stations and present no great problem if you determine their favorite operating times and pay some attention to propagation:

CN8, CR6, CR7, CT2, DU1, ET3, GC, GD, HH, HL, HP, HR, HS, HV, IS1, JX, JW, KB6, KC6(E), KC6(W), KG4, KG6, KG6I, KG6R, KJ6, KM6, KV4, KW6, KX6, MP4B, OD5, OX, PJ, PJ5M, PZ1, SU, SV, TA, TF, TU, VK9-(Papua), VK9(T.N.G.), VP1, VP2(all), VP5, VP7, VP8's, VP9, VQ8M, VQ8S, VR2, 9V1, VS6, YA, YK, YN, YS, ZB2, ZD3, ZD5, ZD7, ZD8, ZE, ZF1, ZD3, A2, 4S7, 5A, 5H3, 5N2, 5R8, 5U7, 5W1, 5Z4, 6O1, 6W8, 6Y5, 7P8, 7Q7, YB, 8P, 8R, 9G1, 9J, 9K2, 9M2, 9M6, 9Y4, EP, FP8.

"The remaining countries have more than 5 active amateurs and should be on your list of first 100 worked:

CE, CO, CP, CT1, CX, DL, EA, EI, EL, F, G, GI, GM, GW, HA, HB, HC, HI, HK, I, JA, W/K, KH6, KL7, KP4, KR6, KZ5, LA, LU, LX, LZ, OA, OE, OH, OK, ON, OZ, PA, PY, SM, SP, TG, TI, U, VE/VO, VK, VU, XE, YO, YU, YV, ZL, ZP, ZS, 4X.

"This gives some idea how difficult it is to work 300 countries even in a lifetime, and explains why we DXers get so excited about expeditions to places in groups 1 and 2.

Gud DXing es 73, Howard, VE3WT"

New and Rare Prefixes

BY9–BY9FZ has been reported active on the low end of 14 mc c.w., but he hasn't been working US stations.

IR –This new prefix is being used by Italian amateurs in the city of Rome during 1970, to celebrate the first Centenary of Rome as the capital of Italy. I1IJ is using IRØIJ, I1JX is IRØJX, etc.

PA9–Foreign amateurs operating in the Netherlands under reciprocal agreements are assigned PA9 calls. John, PA9PRU, has been worked on 20 meter s.s.b.

UK–As mentioned last month, Soviet club stations are now using UK calls. Some further examples are UM8KAA changed to UK8-MAA, and UB5KAW changed to UK5BAW.

The WPX Program

We are very sorry to report that due to urgent professional commitments Howard Kelley, K4DSN, has relinquished his post as WPX Manager. Howard has done a great job with the award, and all prefix chasers owe him a debt of gratitude.

Fortunately we have succeeded in finding a capable replacement so that WPX should be able to continue without any loss of time. The new management is Jerry Hagen, WA6GLD. Future WPX correspondence should be directed to Jerry at: 5031 Arroway Ave., Covina, California 91723.

S.S.B. WPX

484.....WØYDB
485.....WB6KGG
486.....UA9BE
487.....WAØPVW

C.W. WPX

988.....SP6BAA
994.....G3GJW
995.....K8DBW
996.....W6CLM
997.....UN1KAA
998.....UF6KPE
999.....UA4KWP
1000.....W1WY
1001.....UW3AU
1002.....UA6BV

Mixed WPX

223.....KØUXV
224.....W6QFU
225.....K8HZU
226.....K4DSN
227.....WA3HGV
228.....K4BBK

Phone WPX

186.....EA1IO
187.....DK2BL

Endorsements

S.S.B.: YV4QG–450, UA9BE–350, TF2-WKP–350, WØYDB–300, and DJ1YU–250.
C.W.: DL1QT–700, WØAUB–700, DJ7CX–600, K4IEX–600, OK2DB–550, K8DBW–400, UA3GO–400, K4BBK–350, K6TZX–350, UA6BV–350, and UF6KPE–350.
Mixed: KØBLT–700, DJ7CX–650, W3PVZ–650, WA6GLD–650, K8HZU–450, and WA-3HGV–450.
Phone: W1PCD–400.
80 Meters: DJ7CX.
40 Meters: ZL3GQ.
20 Meters: LA9TG, UA3GO, UA6BV, and WA3HGV.
15 Meters: DJ7CX and ZL3GO.
10 Meters: CX2CN.
Africa. DJ7CX.
Asia: K4DSN.
North America: VE3GCO and WA3HGV.
Europe: K4BBK, SP6BAA, UA6BV, UA9-BE and VE3GCO.
Oceania: ZL3GQ.
South America: VE3GCO.

The WPNX Program

17––WN4LKC

YT2–YT2RBO in Yugoslavia was worked on 20 meter s.s.b., 28550 kc at 1347 GMT.

ZA–Frank, DL7FT, hopes to operate from

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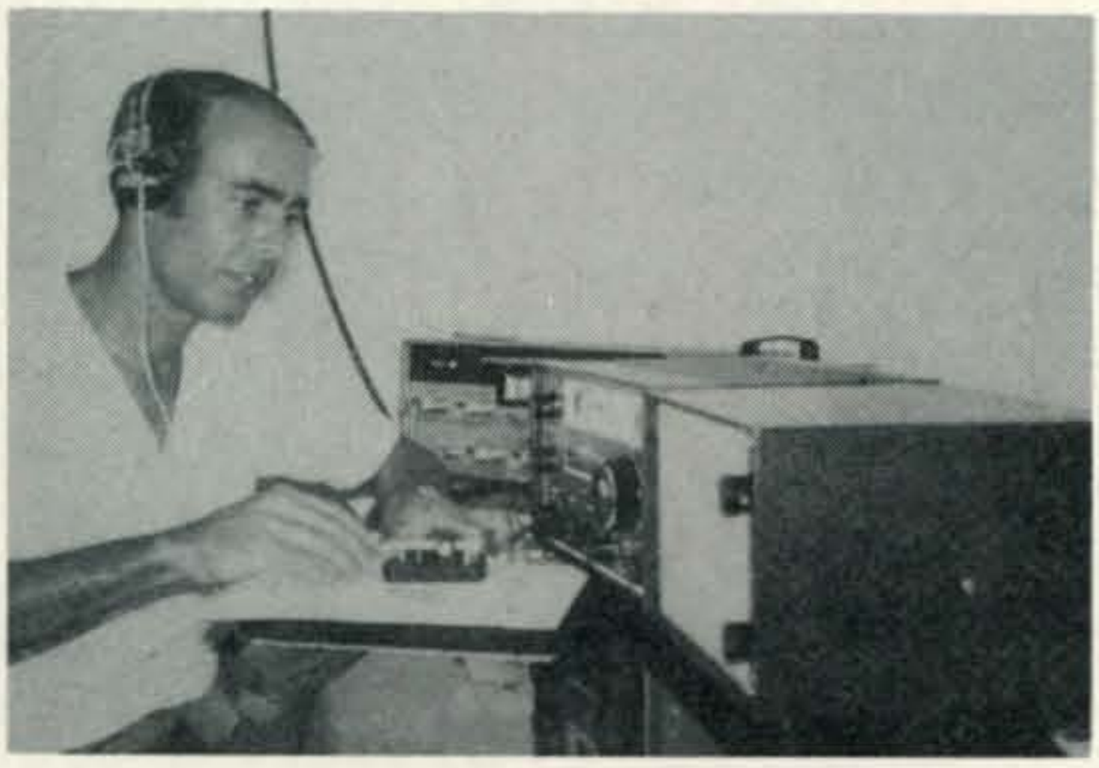

Gerard Procida, FG7TG. This OM is very active on 15 and 20 meter c.w. and occasionally gets down on 7 mc c.w. as well. His QSL Manager is Bob, W5OB, 2609 Halsey Ave., New Orleans, La. 70114. *(Photo courtesy W5OB).*

Albania sometime during the interval May 15-22, 1970. Plans are to transmit around 14195 and listen above 14250. Watch your favorite DX bulletin for later information on this important DXpedition.

3B—It has been reported that the old VQ8 islands will be allotted individual prefixes as follows: 3B6—Agalega, 3B7—St. Brandon, 3B8—Mauritius,, and 3B9—Rodriguez.

The S.S.B. DX Award Program

As the award files are being transmitted from Louise Rippe, W8HDB, to Jerry Hagen, WA6GLD, there will be no S.S.B. DX Honor Roll or certificate authorizations this month. Hopefully these will be back on schedule next month.

Amateur Radio in Japan

Information for this article was sent to us by the Japan Amateur Radio League, P.O. Box 377, Tokyo Central, Tokyo, Japan.

"The first transmissions by Japanese amateurs were made in 1924, and in 1926 the Japan Amateur Radio League (JARL) was established. The operations of the League were interrupted by World War II, but activity was resumed in 1952 when 30 Japanese hams rejoined the world circle of radio amateurs.

"The number of hams in Japan increased slowly until 1958 when two new license classes, the Telephone and Telegraph classes, were introduced. Since that time there has been a rapid growth in the ham population, and in 1968 there were 135,000 licensed operators and about 65,000 amateur radio stations in Japan. The system of certification of station equipment by JARL as a means of obtaining the station license, and of JARL training courses for obtaining the operator license, have provided a significant boost to the developement of amateur radio in Japan.

License Requirements & Power Limits

"There are 4 classes of radio amateur operator licenses in Japan, namely First Class, Second Class, Telephone Class, and Telegraph Class. The power limits for each class are based on 'antenna power.' First Class licensees are allowed 500 watts, Second Class 100 watts, and 10 watts for Telephone and Telegraph Classes. Telephone and Telegraph Class operators are not allowed in the 20 meter band.

"Persons applying for First and Second Class licenses must take the state examination prescribed by the Ministry of Posts and Telecommunications. Persons applying for the Telephone and Telegraph Class licenses may also take a state examination, however they have the option of following a simpler route. This is the successful completion of the JARL training courses. These courses may be held at any time or place if certain conditions are met, whereas the state exams are held only twice a year. In addition, state inspection of equipment used by Telephone and Telegraph Class stations is not necessary after construtution when equipment certified by JARL is used.

"In 1966, 95 JARL training courses were held, and 5661 out of 6631 who attended were graduated. In 1967, 196 courses were held and 11,712 new licenses were granted to 13,416 who attended.

License Fees

"Fees are collected as follows: First Class Operator examination—$1.10; Second Class examination—80¢; Telephone and Telegraph examinations—50¢; station license for 50-500 watts antenna power—$4.20; station license for 10-50 watts antenna power—$2.80; station license for 10 watts or less antenna power—$1.40; and re-issuance of station license—50¢.

Phoenomenal Growth

"The following figures illustrate the rapid increase in Japanese amateur population during the past decade. In 1960 there were 1,546 First Class operators, 1,750 Second Class, 16,136 Telephone Class, and 645 Telegraph Class for a total of 20,077. As of Nov. 30,

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1967 there were 2,164 First Class, 7,488 Second Class, 9,910 Telegraph Class, and 102,-639 Telephone Class for a total of 122,201.

"In 1958 the age of Japanese amateurs were as follows: 15 years– 0.5%, 16 to 20 years–21%, 21 to 25–39%, 26 to 30–20%, 31 to 35–11%, 36 to 40–4%, 41 to 45–2%, 46 to 50–0.7%, and over 50–2%. Of those applying for licenses 5 years later in 1963 the breakdown was as follows: 15 years–14%, 16 to 20–56%, 21 to 25–18%, 26 to 30–6.2%, 31 to 35–3%, 36 to 40–2%, 41 to 45 –0.4%, 46 to 50–0.3%, and over 50–0.1%. High School students made up 62.5% of the applicants, and University students 9%.

"RL Stations"

"JARL maintains 10 RL stations, one in each call area. These are JA1RL–JAØRL. JA1RL transmits beacon signals every Monday to enable amateurs to check the edge of the bands. In emergency situations, JA1RL and the other "RL" stations act as net controls for the entire country and for each district respectively.

League Awards & Contests

"The following awards are offered by JARL with the object of recognizing proficiency and achievement on the part of hams and s.w.l.s throughout the world. All claims must be made by submission of necessary lists, IRC's, and QSLs to the JARL Awards Manager.

AJD (All Japan Districts)–Requires QSOs with JA/JH stations in the 10 different call areas. Certificate fee is 10 IRCs.

WAJA (Worked all Japan Perfectures)–Requires QSOs with 46 different prefectures shown in a list obtainable from the Award's Manager. The fee is 10 IRCs.

JCC (Japan Century Cities)–Requires QSOs with 100 JA/JH stations in different cities. JCC–200,–300,–400,–and–500 are also issued as separate awards. A list of cities may be obtained from JARL for 3 IRCs. The certificate fee is 10 IRCs.

"JARL sponsors one of the world's foremost DX contests, the All Asian DX Contest, held in August of each year. The purpose of this contest is to increase the activity of radio amateurs in Asia, and to establish as many contacts as possible between Asian and non-Asian stations. Complete rules for this contest are published in the CONTEST CALENDAR Column of *CQ* each year."

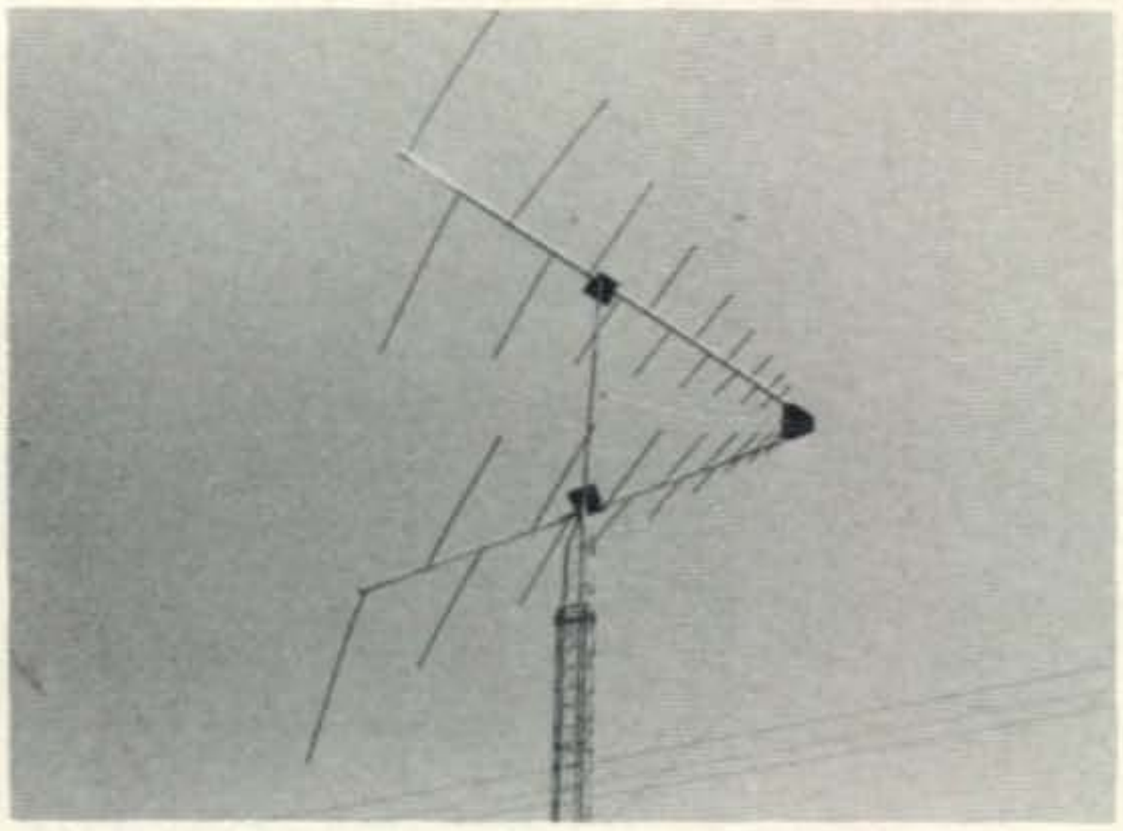
On the left is Bob Snyder, LAØAD, always a top competitor in the CQ Worldwide DX Contests. The gentleman on the right is Duane, 9K2BV, who visited Bob in Norway on his last vacation. Bet that Norway summer is quite a change from Kuwait. *(Photo via LAØAD).*

QSL Information

AC3PT–QSL to W1FLS for contacts made with Fred during his visit. The address is Dr. Liberman, Brown University Music Department, P.O. Box 703, Providence, R.I.

AX9KY–Via VK2SG
C31AH–To DL7FT
CT2AK–c/o VE7BWG
EL2BE–Via WB8ABN
EL8C–To W3BBY, RD2, Hanover, Pa. 17331.
EL9B–c/o W8WRP
EP2DA–Via W2MXB
FB8ZZ–To F8US
FG7TD–c/o WB8ABN
FG7TG–Via W4OB
FM7WF–W, K, VE QSL to W4OPM.
FY7YQ–c/o WA4GQM.
HC8FN–Via WA2WUV
HI8XEX–To VE3DLC
HL9UU–c/o W2SRQ

[*Continued on page 88*]



The QTH and antenna system of Junior Torres de Castro, PY2BJO, in Sao Paulo, Brazil. The large beam works on 14-144 mc (20-2 meters) while the small beam in the center just above the rooftop works on 50-500 mc.

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Propagation

BY GEORGE JACOBS.* W3ASK

FIFTEEN meters is expected to be the optimum DX band during April from shortly after sunrise through the late afternoon and early evening hours. This honor should go to 20 meters during the hours of darkness and the sunrise period.

Exceptionally good openings with strong signal levels, are forecast to most areas of the world on 15 meters during the daylight hours and into the early evening. On some circuits, primarily to southern and tropical regions, the band should also remain open well into the hours of darkness.

With increased hours of daylight, 20 meters is expected to remain open to one area of the world or another, practically around-the-clock. DX conditions should peak during the sunrise period, and again during the late afternoon and evening hours, when excellent openings are forecast to most areas of the world. Exceptionally high signal levels are expected on openings during the hours of darkness.

Fewer DX openings are forecast for 10 meters, but this is normal for this time of year. A few good, openings, however, still should be possible during the daylight hours, especially on paths to southern and tropical areas.

With shorter hours of darkness, there will be less time for 40, 80 and 160 meter DX openings during April. Good DX propagation conditions, however, are predicted for the 40 meter band during the hours of darkness and the sunrise periods, with openings possible to many areas of the world. Some fairly good 80 meter DX openings are also expected during the hours of darkness and the sunrise period, and there is also a chance for an occasional DX opening on 160 meters during this same time period.

Thunder storm activity increases considerably in the northern hemisphere during April, and this should mean higher static levels, especially on the 40, 80 and 160 meter bands.

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

LAST MINUTE FORECAST

April 1 through May 15, 1970

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: April 5, 12, 16-17, 27. May 2, 13-14.			B-C	C
Normal: April 1-4, 6-9, 11, 13, 15, 18-20, 22, 25-26, 28-30. May 1, 3-6, 8-10, 12, 15.	A-B	B-C	C-D	D-E
Below Normal: April 10, 14, 21, 23-24. May 7, 11.	C	D	D	E
Disturbed: None	D	E	E	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 8 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 parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain 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—The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid from April 15, 1970 through June 15, 1970 and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerece, Boulder, Colorado.

DX propagation forecasts for each of the amateur bands from 10 through 160 meters for the period April 15 through June 15, 1970 appear in the *DX Charts* on the following pages. For predictions of short-skip openings between distances of 50 and 2400 miles, refer to the *Short-Skip Charts*, which appeared in last month's column.

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Sunspot Cycle

Solar activity continues to decline, but at a relatively slow pace. The Swiss Federal Solar Observatory at Zurich reports a mean monthly sunspot number of 115 for January, 1970. This results in a 12-month smoothed sunspot number of 102 centered on July, 1969. A smoother sunspot number of 93 is forecast for April, 1970. This is approximately the same level of solar activity that was observed last April, 1967.

APRIL 15-JUNE 15, 1970

TIME ZONE: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	11-16 (1)	08-10 (1) 10-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	08-12 (2) 12-15 (3) 15-19 (4) 19-21 (3) 21-00 (2) 00-04 (1) 04-05 (2) 05-08 (3)	18-20 (1) 20-21 (2) 21-23 (3) 23-01 (2) 01-03 (1) 20-22 (1)* 22-23 (2)* 23-01 (1)*
Northern Europe & European USSR	*Nil*	09-11 (1) 11-15 (2) 15-17 (1)	05-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-18 (2) 18-20 (1) 20-23 (2) 23-05 (1)	18-19 (1) 19-23 (2) 23-01 (1)* 19-23 (1)*
Eartern Mediter-ranean & Middle	*Nil*	09-12 (1) 12-15 (2) 15-17 (3) 17-18 (1)	11-13 (1) 13-15 (2) 15-19 (3) 19-21 (2) 21-23 (3) 23-01 (2) 01-05 (1) 05-07 (2) 07-09 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
West & Central Africa	10-13 (1) 13-17 (2) 17-18 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-13 (2) 13-14 (3) 14-17 (4) 17-19 (3) 19-21 (2) 21-22 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-05 (1) 05-07 (2)	18-20 (1) 20-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 21-02 (1)*
East Africa	13-17 (1)	07-10 (1) 10-13 (2) 13-17 (3) 17-18 (2) 18-19 (1)	04-05 (1) 05-07 (2) 07-08 (1) 13-15 (1) 15-17 (2) 17-21 (3) 21-23 (2) 23-01 (1)	19-20 (1) 20-23 (2) 23-01 (1) 20-22 (1)*
South Africa	09-10 (1) 10-12 (2) 12-13 (1)	00-01 (1) 01-02 (2) 02-03 (1) 07-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-16 (1)	12-14 (1) 14-16 (2) 16-17 (1) 23-00 (1) 00-03 (3) 03-05 (2) 05-07 (1)	19-20 (1) 20-23 (2) 23-01 (1) 21-00 (1)*
Central & South Asia	*Nil*	08-10 (1) 18-20 (1) 18-20 (1)	05-06 (1) 06-08 (2) 06-08 (2) 08-10 (1) 17-19 (1) 19-21 (2) 21-23 (1)	18-20 (1)
Southeast Asia	*Nil*	07-10 (1) 17-18 (1) 18-20 (2) 20-22 (1)	05-06 (1) 06-08 (2) 08-10 (1) 16-17 (1) 17-19 (2) 19-21 (1)	*Nil*
Far East	17-19 (1)	08-10 (1) 16-17 (1) 17-19 (2) 19-21 (1)	03-05 (1) 05-06 (2) 06-08 (3) 08-09 (2) 09-10 (1) 17-19 (1)	05-07 (1)
South Pacific & New Zealand	14-16 (1) 16-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-15 (1) 15-18 (2) 18-21 (3) 21-23 (2) 23-00 (1)	09-11 (2) 11-20 (1) 20-21 (2) 21-22 (3) 22-00 (4) 00-04 (3) 04-07 (2) 07-09 (3)	00-02 (1) 02-02 (2) 02-04 (3) 04-06 (2) 06-07 (1) 02-06 (1)*
Austral-asia	17-20 (1)	08-10 (1) 16-18 (1) 18-21 (2) 21-23 (1)	14-15 (1) 15-17 (2) 17-22 (1) 22-00 (2) 00-02 (3) 02-06 (2) 06-08 (3) 08-09 (2) 09-10 (1)	03-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Northern & Central South America	10-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	06-07 (1) 07-78 (2) 08-12 (3) 12-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	03-05 (2) 05-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-23 (4) 23-02 (3) 02-03 (2)	18-19 (1) 19-20 (2) 20-04 (3) 04-06 (2) 06-07 (1) 20-01 (1)* 01-03 (2)* 03-05 (1)*
Brazil, Argentina, Chile & Uruguay	09-11 (1) 11-14 (2) 14-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-15 (2) 15-16 (3) 16-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	15-16 (1) 16-17 (2) 17-18 (3) 18-22 (4) 22-00 (3) 00-02 (2) 02-05 (1) 05-07 (2) 07-09 (1)	20-21 (1) 21-03 (2) 03-06 (1) 23-04 (1)*
McMurdo Sound, Antarctica	15-17 (1)	08-10 (1) 13-15 (1) 15-18 (2) 18-20 (1)	16-18 (1) 18-20 (2) 20-01 (3) 01-06 (2) 06-08 (1)	19-00 (1) 00-04 (2) 04-05 (1)

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

CENTRAL USA TO:

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

*Predicted times of 80 meter openings. Openinngs 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.

See page 102 for New Reader Service

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

If you enter the **CQ WW WPX SSB Contest** on April 11 and 12th, don't forget to send your logs in to the Contest Committee. Mailing deadline is May 15th.

TIME ZONE: PST (24-Hour Time)

WESTERN USA TO:

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

[*Continued on page 86*]

See page 102 for New Reader Service

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE April, "Story of The Month" about Don Birch, K7NEQ as written by his Wife, Virginia Birch, WA7BAB, in a minute.

January saw an all time high in those qualifying for the All 3079 Counties Plaque; Ben Harris, K5DRF; Bertha Eggert, WA4BMC, 1st to a XL/XYL, 1st All One Band, 1st All One Mode, (All 14 mc A3A); Bud Block, K4AUL; and Mike Lintner, WA3HGV, All 14 mc A3A.

USA-CA-3000 awards, endorsed All 14 mc A3A went to Mike Lintner, WA3GHV; Hank Freiberg, W5ULN; Bertha Eggert, WA4-BMC; and Bob Smolenski, W2OST. "Willie" Longwell, WA7IRD received a Mixed USA-CA-3000 award as did Fred Woodley, VE3-9301 and this is the 1st to an s.w.l., his nearest competitor has but 1500.

Bud Blotch, K4AUL was issued USA-CA-3000, 2500, 2000, 1500 and 1000 awards.

Bob Potter, K9WSL qualified for a USA-CA-2500 award.

Ed McAuslan, W7VJI won a USA-CA-2000 award.

Mixed USA-CA-500 awards went to Phil Metz, W3DAW; Lars Forsberg, SMØBDS; and Jon Zabel, W7WMY.

Sam Cowan, WA4LFL was issued a USA-CA-500 award endorsed All Fone; and John Gillingham, WA8YPZ received a USA-CA-500 award endorsed All A-1.

Donald E. Birch, K7NEQ

Don now has over 3,000 counties. What is needed, besides perserverence, to come so close to the goal? He offers a few prerequisites. You must have: a taste for cold meals ("He's in the county now just looking for a place to pull off the road."); two independently trained ears (one tuned in for polite conversation with your wife, while at the same time the other is tuned in to the receiver); an ample supply of pencils, or other objects of your choice, to bear the brunt of mounting frustrations (after waiting three hours for a desperately needed county, the mobile arrives and the band collapses); friends who are not insulted when you excuse yourself in the middle of a profound dissertation and run out to catch a rare one; a family that can lead independent lives (sustained by the fact that it's only temporary—4 or 5 years); and most of all, a great bunch of guys that are as addicted as you.

FLASH

New Special Honor Roll
All 3079 Counties!

#18—Ben T. Harris, Jr., K5DRF 1-16-70.
#19—Bertha F. Eggert, WA4BMC 1-21-70. (1st to XL/XYL—1st All 14 mc A3A) (See story/foto *CQ* May 1967)
#20—David H. Block, K4AUL—1-22-70. (See story/foto *CQ* August 1970)
#21—Michael A. Lintner, WA3HGV 1-30-70. (All 14 mc A3A) (See story/foto *CQ* July 1970)

Don Birch, K7NEQ in his shack.

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

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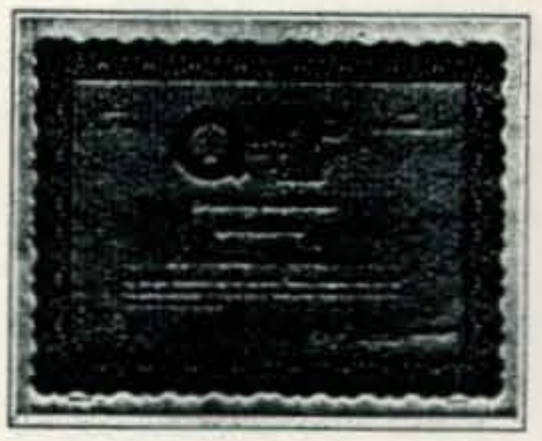
USA-CA HONOR ROLL

3000		2500		1000	
WA7IRD	35	K9WSL	64	K4AUL	189
VE3-9301	36	K4AUL	65	**500**	
WA3GHV	37	**2000**		W3DAW	763
W5ULN	38	W7VJI	91	SM0BDS	764
WA4BMC	39	K4AUL	92	WA4LFL	765
K4AUL	40	**1500**		W7WMY	766
W2OST	41	K4AUL	127	WA8YPZ	767



QRP-25 Certificate

For Don, hamming all started in east-central Indiana about 20 years ago when he discovered the miracle of tin cans and string stretched from tree to tree. One thing led to another and in 1957, at 17, he received the call K9ESC. Like electrons to protons, he was attracted to DXing, but 5 watts and a long wire was like racing Francis the talking mule against Seabiscuit. The only time he had a chance to win was when the Seabiscuits were elsewhere. Nevertheless the hunting instinct was deep-seated.

Ten years, the air force many rigs, a wife and two children later, he found himself settled on five acres in the middle of the Arizona-Sonora desert with the call K7NEQ (*N*ever *E*ver *Q*uiet according to his XYL). During every spare minute away from his job working on microwave radios for AT&T, he delighted in "growing" antennas of all shapes and sizes (from tinker toys for 1296 mc to 1.8 mc monstrosities). He very cleverly indoctrinated his wife and she became a ham (WA7BAB). This was an absolute necessity since all new equipment could then be classified "His *and* Hers".

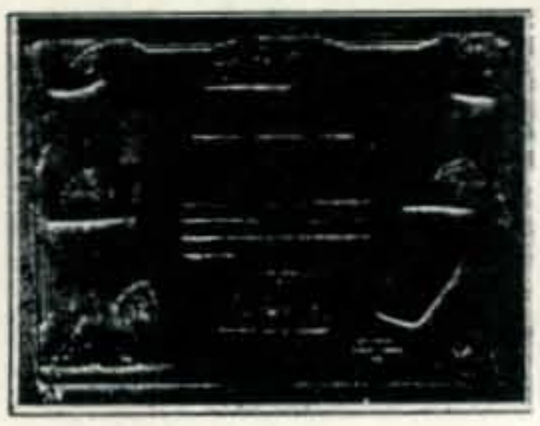
With the purchase of a TR-3, a Bandit 2000, an 80 foot tower and a 4 element quad, the pursuit was on again. He joined the battle of the 1966 World Wide DX Contest and survived as first place winner in the seventh call district.

After getting 265 countries confirmed, the only problem was how to occupy the hours when there was no new DX coming in. Then one day (that fateful day) on 20 meters, HARK!, a pileup. That inherent hunting instinct surfaced once more. DX?? No!! Hello COUNTY HUNTERS, goodby DX.

His curiosity sufficiently aroused, he began rummaging through years of dusty QSL cards. Many elaborate charts, lists, graphs, and other forms of record keeping were compiled only to discover he had less than 500 counties. At that stage it's easy to get new ones by checking into the net daily, and entering the various state QSO parties. Again Don came out on top in the seventh call district in several QSO parties including Illinois and New Jersey. He won't give up now until that last precious 3,079th county is confirmed. His first loves are the beloved mobiles and all the other regulars on the Independent County Hunter's Net (14.336)

Would he do it again? He says, probably not. His wife says probably! Signed, Virginia Birch, WA7BAB.

Our records show that Don waited until September 17, 1969 to apply and received USA-CA-500—#744; 1000—#175; 1500—#110; 2000—#79; these all endorsed All 14 mc A3A. On the same date USA-CA-2500—#56 endorsed All 14 mc and USA-CA-3000 #27, endorsed mixed.



Country Cousins Award

Awards

Country Cousins Award: The Country Cousins Network, a large membership of amateurs organized to help and service mankind, offer this award for working 10 Country Cousins. The NET meets nightly on 3.985 at 0330 GMT during the summer and at 0430 GMT during the winter months. Send GCR list of the 10 QSOs and one 6¢ stamp to: Gregory Young, WA9WVJ, 7527 So. Morgan, Chicago, Illinois 60620. The Country Cousins President is James H. Tusov, WA9-LFR and the Secretary is Arthur Colby, W9EVG.

QRP ARCI: The QRP Amateur Radio Club International has an extensive awards program. Their main object is to demonstrate that the use of limited power (100 watts or less) can create less QRM, but one can still enjoy the hobby and have complete QSOs. Five awards are issued and the cost of each is $1.00 or 10 IRCs, but they are half-price to

[*Continued on page 99*]

See page 102 for New Reader Service

VHF TODAY

BY ALLEN KATZ,* K2UYH

JUST how long can a yagi be made before it becomes inefficient? This question has been tossed around the v.h.f. bands for more years than I can remember. Despite the publication of numerous studies, the arguments still go on and the myth of the "long yagi" persists.

Some months ago we discussed antennas from the point of view of "aperture theory".[1] (An understanding of this theory can be an invaluable aid in comparing the merits of different types of v.h.f. antennas.) At that time we concluded that a "single" yagi offered the most gain for the least physical size. This conclusion, however, was based on the premis of an "efficiently" working yagi. We particularly stressed the fact that as the length of a yagi is increased, its efficiency decreases, and that a point is reached where it does not pay to increase the length of a yagi anymore. To obtain more gain you are better off going to an array of yagis (despite their longer size.)

In fig. 1 we have plotted maximum "practical" yagi gain versus boom length in wave lengths on the lower scale and boom length in feet at 144 mc on the upper scale. The curve of fig. 1 is based upon data from a study conducted at the Air Force Cambridge Research Center.[2] In fig. 2 we have plotted yagi efficiency versus boom length in feet at 144 mc. These efficiency figures were calculated from the ratio of maximum practical yagi gain (fig. 1) to the maximum theoretical yagi gain as estimated from aperature theory. From these curves you should be able to make a decision as to how short you want to cut your yagi before you start stacking.

Before we leave the topic of yagis all together, let me pass on the following yagi facts: there is no one "best" yagi design. There are many combinations of director length, diameter and spacing which will yield maximum gain for a given yagi length. Optimum director dimensions are virtually independent of the feeder-reflector combination used (reflector spacing of about .25 λ is best Maximum gain can be obtained for designs with all directors of the same length and spacing. In general the smaller the director spacing, the shorter the director length. When using wide director spacing (greater than .3 λ) the first director should be close spaced to the driven element (about .1 λ). The longer the yagi the more critical the dimensions. For a yagi lenth of 6 λ an error in the director lenght of .02 λ (about 3/4 of an inch at 144

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

[1]VHF Today, *CQ*, May, 1968.

[2]VHF Today, *CQ*, Sept., 1968.

[3]Ehrenspeck and Poehler, "A New Method for Obtaining Maximum Gain from Yagi Antennas" IRE Trans. on Antennas and Propagation, pp 379-386, Oct., 1959.

A 14 foot single 2 meter yagi atop sixteen 3½' 432 mc yagis at K2UYH. These antennas are topping a 100 foot tower.

See page 102 for New Reader Service

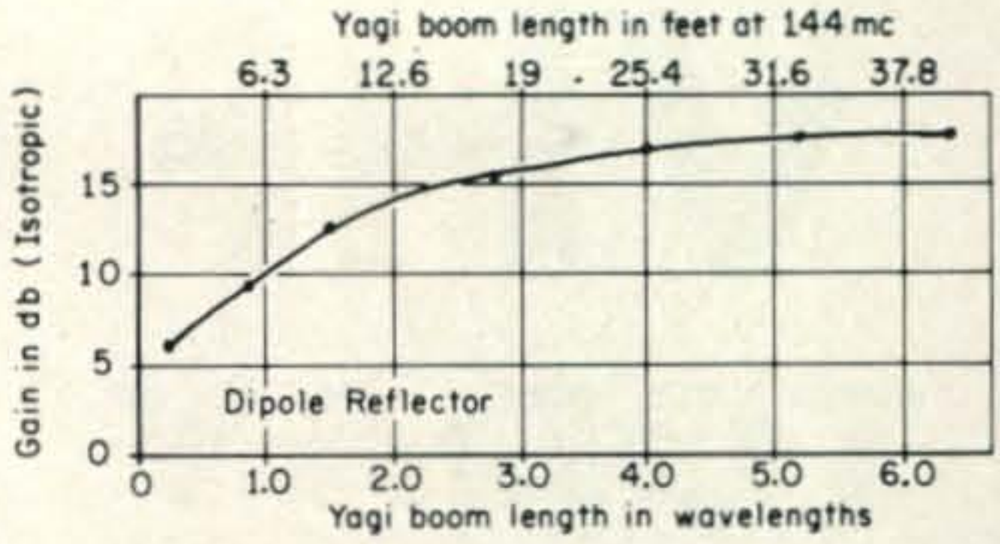


Fig. 1—The maximum practical gain of a yagi antenna.

mc) can cost you more than a db. Incidently. yagis will work at any frequency, even 10,000 mc, but do those director dimensions get critical?

Transistors

Judging by the mail we have received, there is much interest in the broadband transistor amplifier we described in December. Most of this mail was concerned with the availability of the transistors used in the amplifier. As we mention in the description, the type of transistor used in the circuit is not critical. For broadband operation through 432 mc the f_T of the transistors used should be somewhat in excess of 1000 mc. We used KMC 5000 series transistors in this amplifier. KMC transistors are not available through normal distributors, but have been available as a courtesy to hams in small lots at reduced prices. Distribution to hams was disrupted by the untimely passing of W2MRK. These transistors are again available now through Bill Ashby, K2TKN, Box 332, Plukemin, N.J. 07978. Low noise transistors for 432 and 144 mc can be obtained for 5 dollars and for 1296 mc for 10 dollars. Bill asks that you indicate your application along with your request.

As for other transistor types, we must admit we have been a bit spoiled by the use

[*Continued on page 89*]

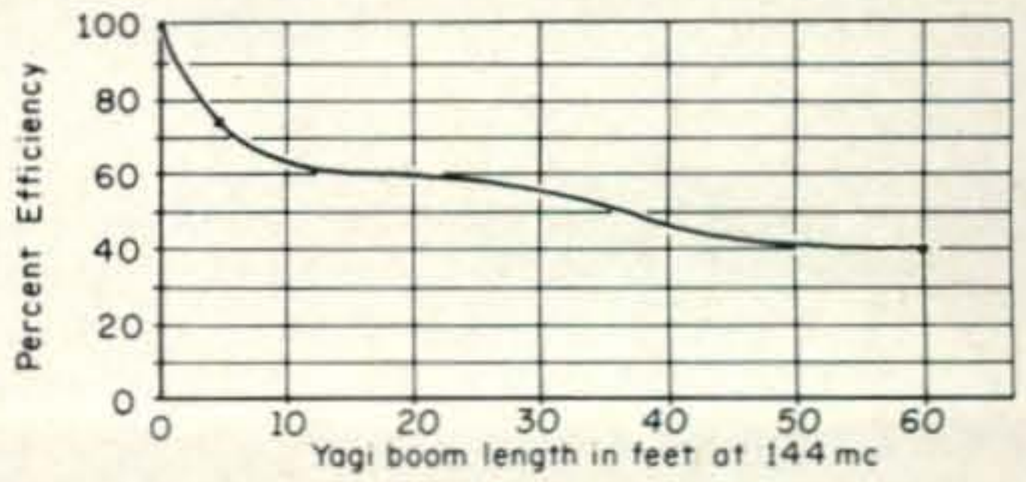


Fig. 2—Yagi efficiency as a function of boom length.

See page 102 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

March 28–	April 19	IARC Propagation Phone
April	4-5	Florida QSO Party
April	4-5	New Mexico QSO Party
April	4-5	SP DX C.W. Contest
April	5	WAB LF Phone Contest
April	**11-12**	**CQ WW WPX SSB Contest**
April	12	WAB LF C.W. Contest
April	18-19	Helvetia XXII Contest
April	19	WAB VHF C.W. Contest
April	25-26	One Land QSO Party
April	25-26	Nebraska QSO Party
April	25-26	Arizona QSO Party
April	25-26	PACC CW/Phone Contest
April	25-26	DARC WAE RTTY Contest
May	9-10	USSR Phone Contest
May	9-11	Georgia QSO Party
May	16-17	YL Inter. SSBers Party
May	16-17	World Telecomm. Contest
June	14-20	Massachusetts Radio Week
June	28	WAB VHF Phone Contest

Worked All Britain Contests

The "WAB" contest is a 12 hour affair, from 0900 to 2100 GMT on the dates listed.

The HF section took place on March 15th phone, and March 29th c.w., but information was not received in time.

Bands: L.F.–1.8, 3.5, 7 mc. H.F.–14, 21, 28 mc. V.H.F.–all above 30 mc.

Exchange: RS/RST and QSO number. In addition UK stations will give county and WAB area nr.

Scoring: Each contact counts 5 points, the same station may be worked on different bands for QSO points.

The multiplier is determined by the number of UK WAB areas worked.

Your final score, total QSO points times the WAB multiplier.

Awards: Certificates, leading station in each country, (Call areas of VE, VK and W/K will be considered as separate countries)

Contacts may be applied for the "Heard All Britain" award. SWLs are not required to submit QSL cards for stations giving a WAB serial number in the contest.

Contest logs go to: Ron Perks G4CP, 74 Long Lane, Newton, Bloxwich, Staffs., England and must be received within 50 days of the contest. Award applications go to: John Morris G3ABG, 24 Walhouse St., Cannock, Staffs., England.

Helvetia XXII Contest

Starts: 1500 GMT Saturday, April 18
Ends: 1700 GMT Sunday, April 19

This is one of the more popular European contests and the HB boys make every effort to activate all 22 Cantons.

Contacts may be made on all bands, 1.8 thru 30 mc. The same station may be worked on each band and mode for QSO and multiplier credit.

Exchange: The RS/RST report plus a progressive contact number starting with 001. Swiss stations will also include their Canton. (ie: 579001/ZH)

The 22 Cantons are: AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH.

Scoring: Each contact 3 points. The multiplier is the sum of cantons worked on each band, a possible 22 on each band.

Final score, total QSO points multiplied by the sum of Cantons from all bands.

Awards: Certificates to the top scorer in each country. (VE & W/K call areas?)

Logs: Use a separate sheet for each band, indicate a Canton the first time it is worked, and check your log for duplicate contacts and accuracy. Include a summary sheet showing the scoring and other information, your name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed.

Mail your log within 30 days to: Marius Roschy HB9SR, USKA Traffic Mgr., Ch. des Grenadiers 8, 1700 Fribourg, Switzerland.

One Land QSO Party

Starts: 0001 GMT Saturday, April 25
Ends: 2400 GMT Sunday, April 26

This is an annual affair sponsored by the

*14 Sherwood Road, Stamford, Conn. 06905.

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New England Chapter #32 of the CHC International. The same station may be worked on each band and mode and again if its a portable in a different country. (N.E. may work other N.E. stations)

Exchange: QSO nr., RS/RST and QTH; county and state for N.E. stations, county/state or country for others.

Scoring: For N.E.—Total QSOs X states X countries X continents.

Others—Total QSOs X N.E. states X N.E. counties.

Frequencies: c.w.—3575, 7060, 14075, 21090, 28090. Phone—3943, 7260, 14340, 21360, 28620.

Awards: 1st, 2nd and 3rd place certificates to each state, country and N.E. county. There are three Trophies, to the top DX station, N.E. station and outside N.E. in N. America. There are also special awards for Novices and S.W.L.s.

Mailing deadline is May 30th to: N. E. Chapter CHC #32, Att: George Levensalor W1DPJ, 399 Buck Street, Bangor, Maine 04401.

Nebraska QSO Party

Starts: 1600 GMT Saturday, April 25
Ends: 2200 GMT Sunday, April 26

The same station may be worked on each band and mode for QSO points. Only single operator stations permitted.

Exchange: QSO nr., RS/RST and QTH; county for Nebr., ARRL section for others.

Scoring: One point per QSO for Nebr. stations, 3 points for others. (Nebr. may work in state stations for QSO points only)

Nebr. will multiply total QSOs by ARRL sections plus a max. of 10 DX countries for final score. Others, QSO points times the Nebr. counties worked. (max. of 93)

Frequencies: 1815, 3600, 3982, 7100, 7260, 14060, 14300, 21070, 21360, 28050, 28600.

Awards: Certificates to the top scorer in each Nebraska county, ARRL section and each DX country. All certificates will be signed by the Governor of Nebraska.

The Lincoln ARC will try to activate some of the rare counties by mobile operation. The same station may be worked in different locations.

Logs must be received by May 31st and go to: Lincoln Amateur Radio Club, Att: Michael Nickolaus WAØKGD, 4921 Tipperary Trail, Lincoln, Nebraska 68512. Include large s.a.s.e. for results:

Arizona QSO Party

Starts: 2100 GMT Saturday, April 25
Ends: 2100 GMT Sunday, April 26

This is the 4th party sponsored by the Saguaro High School ARS The same station may be worked on each band and mode for QSO points.

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

Scoring: Arizona, 2 points per QSO multiplied by number of ARRL sections worked. Out-of-state, 5 points per QSO multiplied by number of Ariz. counties worked. (max. of 14)

Frequencies: c.w.—3575, 7075, 14075, 21075, 28075. Phone—3950, 7275, 14285, 21375, 28600. Novice—3735, 7175, 21110.

Awards: Certificates to the top scorer in each section, second place awards in sections where 4 or more logs are received.

A signed declaration that all rules and regulations have been observed, and that the decision of the committee will be accepted is also requested. Include a large s.a.s.e. if a copy of results is desired.

Mailing deadline is May 25th to: Bob Wright WA7ISP, 4725 N. 70th Street, Scottsdale, Arizona 85251.

PACC DX Contest

Starts: 1200 GMT Saturday, April 25
Ends: 1800 GMT Sunday, April 26

Its the world working the Netherlands on all bands, 1.8 thru 28 mc, c.w. and phone are scored as separate contests with separate logs.

Exchange: The usual five and six figures, RS/RST plus a progressive QSO number starting with 001. PA/PE/PI stations will also include their province. *i.e.:* 579001/GR)

There are 11 provinces: DR, FR, GD, GR, LB, NB, NH, OV, UT, ZH, ZL.

Scoring: Each QSO counts 3 points, and the same station may be worked on each band for QSO and multiplier credit.

The multiplier is the sum of provinces worked on each band, a possible maximum of 88.

Final score, total QSO points multiplied by the sum of provinces worked on all bands.

Awards: Certificates to the top scores in each country and each call district in W/K, VE/VO, CE, JA, PY, VK, ZL, ZS.

Logs: Date/time in GMT, station worked, serial number sent/received, multiplier column for each band, (fill only when its a new multiplier) and QSO points.

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Include a summary sheet showing the scoring and other pertinent information and your name and address in BLOCK LETTERS. The usual signed declaration that all rules and regulations have been observed is also requested.

Contacts on your contest log may be applied for the PACC 100 Award.

Mailing deadline is June 15th to: W.J.M. Paas, PAØABM, Contest Mgr., Zwerfruststraat 1, Middleburg, The Netherlands.

WAE RTTY Contest

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

This is the 2nd annual RTTY contest sponsored by the DARC. Only 36 hours out of the 48 contest period are permitted for single operator stations. The 12 hours of non operation may be taken in not more than 3 periods.

All bands, 3.5 thru 28mc may be used. Both single and Multi-operator stations permitted.

Exchange: QSO nr., RST and time in GMT.

Points: Contacts within one's own continent count 1 point, outside one's continent 3 points. However non-Europeans get 5 points for each EU contact. Like other WAE contests the QTC feature is also used in this contest. Each QTC exchange is worth 1 point. (See July '69 Calendar for details and the WAE country list. QTC exchange is limited to 5 QSOs instead of 10.)

Multiplier: The multiplier is determined by the number of countries worked on each band. The WAE and ARRL country lists are the standards. Europeans will use following call areas as additional multipliers: JA, PY, VE/VO, VK, W/K, ZL, ZS, UA9, UAØ.

Scoring: Final score, total QSO points plus QTC points, multiplied by sum total of countries from all bands.

Awards: Certificates to the following: Top Ten Single operators and Top Five Multi-operator stations, European and non-European. And to the continental leaders and Top Three stations with most QTC's sent.

Mailing deadline is June 10th to: Uli Stolz DJ9XB, In der Ostert 3, D-597, Plettenberg, West Germany.

CQ WW WPX SSB Contest

Starts: 0000 GMT Saturday, April 11
Ends: 2400 GMT Sunday, April 12

We have covered this one thoroughly in the past two issues, so not much object in repeating the details. We do however want to call your attention to one rule change. Contacts on the 40, 80 and 160 meter bands are now worth double the value of those made on the h.f. bands, 20, 15 and 10 meters. This is on a trial basis to see if we can promote more activity on the neglected l.f. bands.

We again expect to hear a big assortment of exotic prefixes out of Brazil, and I am sure from other areas too.

The May 15th mailing deadline will be extended for those in isolation areas. All scores will be published so don't fail to send your log to: CQ WPX SSB Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.

YL Inter. SSBers QSO Party

Starts: 0000 GMT Saturday, May 16
Ends: 2400 GMT Sunday, May 17

Rules for this one are a bit complicated and there have been some modifications from year to year. It is highly recommended therefore that you write to Woody Bennett, WØGNX, 8939 East 31st Street, Kansas City, Missouri 64129 and request a copy of the rules as well as log forms. This is especially important for the teaming of contest groups. Include a s.a.s.e. with your request.

Editor's Notes

Conditions for our 160 contest back in January were rather good. Static levels were a bit high at times but DX was coming thru on both nights. Activity was very high, a few over 300 QSO numbers were heard and there were plenty at over 200 levels.

However the present allocation of frequencies does not make for good contest operation on 160, especially to the West Coast. Must say however that except for a few diehard phone men, the fellows were very cooperative in keeping "DX Alley" clear for the DX stations. Charlie O'Brien W2EQS will have plenty to say in his report.

As usual the last week-end in April is really cluttered up with contest activity. Its going to be a real chore keeping your serial numbers straight if you get involved in one of the state parties.

No word from the OZ-CCA or the USSR contests which are normally held the first week-end in May. I have been reliably informed that the USSR is dropping its c.w. contest this year and running a Phone only contest on May 10th. Hope to have more details next month.

73 for now, Frank, W1WY

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Q AND A

BY WILFRED M. SCHERER,* W2AEF

Broadcast-Station QRM on 160 M.

QUESTION: Have you any data on taking broadcast-station images out of the 160-meter band?

ANSWER: So-called images on 160 meters often are BC harmonics or spurious signals generated by non-linear devices such as rusty drain pipes, plumbing, loose wires, etc., in the neighborhood of the broadcast stations. Little can be done about these at the receiver.

On the other hand, such effects could be r.f. intermodulation products caused by receiver overload by the BC signal, in which case a 1750 kc high-pass filter or a trap (tuned to the BC frequency) at the receiver input should be helpful. To ascertain whether or not such a move might be beneficial, simply use a short piece of wire for an antenna or use an attenuator at the receiver input to cut the signal level down. If the inerference disappears, chances are that the receiver was originally overloaded by the BC signal, thus indicating the possibility of help using the trap or a filter.

Data on a trap and suggested filter are shown at figures 1 and 2.

*Technical Director, *CQ*.

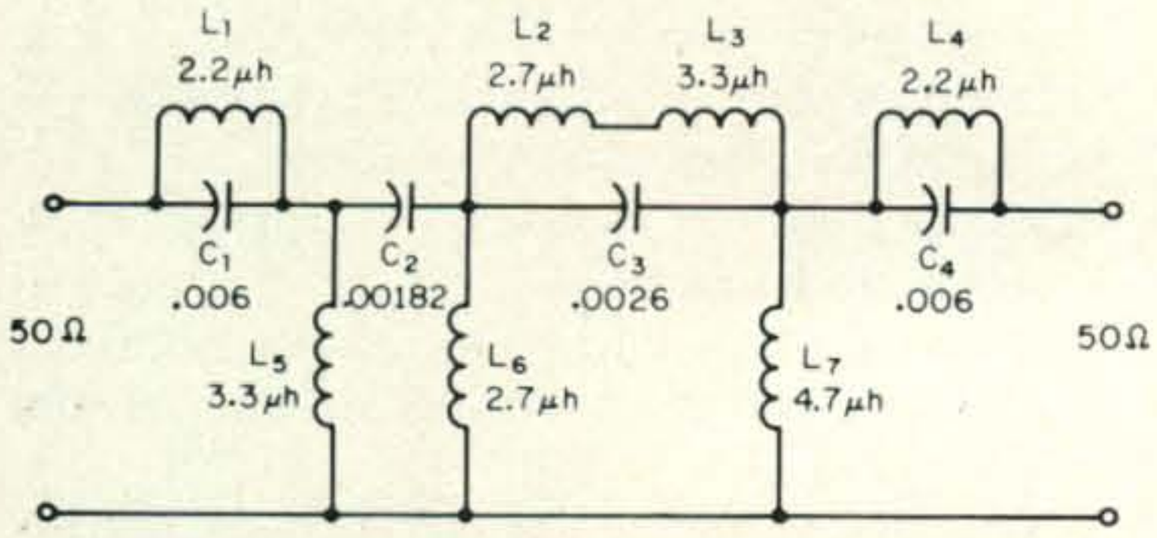

Fig. 1—Configuration and constants for 1750 kc high-pass filter for 50-ohm load impedance. Inductance values are in microhenries, capacitance in microfarads.

L_1, L_4—2.2 μh, Miller 74F226AP.
L_2, L_6—2.7 μh, Miller 74F276AP.
L_3,L_5—3.3 μh, Miller 74F336AP.
L_7—4.7 μh, Miller 746AP.

More on the Dampp Chaser

We wish to thank the dozens of readers who forwarded data and the address of the manufacturer for the "Dampp Chaser", information we were unable to obtain locally for another reader, as reported in the January Q & A Column.

For others who may be interested in this item, the Dampp Chaser is manufacturerd by Dampp-Chaser Electronics, Inc., Post Office Box 1610, Hendersonville, N.C. 28739. It is available in various sizes. A supplier for the device is Electronics, Inc., 1960 Wilkinson Blvd, Gastonia, N.C. 28052.

According to our informers, use of the Dampp-Chaser (a small heating element that is kept activated at all times to maintain a uniformly warm temperature and keep moisture out of equipment) is not restricted to use in radio gear, but is also widely used in other electronic gear such as electronic organs, military equipment and even in closets for preventing mildew.

Triplett Meter Repairs

The following information on meter repairs has been received from Harold Mohr, K8ZHZ, 5670 Taylor Road, Gahanna, Ohio 43230. It is published here for those who may become involved in a similar situation and to correct what might otherwise have been a misapprehension.

"In the September Q & A Column one of your readers complained he had sent a couple of 3″ meters back to Triplett for repairs and that he was informed they did not do this repair work. You mentioned a couple of meter shops where he might get the meter repaired.

"I should like your readers to know that no doubt the meters he had were of the surplus nature and possibly made *special* for the government and which Triplett did not have as a stock item or have repair parts for.

"I recently sent to Triplett a meter taken from a Clegg Zeus in which the hair spring was broken. I received this meter back as

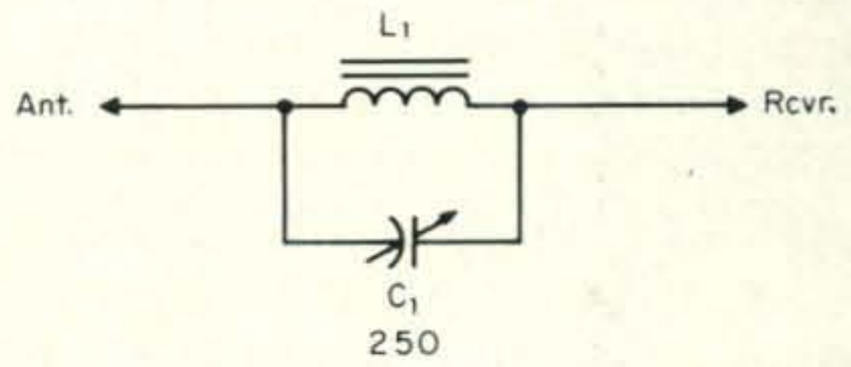

Fig. 2—*Series-connected parallel-tuned trap.* L_1-Ferrite Loopstick, C_2-250 mmf, or Miller Trap 812-BC1 for 1200-1600 kc, 812-BC2 for 800-1200 kc, 812-BC3 for 500-800 kc.

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of today. The repair charges and shipping would not buy a case of "807's". At the price of any service today I do not see how they could unpack, look at and re-pack for the meter for this amount.

"We here in Ohio are proud of our many manufacturers and wish to tell your readers that Triplett is one of the best you'll find anywhere."

Articles on 160-Meter Gear

QUESTION: Can you refer me to any articles on 160-Meter antennas and couplers?

ANSWER: Articles on these aspects of 160-meter operation may be found in *CQ* as follows:

"Top Band Loop Antenna," (receiving only), *CQ*, January 1969, p. 41.
"Inducto-Tuner," *CQ*, August 1969, p. 56.
"Reversi-Coupler," *CQ*, October 1969, p. 44.
"160 Meter Vertical Top-Loaded Antenna," *CQ*, January 1968, p. 74.
"Conical Monopole," January 1966, p. 59.
"160-Meter Vertical Antenna," (uses 137-foot TV tower), *CQ*, March 1964, p. 41.
"Gamma Matched 160-Meter Vertical," (uses beam-antenna tower), *CQ*, May 1961, p. 52.
"Universal Antenna Coupler," *CQ*, January 1961, p. 46.

Manual Requests

A service provided by the Q & A Column that has produced helpful results for many readers, is that of locating hard-to-find equipment manuals. This has been made possible only through the generosity of those who have forwarded their manuals or offered the use thereof for making xerox copies to send to those in need. We now have additional requests for data on the following equipment, (all material will be promptly returned):

Electronics Designs VTVM Model 100.
Polarad Type MSG-2 R.F. Signal Gen.
PRD Model 904 Noise Generator.
Dumont Model 401A Oscilloscope.

R.F. Monitorscope Use with Conventional Oscilloscope

Several inquiries have been received requesting information on how to obtain r.f. envelope displays with a conventional oscilloscope not equipped for an r.f. input, such as may be desired for monitoring the r.f. output of a transmitter with s.s.b. or a.m. modulation.

In most cases simple modifications can be made to the oscilloscope as shown at fig. 3A. The r.f. is fed directly to the vertical plates of the c.r.t. through a capacitive attenuator. The r.f. signal is obtained from across the transmission line using a Tee connector. The resistors, R_1-R_2 isolate the r.f. from the circuitry of the scope. R.F. chokes may be used in place of the resistors. If the scope is a 5 mc job with high-frequency compensation networks at the vertical plates, the modification may upset the frequency response, in which case the resistors or chokes would have to be removed for normal scope operation. This can be set up for convenient changing using the switching method shown at fig. 3B.

Also, if a 5 mc scope is involved and the transmitter frequency is in the 3.5 or 7 mc band, the r.f. signal may be observed without modifications made to the scope. This may be accomplished by connecting a few feet of wire to the vertical input of the scope for use as a pickup antenna. The signal will then be displayed on the c.r.t. and the level may be adjusted with the vertical-input gain control.

[*Continued on page 100*]

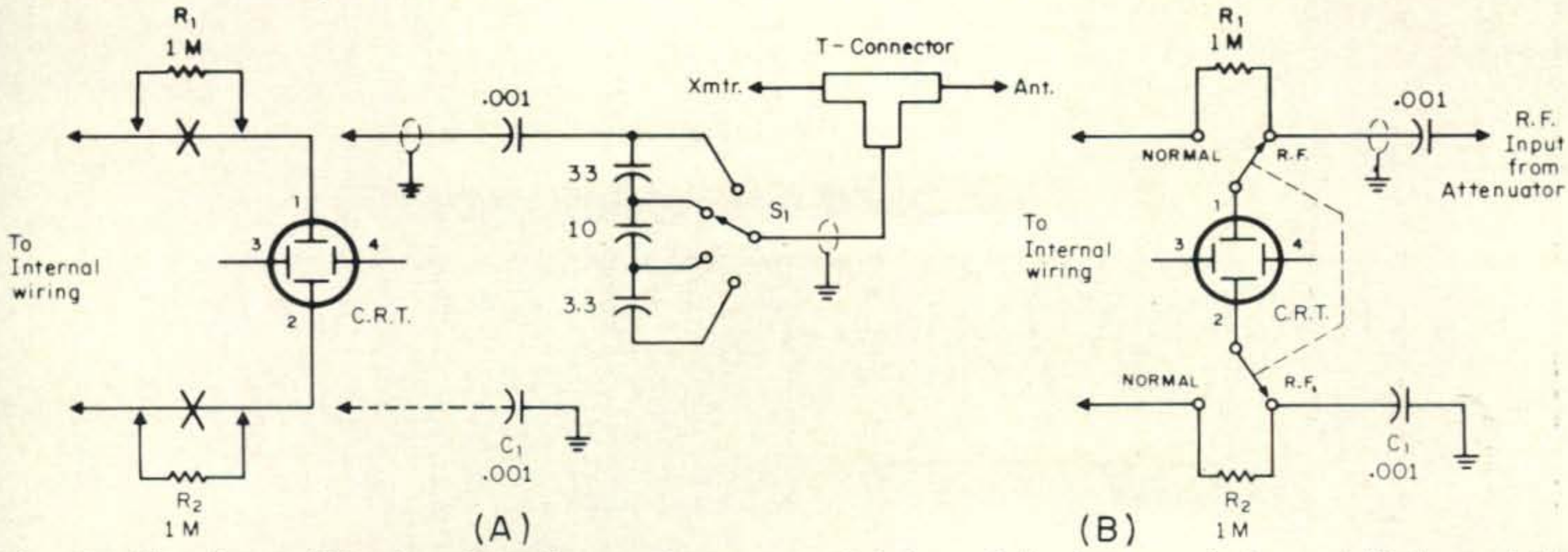

Fig. 3—Circuit modification for direct r.f. connections to vertical-deflecting plates of an oscilloscope not so equipped. Where plate #2 is already grounded, R_2 and C_1 will not be needed. Similar isolating resistors at plates 3 and 4 will minimize r.f. leakage and phase shift through the instrument's wiring that could cause pattern distortion. Install resistors at the c.r.t. socket. A simple switching system to bypass the isolation resistors is shown at (B).

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

I WANT to touch on two goodies this month; both are RTTY gear, and have been around a while, but I have gotten enough mail on them in recent months to indicate that some interest remains. The TT-40/SGC-1 (fig. 1) and the Northern Radio Model 152 terminal units are widely available to the RTTY gang, and although they are older, tube-type sets, they offer some utility, particularly for the v.h.f. man who operates Audio Frequency Shift Keying.

The 152 is a dual unit, designed to handle two wire or microwave lines in a single chassis. These sets had two complete demodulators, with separate filters, power supplies and all, in one chassis.

The SGC-1 was built about 23 years ago for use in high-frequency RATT work (Navy slang for RTTY) between shore stations and ships. It, unlike the N.R. 152, will give fair

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

Fig. 1—Front view of the TT-40/SGC-1 terminal unit.

performance on the fading plagued bands between 2 and 30 mc.

The 152 was used in a rack setup, usually with several other units, to receive multiplexed communications. Each 152 was set up for a different tone pair, which it separated out of the composite point-to-point signal. The 152 has an internal power supply for its printer loop, with a separate loop current meter for each dual section, on the 3½ by 19 inch panel.

Since it was built for wire line or microwave circuits, the 152 deals with noise or bandwidth restriction, but not with fading, and it performs rather poorly on h.f. RTTY.

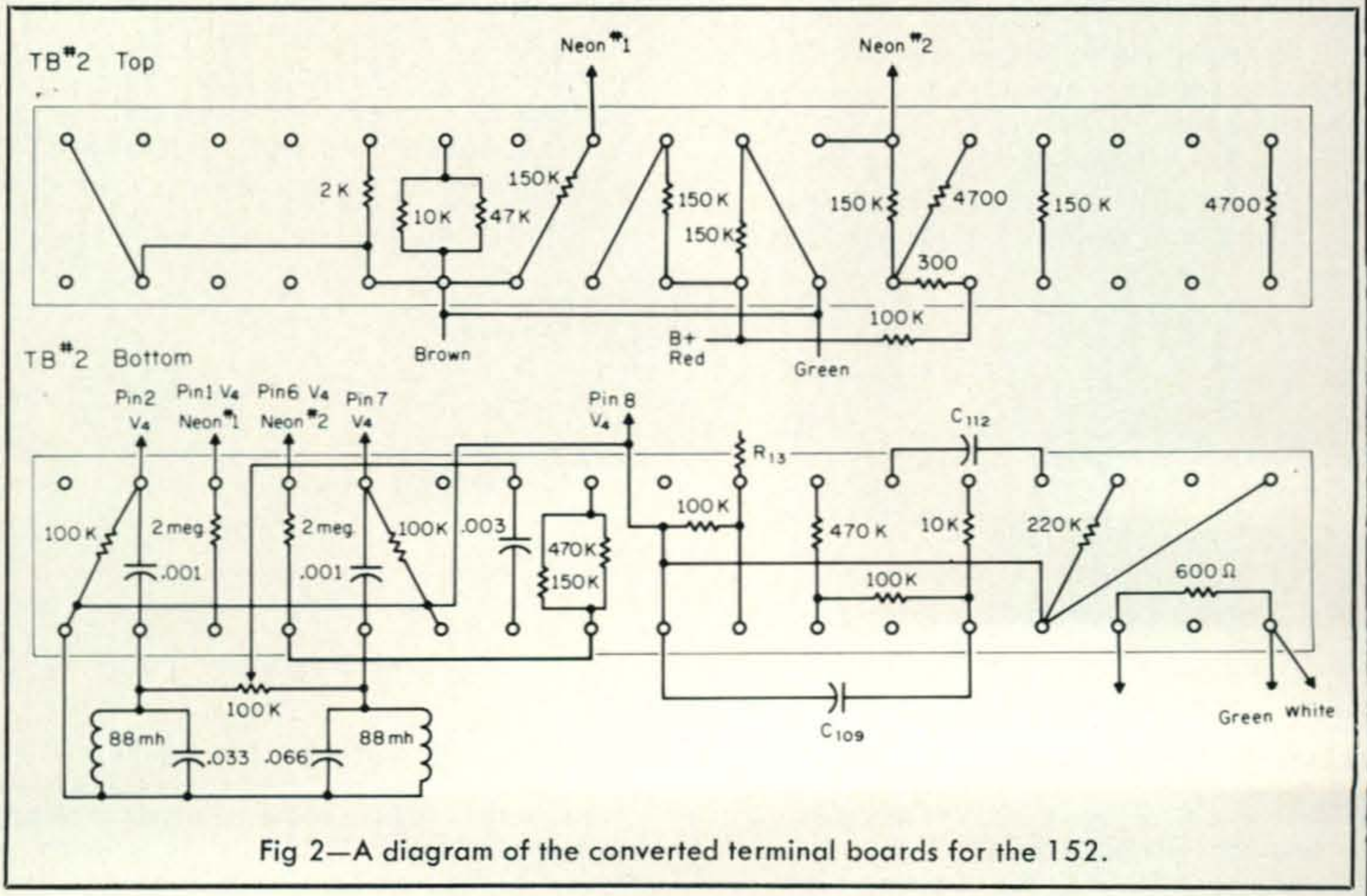

Fig 2—A diagram of the converted terminal boards for the 152.

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The set uses 11 tubes in each section, draws 40 watts at 117 v. a.c., and has a nominal input impedance of 600 ohms.

The frequencies of the tones handled by each 152 section are determined by plug-in filter units that mount in cavities in the rear of the unit. Frequency sets are plus or minus 42½ c.p.s. or 120 c.p.s. depending on the filter used, and range (center frequency) from 425 c.p.s. to 3655 c.p.s.

Obviously, even the wide band filters are of little direct amateur use. It is possible to re-tune the filters slightly, by changing the tuning capacitors on each filter, but an easier way would be to use toroids and build a separate new filter unit for standard RTTY tones, 2125/2975, or narrow shift, 2125/2295. Several years back, W6OJF and AF7DVK worked out a conversion of the 152, including neon tuning eyes. One bulb fires on mark, one on space, and during reception they should fire alternatively.

In the W6OJF conversion, the 88 mh toroids are mounted on aluminum panels that fit in place of the original filters, which are not used. Fig. 2 is a diagram of the converted terminal boards in the set.

The manual, with schematics, is obtainable for $4.00 from Northern Radio Co., 143 West 22nd St., New York 11, N.Y.

In addition to the 152, Northern Radio made a type 153 dual tone *keyer* in the same style case. The N.R. #164 is a dual unit with a receiving converter and a transmitting keyer in one cabinet.

The TT-40/SGC-1 should be fairly good

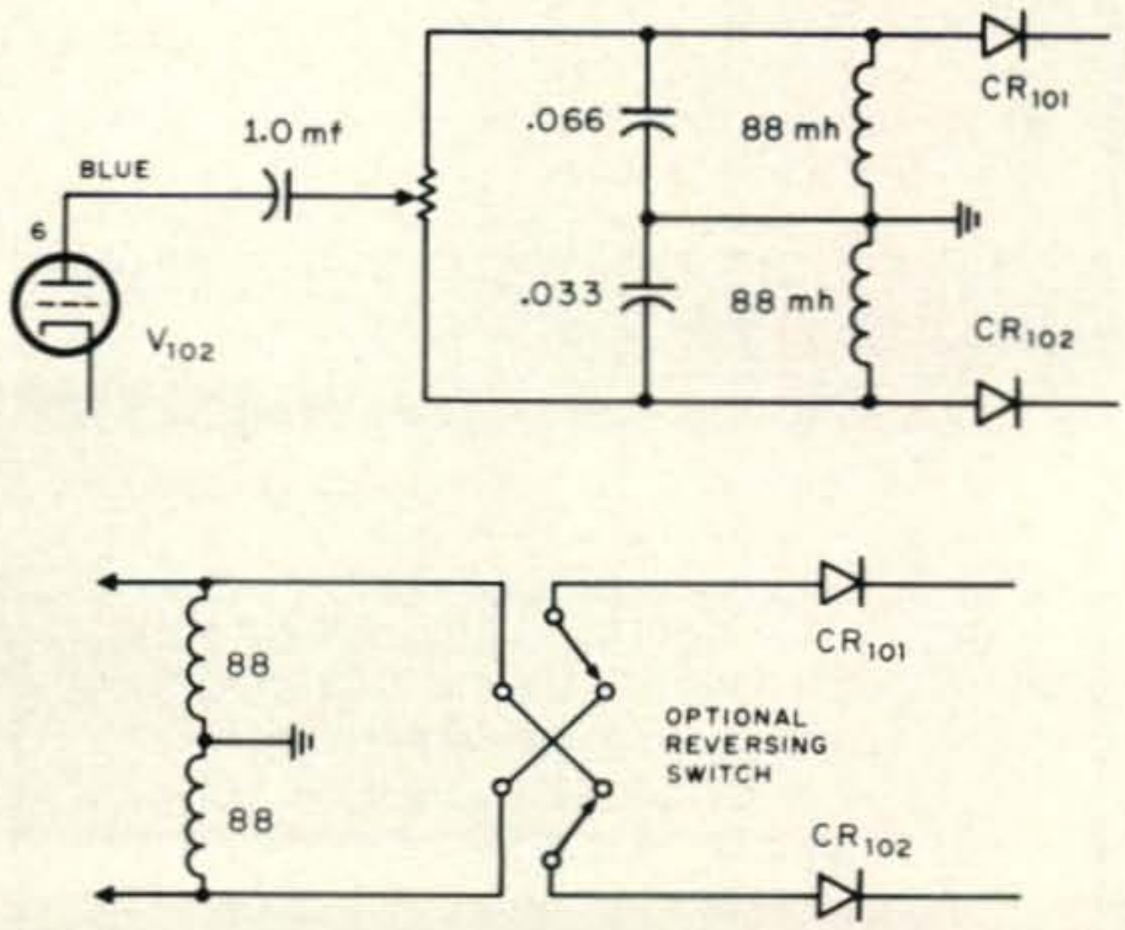

Fig. 3—The converted 2125/2975 discriminator.

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on h.f. bands. It has a good bandpass filter at the input, and a standard f.m. limiter-discriminator demodulator, but it suffers from non-standard tones, set up for the odd narrow shift of 200 cycles (500 and 700 c.p.s.). The 700 c.p.s. tone is "mark," and the 500 c.p.s. tone "space," so in addition, the design operates in an opposite "sense" from more recent demodulators, which use the higher tone for space.

W2DXD worked out a conversion of the TT-40/SGC-1 that appeared in *RTTY Magazine* several years ago. Of course he used 88 mh toroids (what else) in place of the original inductors. Fig. 3 shows the converted 2125/2975 discriminator wired between V-102 and CR-101/CR-102, with a reversing-sense switch and a 'scope monitoring jack added as well. In this conversion, Z-102 may be eliminated altogether, as it is of little use to amateurs. The input bandpass filter, Z-101, must be either by-passed, or substituted with a standard-tone filter made from toroids. Specifications for several values of filters were described in *QST*.

The SGC-1 contains an AFSK oscillator used to transmit (or retransmit) an RTTY signal. To convert the oscillator from 500/700 c.p.s. tones to standard amateur frequencies, remove C-111 and C-112, both .0036 mf., and replace them with .001 capacitors. Final tuning of the output should be done with pots R-146 and R-147. Remove diodes CR-103 and CR-104 and re-installed in the opposite sense.

As designed, the SGC-1 has a 3 second delay in going from Transmit to standby and a 1/2 second delay in going from receive to standby when in its automatic mode. This is a circuit that will operate a transmitter relay when you start typing, and shut the transmitter off when you stop for longer than a three second pause. When in standby, reception of a mark tone will start your printer. The delay time may be changed by replacing C-114. A smaller value, say .25 mf in place of the original .5 capacitor would be a start if you wanted to shorten the delay.

AFSK output is either 600 ohms or 50 ohms, changed by moving a link on terminal board E-105.

The SGC-1 uses 11 tubes, and operates off normal 117 v. a.c. lines. The manual is Nav-Ships 91152, and may be obtained from Sam Consalvo, 4905 Roanne Dr., Oxon Hill, Md.

The unit uses octal polar relays for receive

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and transmit. In buying one of these terminals, be certain either that the relays are still installed, or that you can find replacements. There should be a spare relay in the set.

Controls on the set include the R-146/147 pots which are located on the side of the chassis, along with the send-level pot, R-150.

Amplifier [*from page 20*]

Drive Power	Operating Class	Plate (ma)	Plate (volts)	Plate Pwr. (watts)	R.F. Output Pwr. (watts)
350 w. Swan 500	B†	700	2800	1960	1450
175 w. Drake TR4	B†	450	2900	1305	1000
350 w. Swan 500	AB_1‡	775	2800	2170	1550
175 w. Drake TR4	AB_1‡	670	2800	1876	1300

Table I—Drive level versus Class B and Class AB1 in super cathode drive. Frequency used was 14.2 mc with plate and loading capacitors adjusted for maximum output.
†No bias or screen voltage in Class B.
‡Screen voltage = 300 v. and bias set for 250 ma plate current.

Table I using both the Drake TR4 at 175 watts and the Swan 500 at 350 watts peak out. The final has been used nearly a year with the Collins 32S3, which drives it to just under the 2 kw p.e.p. limit on all bands. Peak output power is approximately 1300 watts on all bands. With 1800 p.e.p. dc input plus 130 watts drive (1930 watts) plate efficiency has been measured up to 70%. Looking at the circuit of fig. 9 one can see the tube is operating similar to a low gain, cathode driven triode with degeneration. Since no flat topping occurs using this method of drive, no a.l.c. or other feedback control is required.

For operating c.w. the bias voltage should be increased until input power does not exceed the kw input level. The efficiency will improve slightly since the class of operation is changed; static plate current should be as follows c.w. = 50 to 100 ma, S.S.B. = 250 ma.

Since this configuration is capable of much over the 2 kw p.e.p. legal limit one must be careful in setting up and operating into the antenna. Driver power must be added to the plate d.c. power to prevent exceeding the legal limit. For example, B+ is 3000 volts at 620 ma resulting in 1860 watts peak d.c. plus 130 watts driver power for a total of 1990 watts p.e.p.; with a 50% duty cycle 995 watts average results with a plate current of 310 ma. ■

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.

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Propagation [*from page 72*]

Australasia	12-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	11-13 (1) 13-18 (2) 18-20 (3) 20-22 (4) 22-00 (3) 00-01 (2) 01-02 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-03 (4) 03-07 (3) 07-09 (2) 09-10 (1)	00-01 (1) 0-02 (2) 02-05 (3) 05-06 (2) 01-02 (1)* 02-04 (2)* 04-05 (1)*
Northern & Southern South America	09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	06-08 (1) 08-10 (2) 10-14 (3) 14-17 (4) 17-19 (3) 19-21 (2) 21-23 (1)	15-17 (3) 17-21 (4) 21-01 (3) 01-04 (2) 04-07 (3) 07-15 (2)	18-19 (1) 19-20 (2) 20-01 (3) 01-03 (2) 03-05 (1) 20-00 (1)* 00-02 (2)* 02-04 (1)*
Brazil, Argentina, Chile & Uruguay	08-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-00 (3) 00-03 (1) 03-06 (2) 06-07 (1)	18-19 (1) 19-02 (2) 02-03 (1) 19-02 (1)*
MsMurdo Sound, Antarctica	18-20 (1)	14-17 (1) 17-20 (2) 20-23 (1)	15-17 (1) 17-19 (2) 19-21 (3) 21-00 (4) 00-02 (3) 02-03 (2) 03-05 (1)	20-21 (1) 21-23 (2) 23-04 (1) 04-06 (2) 06-07 (1)

CQ Reviews: Ten Tech [*from page 54*]

inpedance, well-filtered and regulated supply. It also was found advisable to keep the unit away from strong 60-cycle a.c. fields, such as that produced by power transformers in other gear; otherwise, hum pickup may be experienced in the receiver.

Operating from our location with c.w., many good 80 and 40 meter QSO's were had with stations in the Midwest and along the Eastern seaboard and from our experience at other times with low power, QRP DX also can be worked, particularly on 15 meters. These little rigs are ideal for a barrel of fun.

The Ten-Tec Power-Mite, Model PM2, sells for $54.95, a price which is less than would be the cost if you scrounged around for the parts and put a similar job together yourself. The Model AC-3 15-meter r.f. converter for receiving is priced at $8.95. The individual modules used in the Power-Mite also may be purchased separately by those who might like to tinker around to suit their own individual ideas.

Other Ten-Tec transceivers are available for 40-20 meter operation and include sidetone monitor, receiver muting and break-in keying. Ten-Tec also puts out a varied line of "squeeze" type electronic keyers. Further information and prices on these products may be obtained from the manufacturer: Ten-Tec, Inc., Highway 411, East Sevierville, Tennessee 37862. —*W2AEF*

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Tower Installation [*from page 50*]

bolted into it, one on each side of he mast. Next, a BN-86 Hygain balun was hung from the boom, but I didn't use my head in locating it. As it turned out it was so far away from the driven element that the leads which connected the two were too long. Don't make that mistake. Mount the driven element first, then jam the balun up against it, to keep the leads as short as possible. When I checked out the beam later, the s.w.r. was too high, but when the balun was moved and the leads shortened the results were as expected.

Once the driven element was clamped, using the masking tape marks as a locating guide, the tower was raised far enough to attach the remaining piece of boom that belonged on that side. Then both the reflector elements were fastened, again using steel wool and Penetrox at the clamps.

Now half the antenna was done. The tower was winched upright, and the main winch was worked until the antenna rose above the interfering trees. It was then rotated 180°, the tower was lowered all the way and tilted again for access to the other side of the boom.

The three directors were then attached to complete the assembly. With all work done, the tower was again hoisted erect and raised to its full height. What a sight! One neighbor even said, "What a beautiful tower!" Of course, men in white coats came for him next day.

Results have been gratifying. With 600 watts input, I have been able to work nearly every DX station I want on the first or second call, even in pileups, including a couple of AP5's and a 3V8 that had a really huge group calling him. VK's, ZL's and JA's have given me consistently excellent reports. Even with the antenna resonated for c.w., I have ventured on to s.s.b. a few times, enough to know that results there are better than I have any reason to expect. For instance, on s.s.b. I worked A2CAH (Botswana) on the very first call with 5 × 9 report.

My thanks to all the gang who pitched in one way or another—Mac, WA2DEV; John, K2QAI; Joe, WB2NLM; and Elliot, W2MUM. Also to Ezra, K2UUJ for his moral support. Thanks too to the gang at Rohn, Hygain and Cornell-Dubilier for their advice and cooperation in answering my many questions, and to the many DX stations who took the time to give me comparitive reports. Most of all, though, to Rosalie, my XYL, who patiently sat through four boring (for her) weekends while I was working on this project, and even volunteered her help at various times, including typing this long manuscript. ■

CQ ADVERTISING RATES

Each month our advertising department receives numerous requests from readers for advertising rates. We've decided that we can save everyone some time by listing those rates right here. The costs per ad will vary, depending upon the number of ads run during a twelve month period. Advertisers may earn a rate from *the time the first ad appears*, rather than being obligated to run on a calendar year basis.

	1 or 2 times	3-5 times	6-11 times	12 times
Full Page	$525.00	$470.00	$430.00	$385.00
1/2 Page	275.00	255.00	235.00	215.00
3/8 Page	220.00	205.00	195.00	180.00
1/4 Page	150.00	140.00	130.00	120.00
3/16 Page	106.00	101.00	97.00	93.00
1/8 Page	80.00	75.00	70.00	65.00
1/16 Page	40.00	38.00	35.00	33.00

Costs for second color are $75.00 per ad. Bleed charges are $50 per page, $35 per fraction. Ad copy should be submitted by the 15th of the second preceding month; i.e., April issue closes by February 15th. For additional information or assistance contact CQ advertising department.

OSCAR News [*from page 61*]

Typical of the many interesting observations reported are the following contained in the log submitted by K1HTV of Meriden, Conn.

"The period calculated here after 60 orbits is 115 minutes 5 seconds. The westward progression at the equator appears to be 28.66 degrees per orbit.

"Ten meter modulation is very low and very different to copy. Maximum 2 meter signal heard so far has been 27 db above the noise.

"I have sometimes noted that when the 10 meter signal is nearly overhead it drops out completely for a while. The F layer of the ionosphere is probably shielding the signal from the earth until the satellite moves up or down range a bit. When 10 meters has been open, I have heard the 29.450 mc signal as far down range as the island of Gough in the South Atlantic, and as far to the northwest as the Asian mainland at 200 degrees west longitude and 55 degrees north latitude. No skip reception has been observed on 2 meters, although I have listened carefully for it.

"The 2 meter frequency goes from 144.0485 up range to about 144.0437 mc down range if my calibration is correct, with the greatest variation noted on overhead passes.

"My observations tend to show that the W1AW

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OSCAR predictions of equatorial crossings were too far to the west by 3 or 4 degrees, at least for the first 50 orbits."

OSCAR 6

AMSAT is now firming up plans for OSCAR 6, a long life, solar powered translator. It is hoped to have it launched shortly before the beginning of the ITU's World Conference on Space Communications which will convene in Geneva, Switzerland during June of 1971.

This conference will cover all aspects of space communications, including frequency allocations, and it is expected to be of considerable importance to amateur radio.

More news about OSCAR 6 and the ITU Conference in special articles which will appear in *CQ* during the coming months. ■

SAPS [*from page 43*]

other v.h.f. bands and over much greater distances. In March, 1969, he worked Palma, Mallorca on the 432 mc band, a distance of 225 miles. This was followed a month later with a 2 meter SAPS transmission to Ajaccio, Corsica, nearly 325 miles from Narbonne.

Just this past week I received word from Narbonne that successful 2 meter communications was established with Tunis, 525 miles across the Mediterranean using a SAP system.

One thing unusual that I did notice about a signal propagated from a submerged antenna is the fading caused by passing ships. When a large ship passes through the propagation path, it produces the same type of fading on the signal that an airplane produces when it flies through the field of atmospheric propagation. The fading produced by a ship is, of course, somewhat slower.

Dr. Ducandre has also found that a smooth sea produces the strongest SAPS signals. The choppier the sea, the greater is fading and signal loss, which is somewhat analogous to ionospheric behavior. He has measured up to a 6 db loss with moderate seas, and in excess of 12 db during heavy storms. He also points out that the saltier the water, the stronger the signal, with as much as 10 db difference noted between similar propagation paths in salty and sweet water.

Some underwater h.f. propagation tests have also been carried out, but without the spectacular results achieved on v.h.f. As a result of larger dimensions, Dr. Ducandre has not yet been successful in developing an efficient underwater antenna system, or an HM coupler that gives a satisfactory s.w.r.

Dr. Ducandre is certain that with the right amount of power and antenna gain, there should be no limit to the distance that radio waves can travel from a submerged antenna-propagation system. This summer he plans to move some of his equipment to the Atlantic coast of France, and he is looking for volunteers living on the English Channel and Atlantic coasts of Britain, on the west coast of Africa, coastal areas of Iceland, Greenland and other Atlantic islands, and on the North American coast who would like to conduct trans-Atlantic SAPS tests with him on the v.h.f. bands.

Thanks to the genius of Dr. Simon Ducandre, amateur radio communications on the v.h.f. bands may some day sound very much as they do now on 20 and 40 meters, and seaside home locations will be sought after by radio amateurs with the same zeal that they now seek them on hilltops! ■

DX [*from page 69*]

HM4FA–Via W2MBU.
HS3DR–To VE3DLC
HS4ABF–c/o W7FNY
HS5ABD–Via W6DQX, P.O. Box 5491, Los Angeles, Ca. 90055.
HV3SJ–To WB2ETI
JW3XK–c/o LA6RL
KC4USX–Via K2BPP
KC6EJ–To WA6AHF
KP4BCL–c/o WA3JEM, 213 Main Street, West Newton, Pa. 15089
KZ5NR–Via WA9PUZ
M1I–To I1BNZ
MP4QBK–W, K, VE c/o K4MQG, 1114 Crestview Drive, North Augusta, S.C. 29841, Others to MP4BHH.
MP4TDA–Via G3HSE
OJØMR–To OH2NB
OX3WQ–c/o OZ6Z
SM7TE–Via K6KQN
TA2AE–To DL7FT
TA2SC–c/o K4EPI
TF3ST–Via DL7FT
TF5TP–To DL7FT
TI9CI–c/o TI2CMF
VK9HM–Via WA6EAM
VKØKW–To VK7KJ
VP8BK–c/o K2JXY
VU2BX–Via WAØLGR
WX3MAS–To W3OK
XW8CR–c/o W2CTN
YAØCDRC–Camel Driver's Radio Club, P.O. Box 638, Kabul, Afghanistan
YT1BCD–Via WA2WDE
ZC4AK–To WA2CMV
ZC4RC–Box 216, Famagusta, Cyprus
ZD8DB–c/o WØEZT
ZK1AJ–Via KH6GLU
ZS2MI–To ZS6LW
ZS6ME–c/o W5QPX
3C1QQ–Via W4DQS
3V8AB–To K6KQN for contacts in *August, 1968 only.*
5N2AAF–c/o W7VRO
6W8DY–Via VE4SK
6W8XX–To F8XX
8P6AY–NOT via W4OPM
8P6CC–NOT via W4OPM
9H1AZ–co G3LQP
9J2RQ–Via VE3GHL
9J2WS–To W4LF, 721 Second St., Neptune Beach, Fl. 32233
9L1RP–*c/o GW3AX*
9X5VL–Via VE3EMQ

73, John, K4IIF

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VHF [*from page 76*]

of KMC transistors and have not kept pace with the rapid changes taking place in the transistor market Suggestions by others who have constructed the amplifier are 2N3563, 2N918 or 2N2857 for operation through 220 mc, 2N3563 for operation through 144 mc.

73, Allen Katz–K2UYH

D.C. Converter [*from page 25*]

gauge Mylar insulated wire about five feet long. Pass the two *start* ends of the wires through a hole in the form just above the last winding (L_4). Wind six double turns, pass the *finish* ends through a hole in the form, shellac, apply the paper band and secure with several turns of heavy cotton string; then apply a coat of shellac. The windings are now complete and a summary is shown in fig. 4.

Clean the ends of the ferrite core and with epoxy cement attach the other half of the core. Set the transformer aside for at least twenty four hours. Scrape the insulation from all wire ends and tin with solder. It is much easier to do this before the transformer is installed on the chassis.

The transformer may be mounted using small brackets through the corners of the form boards or with a nylon cable clamp around the exposed section of the core. Do not use a metal strap around the core as it will act as a shorted turn. ■

Scratchi [*from page 14*]

project–like buying Scratchi a new xmittetr. *(Hon. Ed., don't worry about this, on acct. all Leo's are so stubborn they won't take advice from anyone.)*

VIRGO, Aug. 22 to Sept. 21–Nobuddy can ever please you guys. You're sensitive and critical. You won't buleeve what I say anyway. You ought to, tho, on acct. 1970 can be a disaster unless you avoid peeple. Shut the rig down and take a yeer off. Find a Gemini frend and start a stamp club.

LIBRA, Sept. 22 to Oct. 22–Always try to get into a ragchew with a Libra–they are frendly and sympathetic. In 1970, tho, you Libra's may have to make some quick decisions, so be reddy for them. Above all, stay out of argewments, espeshyoually with the XYL. You're doomed to lose.

SCORPIO, Oct. 23 to Nov. 21–The comfort and luxury-loving amchoors. And this is there yeer. Be forcible and the world is yours. Just a single quick seek-you and the dee-x will smother your freakwency trying to QSO you.

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A peechie yeer to work new countries.

SAGITTARIUS, Nov. 22 to Dec. 20—This sine produces amchoors who are fussy about detales. Their logbook contains all sorts information, like fase of moon, temperachure outside shack door, wind direckshun, etc.

If you being this sine, expect changes in 1970. You may move to another call area. Not worrying, howsumever, as finacial pichure are good.

OK, Hon. Ed., there you are. Now your reeders having some helpful informayshun. I would have doing a reel good horrorscope on you if I had knowing when you were born, but not knowing. With your luck, you are probably a Gemini.

Respectively yours,
Hashafisti Scratchi

WCARS [*from page 39*]

Brief Calling Procedures For 7255 And 7258

This column is devoted to news of the "Instant Services," WCARS and EASTCARS, 7255; and MIDCARS, 7258, and other amateur public service activities. If you need to use these monitored calling and emergency frequencies, here is the proper procedure:

"BREAK-BREAK-BREAK" – *Emergency only*—used for messages having a life and death urgency—such as highway accidents—all stations stand by while control determines method of handling.

"BREAK-BREAK"—Priority or urgent traffic having a specific time limit. Traffic hazards and obstructions are priority.

"CONTACT"—Notifies control that you wish to contact a station just heard.

"INFORMATION" – Notifies control that you have information that may explain or expedite traffic at hand or for any other contingencies.

Your call letters only—The only proper way to break for routine matters—never say "break."

Never transmit more than one brief sentence without dropping your vox or mike button.

Always move all routine messages and contacts at least 4 Khz. off of Service frequency.

See you on your nation's two calling frequencies, 7255 or 7258, or on WORLDCARS.

73, Ed. WB6IZF/8F6/VK8, etc.

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See page 102 for Reader Service

Ham Shop

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

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

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

MANUALS-- TS-173/UR, TS-323/UR, TS-175/U. $5.50 each; R-390/URR, R-390A/URR, $6.50 ea., Many others. List 20 cents. W3IHD, 4905 Roanne Drive, Washington, D. C. 20021.

SELL PACKAGE DEAL:- 813 tube, socket, filament transformer included, 7 amp. variac, 1600-0-1600v./375 ma. transformer, filter choke, two 8 mfd. 2000v. condensers, 0-500 millimeter, TR switch. Everything $45.00. TRADES considered. Stan., W8QKU, 2748 Meade, Detroit, Mi. 48212.

HD-10 OWNERS - Custom built carrying case. Free photo. Johnson, 7126 Tamarack Drive, Dublin, California. 94566.

PRE 1925 RADIOS and tubes wanted. Also Edison Cylinder records. Dick Sepic, 1945 East Orange Grove Blvd., Pasadena, Calif. 91104.

CLOSING OUT LIKE NEW - 1969 - KWM2 30L1 AC power supply, Drake TR4 AC power supply, Telrex 6 Elm wide spaced 20 meter beam, IKW Home brew 6 ft. amplifier, ABI & SSB. New CDR large rotator indicator cables, 39 ' Vesto Tower Hammarlund HQ180 rcvr, Hammarlund HQ 110 rcvr, Johnson 6N2 xmtr, Tapetone converters & power supply for 2 & 6M for Hammarlund rcvr air mobile, electric antenna reels, Coax cable loads of new tubes, all kinds: 4-400's, 4-250's, what not; will sell to one or two parties. No peapickers, penpals, or chislers. Want a bargain. Come & get it. No collect calls. WA4URQ, Harry Weinberg, days only (803) - 546-6811, no calls after 6 p. m.

WORLD RADIO has used gear with trial-terms-guarantee! SR34AC $129.95; HW32 $89.95; Swan 250 $199.95; 500C $379.95; DuoBander 84 $99.95; 753 $119.95; SB33 $189.95; Galaxy 5mk-2 $279.95; 75A3 $209.95; 75S3B $499.95; SX-101mk3 $159.95; Drake 2A $159.95; 2B $179.95; NC300 $149.95. Free "blue-book" list for more. Write: 3415 West Broadway, Council Bluffs, Iowa. 51501.

W7OK will schedule hams needing Nevada for WAS or 5 Band WAS SSB or CW. Don Brickey, 4318 Cory, Las Vegas, Nevada. 89107.

TELETYPE PICTURES FOR SALE. Vol. one, $1.00. Vol. two with larger pictures and new innovations, $2.00. Audio and perforated tapes available. W9DGV, 2210-30th St. Rock Island, Illinois. 61201.

SALE: Clegg Zeus $300 and Interceptor $325; Drake TR4 with power supply $500 and R4B $325; Olson "6" with Lafayette 6 & 2 VFO $100. All mint condition, factory manuals and cartons. Any reasonable offer considered. Barney Scholl, 1655 Kimberly Road, Sharon, Pennsylvania. (412) 342-4462.

INDIANA'S MOST PROGRESSIVE HAMFEST Sunday, May 24, rain or shine. Sponsored by Wabash Co. Amateur Radio Club. Admission $1 Donation. Write Bob Mitting, 700 Centennial, Wabash, Indiana. 46992.

JUNE 7, 1970 Save this date for the Starved Rock Radio Club Hamfest. Same place as last year. Details on request after April 1, 1970. Write SRRC/W9MKS, G. E. Keith, Secretary-Treasurer, RFD number 1, Box 171, Oglesby, Illinois. 61348.

RAGS Hamfest - Syracuse, New York, April 11, 1970, at Song Mountain. Box 88. Liverpool, New York. 13088.

APRIL SHOWERS may bring May flowers, but they also bring thoughts of the Hudson Division Convention, October 17-18, Hilton Motor Inn, Tarrytown, N. Y. Exhibits, Lectures, Contests, Gabfests, New York City Sightseeing, Fun. You won't need an umbrella. Get all the facts from Hudson Amateur Radio Council, Box 58, Central Islip, New York 11722.

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 the free brochure write REI, 1336 Main Street, Sarasota, Florida 33577 or call (813) 955-6922.

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

NOVICE CRYSTALS: 40-15M $1.33, 80M $1.83. Free flyer. Nat Stinnette Electronics, Umatilla, Florida. 32784.

NOVICES: Need help for general ticket? Complete recorded audio-visual theory instruction. Easy, no electronic background necessary. Write for free information. Amateur License, Box 6015, Norfolk, Virginia. 23508.

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MY JUNQUE BOX Runneth over, request list of bargains. W. C. Holder, 1000 West Alden Avenue, Valdosta, Georgia. 31601.

WANT Knight 600B Tube Tester, must be in good condition and reasonable. W. C. Holder, 1000 West Alden Avenue, Valdosta, Georgia. 31601.

WORKED WC4GSC? This special prefix station was operated by the Georgia Southern College Radio Club. QSL via W4DQD.

FOR SALE: Clegg 99er, $55, Knight V107 VFO. $20. Both for $70 in excellent condition. D. Reese, 747 Madison Avenue, Charlottesville, Va. 22903.

JOIN "SOCIETY OF WIRELESS PIONEERS." Former and present commercial brass pounders eligible. DE W3MSN, P. O. Box 530, Santa Rosa, California. 95402.

5" SCOPE-KNIGHT DC to 15 MHZ Lab Scope with dual trace, and Hi Gain plug ins & blank. Mint condition, Make offer or will accept trade. Original cost $850 as kit. WA3CIV, D. Dwight, Mounted Rte., New Cumberland, Pa. 17070.

SELL: Heath HW-100 and Power Supply. Like new, $275. HO-13 Ham Scan, $30. Heath Sixer, $20. WA9RFN, 2423 Crest, South Bend, Indiana. 46614.

WANT: 4E27 Tubes for cash (NOT 4E27A's). Pullouts okay if they work. J. D. De Shong, 11847 East 16th Street, Tulsa, Oklahoma. 74128.

RTTY PAGE PRINTER W/BASE, W2JAV TELEPRINTER DEMOD; DONALD STONER RT-1 TERM. UNIT, LOTS OF PAPER. NEED HAM 'M' CONTROL UNIT, SSB GEAR; OR. WB6HEZ, DOWNEY, CALIF. 90242.

HALLICRAFTERS HT-44 with PS-150-120 $210 National NC-300 spkr, 6, 2 converters $140 Both exc. condx with manuals will separate. George Misic, 37370 Windy Hill, Solon, Ohio. 44139. (216) 248-7099.

ALL PARAMETRIC Amplifier Assembly; includes Klystron Pump, Waveguide Attenuator, Varactor, Idler Cavity, "N" Output to Circulator: trade or sell, SASE & ur list VHF/UHF. W4API, Box 4095, Arlington, Va. 22204.

NOVICE XTALS. Two 40M and two ISM. First $5 takes all. WB4NML, Box 505, Andalusia, Alabama. 36420.

CANADIANS: Complete amateur equipment service by fully equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta, Canada.

TRADE: Galaxy III for Camera Equip. Prefer 16 MM. Movie. H. Uthoff, Box 351, Kimball, Nebraska. 69145.

MAGAZINES: Sell CQ July 1966 thru March 1969 and October 1969 plus 7 extras. QST August 1964 plus March thru December 1967. 73 Magazine August 1966 thru March 1967. Short Wave Magazine (English SWM) November 1961 thru April 1959 thru February 1964. What am I offered? O' Brien, W2EQS, 48 Prospect Ave., Westwood, New Jersey. 07675.

TRADE: TX-62, CN-50/144, HE-45B, HB 6m PA for Lampkin 205A Mtr and CB gear. Smith; 915 Lovera, San Antonio, Texas. 78201.

DX-60, 5 XTALS, Dow Key Relay, Ex. Condx. $60. WA6PNN. R. Schneider, 19109 Derwent Pl., Northridge, California. 91324.

FOR SALE: Practical Wireless Telegraphy.- Buche 1918. Amateur Radio Hand Book With supplement. Radio Society of Gt. Britain, 2nd Edition, 1946. Offers. Douglas, W6CUG, 2254 Pepper Dr., Concord,California. 94520.

FOR SALE: B & W 6100 (SSB), $350. CE 200-V, $400. HRO-50T, ABCD Coils, CE "B" Slicer, $185. 75A4, 0.5, 2.1, 3.1, 6 kc, SPKR, $495. James Craig, W5VRO,1, 29 Sherburne Avenue, Portsmouth, New Hampshire. 03801.

WANTED: Capacitor decade box, 500 or 800 cycle filter for 75A4, and hand held or packset Hi Band FM gear. Robert Rossi, WA0OTF, 4111-55th Street, N. W., Rochester, Minnesota. 55901.

CLEANING SHACK Have to get rid of: 1 Dubilier Mica Trans. Cond. 1917 unit; 1 WE horn speaker old time; 1 Ratheon ER210 and socket; 1 WE 216A with socket; 1 Upright Tel. with dial; ½ Spool of Nichrome - 10 thousands; 1 2API Tube; 4 - HK 24G Tubes; 1 - WE 331A; 1 6-meter Maverick Filter; WANT: H.R.O. 60 coils AC-AD-G. Fred Brauner, W4JZB, 5719 Taylor Street, Hollywood, Florida. 33021.

METER RELAYS, Weston number 705, 0- 10 microamps full scale or 5-0-5 by shifting zero adjustment. New, $5.95 each. W4JGO, 643 Diamond Road, Salem, Virginia. 24153.

JOHNSON VALIANT II. F.W., New Tubes, Exc. Cond. - $175.00. Also 250 W Match Box, D104 Mike on G Stand. All three $225.00. REA PP in 48. WA5DZP, 314 E. Main, Ada, Ok. 74820.

SR-200, P-2000, immaculate, new-like condition, no bugs, manual, original carton. Don Payne, K4ID, Box 525, Springfield, Tennessee, 37172. Nights (615) 384-5643.

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CLEANING SHACK, All kinds solid state devices xmit. and rcv. tubes. 10 yr. accumulation. Some real goodies. Send for list. K8NNU, 1034 Creyts, Lansing, Mich. 48917.

HEATHKIT 10-1-oscilloscope new 3-69, Morrow CM-1 monitor, offers-write R. Shideler, 3225 "A" Tecumseh Ave., South Gate, Calif. 90280.

FOR SALE: Hallicrafters HT32A all 10 meters xtals instruction manual. Like new. Collins 75A2 with product detector and instruction manual. Currin L. Skutt, W8FSZ, 119 N. Foster Street, Lansing, Michigan. 48912.

FOR SALE: D104 mike & PTT Stand like new $20.00—Turner 256 Crystal mike, mint cond. $10.00. K3YMN, 2185 Sampson Street, Pgh, Pa. 15235.

SELL: Compl. CQ & QST files, July 1948 to June 1969. Mint condx. $110/Set-No singles. W6FIP, P.O. Box 15493, Sacto, Calif. 916-927-4840.

WILL TRADE OR SELL: Berkeley model 5100 Eput electronic counter. Want Hy-Gain HD6DXX or Drake 2B. Bob Wagner, Box 582. Fairview, New Mexico. 87532.

WANTED: Heath Twoer. Must be in working condx. Please, no junk. WB6EYN, Robert Tate, 363 Tenth Avenue, San Francisco, Calif. 94118.

SELL: Precise model 300 Wideband oscilloscope. Good condition. Will ship. $30. L. J. McNamee, WB2-KTX, 10 Hyacinth Lane, Holbrook, L.I., N.Y. 11741.

WANTED: 432 mc. junk, scraps anything any condx. send data, prices. Howard J. Eich, 5950 Kedron Street, Springfield, Va. 22150.

LINEAR HEATH SB-200 like new extra pair spare tubes. $220, FOB. K4JK, 2804 Broadview Dr., Huntsville, Ala. 35810.

WANTED: Diagram and service instructions for Webcor Royal Coronet Recorder. Daniel Gibbons, P.O. Box 84. T Alara, Peru.

CANADIANS: Complete amateur equipment service, Lic'd technician, fully equipped, kits serviced. Bob Fransen, VE6TW, Box 197, Sherwood Park, Alta., Canada.

LAMBDA regulated power supply, Model 29, $25 FOB. Carl C. Drumeller, W5JJ, 5824 N.W. 58th Street, Oklahoma City, Okla. 73122.

FOR SALE: Hallicrafters SX115 mint condition with manual. $260.00. Calvin J. Miller, W8VV, 2080 Woodcliff S.E., Grand Rapids, Michigan 49506.

BC-683 Receiver (27-40mc). w/ACPS & manual, excellent, $35.00 express collect. Art Beahr, 8719 Oxwell Lane, Laurel, Md. 20810.

LAUREL & HARDY MOVIES. Std. 8mm B&W, 400 ft. 1/2 hr. silent featurettes of 1920's, $6.00 ea. Art Beahr, 8719 Oxwell Lane, Laurel, Md. 20810.

FOR SALE: Hammarlund HQ-140X receiver, $99; Heath Twoer $30. Both good condx. Local deal. WA2HGJ, Highland Park, N.J. (201) 572-2980.

HAM TRANSISTORS REWOUND, Using Hi temperature wire and insulator. Jess Price, W4CLJ, 411 Gunby Ave., Orlando, Fla. 32801.

SELL: Two superior 116U-2 Variacs. 7.5 amp. 0-140 or 0-240V. Near new condition. $20. each. J.B. Robison, 2411 Metz, Houston, Texas. 77034.

WANTED: Used TA-33 JR or Thunderbird Junior. LaVern Smith, 3104 Catherwood Avenue, Indianapolis, Indiana. 46226.

WANTED: Someone to make phone patch described Sept. 68 CQ Mag. in my 564H phone. W4EFG, Box 125, Skyland, N.C. 28776.

THE WORKED ALL BRITAIN AWARD: Grant Gazetteer, Record Book price $1.50 or 15 IRCs from G3ABG, John Morris, 24 Walhouse Street, Cannock, Staffs., England. USA WAB Rep is W2HWA.

See page 102 for Reader Service

FOR SALE: BC-10 Transmitters modified for commercial use. $35.00 each. Post Office Box 23503, New Orleans, Louisiana. 70123.

WIRELESS SHOP: New and reconditioned equipment. Write, call or stop for free estimate. 1305 Tennessee, Vallejo, Calif. (707) 643-2797.

CANADIANS: Sell Collins 755-3. 2.1 KC and 200 CPS Filters. Excellent condition. G. Stewart, 26 Dominion Bay, Thompson, Man. (VE4GS).

TOROIDS: 40/$10.00 (5/$2.00) 88 or 44mhy. center tapped. Reperf tape $10/case/40. Mite printer $160. Model 32KSR reconditioned $200. Lorenz ASR printer (all 60 speed) $100. Want 28 teletype. Stamp for list. Van W2DLT 302X Passaic Avenue, Stirling, N. J. 07980.

WANTED: GONSET SIDEWINDER 2 mtr. transceiver. Does NOT have to be in work. condition. Send information to: F. Balogh, Box 165, St. David's, Ontario, Canada.

SB-200 Absolute Mint Operating Condx. Best offer over $175. R. Jansing, 100 St. Mary's Blvd., Green Bay, Wisconsin. 54301.

COLLINS S LINE COMPLETE FOR SALE. 7583, 32S3, 30S1, 516F-2, 312B4, SM-2 with 25 G Rohn 50' Tipover tower plus 56' straight tower with three element cushcraft 20 meter beam plus 2BDQ Hygain dipole. All cabling plus 200 ft. RG8U coax and Ham-M rotor. On the air WITSC-Will Dyer, Temple, N. H. Telephone: (603) 878-1369. All above purchased new by me. Sell complete for $2700.00.

QSLS. SECOND TO NONE. Same day service. Samples airmailed 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah. 84015.

WRITE, PHONE OR VISIT us for the best deal on new or reconditioned Collins, Drake, Swan, Galaxy, Hallicrafters, Hammarlund, Hy-Gain, Mosley, Waters, Henry linear, BTI linear, towers, rotators, other equipment. We meet any advertised cash price on most equipment. We try to give you the best service, best price, best terms, best trade-in. Write for price lists. Your inquiries invited. HENRY RADIO, Butler, Missouri. 64730.

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

WANTED: Johnson variable capacitor model number 200DD35. State price. All replies answered. N. B. Melick, 748 So. 28th Street, South Bend, Indiana. 46615.

"VENEZOLANOS-se vende maquina de teletipo (Teletype Corp.), modelo 15, con convertidor Northern Raduo 152, ambos en perfectas condiciones. WA3HXR/YV5 tel. 61-80-67 Caracas."

FOR SALE: Swan 400 xcvr, 406 tuner, 12 v. mobile p.s., $275.00. WA5WKR 2708 N.W. 120th St. Oklahoma City, Okla. 73120.

ROCHESTER, N. Y. is again Hamfest, VHF meet and flea market headquarters for largest event in northeast, May 16, 1970. Write WNY Hamfest, Box 1388, Rochester, N. Y. 14603 for program and information.

WANTED: Used Drake TR-4, Blanker preferred, used AC-4, used DC-4. Must be in perfect operating condition. State price. W1FTE, Skip Colton, 222 North St., Windsor Locks, Conn. 06096.

DRAKE R-4 Receiver with MS-4Speaker, new condition, with manual in original carton, $200.00; Central Electronics 200V Transmitter, the cadillac of all transmitters, also like new, $340.00; Both of above for $500.00; Gonset 6 meter communicator IV, AC & DC supply, excellent condition $125.00; Also Hornet TB-1000-4 el beam, will not ship beam, $50.00; L. G. Russell, K5ZCJ, 11714 East 17th Place, Tulsa, Oklahoma. 74128. Telephone: GE7-1244.

SCIENCE TEACHER Needs lucrative summer employment. Anywhere, anything for a good paying job. James Jipping, W9JAR, 3122 Ridge Rd., Lansing, Illinois. 60438.

WANTED: Antique Test Equipment. State make, Model number, Condition, and Price desired. Ed KNIGHT WB8DVP, 25125 Kingshire, Southfield, Michigan. 48075.

CLEANING HOUSE-Excellent Navigator- $70.00, Ranger- $60.00, New 10 element 2 meter beams- $25.00 each or 2 for $45.00. Much more- Stamp for list. J. Shank, W3CNS, 21 Terrace Lane, Elizabethtown, Pennsylvania. 17022.

WANTED: Harvey Wells "Z" match. L. Moore, K5UXR, Rte. 1, Box 59N, Forest City, Arkansas. 72335.

FOR SALE OR TRADE: About 500 QST, CQ, PE, EW and other radio magazines back to 1946, good condition, 10 cents each plus postage if you take all, or will trade for magazines, catalogues, books, QSLs, certificates, etc., before 1925. Henry Wenden, K8IKO, box 222, Worthington, Oh. 43085.

FOR SALE: SB-101, (400hz), HP-23ASB-600, Mike, TR-44, CL-33, 48' Spaulding. All cables. Make reasonable offer to WA7HIL, Evan Oulashin, 205 NW 87th, Portland, Oregon. 97229.

See page 102 for Reader Service

WANTED TO BUY: Johnson 6N2 Thunderbolt VHF Linear Amplifier. Robert Dixon, W8ERD, 311 E. Kelso Road, Columbus, Oh. 43202.

SELL: 100KHz Calibrator, new, $12. Variable noise generator for rcvr rF alignment, new, $10. W4ZSC, 2665 Hawthorne Dr. NE, Atlanta, Georgia. 30329.

FACSIMILE: XEROX TELECOPIER, 180 speed, EXCELLENT CONDITION, $350.00, Westrex equip also. L. Lis, K9HDD, 10401 Leslie Lane, Chicago Ridge, Illinois. 60415.

SELL OR TRADE: HQ-150; geloso ham receiver; Lettine 6 & 2 meter Xmitter with HA-5 VFO. C. Johnson, K2EDP, Tel: (201) 697-7977.

TUBES FOR SALE: 2 new boxed 834's, $1.00 each. 2 new boxed 809 tubes, $1.00 each. 1 Taylor 814 tube with box-maybe pullout, $1.00. 1 Taylor 211 tube, .25. 1 Taylor 805, $2.00 pullout. or $5.00 for all AS-IS FOB. J. D. DeShong, 11847 E. 16, Tulsa, Oklahoma. 74122.

CRYSTALS: SASE for list. Jess, K8LJW, 351 Mower Road, Pinckney, Michigan. 48169.

1969 FOREIGN CALLBOOK, $2.50; 1969 QST's, 25 cents each. W2JBL, George Clark, 123 Davis Ave., Hackensack, N. J. 07601.

SALE: Heath HW100 and AC Power Supply-$275. Johnson Ranger I, $75. WA4NMY, 4803 Russell St., Richmond, Virginia. 23222.

WANTED: PWR supply (AC) for A-54-H transmitter. Also modifications INF. on SX-71 RCVR, Box 335, Nampa, Idaho. 83651.

WANTED: 4-1000A socket. Will trade or pay. You make first request. WB2APX, Apt. 12, 3409 Powelfon, Phila., Pa. 19104.

WANTED: Buy or trade, Pierson KP-81 or KE-93 Receiver. R. Ellis, W7DMI, 1356 Elizabeth St., Las Vegas, Nevada. 89109.

SELL: Mint 75A-4, slow speed knob, spkr $365; Ham Scan HO-13 $60; New 813 $8; Used 4-125A and 4-250A $8 each, 4500-0-4500 v. 120 ma 220 primary, Hermetically sealed $7; 1200 V 1 Amp $10; W0AIH, Rev. Bittner, 814 4th St. S., Virginia, Minnesota. 55792.

SELL: SX146 with R51 SPKR, 10 M xtals, cal. us c, $165; also good DX100, $65. WA2IBE, Ironia, New Jersey. 07845.

WANTED: NOVICE XMTR AND XTALS in good condition. Will trade Heath HW-30 or pay cash. Rob Schmitt, WN7MLJ, P. O. Box 279, Payson, Arizona. 85541.

MOVED TO SMALLER HOME, must dispose of excess xmHrs, rcvrs, Test equipment, parts, tubes, SASE for list. J. B. Forman, W2BUU, c/o GEN. ELECT. CO., 2001 Jefferson Davis, Arlington, Virginia. 22202.

CE 20A, FW, serial E 8355, with QT-1, BC 458 VFO, and complete manual, $100. K O Soule, 507 Houston Street, Kilgore, Texas. 75662.

FOR SALE: SCR-522 Xmtr $15; 3" 500Ma meters, $3.50; 1/4" Electric drill $6; W4TKD, J. Wingfield, 344 Linda Ln., Ft. Walton Beach, Florida. 32548.

SB-301 for sale or trade. Mint. Want SB-110A or Clegg Venus. G. Clark, WA3BBJ, 3942 Wynwood Drive, Sharpsville, Pa. 16150.

WANTED: W8FYO Key Lever for Electronic Keyer. John Becker, 2435 Birchwood Lane, Wilmette, Illinois. 60091.

PLEASE SELL OR LEND ME your Gotham triband instruction sheet. Also want to buy 40' tiltover tower. Jud, 125 Buckwood Dr., Richmond, Ky. 40475.

WANTED: Back issues of Ham Radio, 73 and RTTY, Bill Brosseau, W5BSU, 1210 So. 93rd East Ave., Tulsa, Okla. 74112.

CHIPPEWA KL-1 Linear, uses 4-400A's, best offer; Hw-16 Heath CW transceiver, $85. K3UEJ.

SWAP: Old but gud Super-Pro for HW-32 & PS. C. A. Bowers, 4133 Stonecutter Way, N. Highlands, California. 95660.

GALAXY V Mk2, xtal cal, cw filter, RV-1, AC and DC supplies, excellent condx, package deal only, $450 firm, K4ZLE, 60 Fike, Havelock, N. C. 28532

SELL: Realistic RP 30 to 50 MHz fm Receiver, good condition, $35 or trade for 5 watt solid state CB. K1CCW, 6 Wirthmore Ln., Lynnfield, Massachusetts. 01940.

WANTED: DRAVCO DR-30 receiver. STate condition and price. W7BIF, 107 Wyoming St., Boulder City, Nevada. 89005.

SELL: HE-45B xcvr; HE-61 VFO; AMECO TX-62, VFO-621, CN-50, CN-144, HB 6m PA. G. Smith, 915 Lovera, San Antonio, Tx. 78201.

LINEAR: CE 600L, Broadband no tune! 6 Bands incl. 160M only 20w. drive $190. J. Taylor, W2OZH, 1257 Wildflower, Webster, N. Y. 14580.

COLLINS 75S-3B Rcvr, $395; 32S-3 Xmtr. with 516F2 supply, $495. W2HU, 37 Rodney Lane, Westbury, N. Y. 11590. Tel: (516) 333-7312.

See page 102 for Reader Service

FREE PS xfmr with each sale A-RC-5 Xmtr. Most freq. on hand, FB condx. Sell NEW HW-17 - Local Pref. WB2OBO, FL4-7152. Adr call bk.

WANTED: Collins 75S-1 or 75S-2. Also need meter for Ham-M control box. Mike Ludkiewicz, W1-DGJ, 143 Richmond Road, Ludlow, Ma. 01056.

WANTED: Collins 51-S, mint. A. E. Gamon, K8A-CF, 1120 E. Ash Street, Mason, Mich. 48854.

FOR SALE: Teletype model 26 with table, cover, sync motor, $55.00 FOB. W6DOU, 3154 Stoney Point Road, Santa Rosa, California. 95401.

NEED "G" 180-430 Coil for HRO60. SELL mint 5 x 100, $125 or trade? HW-16? K7JVZ, Box 373, Sparks, Nevada. 89431.

SB-300: Excellent, SSB filter, no mods, little use, first Check for $195 or more, FOB, Ken Coit, 139-05 Bethpage, Wheaton, Md. 20906 (301) 871-8503.

UCS375 or 700 W/DIGIDIALS, $25 EA, Card 500 PF/3KV $5. Want HC6 Xtals 1.650, 32.0,33.0, 33.5 MC, Coax SWS. JT, W7ZFB, 4304 Willow Wood Drive, Annandale, Virginia. 22003.

FOR SALE: NCX-3, AC supply. Mint condition. $200. Frank Gibes, W9HFI, 4424 W. Altgeld, Chicago, Illinois. 60639.

WANTED: Heath GD-125, HD-15, SB-600 and SB-640. Rod, W7YBX, 5632-47th SW, Seattle, Washington. 98116.

MUST SACRIFICE: Viking Thunderbolt, Collins 75A2 Hallicrafters HT32A All with manuals and on the air. Currin Skutt, 119 N. Foster Street, Lansing, Michigan. 48912.

GOING SIDEBAND? Mint, All Band SSB XMTR Heath HX-20 W/AC $100.00. Contact K. C. Jones, W6RLN, Huntington Beach, California. 92646.

NEED BC 454 and 455 in Exc. Cond. or better. State cond. and price. Paul Rich, Box 4, Morton, Illinois. 61550.

WANTED: Antenna Coupler for matching 80M. end-fed wire to an NCX-3. Dick, W2FGL, 19 Mango Ln., Liverpool, N. Y. 13088.

SELL: 6 volt D.C. to 110 volt A.C. rotary converter. 80 watts continuous. Cheap! W8VVD, Box 452, Birmingham, Michigan. 48012.

THE COMPLETE COMMUNICATIONS COURSE of NR1 for FCC first phone. All texts and supplemental manuals, tests and study material for $50 plus postage. No kits or help from school included. Bob Farricy, WB2YEE, 1017 Westmoreland Ave., Syracuse, New York. 13210.

DOCTORS: All physicians, dentists, osteopaths, veterinarians, and PhD's in Biochemistry, Bacteriology, pathology, pharmacology and other related paramedical fields are asked to send name, call, etc. to K4RTA for listing in CHC, $24.00. World wide doctors Ham Directory, K4RTA, 105 Freshrun Drive, Hendersonville, Tn. 37075.

WANTED B & W 1 KW Band Switching Turret. Also 0-350 MMF 10KV Vacuum Condenser. W4-AIS, 300 Thornwood Drive, Taylor, S.C., 29687.

WANTED: To Borrow - Manuals for Heathkit AT1 and VF1; Elmac PMR6 Rx. K4OLQ, Box 24, Watkinsville, Georgia. 30677.

WANTED: Power Transformer and Manual for Eico Scope Model 470. S. H. Rice, WB4FIL, Rt. 1, Maysville, Kentucky. 41056.

SURPLUS SALE: TCS, ARB, ARC3, and 2 BC-779 Super Pro's with power supplies. Ed Block, K5ENL, Rt. 4, Box 127, Grandview, Tex. 76050.

1500 WATT PEP, 80-10 MTR. final with variable power supply. Excellent condx. with complete schematics. R. Mendelson, W2OKO, 27 Somerset Place, Murray Hill, New Jersey. 07974.

SB-200: Mint condition, $200. Pick up. Now have built SB 220 linear. Max Sherr, W2TQP, 182-41 80th Road, Jamaica, New York. 11432.

WANTED: Kits to wire. 10% of cost. Sell 250w GG Linear, $50 or best offer. Kirby, 11 Berkshire Ct., Huntington Stn., N. Y. 11746. Phone: (516) HA3-8944.

75S3B/32S1/5I6F2 - $900. Will buy KWM2 or take one in trade on gear listed. W0BNF, Box 105, Kearney, Nebraska. 68847.

WANTED: GALAXY REJECTOR. State Condition. J. Gunderson, 13312 Inverness Road, Hopkins, Minnesota. 55343.

FOR SALE: Excellent novice rig in mint condx Harvey Wells TBS 50C wid matching HD power supply $15.00. Also Heath VF-1 $7.50 or both $20.00. Manuals and will ship. R. Coan, 1513 Farlow Avenue, Crofton, Md. 21113.

SALE: NCX-3 with A.C./D.C. Supplies Hi-Gain Mobile Antennas with 75/40/20 coils. Mint cond. $200.00. W1UXL, 90 Devon Rd., Norwood, Massachusetts. 02062.

SALE-HALLICRAFTERS SR42A two meter transmitter/receiver. Includes 4 crystals between 145-146 MC input 14 watts used less than 25 hours. 120V 60HZ input, price $100.00. W3DJD, 205 Elliger Avenue, Fort Washington, Pa. 19034.

See page 102 for Reader Service

SELL: Globe HG-303, 90 watt, 80-10 meter, CW crystal controlled transmitter and matching VFO V-10, manuals, $48, WB2MQL, (516) 221-64 86, during the evening.

FOR SALE: 120 ft. crank-up tower V T Voltmeter Oscilloscope both Heath. Best offer. WA5 BMM, J. Lundy, Box 26, Deming, N.M. 88030.

JOHNSON MATCHBOX: Like new with built-in SWR Meter. Model 250-23-3. Perfect for any All-band Transceiver to LW Antenna. $45. W2MLO, 410 Scranton Avenue, Lynbrook, N. Y. 11563.

COUNTY HUNTERS. Make plans to participate in the 1970 Georgia QSO party in May. Georgia Southern College Radio Club will activate a rare county. L. E. Price, W4DQD, P. O. Box 2067, Ga. Southern College, Statesboro, Ga. 30459.

CERTIFICATE HUNTERS. Fastest growing club in the world - For Free Information: NAHC, New York Chapter, Joseph Schwartz, 43-34 Union St., Flushing, New York. 11355.

829-B TUBES, G.E. and RCA. Guaranteed $6.00 each postpaid. E. M. Shook, W5IT, 227 West Wood-in Blvd., Dallas, Texas. 75224.

HALLICRAFTERS HT-33B WANTED for cash. State condition and price. Have Heath SB-200 like new, $175. Harry Cornwell, W7LUT, Rte 1, Box 19, Forsyth, Montana. 59327.

LOOKING FOR SERIOUS EXPERIMENTER to TRADE new hi-powered EIMAC 8164/3-1000Z rec'd for Xmas and cant use. What hv u in Tran-cvr or Tx gear? W6AT, 606 Buckeye, Vacaville, California. 95688.

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810 TRIODES, You pay postage, I give you six tubes. All used, but usable. Bob Davis, K0FPC, 1641 South Main, Ottawa, Kansas. 66067.

COMPETITION? You bet. Join a new contest/DX group placing 3rd nationally in first year. If within 100 miles of Central Conn., contact K1GUD, K1-JHX or K1VTM.

WANT Construction manual for DX-40. Will pay cash. FOR SALE: Unconverted ART-13 w/tubes, $25.00. W. S. Anderson, WA4MTZ, 68 Russell Ave., Garden City, Ga. 31408.

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75 A 4 RECEIVER in good condition with original book 3.1 filter SN number 1329, $325.00. WA4-AUF.

MUST SELL: School expenses. NCX-200, AC-200, XCU-27 Calib., VOX parts; $300.00. FOB D. Naatz, c/o ILC, W. Grover Rd., Eau Claire, Wisconsin. 54701.

HAM TRANSFORMERS Rewound, using Hi-Temp Wire and Insulation. Jess Price, W4CLJ, 411 Gun-by Avenue, Orlando, Florida. 32801.

STAMP COLLECTORS 20 New Zealand F.D.C. or Future issues Mint Stamps Swap New U.S. Call bk. UHF converters or sell. 2L2VF. W. G. Wright, 12 Koraka Street, Stoke Nelson, N. Zealand.

WANTED: 73's - Jan, Dec-63, Jun-62, Jan, Feb, Mar, Apr-61, Oct, Nov-60. KL7FSF, 1904 W. 46 Avenue, Anchorage, Ak. 99503.

SELL FEDERAL Gen. 10KC-50MC $75; Paco G-32 sweep Gen. $65; Measurements 79 pulse gen. $35; Robert Ireland, Pleasant Valley, N.Y. 12569.

FOR SALE: Parks 6 & 2 Meter Converters IF. 28-32 mc. J. Gysan, W1VYB, 53 Lothrop St., Beverly, Mass. 01915.

FOR SALE COLLINS S LINE. Exc. Cond. 30S-1 32S-1 w/power supply 75S-3. WA5BMM, J. Lundy, Box 26, Deming, New Mexico. 8803. Best offer.

WANT: Code records - 5wpm to 15 wpm or more Also need CPY "GEN CL. LICENSE HAND-BOOK" by H. S. Pyle. PSE SASE. D. Watson, Star Rt., Northport, Al. 35476.

WANTED: Buy or Swap. Berkeley 785, 1 MHZ DCU, or similar. Have 707AH, 1 MHZ or 705AH, 100 KHZ for trade. W9TKR, 505 South Elmwood, Waukegan, Illinois. 60085.

SELL: HAMMARLUND HQ-140X receiver, $80; Heath Twoer, $30; Eico 730 Modulator, $25. All good condx. WA2HGJ, Highland Park, New Jersey. 08904. (201) 572-2980.

VFO FOR SALE: Heath HG-10, 80-2 meters, mint condition, with manual, $30 FOB, Richard Beatie, 1904 East 114th Avenue, Tampa, Fla. 33612.

WORKED SOUTH AMERICA CERTIFICATE: Work all 13 countries. Send $1 and confirmation to HC1TH, Box 583, Quito, Ecuador, South America.

WANTED: Information on connecting scope to Swan 350 to Receiver. Mike Morrisey, 752 High Street, Harrodsburg, Ky. 40330.

WANTED for a novice xerox copy of circuit diagram for WRL Model 90-A Glove Chief Transmitter. Mail to R. G. McCuistion, P. O. Box 4334, Midland, Texas. 79701.

QUAD NEW UNCRATED. 4 element 3 band Skyline fiberglass spreaders. Cost 230 sell 100 or trade. George Clark, W6GAW; 1741 La Coronilla, Santa Barbara, California. 93105.

See page 102 for Reader Service

USA-CA [*from page 74*]

members of the QRP A.R.C. Awards manager is: Hugh F. Aeiker, WA8CNN, 929 South Park, Charleston, West Virginia 25304. A list of members can be obtained by sending an S.A.S.E. to WA8CNN.

QRP-25: Issued for working 25 members of the QRP A.R.C. Members must have been running 100 watts or less (200 watts p.e.p. s.s.b.) at the time of the QSO. Endorsements are issued for 50, 100, 200, and every additional hundred members thereafter. Also for working 10 members on the bands above 50 mc. Send log data, including members numbers or power, with fee for basic award. For later endorsement seals send 10¢ or an S.A.S.E. with list of additional members (and their #s) worked.

WAC/QRP: Issued for confirmed contacts with low power stations in all six continents. Power inputs of less than 100 watts must have been used by both sides. Send QSLs or GCR list including powers on both side, with fee.

WAS/QRP: Issued for confirmed contacts with low power stations in each of the 50 U.S. States. Power inputs of less than 100 watts must have been used by both sides. Send QSLs list including powers used on both sides, with fee.

DXCC/QRP: Issued for confirmed contacts with low power stations in 100 ARRL countries. Power or QRP rig must be indicated on QSLs and applications. This award is available to QRO operators but a special endorsement seal will be added if two-way QRP was used for all contacts. Apply by sending QSLs or GCR list including powers used and fee.

KM/W-1000-Mile-per-Watt Award: Issued to any amateur transmitting or receiving the transmissions of a low-powered station such that the great circle distance between both sides, divided by the power input of the low-power station equals or exceeds 1000 miles per watt. Additional certificates will be issued for accomplishing this on different bands or using different modes. To apply send full log data including powers used on both sides, signal reports exchanged, band and mode, and operating QTHs on both side, plus fee.

Special notes regarding QRP Awards: Since a list of member *numbers* is not published, satisfactory proof of contact for any of the awards will be the members number shown on the application without the need for possessing a verifying QSL. If the member number is not indicated, the QSO must be verified by a QSL and his power (or QRP rig) indicated. All awards are also issued to s.w.l.s on a heard basis; amateurs may use s.w.l. reception reports in lieu of two-way QSLs in applying for any of the awards. For the purposes of this program, s.w.l.s will be considered low-powered operators (but not necessarily club members). QRP Corresponding Secretary is: Elmer J. Worth, K3YNN, 946 Franklin St., Reading, Pennsylvania 19602.

73, Ed., W2GT.

Our Readers Say *[from page 7]*

JA2AC; and Hajime, JA2OZ; both broadcast engineers who have lived here for months, studying American TV systems at CBS. They could not apply for a W license here. Presently, Seiichi, JA2ENU; Mikio, JA7DBG; and others living and working in New York City, with long term contracts, but they cannot enjoy their hobby: amateur radio.

This is very unfair and I hope this situation will soon be corrected. Our new Ambassador to Japan, the Hon. Armin H. Meyer, W3ACE, ex-EP3AM, etc., can do a lot in this sense. I think the ARRL should suggest such an agreement as soon as possible.

George Pataki, ex-YO2BO
Jackson Heights, N.Y.

Missouri Call Letter Plates

Editor, *CQ:*

I was appalled to read in today's paper that the "Show Me" state of Missouri will not have ham license plates available during 1970. Somehow the over 700 hams in Missouri who hold such plates, including myself, never knew that we were in danger of losing them until it happened. If anyone has any suggestions in addition to writing to our legislators and/or sending in a petition. I should appreciate hearing from him. Also, I wonder how many states now have ham plates available? How about suggestions for reincorporating them into the laws relating to license plates.

Richard M. Jacobs, WAØAIY
Kansas City, Missouri

Speed Demons?

Editor, *CQ:*

Why in the world do so many c.w.'ers do such a real good job in sending slow, well spaced messages, and then suddenly throw their call letters at about 20 or 30 w.p.m.?

I am sure that other Novices, like myself, have had this happen to them many, many times and have, at the end of the message been left hanging in mid-air, not being able to read the sender because we can't copy that fast. So why not slow down fellows, and give us a break and yourselves, too, because we never do find out who you are.

Robert Grafe, WN9ASD
Chicago, Ill.

See page 102 for New Reader Service

Q & A [*from page 81*]

For higher-frequency use, a mixer with an appropriate heterodyning crystal for a 5 mc i.f. would be required for this type application.

Recommended Publication

Twenty-five years or so ago the Federal Telephone and Radio Corporation (I.T.&T.) put out a publication *Reference Data for Radio Engineers*. It proved to be very popular, resulting in the printing of other larger editions during the intervening years. The latest one is the 5th Edition which is greatly expanded and which covers much more ground than does the earlier versions.

There are 45 chapters of material, covering such subjects as: frequency data with conversion factors, nomenclature for various frequency bands, frequency allocations, etc.; units, constants and conversion factors; properties of materials; composition and color codes of components; 3 chapters on filter network theory and design; bridge and impedance measurements; magnetic core transformers, reactors, amplifiers; rectifiers; feedback-control systems; electron tubes; semiconductors and transistors; modulation; transmission lines; antennas; waveguides and resonators; propagation; Radar fundamentals; digital computer mechanics and logic; navigational aids; electroacoustics; nuclear physics; quantum electronics; information theory; probability and statistics; fourier waveform analysis; Maxwell's equations; and a profusion of other tables and charts.

Of course, where one publication covers such a wide range of subjects, each one cannot be dealt with to extreme details; however, the basic data required to be useful in solving problems is complete and well presented. On the other hand, some subjects, such as filter networks, are covered in more depth.

The average length of each chapter is about 30 pages, cleanly printed on a fine-quality matte-finish paper on pages size 9½" × 6" bound in a hard-cover volume 1¾" thick.

We can highly recommend this publication as an indispensable reference for the more advanced amateur and for engineers for whom the cost of $20 for the book should be well worth while. *Reference Data for Radio Engineers*, (5th edition), is published by Howard W. Sams & Co., (A Subsidiary of I.T. & T.) 4300 West 62nd Street, Indianapolis, Indiana 46266.

73, Bill, W2AEF

See page 102 for New Reader Service

CQ BOOK SHOP

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

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

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

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

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

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

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

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

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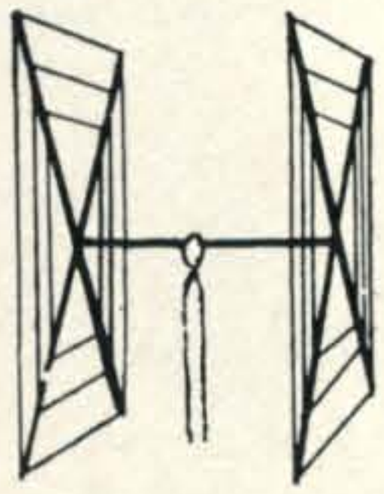

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Shipping Weight: 28 lbs. Net Weight: 25 lbs.
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Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
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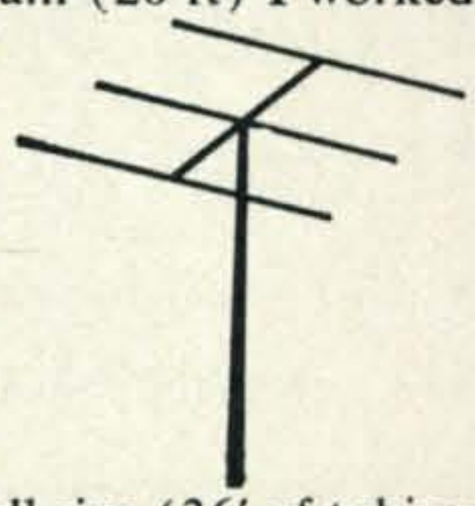

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*20' boom

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