CQ

ICD

June 1970

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Model Control by Radio
The Two Gallon Cavity for 6M.
CQ Reviews The Heathkit SB-220 Linear Amplifier

The Radio Amateur's Journal

Want to start a pile-up?

The New Heathkit® SB-102

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

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

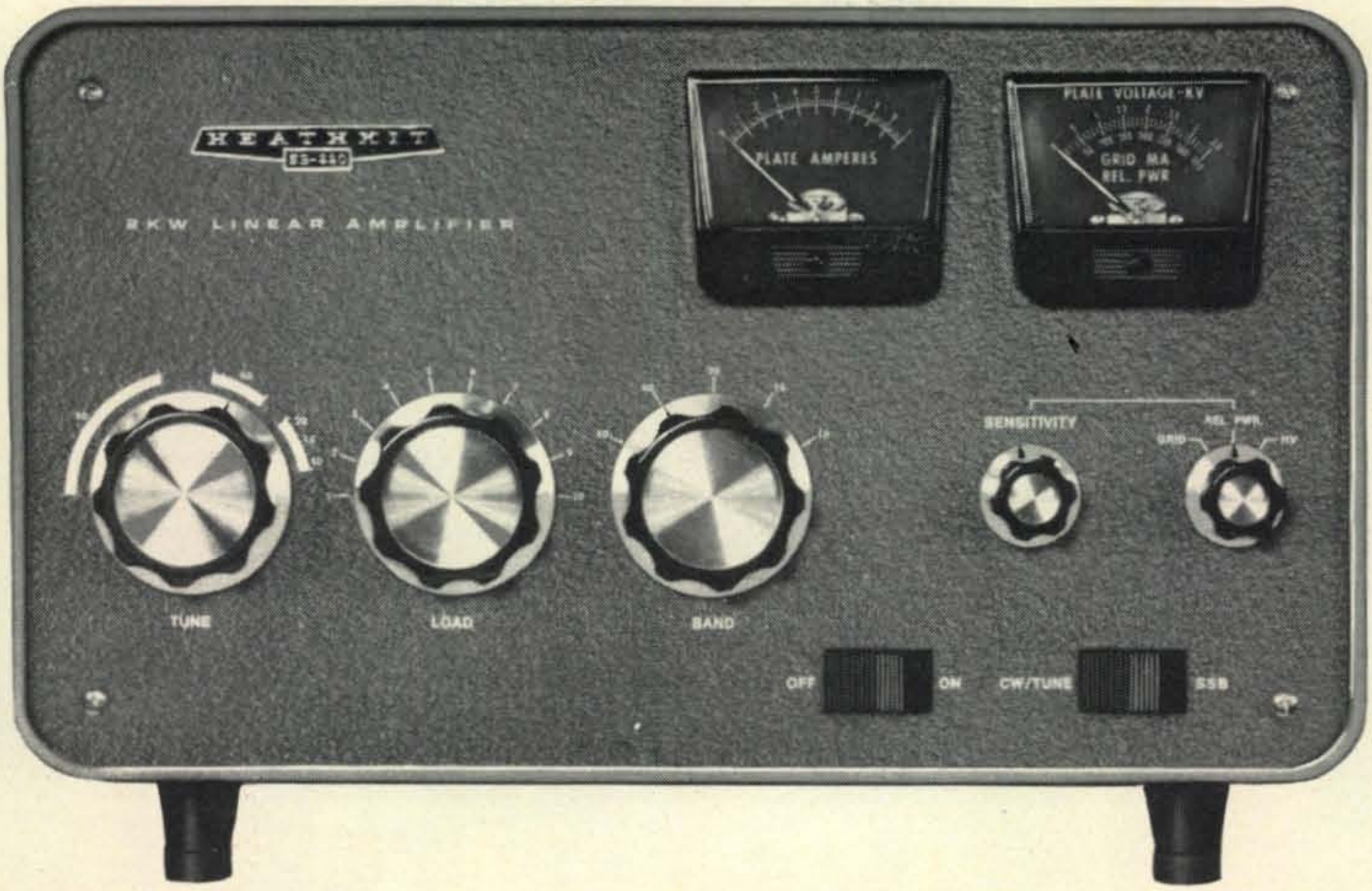
Hot new receiver circuitry delivers improved sensitivity . . . now less than 0.35 uV for 10 dB signal plus noise to noise. This increase gives you solid copy longer when the band is on the way out.

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

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

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

SB-102 SPECIFICATIONS — RECEIVER SECTION: Sensitivity: Better than 0.35 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **SSB selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down — 2:1 nominal shape factor — 6:60 dB. **CW Selectivity:** (With optional CW filter SBA-301-2 installed) 400 Hz minimum at 6 dB down, 2.0 kHz maximum at 60 dB down. **Input impedance:** Low impedance for unbalanced coaxial input. **Output impedance:** Unbalanced 8 and 600 ohm speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Spurious response:** Image and IF rejection better than 50 dB. Internal spurious signals below equivalent antenna input of 1 microvolt. **TRANSMITTER SECTION: DC power input: SSB:** 180 watts P.E.P. continuous voice. **CW:** 170 watts — 50% duty cycle. **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm non-reactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2:1 SWR. **Oscillator feedthrough or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit-receive operation: SSB:** Push-to-talk or VOX. **CW:** Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker in CW mode. Approx. 1000 Hz tone. **Microphone input impedance:** High impedance. **Carrier suppression:** 50 dB down from single-tone output. **Unwanted sideband suppression:** 55 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **Noise level:** At least 40 dB below single-tone carrier. **RF compression (TALC):** 10 dB or greater at .1 ma final grid current. **GENERAL: Frequency coverage:** 3.5 to 4.0; 7.0 to 7.3; 14.0 to 14.5; 21.0 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megahertz). **Frequency stability:** Less than 100 Hz per hour after 10 minutes warm-up from normal ambient conditions. Less than 100 Hz for ±10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Visual Dial Accuracy — "resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 Hz. **Calibration:** 100 kHz crystal. **Audio frequency response:** 350 to 2450 Hz ±3 dB. **Phone patch impedance:** 8 ohm receiver output to phone patch; high impedance phone patch input to transmitter. **Front panel controls:** Main (LMO) tuning dial; Driver tuning and Preselector; Final tuning; Final loading; Mic and CW Level Control; Mode switch; Band switch; Function switch; Freq. Control switch; Meter switch; RF gain control; SSB-CW filter switch. Audio Gain control. **Internal controls:** VOX Sensitivity; VOX Delay; Anti-Trip; Carrier Null (control and capacitor); Meter Zero control; CW Side-Tone Gain control; Relative Power Meter Adjust control; P.A. — Bias; Phone Vol (headphone volume); Neutralizing. **Rear Apron Connections:** CW Key jack; 8 ohm output; Spare A; Spare B; Phone patch input; ALC input; Power and accessory plug; RF output; Antenna switch; Receiver Antenna. **Power requirements:** 700 to 800 volts at 250 ma; 300 volts at 150 ma; —115 volts at 10 ma; 12 volts at 4.76 amps. **Cabinet dimensions:** 14 7/8" W x 6 5/8" H x 13 3/8" D.



Turn on your Benton Harbor maxi-rig!

he New Heathkit® SB-220

asiness end of the Maxi-Rig! Gives your signal the thority it takes to punch through those pile-ups (or art one yourself). And keeps you operating under con- tions that drive the other guys QRT.

pair of conservatively rated Eimac 3-500Z's provide to 2000 watts PEP SSB input . . . 1000 watts on CW *d* RTTY. Requires only 100 watts PEP drive. Pretuned oad band pi-input coils deliver maximum efficiency and w distortion on the 80-10 meter bands.

he built-in solid-state power supply can be wired for ther 120 or 240 VAC and switched back again in min- es if your power requirements change. Circuit breakers ovide added protection and eliminate costly fuse chang- g. And for cooler operation and extended tube life, ling plate current is reduced by Zener diode regu- ted bias.

he layout of the new "220" is designed for fast, high olume air flow with a husky, quiet fan in the PA com- artment doing the job. Result: the "220" actually runs ooler than most exciters.

ther features include two front panel meters for con- nuous monitoring of Ip plus switch-selected monitoring f Rel. Pwr., Ep & Ig . . . ALC output to reduce over- riving and distortion . . . safety interlocked cover . . . asy 15-hour assembly and handsome Heathkit SB-Series tyling.

Tired of stumbling barefoot through the QRM? Order the shoes for your Maxi-Rig now . . . the new "220" . . . another hot one from the Hams at Heath.

• Full 2 kW PEP input on SSB . . . 1 kW on CW and RTTY • Boardband pi-input on 80 through 10 meters • Two Eimac 3-500Z tubes • 120 or 240 VAC wiring options • Zener diode regulated operating bias for reduced idling plate current, longer tube life, cooler operation • Double shielded to reduce stray radiation • Solid-state power supply • Two front panel meters for continuous monitoring of plate current, plus switch selected monitoring of Rel. Pwr., plate high voltage and grid current • Quiet, high volume fan for cool running • ALC output • Easy 15 hour assembly.

Kit SB-220, 55 lbs.....**$349.95***

SB-220 SPECIFICATIONS — **Band coverage:** 80, 40, 20, 15 and 10 meter amateur bands. **Driving power required:** 100 watts. **Maximum power input:** SSB: 2000 watts P.E.P. CW: 1000 watts. RTTY: 1000 watts. **Duty cycle:** SSB: Continuous voice modulation. CW: Continuous (maximum key-down 10 minutes). RTTY: 50% (maximum transmit time 10 minutes). **Third order distortion:** —30 dB or better. **Input impedance:** 52 ohm unbalanced. **Output impedance:** 50 ohm to 75 ohm unbalanced; SWR 2:1 or less. **Front panel controls:** Tune, Load, Band, Sensitivity, Meter switch, Power CW/Tune — SSB, Plate meter, Multi-meter (Grid mA, Relative Power, and High Voltage). **Rear Panel:** Line cord, Circuit breakers (two 10 A). Antenna Relay (phono), ALC (phono), RF Input (SO-239). Ground post. RF output (SO-239). **Tubes:** Two Eimac 3-500Z. **Power required:** 120 VAC, 50/60 cycles, at 20 amperes maximum. 240 VAC, 50/60 cycles at 10 amperes. **Cabinet size:** 14⅞" W x 8¼" H x 14½" D. **Net weight:** 48 lbs.

FREE 1970 CATALOG

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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AM-234

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The Swan 250-C Transceiver on 6 meters, and the TV-2B Transverter on 2 meters. The outstanding performance of this team is opening up greater activity and DX in the VHF regions. Join in the fun and excitement.

. . . for 6 meters

SWAN 250C

- 50-54 mc coverage.
- 240 watts P.E.P. input.
- 180 watts CW input.
- Nuvistor Cascode front end.
- Crystal lattice filter.
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- Selectable sideband.
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$450

. . . for 2 meters

MODEL 500C MODEL 117XC MODEL TV-2B

SWAN TV-2B TRANSVERTER

A receiving and transmitting converter for the 144-148 mc band. Designed to convert any Swan Transceiver to operate on the 2 meter band. May be used with the Swan 250, 350, 400 and 500 Series transceivers. Requires just one power supply for both units.

- 240 watts P.E.P. input.
- Nuvistor Cascode front end.
- I.F. input and output may be in 6, 10, 15, or 20 meter band.

$350

See your Swan dealer for details.

SWAN ELECTRONICS

305 Airport Road
Oceanside, California 92054
A Subsidiary of Cubic Corporation

JUNE, 1970 VOL. 26, No. 6

CQ

The Radio Amateur's Journal

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DEPARTMENTS

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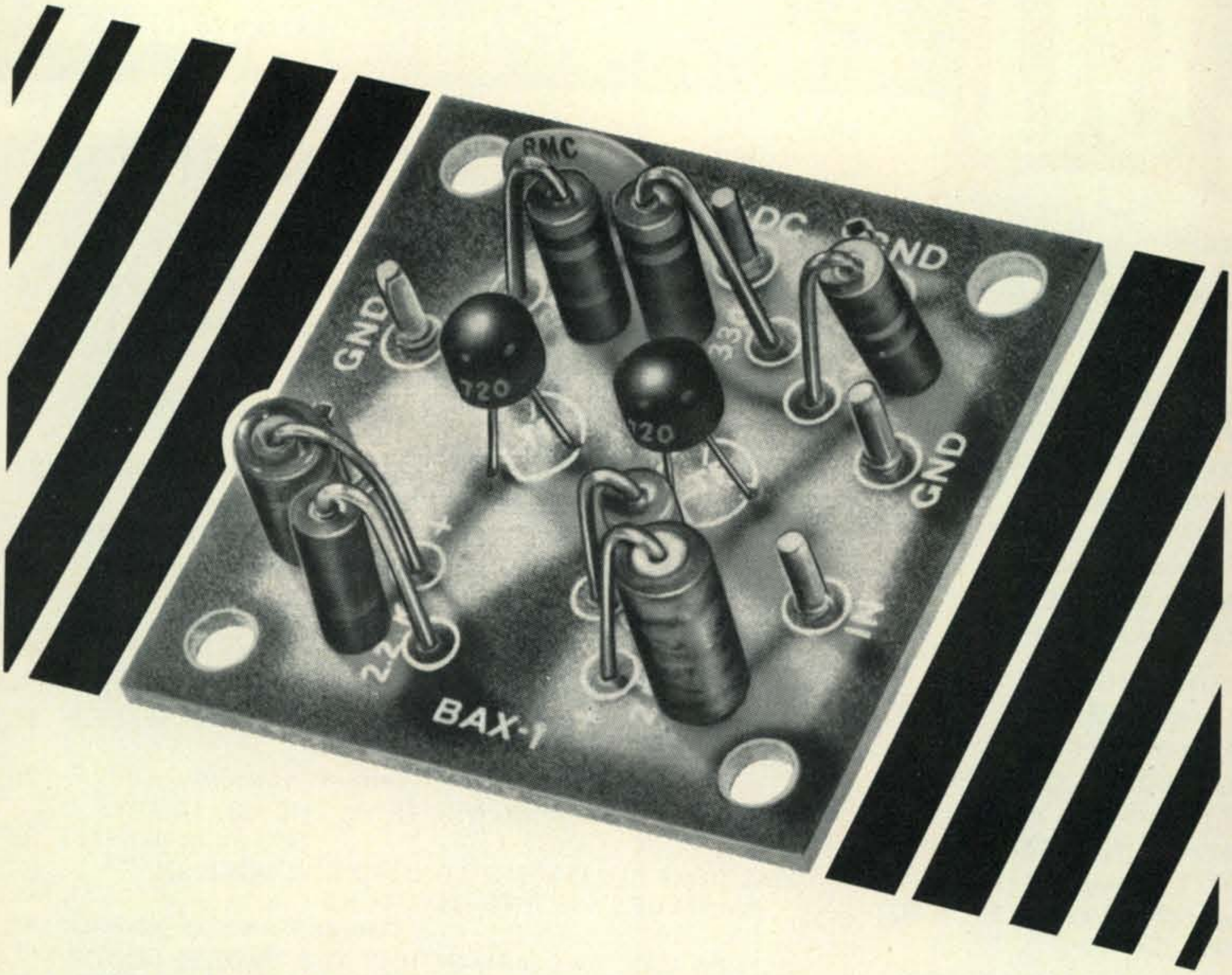

International BAX-1 Broadband Amplifier is a general purpose unit which may be used as a tuned or untuned amplifier in RF and audio application. For example: when used as untuned RF pre-amplifier connect between antenna and receiver antenna posts. Ideal for SWL, Experimenter or Amateur applications.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

Write for complete catalog.

6 to 30 DB GAIN!

WITH ICM LOW COST BAX-1 BROADBAND AMPLIFIER (20 Hz to 150 MHz)

INTERNATIONAL

CRYSTAL MFG. CO., INC.

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ZERO BIAS

As we indicated in last month's Zero Bias, CQ's petition to make ham equipment and license fees deductible on individual personal income tax returns was filed with the Internal Revenue Service in late March. To date, we've received no reply from IRS, but this is to be expected during this time of the year when they're so busy handling millions of returns. It's also possible that a direct ruling might not be coming from IRS at all, but might well require action from Congress. That's why we strongly urge our readers to make their opinions felt to their Senators and Representatives immediately. Quick action might well get the ball rolling on this measure in time for filing of 1970 returns.

In case you missed reading our original petition, the arguments for exemption were taken directly from the FCC part 97.1 of the rules governing the Amateur Radio Service. According to FCC the basis and purpose of the Service is as follows:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary non-commercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronic experts.

(e) Continuation and extension of the amateur's unique ability to enhance international good will.

This petition was discussed with literally thousands of amateurs at the Dayton Hamvention last month, and enthusiasm was keen to say the least. In fact, we learned that many amateurs are already using ham equipment as tax deductions in conjunction with their efforts on behalf of the various MARS programs. Since that's the case, we feel that the stage has already been set. Many hams we spoke with at Dayton indicated that they intend to deduct the cost of their stations & license fees on next year's returns. We urge all readers to consult their accountants as to the correct procedures for doing so. It would be a crime to lose out on a legitimate deduction simply by using an incorrect procedure.

Benjamin N. Lazarus, W2JB

On March 25, the amateur world lost another fine old timer, and CQ's Contest Committee a dear friend and assistant, Benjamin N. Lazarus, W2JB. Ben died suddenly at his home, apparently of a heart attack. Hamming had been a special part of Ben's life for 58 of his 76 years, the last seven years being spent in retirement from his broadcast engineer duties. In retirement, though, he continued to be active in contest activities, and was a charter member of the CQ Contest Committee. Ben was also a member of the Veterans Wireless Association, OOTC and QCWA.

On The Cover

V.H.F. from the South Pacific? Why not! The cover scene this month shows Trevor Ferguson, 5W1AR, and E. A. Clark, 5W1AL, operating a 50mc Field Day-type setup in front of Trevor's home in western Samoa. The antenna in the foreground is a homebrew 50mc quad.

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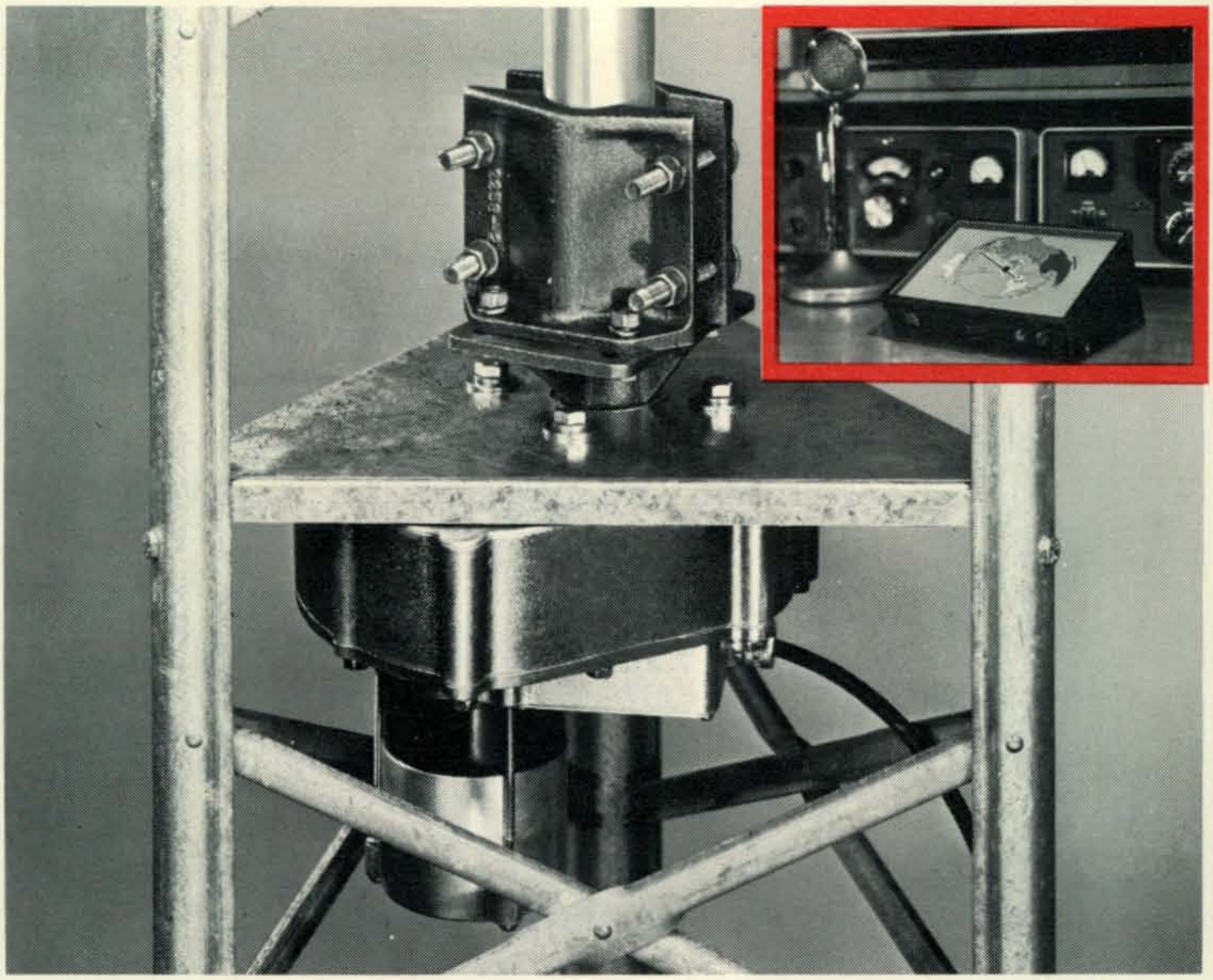

HY-GAIN'S NEW 400 ROTO-BRAKE

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.

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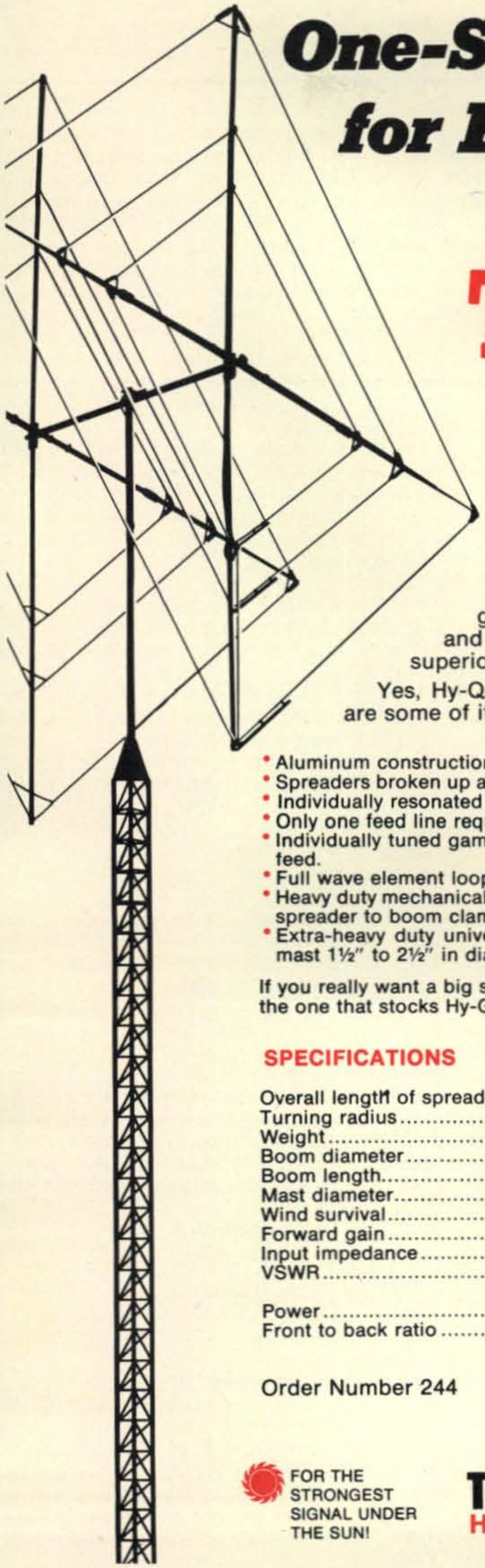

One-Stop "Shopping" for Everything You Want in a

TRI-BANDER QUAD

Why shop around for, and put together, bits and pieces of a tri-band, two-element quad at greater cost particularly when—after all is said and done—Hy-Gain's *complete* Hy-Quad delivers superior performance?

Yes, Hy-Quad is the only quad that is complete; and here are some of its features:

- Aluminum construction that is made to stay up.
- Spreaders broken up at strategic electrical points with cycolac insulators.
- Individually resonated elements with no inter-action.
- Only one feed line required for all three bands.
- Individually tuned gamma matches on each band with Hy-Gain exclusive vertex feed.
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- Heavy duty mechanical construction of swaged aluminum tubing and die-formed spreader to boom clamps.
- Extra-heavy duty universal boom-to-mast clamp that tilts and mounts on any mast 1½" to 2½" in diameter.

If you really want a big signal, buy one at the best distributor under the sun. He's the one that stocks Hy-Gain.

SPECIFICATIONS

Overall length of spreaders	305"
Turning radius	13' 6"
Weight	42 lbs.
Boom diameter	2"
Boom length	8"
Mast diameter	1¼" to 2½"
Wind survival	100 MPH
Forward gain	8.5 db
Input impedance	52 ohms
VSWR	1.2:1 or better at resonance on all bands.
Power	Maximum legal
Front to back ratio	25-35 db depending upon electrical height.

Order Number 244 Ham Net $129.95

FOR THE STRONGEST SIGNAL UNDER THE SUN!

THE HY-QUAD from HY-GAIN

HY-GAIN ELECTRONICS CORPORATION

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

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OUR READERS SAY

Random Thoughts on C.W.

Editor, *CQ:*

Re your article, page 108, February 1970, "Random thoughts from the boys in the back room," and the letter from K4CN, March 1970. I have some ideas on the subject that I'd like to pass along for what they're worth. It seems to me that all that's happening to equipment sales is that most everybody that is interested has bought an s.s.b. transceiver. That's about all I've seen advertised lo these many years, except for a few companies that are jumping on the low-power 2-meter bandwagon. What about the c.w. operator? Just show me one ad for a v.f.o. controlled c.w. transceiver, designed for the c.w. man, that has appeared in your magazine, running at least 50 watts. "There just ain't no such animal."

I run strictly c.w., here, and a quick check through my QSL collection tells me that the majority of operators running c.w. most or all of the time use Novice type gear, that is, rock-bound, or that have external v.f.o.'s and/or other external black boxes, or some model of the quite popular Johnson line and the remainder is filled by Heath, Collins or Swan, Drake, etc. There aren't too many c.w. addicts, I don't think, that are going to shell out $500 to $1600 for a rig that has 2.1 kc selectivity. How many rigs have good break-in capability? How many will load the average field day antenna or portable or mobile? Not the theoretically nominal 50 ohms that is so widely advocated by all manufacturers but seldom obtained note the many articles on transmatches and related equipment ads). Also look around at the large number of a.m. rigs that are being pressed into service, and I emphasize pressed, mainly because they are available and I might add, have power supplies and c.w. notes that would put the average s.s.b. rig to shame. C'mon fellas, it seems like somebody is neglecting about 50% of the ham population. Maybe I'm naive, and maybe c.w. is on the way out, but I must agree with O.M. Hollis about the wide-spread use of c.w. commercially. I don't have access to all the information that ham equipment manufacturers must have on the market, but it seems to me that without at least one unit on the market, their sales projections must be at least a little bit misleading. I must also agree with K4CN about the radio industry trying to relegate c.w. to the graveyard. I believe the EIA also frowns upon the c.w. art, and s.s.b. notwithstanding, it is an art. I happen to be one of those who are fortunate enough to be blessed with some aptitude in this mode and learned the code through one of the better users of c.w. today, the US Army. They felt that in my M.O.S., I could be of greater use to them with a knowledge of c.w. and went to great lengths to get me up to 18 w.p.m. Hi! I owe them a debt of gratitude even to this day. I realize everyone has the right to his choice of mode and this is as it should be, the more versatile we can be the better we are for it, but what irks me is that I am penalized because the mode I have chosen happens not to be in vogue with a few vocal s.s.b. gentlemen and equipment manufacturers. (I refer to the EIA because of their proposals to apparently downgrade technical progress and c.w. proficiency in the name of swelling our ranks and thereby promoting equipment sales.) Which gives you an indication of what happened to the citizens radio service. I wonder how many potential hams are burning up 27 mc right now. I'm not fooled by the fine print in the ad for the little 100 watt linear that states "Not legal for use on 27 mc Class D band," or some such. You tell me those guys aren't working skip and having a ball at it. FCC notwithstanding.

Also never lose sight of the fact that the total ham population of the US is something like a quarter million, more or less. That's not what I'd call a mass market by any means. And right now I'd say the market is saturated, fellas. You can only sell so much.

So, there it is, men. My little 90 watt QRP opinion. My message to manufacturers is:

1. Cater to the c.w. man a bit more.
2. Give hams what they *want*, not what you *think* they want.
3. Give CB back to those it was intended for. (My congratulations to those CB'ers who are really performing a valuable service)
4. Produce more kits. Heath is selling, I hear.

And to you, the Honorable Seek-You, please continue and upgrade your fine articles. They are educational, profitable for readers and help fill the huge void left by equipment manufacturers. Did you ever notice how many articles are devoted, in all ham publications, to improving the rig's capabilities, mostly as to c.w. operation? That tells me something. These FB articles by W2AEF, W2EEY and countless others are really our last bastion of defense against those who would cast us aside in their heroic, profit-motivated climb to convert or maybe subvert all hams to their way of thinking. These guys are real hams, just as those hardy souls in DX-land are who brave the wrath of many by coming above 25 kc from the low end to work guys like me, an unimportant General. You know, some even work Novices! But that's another letter. Hi! Many thanks for past services rendered and keep up the good work.

Al Brandt, WA3KOI
Gibsonia, Pa.

Incentive Controversy

Editor, *CQ:*

I have been reading many letters from readers of three amateur radio magazines since the incentive licensing program received the green light. And every time I do, I feel a little sadder. It seems that the differing factions of the hobby just won't stop fighting. It is my opinion that if someone doesn't start pulling these two groups closer together, the future of amateur radio will be very dim.

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My personal opinion of incentive licensing is one of favor for the system. Initially I did not feel this way but after much discussion and serious thinking I realized that its rebirth was inevitable. The reasons for its recurrence are mostly due to the operating characteristics of hams themselves. Sloppy signals and improper operation of even commercial equipment along with poor operating habits have caused many foreign hams to point and laugh at us, others to feel disgusted. At times you can look at eleven meters and seventy-five meters and wonder what the difference is.

To those stubborn and notably selfish individuals who take the firm stand that incentive licensing is all bad and should promptly be repealed, I would like to say this. You may gripe now because you have lost (only from your own inaction) some of your favorite frequencies. But how would you like to see the complete loss of whole bands such as ten meters, and segments missing from other bands, never to be reclaimed again?

Never happen you say? I very much doubt it. As the electronic monsters of today grow even larger, more frequencies will be needed by government agencies, aids to navigation, public broadcasting and various other services. These allotments are not going to magically appear. They are going to have to be taken from those whose use of the spectrum is considered of lesser importance. And, fellow hams, they are looking right at us and the frequencies we use.

Incentive licensing is a bad deal? Maybe so, but picture this. The year is 1975—160 meters is gone, given to the more valuable LORANA service. 40 meters is chopped in half, commercial broadcasting has expanded. Ten meters is completely gone, given to the overcrowded Citizen's radio service. Two and six both have segments gone, allocated to other communications services. Scare you? It ought to, and unless YOU do your part to keep it, it is practically inevitable. You have to prove you have a better use for it.

Some say the material in the high class exams is only for the professionals. Once this was true, but not now. Materials covered has changed and as far as I can see, it is all useful. You need this knowledge these days just to repair your own equipment, let alone build it. You don't send your equipment out to be fixed, do you? Are you going to let the TV-radio repairman prove his superiority to you? Take a look at the material covered. Can't you find anything that you have wondered about at one time or another and wished you knew more about the subject? You already passed one test, surely you can pass another. Did you stop at grade school?

To those who have already passed your Advanced and Extra class why not lend a helping hand to those who feel it is "impossible"? You know it wasn't as tough as it looked. Spread the word by proving this fact to others.

I am certainly not a professional and I don't consider myself as an egghead. But I have looked at the higher class license material and expect to pass my Extra exam, just as I passed my General. But I have one advantage over some. I have not

[*Continued on page 85*]

Announcements

Stolen Equipment

The following list of equipment has been stolen from Texas Instruments, Inc., 13500 North Central Expressway, Dallas, Texas:

1 ea. KWM-2A Transceiver w/136B-2 N.B. S# 16922
1 ea. KWM-2A Transceiver w/136B-2 N.B. S# 16942
1 ea. 312B-4 Cabinet Speaker S# 63314
1 ea. 312B-4 Cabinet Speaker S# Unknown
1 ea. 516F-2 Power Supply S# 58705
1 ea. 516F-2 Power Supply S# 58521
1 ea. 30L-1 Linear Amplifier S# 27604

Anyone having information that will assist in locating this equipment is asked to contact: Dave Leopard at the above address:

Australian ATV

The Wireless Institute of Australia wishes to advise that slow scan or narrow band TV has been approved by the Post Master Generals Department for use on all amateur bands as presently authorized in Australia. Standards to be used are entirely at the discretion of the amateur, although band-width of emissions shall not that of an A3 s.s.b. or d.s.b. signal. Where A3 and A5 emissions are used simultaneously on the same carrier frequency, the total band-width shall not exceed that of an A3 d.s.b. emission. Identification is to be by call-sign in visual form on televised picture and by telegraphy on telephony sound channel.

Corrections

In the "Delayed Switching For Transistor Receivers" article (Feb., p. 39) the second equation should read:

$$C_1\ (in\ mf) = \frac{T}{R_1 \cdot \log_e \frac{V_{IN}}{V_{IN} - V_{CR_1}}} \cdot 10^6$$

There were 4 errors in the "A Homebrew All-Band Solid State Communications Receiver" (March, p. 22).

1. Fig. 2—The botton end of the secondaries of the antenna coils T_2, T_3, and T_4 should be bypassed with a 0.02 mf capacitor.
2. Q_6 should be a 3N141 instead of a 3N140.
3. Pin 2 of Q_5 should be bypassed with a 0.02 mf disc.
4. The 1K resistor from point P in fig. 6 to the secondary of T_8 should be 4.7K.

Atlanta, Ga,

The Atlanta Radio Club will hold its 44th annual Ham Fest, June 13 & 14, at the North DeKalb Shopping Center. The main prize is a Swan 500 C Transceiver with a.c. supply, along with many others. There will be many contests for the amateurs, as well as games and other activities for the ladies. Further information may be obtained from John Fearon, 3384 Peachtree Rd., N.E., Suite 705, Atlanta, Ga., Telephone 261-4924.

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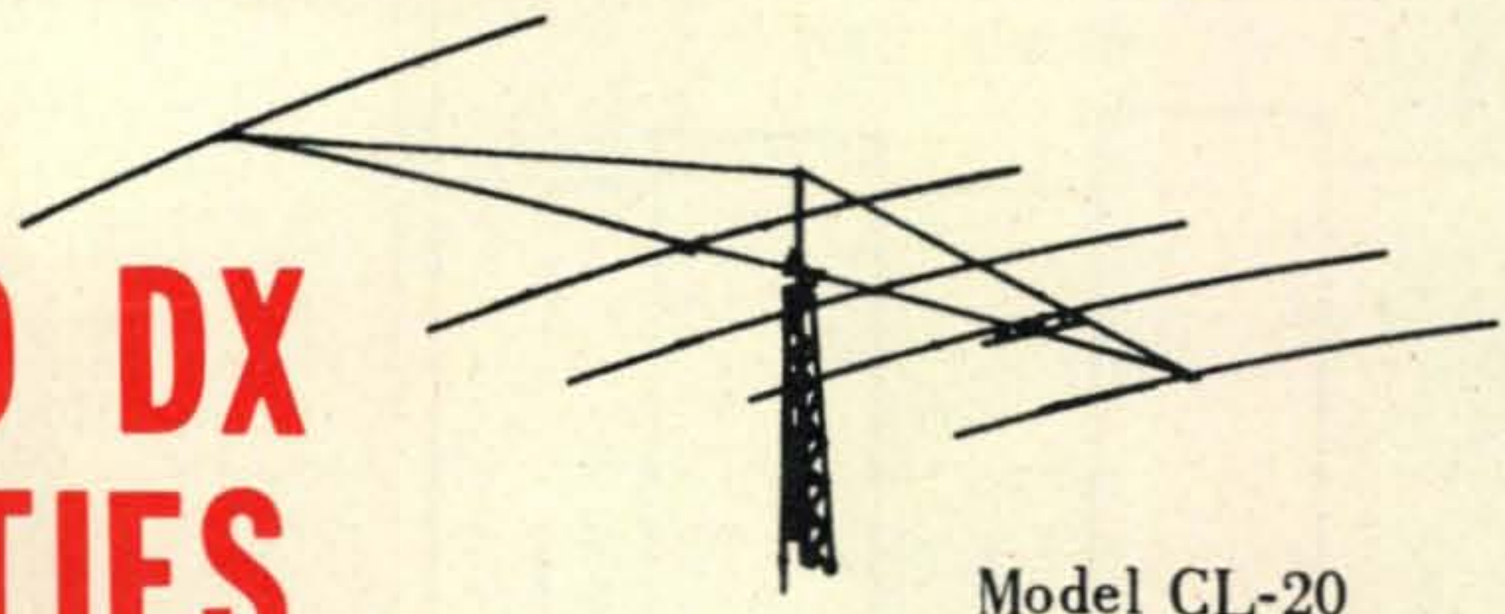

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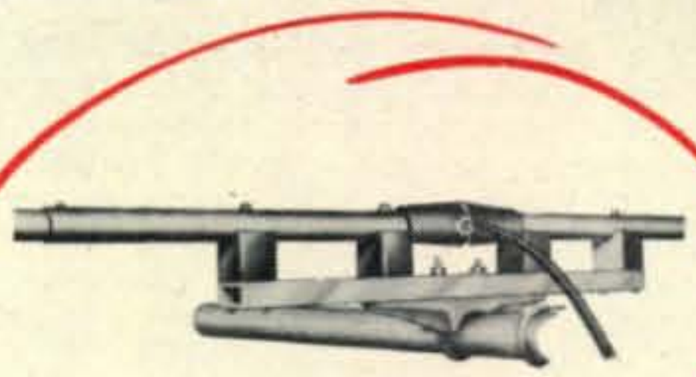
- FEED POINT IMPEDANCE: 52 ohms.
- NUMBER OF ELEMENTS: 5. Aluminum tubing; 6063-T832.
- MAXIMUM ELEMENT LENGTH: 38 ft. 1½ in.
- BOOM LENGTH: 46 ft.
- RECOMMENDED MAST SIZE: 3 in. OD.
- TURNING RADIUS: 28 ft.
- WIND SURFACE: 18.7 sq. ft.
- WIND LOAD (EIA Std. 80 MPH): 364.45 lbs.
- ASSEMBLED WEIGHT: Approx. 139 lbs.
- SHIPPING WEIGHT: Approx. 145 lbs. via truck.



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The Midwest YL Convention will be held June 19-21, 1970 in Flint, Michigan. All YLs are invited to "make Michigan your vacation spot" this summer, and join in the convention activities which will be held at the Drifter Motel, G-4186 Corunna Rd., one-half mile west of I-75. They begin with a buffet supper Friday eve. On Saturday the luncheon and banquet will be at the Sveden House and OMs are invited to the banquet. Write to: Marion Bees, W8UAP, 2039 E. Whittemore, Flint, Mich. 48507, for reservations.

Nashville, Tennessee

A Music City Hamfest is planned for June 21, by members of the Nashville Amateur Radio Club and the members of The Old Hickory Net. The reserved site for the event is the Edwin Warner Park, picnic area #3. There will be ample parking space, playground for the children, picnic tables, and shelter in case of bad weather. Stations will be set up on 75, 6, and 2. Plenty of prizes will be given out. Activities start at 12:30 P.M. For further details write to: Theda Givan, K4DIZ, Box 26, Whites Creek, Tenn. 37189.

Huntingdonshire, England

The United States Third Air Force has given permission for the Amateur Radio Mobile Society to hold their Carnival Rally on July 5, 1970, at Alconbury, United States Air Force Base in Huntingdonshire, England. There will be talk-in stations on 160 and 2 meters. Any inquiries regarding the Rally or regarding Reciprocal Licensing arrangements should be addressed to: BCM/ARMS, London, W.C.1. Application forms for British reciprocal licenses can be obtained from:

Ministry of Posts and Telecommunication,
Telecommunications and Radio Regulatory Department,
Radio Regulatory Division,
Amateur & Special Licensing Branch,
Waterloo Bridge House,
Waterloo Road,
London, S.E.1.

The cost is £3 ($7.20) for a Fixed License or £1.10. Od. ($3.60) for a Mobile License. Amateurs can apply for both, or either, but a separate Mobile License is necessary in Britain for Mobile operation.

Quebec, Canada

The annual convention of the Quebec Amateur Provincial Association (RAQI) will be held in Quebec City, July 10-12, 1970. All amateurs of Canada and the United States are invited to this exciting convention. Conferences, banquet, dance, contests, plenty of activities for the XYL. For more information write to: Michel E. Montpetit, VE2ASU, RAQI Propagandist, 685 74th East St., Quebec City 7, Canada.

Tacoma, Washington

The Washington State Hamfest will be July 11-12, this year. It will again be sponsored by the Radio Club of Tacoma, and will be held at the Sportsmen's Chateau, 164th and Canyon Road, south of Tacoma. Plenty of activities for the whole family are planned. Camping space is

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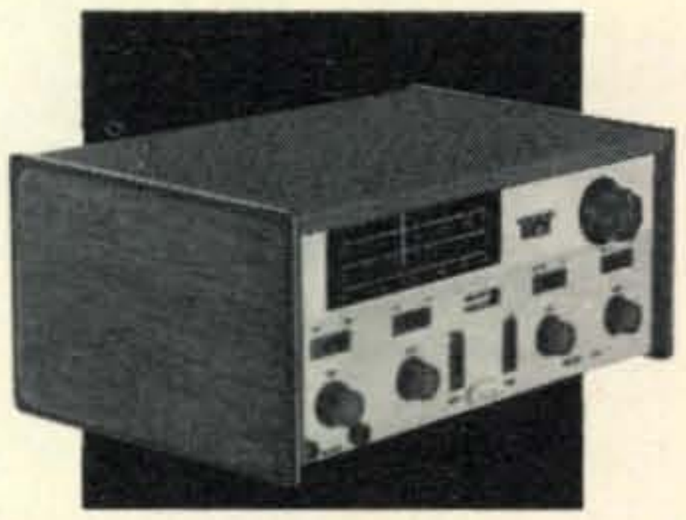
Old timers who are a little bored with high power are finding the Power-Mite a refreshing challenge. Beginners experience all the thrills of conquering distance and making new friends.



POWER-MITE PM 2 $54.95
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Transceivers are wired, ready-to-operate low power band-switching packages, with flywheel tuning and slide-rule dial. The PM 1 & PM 2 can be crystal controlled for Novice use.

SPECIFICATIONS	PM 3 / PM 3A	PM 2 / PM 1
Frequency range	(Band) 40 meters (Range) 7.0-7.4 MHz 20 meters 14.0-14.8 MHz	(Band) 40 meters (Range) 7.0-7.3 MHz 80 meters 3.5-4.0 MHz
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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available. Dinner reservations for Saturday night must be made in advance and tickets cost $5.00 which includes registration. For reservations, accommodations, and complete information write to: John Austin, K7CZF, 8478 Eastside Drive, N.E., Tacoma, Washington 98422.

Michigan City, Indiana

Indiana Radio Club Council's Annual picnic will be held Sunday, July 12th at Memorial Park Michigan City, Indiana. Write to: William Cannon, W9ILS, for information, tickets, and reservations at 205 North Roeske, Michigan City Indiana 46360.

Evansville, Indiana

The Tri-State Amateur Radio Society would like to announce its 23rd annual Hamfest to be held Sunday, July 12, 1970, at the 4-H Rural Youth Center on Highway 41 North. Advance registration $1.50 and $2.00 at the door. For details contact Jack Young, K9LAU, P.O. Box 492, Evansville, Indiana 47703.

Mt. Pleasant, Iowa

The Mt. Pleasant Amateur Radio Club cordially invites you to attend the Southeastern Iowa VHFers Picnic, to be held at McMillen Park, in Mt. Pleasant, on Sunday, July 12, 1970. Doors open at 9:00 A.M. Pot luck lunch, free coffee, trunk sales. Everyone welcome. No charge. Talk in on 50.480 and 3.950 mc. Call WBØAKS.

Cadyville, New York

The annual Hamfest of the Champlain Valley Amateur Radio Club will be held on July 19, starting at 10:30 A.M. at the club shack on the Akey Road, Cadyville, N.Y. (7.2 miles West of Plattsburgh on Route 3). Food and beverages available on the grounds, talk in on 146.34-146.94 f.m. (W1KOO) and 3925 kc s.s.b. (WB2-EWJ). Send advance registrations ($1.50) to CVARG, Box 241, Cadyville, N.Y. 12918.

Fermanagh, Northern Ireland

For the second year running an amateur Radio station will be established for the duration and in conjunction with the 1970 Fermanagh Festival. The station, GB3FRE, will be in action at the Townhall Enniskillen, from Friday, June 19 through Sunday, June 28th. At least two fully equipped operating positions will be set up using KW and TRIO transceivers feeding antennas consisting of an inverted Vee for 160 meters, a horizontal trap dipole for 80-10 meters and a Hygain 14 AVQ for 40-10 meters. Operating time, which will be mainly in the evenings, will be spent most of the time on 160, 20, and 15 meters s.s.b. and c.w. The Fermanagh licensed amateurs which only number three will be assisted by amateurs from other counties during ths period. The principal objects of GB3FRE, are: To enable amateurs throughout the world to have a contact with this rare county. To publicize Fermanagh. To interest members of the public in Fermanagh and elsewhere in amateur radio. A special QSL card will be issued to all stations from who a QSL is received. Last year, GB3FRE was in great demand and worked approximately 800 stations in all continents.

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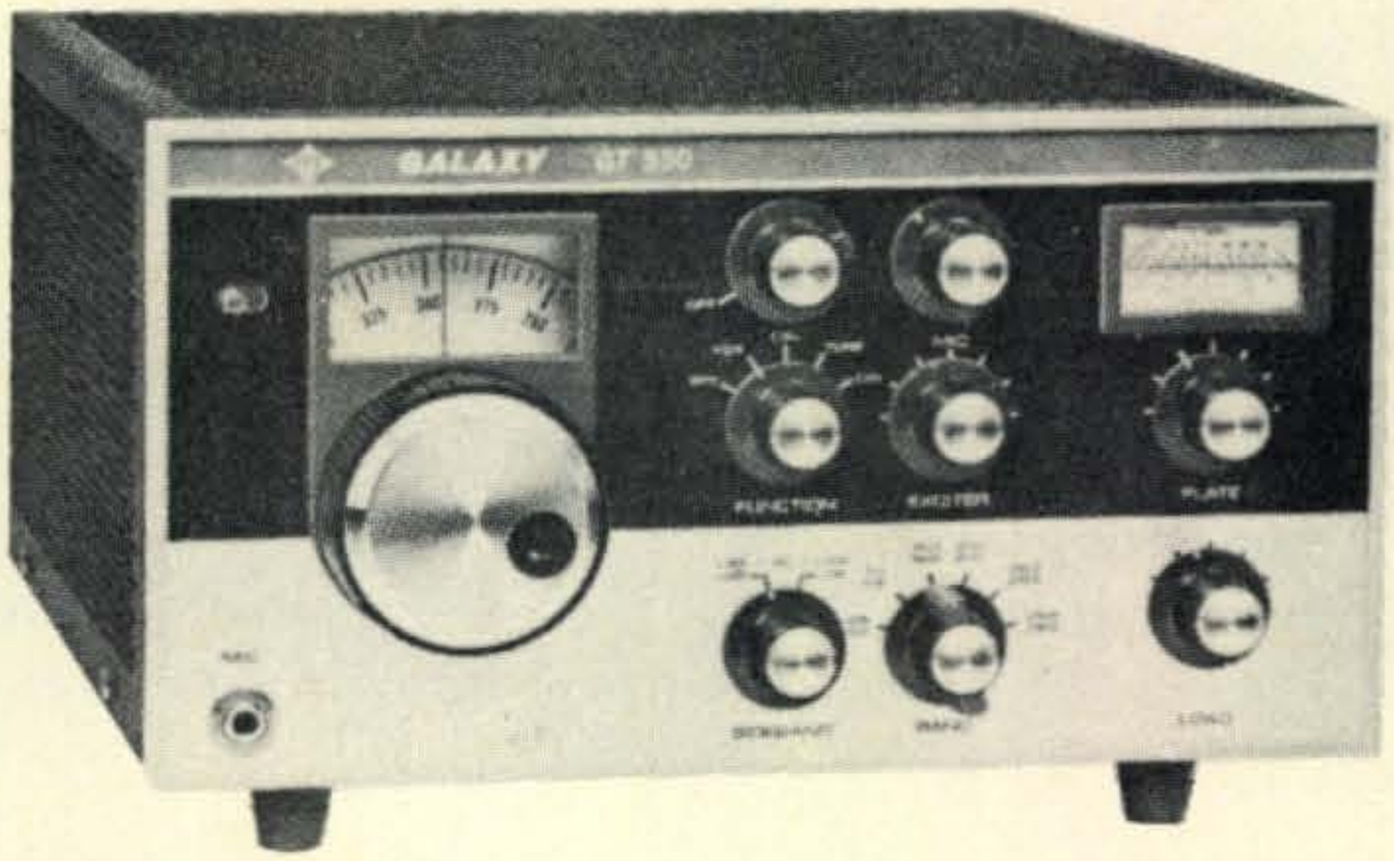
"For those who care enough to send (or receive) the Best"



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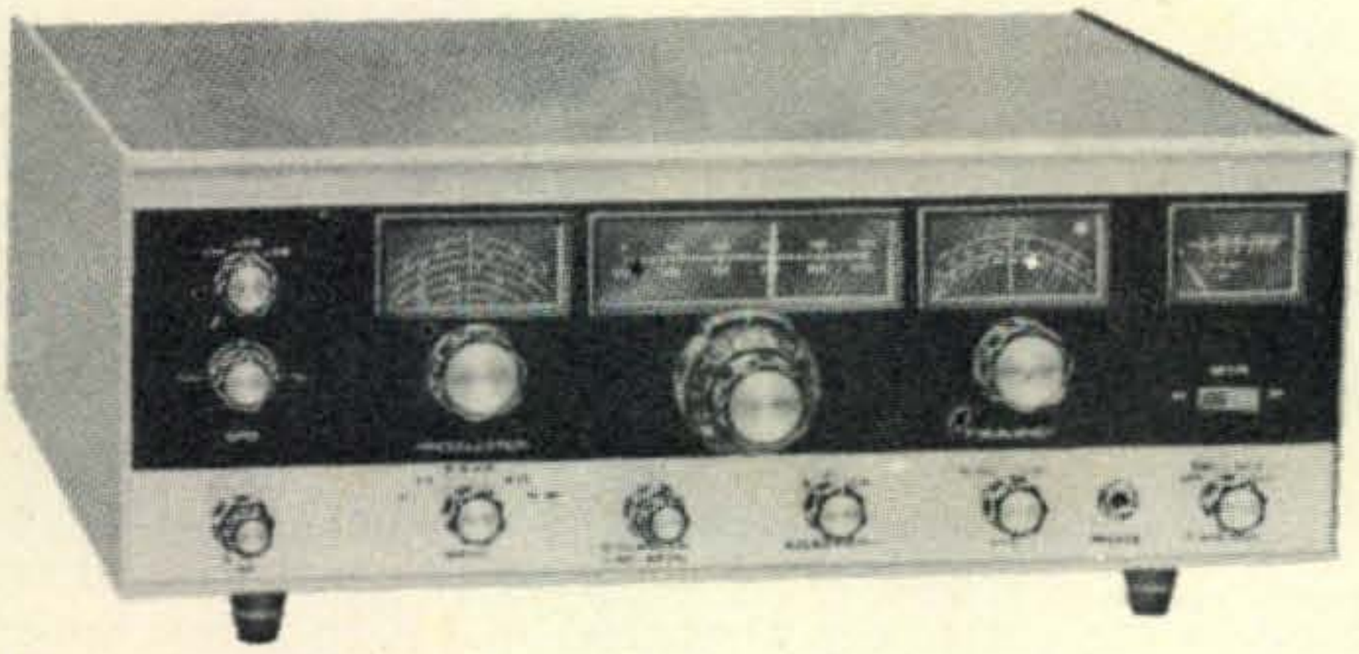

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MODEL CONTROL BY RADIO

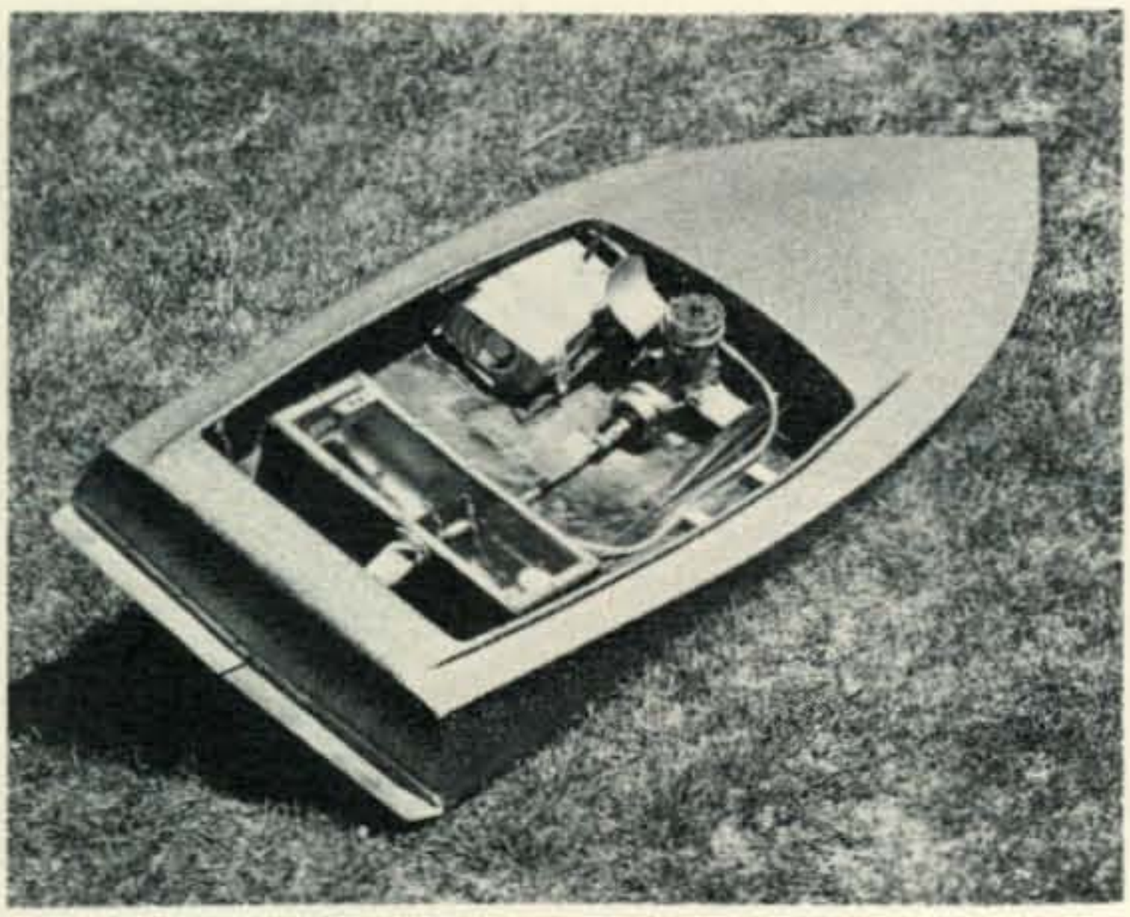
BY HOWARD G. MCENTEE,* W2SI

Part I

This two part article covers the history of radio control systems of models and the present day controls. Much of the early work done in the area was accomplished by amateurs as the control system was operated in the old 5 meter band. Part I below covers the history and development and Part II will cover the present day techniques and equipments.

THE control of various sorts of models by radio is an absorbing pastime for several hundred thousand Americans, including quite a few licensed amateurs. We will try to cover, in this article and a succeeding one, a little of the history of model radio control (or R/C as it is widely termed) the types of models in use today, the equipment that is now predominant and a bit on how it functions.

*490 Fairfield Avenue, Ridgewood, New Jersey 07450.



Typical high speed R/C craft of the class called "Ski Boats." It has a fiberglass hull and the radio controls the throttle and rudder. The entire radio installation is in a waterproof box at the stern as these speedsters often flip over.

"Modern" radio control might be said to have started around 1937; at that time Clinton DeSoto and the late Ross Hull developed much new equipment and had many successful flights with several large model planes. The results of their work were detailed in *QST* and other magazines of the day. They were able to persuade Raytheon to develop a special gas tube expressly for R/C purposes. Of course both hobbyist and other R/C experimenters had been active long before this; crude R/C "flying bombs" had been tried during World War I, for example. But the impetus and publicity given to model R/C by the ARRL group interested many other amateurs in the field. Also, in 1937 came the first widely publicized R/C model plane contest held at the National Model Airplane Championships (10th of a continuing series) in Detroit. While that first Nats R/C event had only six entrants, and successful R/C flight was demonstrated by only one flier, (two others tried and the rest abstained) the pattern for future meets was established.

By 1939 much progress had been made; the magazine "Radio" carried a lengthy article by Californian Ed Rockwood describing a rudimentary form of what we now call "proportional control," which is practically universal today.

Probably because the ARRL experiments had been accomplished on what was then

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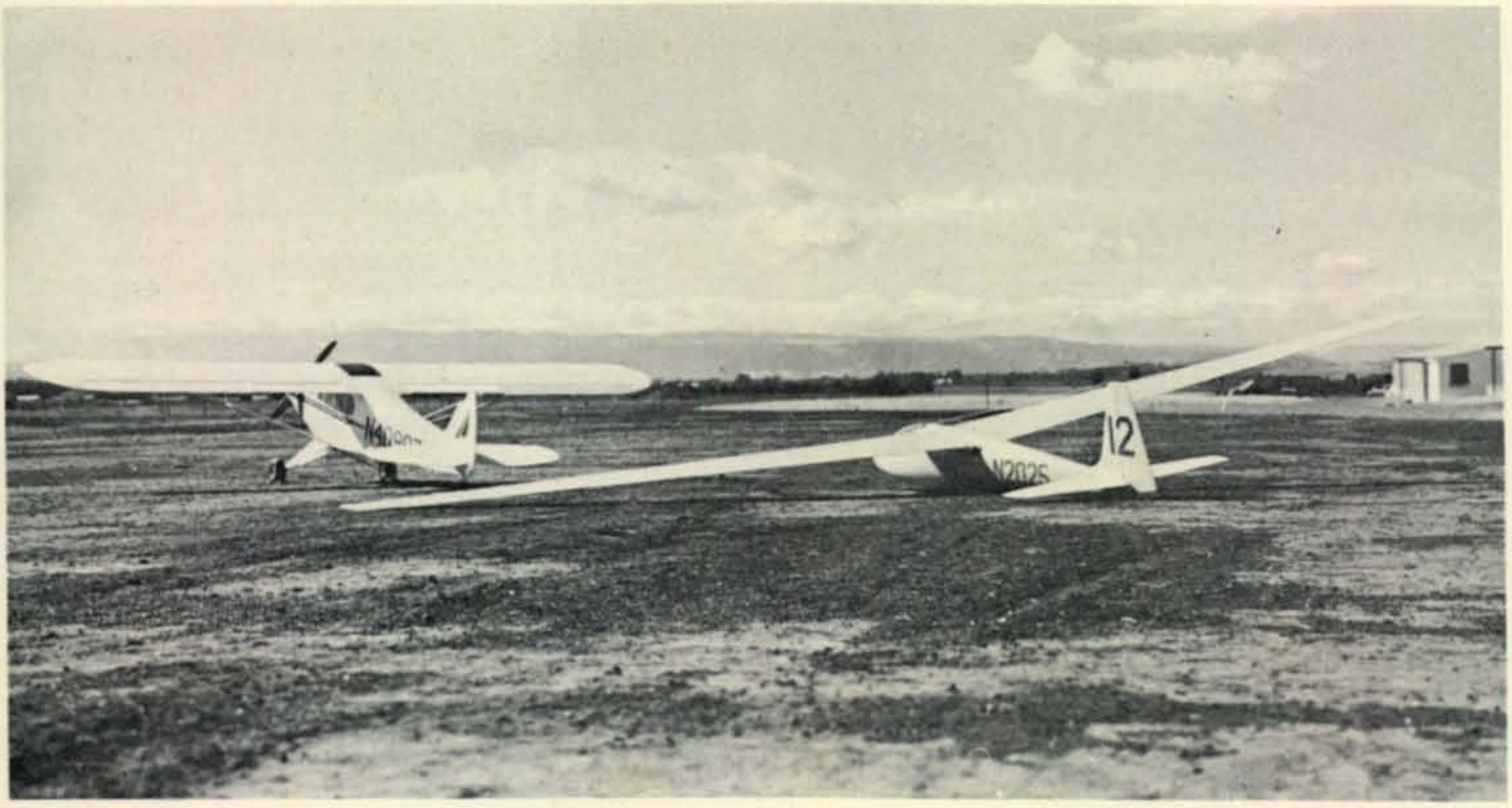

No, this is not a full size Cub getting ready to tow a KA6E glider aloft. It's really an 8' span R/C Cub built by Jerry Nelson and the glider (which the Cub does tow) is a scale 12 footer. The glider model which Nelson manufactures has rudder, elevator, ailerons and wing spoilers controlled via R/C.

the 5 meter amateur band, most all operation up until WWII, and for several years thereafter, was also on similar frequencies.

The war brought great advances in electronics, of course, and model R/C profited considerably therefrom. The prewar Raytheon gas tube was reduced in size, designated the RK61, and was in use for the next 10 years or so. These gas tubes allowed extremely simple super-regen circuitry, had fairly low filament current. The plate current was only about 1½ ma maximum, so very sensitive and delicate relays were required. Despite their seeming advantages these tubes had serious drawbacks; they cost much more than sub-miniature hard tubes, and useful life was only a couple of hours. (This life could sometimes be extended a bit by "cooking" the tubes in the kitchen oven.)

Sub-miniature tubes, mostly from the Raytheon line were put to wide use by experimenters. A few of them are still in use today, but of course transistors sounded the death knell for all tubes in this field where reliability, small size and light weight, plus minimum battery power drains were prime factors.

Surplus

Surplus gear from WWII provided low cost storage cells and vibrator power supplies, battery tubes, meters, antennas and other parts that allowed experimentation at very low cost. Several New York surplus dealers specialized in R/C parts and equipment. Transmitters up until perhaps 1955 were almost universally of the ground-based type; long vertical antennas and heavy battery supplies helped put out husky signals to make up for the shortcomings of many of the receivers.

At that time virtually all receivers were super-regen; a fair number of such regens are still in use. They provided good sensitivity and real simplicity, but were often difficult to adjust and even *more* difficult to keep in adjustment. The majority of receivers, and transmitters too, utilized only a single tube. Receiver tube currents were quite low and life quite good (except for gas tubes). Transmitter tubes, however, were pushed to, and often beyond, their limits in an effort to achieve better range and reliability. Miniature 1½ volt filament tubes were often driven to over 5 watts, well beyond both plate current and voltage maxes, and far too much drain for the fragile filaments to withstand for long.

All the early equipment was c.w. operated; at the transmitter you simply turned the signal on and off. Most transmitters had a plain pushbutton to allow such keying—but the operator needed a very educated thumb to send the proper signals, especially when disaster was impending. Around 1950 some of the more advanced experimenters showed that much better reliability, and immunity from interference, could be had by leaving the transmitter r.f. on continuously and key-

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A typical multi-control stunter built from a kit made by Dumas Products, Inc. The 62" span plane is called the Triton and was designed by Jim Kirkland.

ing an audio tone to move the controls in the model. This required more complexity at both transmitter and receiver (more than one tube for both) and the majority of modelers stuck to the simpler c.w. systems.

New Frequencies

The early fifties saw another real milestone reached when the FCC announced R/C hobbyist spots at 27.255 mc and 465 mc where licenses could be had without need for learning the code or taking any sort of examination. This move really opened the floodgates of model R/C activity, both on the part of hobbyists, and by providing economic incentive for the start of a real R/C manufacturing industry.

Actually, 465 mc was never too widely used. The equipment had to be type-approved by the FCC, a lengthy and costly procedure; only two makers stuck it out long enough to obtain FCC certificates. The equipment required heater-type tubes for both transmitter and receiver, thus filament supplies had to be heavy, or of very short life. Nickle-cadmium cells hadn't reached the hobby field at that time; had they been available it is possible that 465 mc might have enjoyed much greater use, as the nickle-cads would have provided reliable lightweight "A" batteries of constant voltage.

The 27.255 mc spot was proven useful for model R/C by a few selected modelers affiliated with the Academy of Model Aeronautics, for many years the governing body of model aviation. At that time, 27 was not a "band" as we now have—it was just a single spot frequency. As more and more new R/Cers started operation on this spot, congestion and interference got worse and worse. The AMA requested additional exam-free frequencies for R/C. Finally in 1958 the FCC set up the Citizen's Band arrangement we have today, which allows R/C operation on six spot frequencies buried in a welter of CB phone frequencies. Again model R/C had room to expand, and did. But phone transmitters on the Citizen's Band, plus traffic light systems and other non-hobby operations grew right along with R/C. As interference got worse, the AMA eventually requested that R/C be allowed in the area between 72 and 76 mc. In 1966 the modelers were given five spots in this band for "exclusive" model control purposes. Actually, other services were then using frequencies very near the R/C spots and still more are today. But 72 was great for R/Cers after the cacophony heard all over the 27 band. In many areas, of course, the 27 mc spots are still very useful, so even though we have the "safer" 72 spots, much successful flying is accomplished on 27. But the possibility of a nearby phone transmitter "taking control" is a distinct risk in many areas, and often results in a spectacular crash with liklihood of serious personal and property damage, to say nothing of losses to the unlucky flier. It was mainly this very possible danger of interference-caused crashes that led the FCC to set up the 72 mc spots.

The rules and specs made superhets practically mandatory on the 72 mc spots. Worse and worse phone interference and a desire to operate more than one 27 mc plane at a time at model flying fields had already started a movement to superhets on 27. A little later, mainly due to haphazard R/C manufacturer selection of frequencies on the 50 mc band, the AMA had set up seven spots here. These are in practically universal use by R/Cers operating on this band today, but are not, of course, required by the FCC. The 51.00 and 52.04 mc frequencies were designated solely for use with super-regen receivers. For superhets the spots are 53.100, 53.200, 53.300, 53.400 and 53.500 mc. Careful study preceeded these selections; the modelers did not want to operate near the low end of the band due to heavy amateur activity there (The 51 mc spot has seen little use for this reason.) The 51 and 52.04 spots were spaced widely apart, both from each other and from the 53 spots, to allow super-regen operation concurrent with superhets at the same field. We didn't want to go too close to 54 mc as there are many second harmonics there, from both

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R/C and CB phone rigs. Consideration also was given to avoiding image troubles on the superhets.

Model Types

Rough estimates put the number of R/Cers in the U.S. today at around 300,000. Perhaps 90% of these are model plane fliers, 8% run R/C boats, and 2% are R/C auto enthusiasts. Some modelers are active in all three fields. Organized R/C car activity is quite new, but is expanding rapidly, as indeed is all of the model control field. Planes come in a wide variety of styles, but so-called "stunt" planes predominate. Various more specialized categories include pylon racing, flying exact scale models of full-sized craft, piloting R/C gliders or planes that operate off water. While there are several hundred R/C plane competitions each year, by far the greatest percentage of modelers fly in the "sport" category, the so-called "Sunday fliers." They might pilot any or all of the above categories, and possibly more unusual ones besides.

As their name implies, stunt planes are designed and fully capable of doing just about every maneuver in the book. They have engines of high power; some engines we use weigh only 14-16 ounces yet provide well over one horsepower in the air. These planes are often trimmed for "neutral stability," they go where you point them; many travel at 60 m.p.h. or more. Scale planes are generally slower, heavier, are very carefully detailed and decorated in copy of their prototypes, and are sometimes rather marginally stable! Many multi-engined stunt and scale planes have been successful. Pylon racers, as one might imagine, are designed and built mainly to go *fast*. They hit well over 100 m.p.h. on the straightaway. Racing rules specify maximum engine size but "hopping up" of these engines and use of exotic fuels enables them to produce fantastic powers for short periods. The models must be close or exact scale copies of "Goodyear" racers; points are given for good finish, *etc.*

R/C gliders can soar for many hours on rising currents of warm air (thermals) or on the lift caused by wind impinging upon an upward land slope. Water planes rise from and land on water, of course; they are often ordinary stunt planes with floats substituted for the wheels. Flying boat ypes are also popular and effecive.

R/C Plane Meets

R/C plane meets are generally sanctioned by the AMA. The R/C boat and car groups also have organizations to sanction meets. The biggest model plane meet in the U.S. each year is the Nationals; as many as 1500 modelers may enter, and there could be 100 or more entrants in the various R/C events, quite a contrast with 1937. The Nats will be held at Glenview Naval Air Station north of Chicago in late July of 1970. The U.S. Navy has co-sponsored the Nationals with the AMA continuously since 1948. International R/C competition has grown to the point where there will be a Stunt meet every two years, with an R/C Scale World Championships during the years between. The 1969 Stunt World Champs was held at Bremen; 25

Exact scale model of a Russian YAK plane (full size stunt competition) built by Iowa modeler Claude McCullough.

Manufacturers of Radio Control Equipment

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EK Products Inc.
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Hurst, Texas 76053

Cannon Electronics
13400-26 Saticoy St.
N. Hollywood, Calif. 91605

Model Rectifier Corp.
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Edison, N. J. 08817

World Engines
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Cincinnati, Ohio 45236

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Denver, Colo. 80222

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Benton Harbor, Mich. 49022

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Ace Radio Control
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Retailers of Models and R/C Equipment

America's Hobby Center
146 W. 22 St.
New York, N. Y. 10011

Hobby People
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Los Angeles, Calif. 90011

Stanton Hobby Shop Inc.
4734 N. Milwaukee Ave.
Chicago, Ill. 60630

Polk's Hobby Dept. Store
314 Fifth Ave.
New York, N. Y. 10001

Manufacturers of Model Airplanes

Carl Goldberg Models
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Chicago, Ill. 60608

Sterling Models Inc.
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Philadelphia, Pa. 19144

Top Flite Models, Inc.
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Chicago, Ill. 60616

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Briarwood Rd.
Oakwood, Ga. 30566

countries were represented and there were 67 stunt fliers. (Any number of countries may enter, but teams are limited to a maximum of three fliers.) The U.S. has been very successful in these World Championships.

Controls

Stunt planes can have just rudder control—or as many as seven or eight controls—but the majority have R/C-operated rudder, ailerons, elevator and engine throttle. Many have steerable nose or tail wheel, and wheel brakes, to facilitate ground taxiing. Other controls might be working wing flaps, retractable landing gear, variable mixture control on the engine carburetor, *etc.*

With a plane designed for this purpose, and with a competant pilot, a plane with just rudder control can do surprising maneuvers including loops, spins, wingovers, rolls and many others. Addition of elevator control makes many of the maneuvers easier and smoother and enlarges the list to include outside loops, inverted flight and so on. Planes which are equipped with ailerons use the rudder very little—mostly for takeoffs (the rudder will steer the plane during the ground run, when the ailerons are not effective) and one or two air maneuvers, such as spins and wingovers. Turns are generally made with ailerons only.

In the more advanced systems, all four main controls—and some of the auxiliaries mentioned—are handled by separate servos in the model. However, simpler systems can provide rudder, elevator and throttle control from a single servo. We'll go into more detail on these matters in Part II. However, we should mention that equipment for a miniscule rudder-only plane (such planes may have a wingspan of as little as 12", engines may weigh as little as .8 ounce) powered by cells potent enough to steer the plane for 20 minutes or more. These tiny planes have flown successfully powered by midget glow-ignition engines. At the other end of the range, four-control systems of the latest design average out around 12-13 ounces and the nickel-cad battery will provide power for as much as four hours before requiring a recharge.

We should perhaps note here that there is growing use of hobby-type R/C equipment, engines and even complete planes in research and development by industry, by manufacturers catering to the Armed Services, in entertainment (TV and movies) and so on. Hobbyists working in these fields are usually responsible for these "serious" uses of hobby gear—but results are generally so satisfacory, and costs so low (compared to use of equivalent commercial rather than hobby gear) that such utilization is on the definite upswing. Such widely known establishments as NASA, Sandia Labs, Lockheed, the U.S. Army, North American Rockwell, Ford Motor Co., Pratt & Whitney Aircraft, General Dynamics, many college research groups and many movie concerns have put R/C "toys" to doing serious work—and almost without exception have been very enthuiastic over the results.

[*To be continued*]

See page 102 for New Reader Service

New action in R/C racing...
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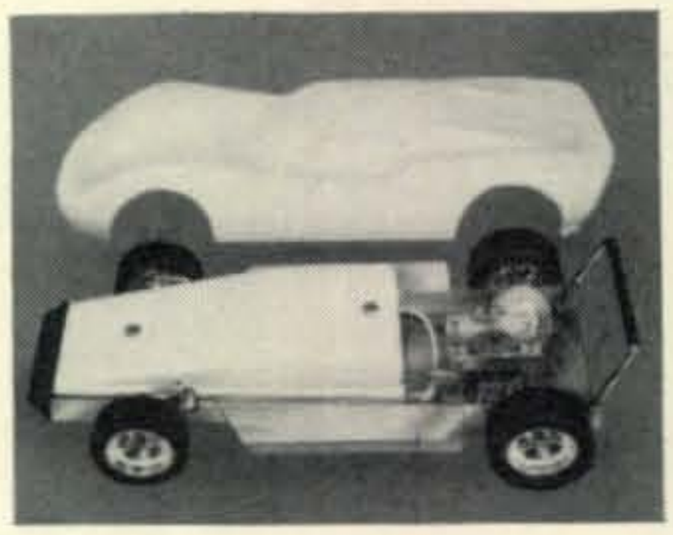

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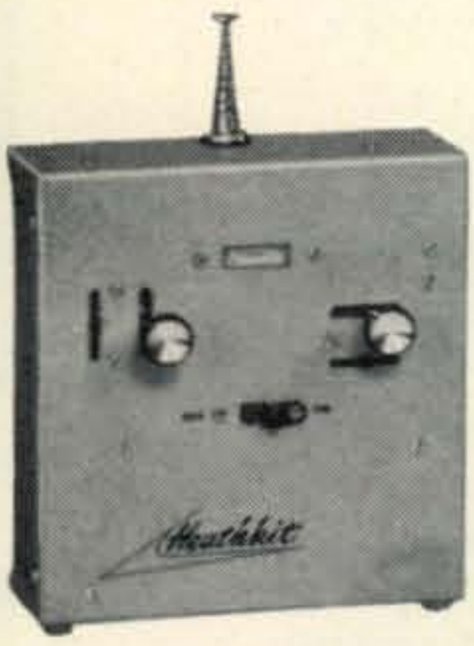

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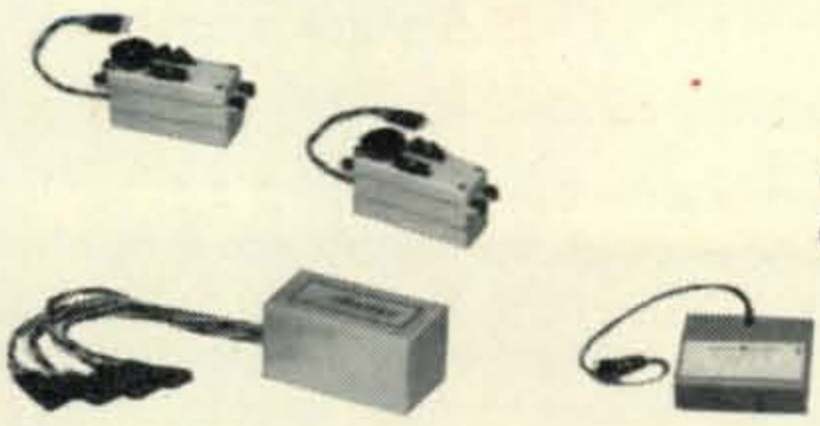

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GX-209

See page 102 for New Reader Service

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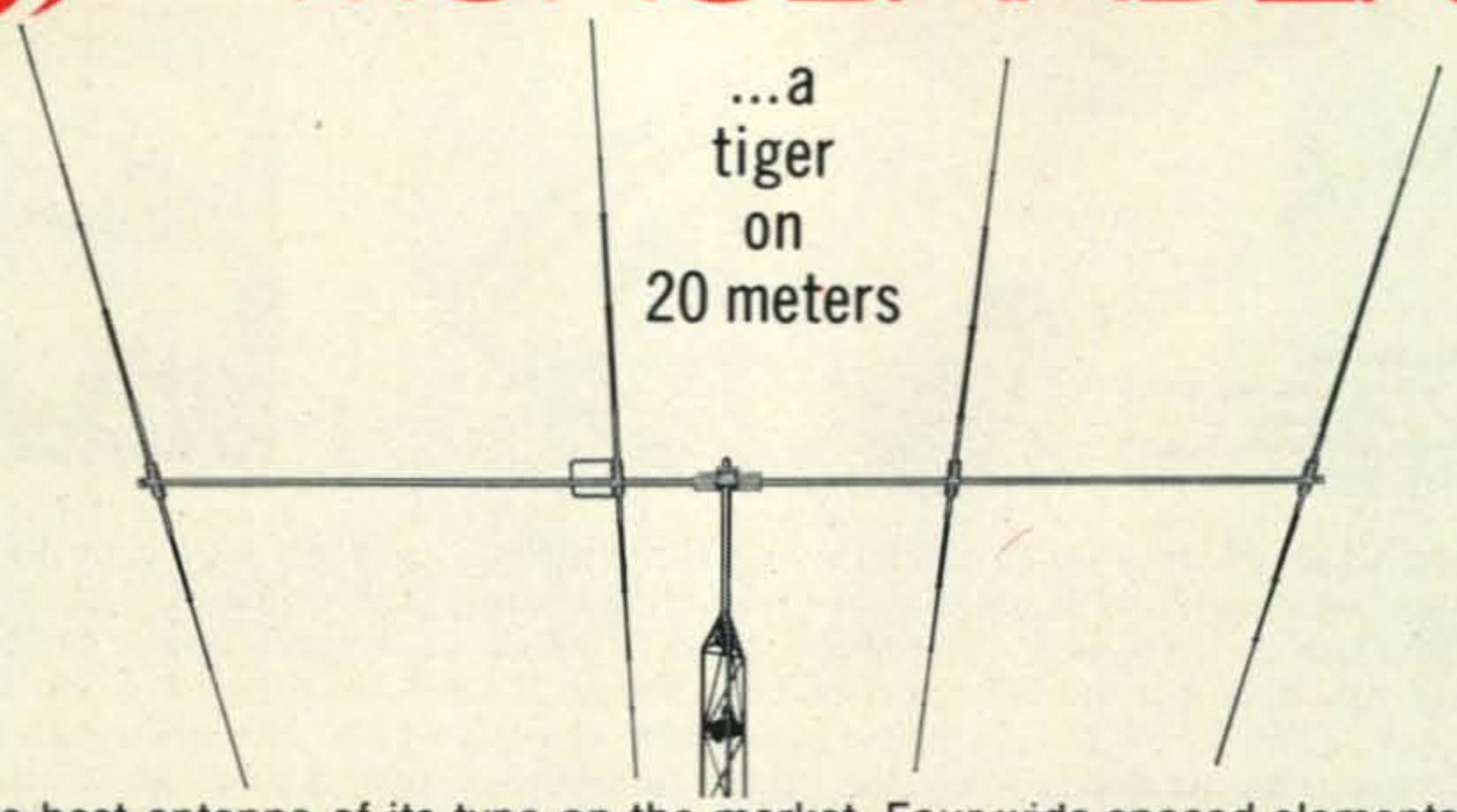
HY-GAIN 204BA MONOBANDER



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See page 102 for New Reader Service

THE TWO GALLON CAVITY

A CURE FOR 6 METER TVI

BY TOM GIBSON,* W3EAG

FOR the six meter buff who is bothered with TVI due to spurious out-of-the-band radiation, I can think of no simpler cure than the resonant cavity described here. It is simpler to construct than an L-C filter, requires no alignment after construction and is tunable across the entire band.

One of the problems arising in six meter operation is the presence of the seventh harmonic of the 8 mc v.f.o. or crystal in the output. This harmonic will fall in the 58 to 59 mc region depending on the specific frequency of operation. Since this is in the frequency range of Channel 2 TV (54 to 60 mc), a lot of TVI can result. Figure 1 shows the output of just such a transmitter operating on 50.25 mc as displayed on a spectrum analyzer. The signal on the left is the six meter carrier while the seventh harmonic of the crystal appears at the right only 14 db below the carrier level. For a hundred watt carrier, this means a four watt signal is being transmitted in Channel 2. Anyone who ever operaed a Sixer knows that this can be a potent signal.

Figure 2 shows the same transmitter output but with the two gallon cavity installed beween the load. The spurious seventh harmonic is now 36 db below the carrier level. Using our hundred watt carrier as a reference again, we find that the undesired signal is now reduced to 0.025 watts. Quite an improvement from the previous four watt level.

The swept response pattern as displayed on an oscilloscope gives pictorial evidence of the cavity's sharp tuning characteristic. Figure 3 shows the response with the device tuned to 50 mc and the sweep generator sweeping about 10 mc centered at 50 mc. The two birdies riding on the trace are markers at the 3 db bandwidth points. They indicate a bandwidth of 1.53 mc. We can calculate the loaded Q from this using the formula:

$$Q = \frac{f_o}{BW}$$

$$Q = \frac{50}{1.53}$$

Thus: $Q = 32.7$

Construction

Construction of the cavity starts with two one gallon cans (from which we derive the title for this article). Power handling will be

*1739 Williams Way, Norristown, Pa. 19401.

See page 102 for New Reader Service

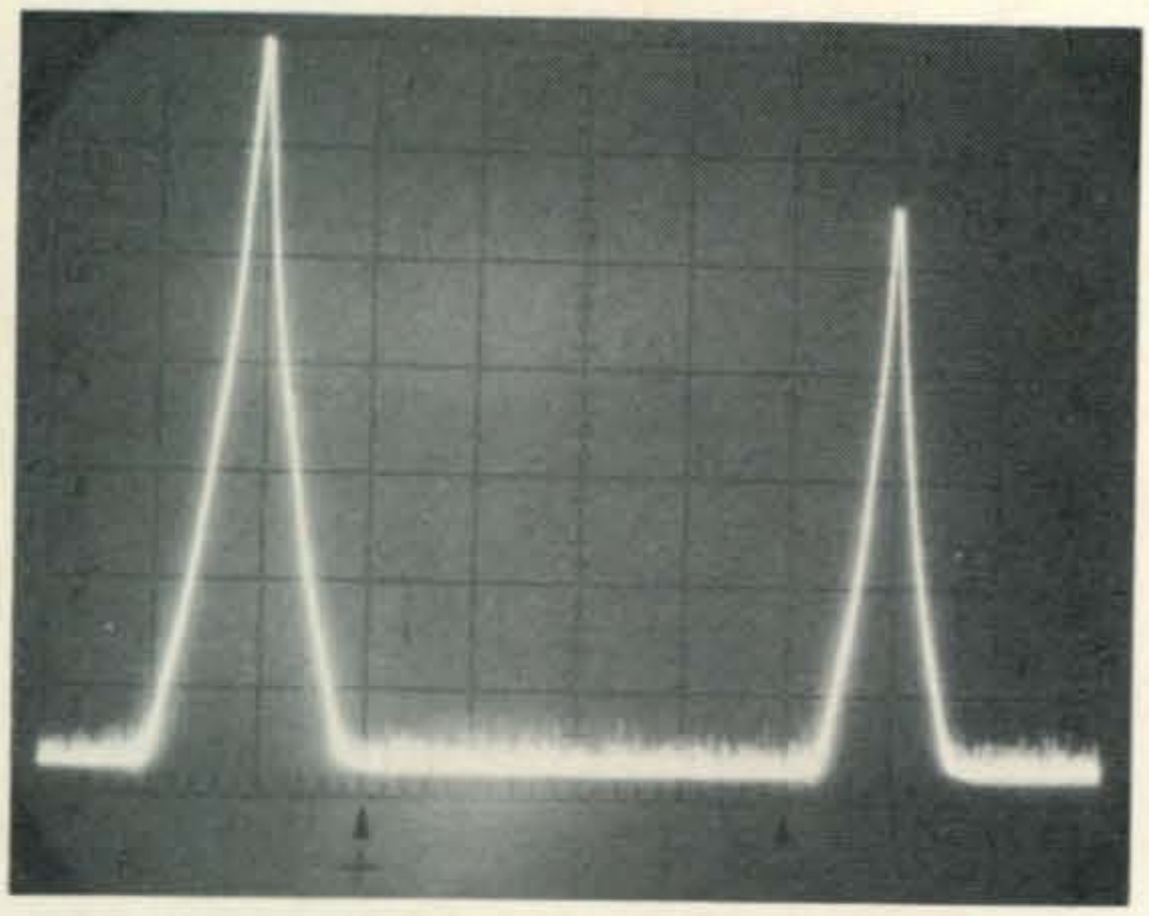


Fig. 1—Logarithmic display on a spectrum analyzer shows the 50.25 mc carrier with an undesired seventh harmonic of the 8.375 mc crystal appearing at the right 14 db below the carrier level.

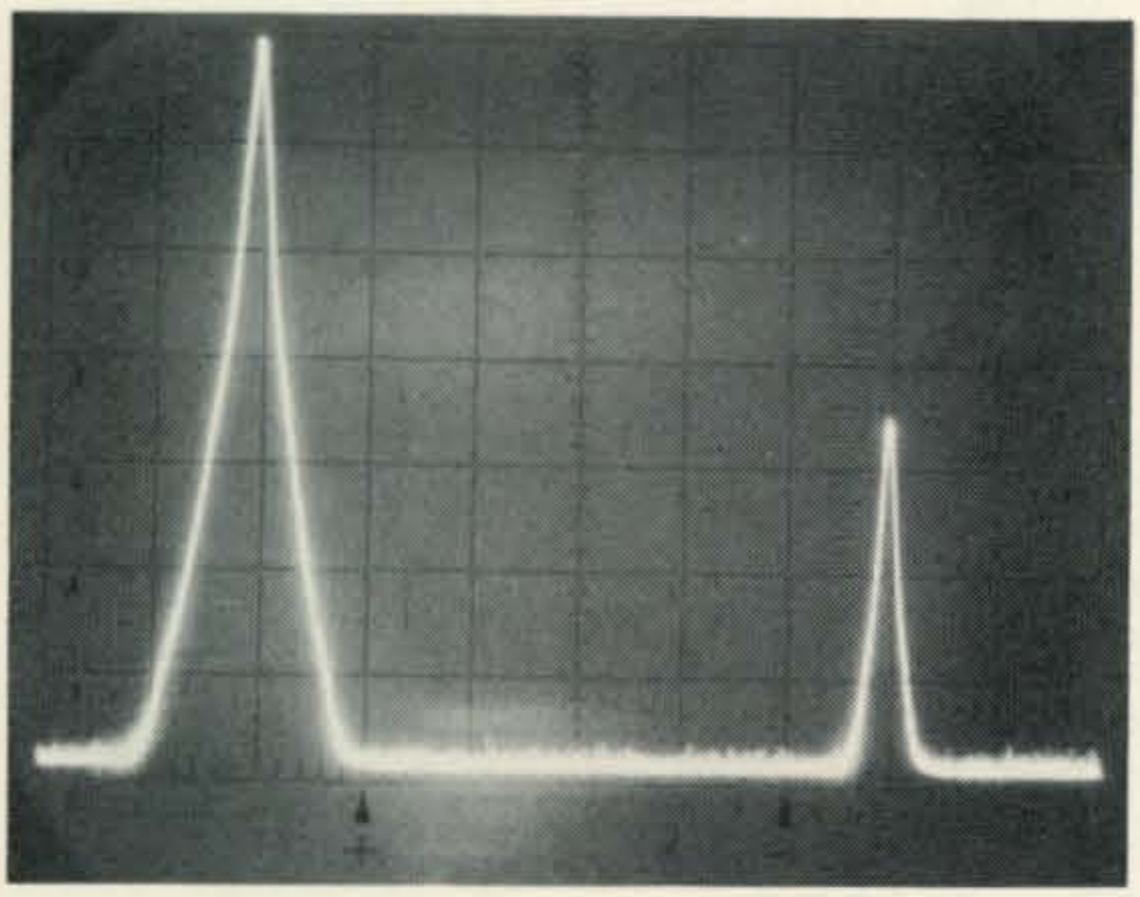


Fig. 2—Spectrum analyzer reveals the effect of inserting the resonant cavity between the transmitter and the load. The spurious signal is now 36 db below the carrier level indicating a 22 db rejection of the unwanted signal by the cavity.

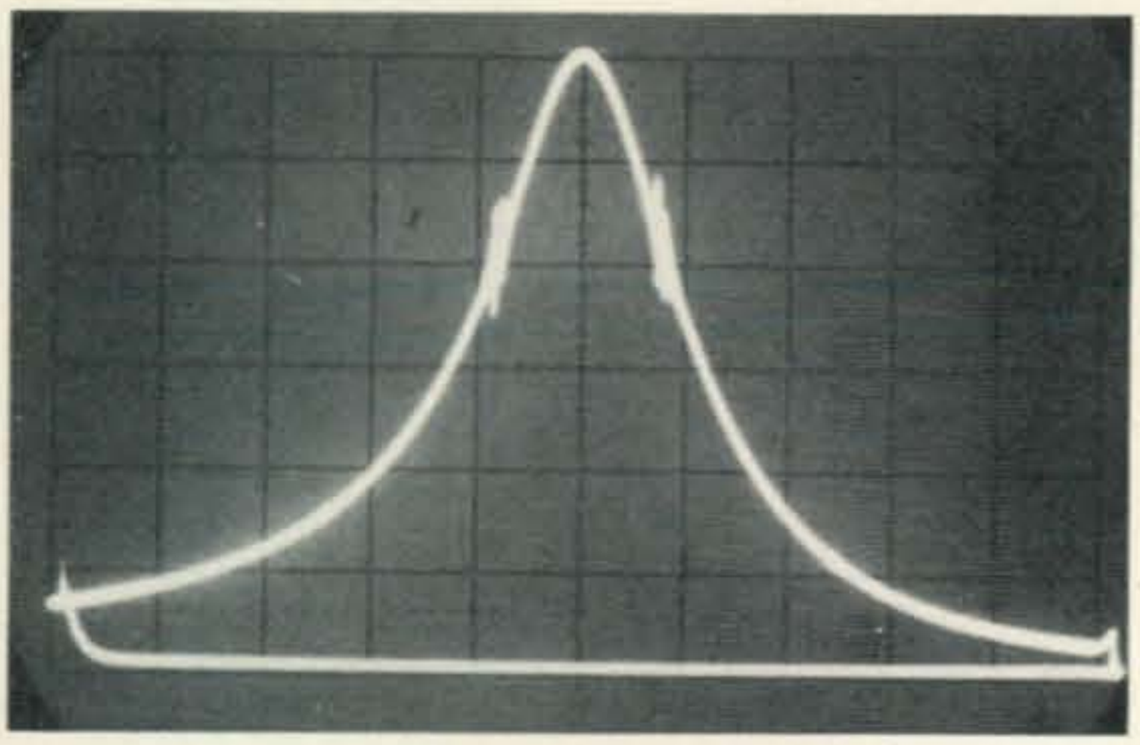


Fig. 3—Response of the resonant cavity for a total sweep width of 10 mc centered on 50 mc. The two birdies are markers at the 3 db bandwidth points, 49.20 mc and 50.73 mc. This gives a bandwidth of approximately 1.53 mc for a calculated Q (loaded) of approximately 33.

dealt with later in this article. The author has used both oil cans and soft drink syrup cans with good results. It is necessary to cut the tops from these two cans but the bottom should remain inact. The center column is made of frozen juice cans or, if you're a weight watcher as I sometimes am, Metrecal cans. One of the cavities uses 2" copper tubing which does away with the drudgery of soldering the cans together for the column. After you have a 13" center column prepared, solder it to the center of the bottom of one of the gallon cans. An SO-239 connector should be mounted next, one on each side of the can 7" from the bottom. See fig. 4.

In order to mount the coupling loops, drill a hole, large enough to pass the #12 wire, 1½" from the outer wall in the bottom of the can and directly below each SO-239 connector. Now bend the loop from #12 copper wire using about 10" of wire so that the wire passes through the hole in the bottom of the can. Solder the loop to the SO-239 connector at the top and on the outside of the can at the bottom. Cut off the excess wire at the bottom.

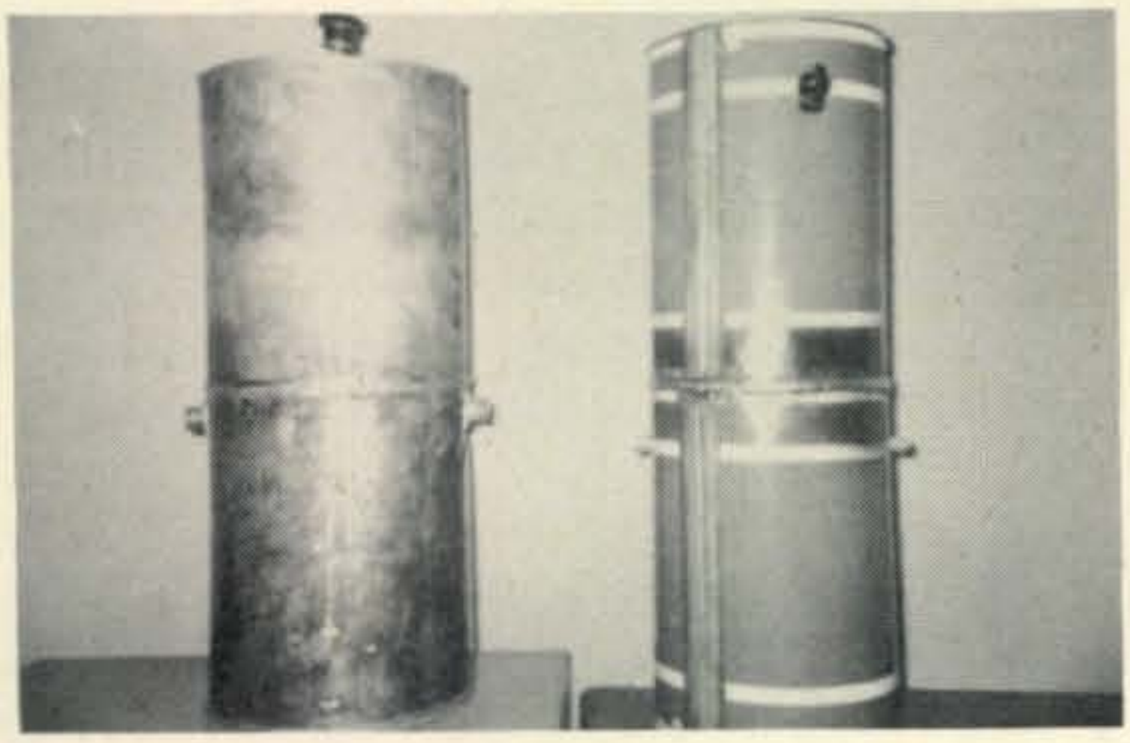
The next step is to install the tuning capacitor on the top of the center column using a flexible copper strap or braid to make the connection. A hole must be cut in the top can to accommodate the capacitor mounting bushing. An alternative mounting method for the capacitor is to cut the mounting hole in the outside wall of the top can near the top so that the tuning knob is on the side rather than on top when the unit is finished. This method was used in building the second cavity which is the one on the right in fig. 4. Note that the tuning knob is on the side, near the top, facing toward the camera.

Final assembly begins with fishing the shaft of the tuning capacitor through the hole in the top can. After this is done and the capacitor has been secured, all that remains is to solder the lip of the bottom can to the lip of the top can. A hundred watt iron should be sufficient. I tried a propane torch, at first, and found that it overheated the work terribly.

Power Capacity

The power handling capacity of this cavity is limited by the spacing of the tuning capacitor plates. Measurements made on the two cavities referred to in this article, indicate a voltage transformation of about five to one from the input loop to that at the top of the

See page 102 for New Reader Service



View of two cavities built by the author. The left unit is constructed from two one gallon oil cans with a center column of 2" copper pipe. The right hand unit is made of two one gallon soft drink syrup cans. The center column is made of Metrecal cans soldered together.

cavity across the tuning capacitor. For full legal input, this would mean about 1900 volts across the capacitor so choose your spacing accordingly.

Receiving

So far, we have only considered the use of the two gallon cavity as a transmitting band pass filter. It can, however, be used for both transmitting and receiving. It is quite convenient to do this by simply inserting the cavity into the feed line between the antenna change-over relay and the antenna. When this hook-up is used it is possible to eliminate out-of-the-band signals which might interfere with reception. I once operated in an area near a 36 mc radio paging transmitter which produced a beautiful image in my six meter converter, which had a 7 mc i.f. output. Inserting the cavity into the feed line, eliminated this undesirable signal. With my present converter, I get about an S-unit increase in received signal by using the cavity.

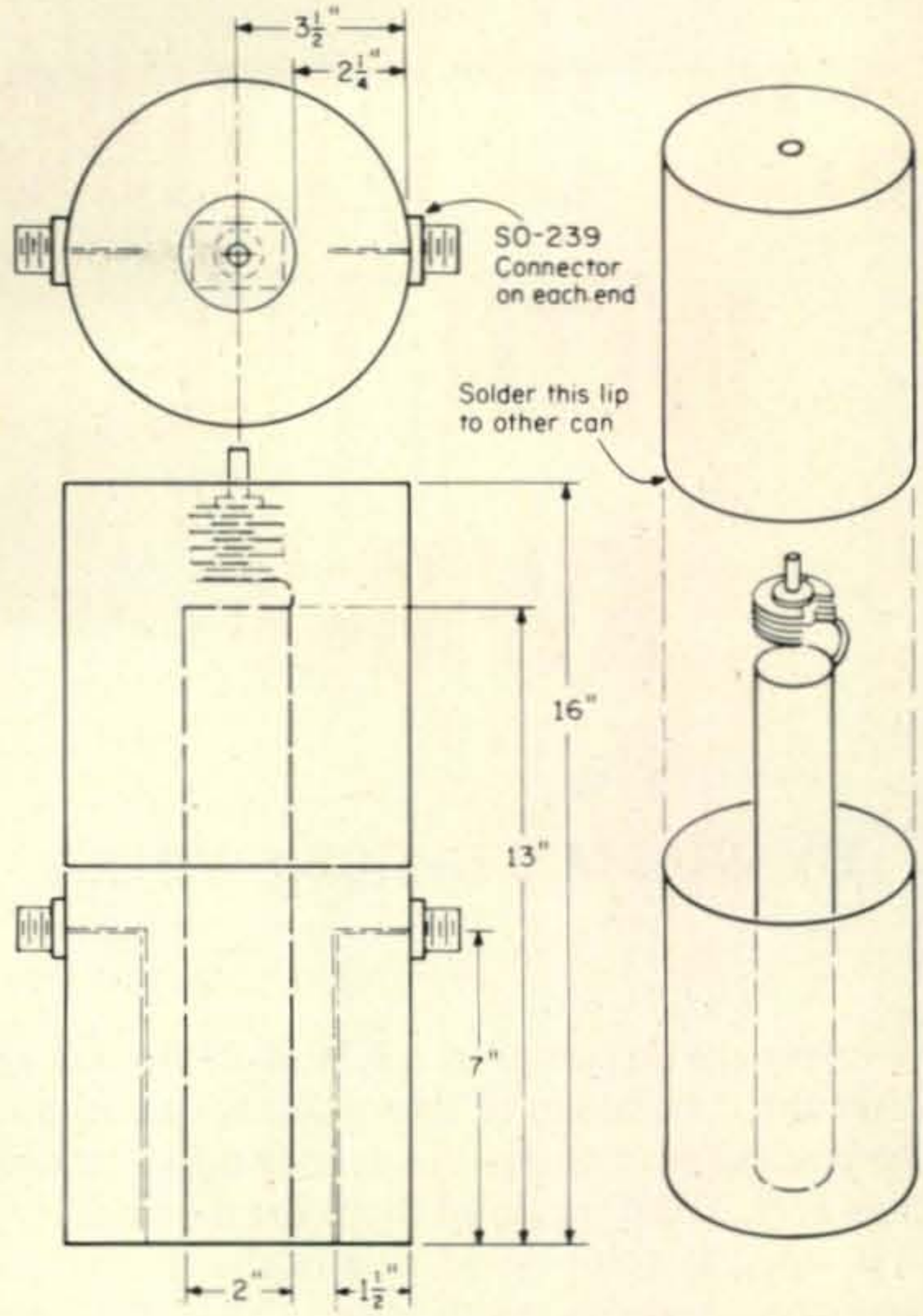


Fig. 4—Construction data for the six meter tunable cavity. The outer case is formed from two one gallon cans and the inner column from 2" copper tubing or stacked juice cans soldered together. The tuning capacitor (a Johnson #149-6 140 mmf variable) can be mounted at the top or side of the can. (See the photo.) It is attached to the center post with a copper strap. The coupling loops connected to the SO-239 connectors are made of #12 copper-wire soldered to the bottom of the cavity.

I would like to express my appreciation to American Electronic Laboratories, Inc., EmTech Division at Montgomeryville, Pa., for the use of lab facilities in developing much of the data presented here including the waveform photographs. ■

C.W. SPOTTING WITH THE KWM-2

BY WILLIAM BEGGS,* WB4JSV

If you are an owner of a KWM-2, you know that the c.w. mode of operation leaves much to be desired, namely the carrier off-set is too much (1,350 c.p.s.) and there is no c.w. filter. The logical solution to this is the use of an external receiver with the KWM-2. This works fine except when you want to find your transmit frequency or spot a station already tuned in on the receiver. To do this you have to do several different things with the KWM-2. These are: 1—Key your transmitter by hitting your key if using v.o.x. break-in c.w., or key your transmitter and then hit the key if not using v.o.x. 2—If you are using a muted receiver, you will have to put the receiver back into receive mode.

This procedure can be very painful when working contests or a rare DX station who keeps changing his receive frequency. Your full power output is also creating a lot of uncalled for QRM for the DX station you are trying to work.

Modification

My solution to this problem is a simultaneous application of four grounding circuits, performed through the use of a 4 p.d.t. relay which is activated by turning the OFF, ON, NB, CAL switch to the NB position. These four functions are as follows; 1—Turn the KWM-2 to the transmit mode. 2—Turn the external receiver to the receive mode if you use mute. 3—Ground the c.w. key input (to turn on the c.w. tone osc.). 4—Decrease the output of the transmitter to a very low level so as to not interfere with the station you are spotting.

I first installed a 4 p.d.t. relay in the unit near the first shield can in the middle of the set under the chassis. One side of the relay is wired to pin 4 of J_{24} under chassis. The other side of the relay winding is wired to the +275 v.d.c. through a 27K resistor. The closest point to get the +275 volt line is from pin 3 of J_{17}. I then proceeded to wire the four sets of contacts up as follows; 1—Wire all the armatures (swinging contacts) to ground. 2—Wire the normally open contacts as follows: one to the p.t.t. jack (J_{16}), one to the c.w. key input, one to pin 9 of socket V_3 (6AZ8) and one to the mute jack (J_{21}). Then wire one of the normally closed contacts to J_{20}. Remove the short between J_{20} and J_{21}. This completes the wiring as shown in fig. 1.

To use this new feature, just turn the OFF, ON, NB, CAL switch to NB position and tune the v.f.o. until the desired audio is heard. Return the switch to ON position and you are ready to transmit right on frequency and you have not created any unnecessary QRM. The level of the spotting signal in my receiver is approximately S7, a very easy to spot signal.

Conclusion

This addition can be made to the unit even if the noise-blanker has been installed, by using a subminiature pushbutton switch to take the place of the OFF, ON, NB, CAL switch. This switch can be mounted by drilling a hole through the Collins trademark emblem over the v.f.o. dial and installing the switch. This

[Continued on page 85]

*420 Ocean Spray Avenue, Satellite Beach, Florida 32935.

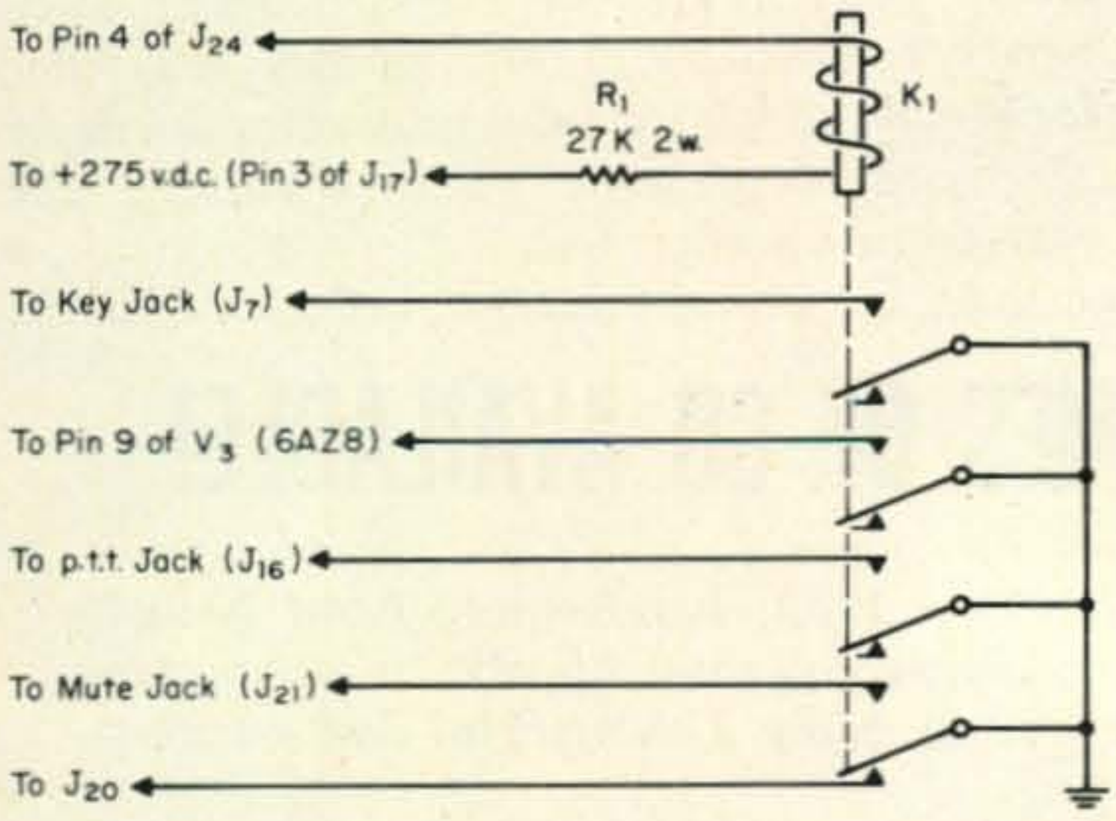


Fig. 1—Relay wiring to permit c.w. spotting with the KWM-2 using a separate receiver. When using this modification J_{21} must be the mute jack and the short between J_{21} and J_{20} has to be removed. Relay K_1 is a 110 volt 4PDT, Comar Electric unit #CRO-1606 or a similar type.

See page 102 for New Reader Service

THE ARC-500 LINEAR

BY DOUGLAS SMITH,* WA9UTP

THE ARC-500 is a small 780 watt p.e.p. linear constructed around the old ARC-5 chassis. These units can be found in any surplus store at about seven dollars. The best ones are the BC-458 and BC-459 because the roller coils have larger wire. This linear is ideal for use with most of the small transceivers on the market that run from between 100 to 200 watts p.e.p.

The circuit is simple (See fig. 1) and very few parts are required. The parts can be scrounged from the junk box, gotten from other hams by swapping, homebrewed and (Heaven forbid!) bought new. The tubes used, as shown in fig. 1, are 6JE6's, but can also be 6KD6, 6LQ6, 6KM6 or 6JB6 all of which are easily obtainable from any TV supply house.

The power transformer can be gotten from a junked TV set as well as many of the disc ceramic bypasses.

Construction

Construction starts with taking all the parts off the ARC-5, tube sockets and all. A small plate is made to mount the three new tube sockets in the same area as the old 1625's.

A small plate is also made to cover the lower portion of the front panel. The PLATE and LOADING control shafts exit through this plate.

The power transformer is mounted on the back part of the chassis and should be mounted above the chassis to leave room for the rectifier board and filter capacitors. The diodes and the paralleling 330K resistors are all mounted on a small peg board with the filter capacitors mounted over the board. Small stand off insulators can be used to hold the diode board in place and the high voltage lead brought up through a grommet to the top of the chassis.

All of the capacitors used are disc ceramics at 600 volts except for three which have a 2.5 kv rating (as noted in fig. 1). The disc ceramic bypass capacitors should be wired with very short leads. Ground lugs can be placed under the sockets to permit all grid bypasses to be placed directly at the sockets.

The three parasitic chokes are made up of six turns of #18 wire on a 47 ohm 2 watt resistor. The two r.f. chokes can be National R-154 or homebrewed from 155 turns of #26 enameled wire, close wound on a 5/8" form. The form can be any insulating material that will withstand the heat of the tubes.

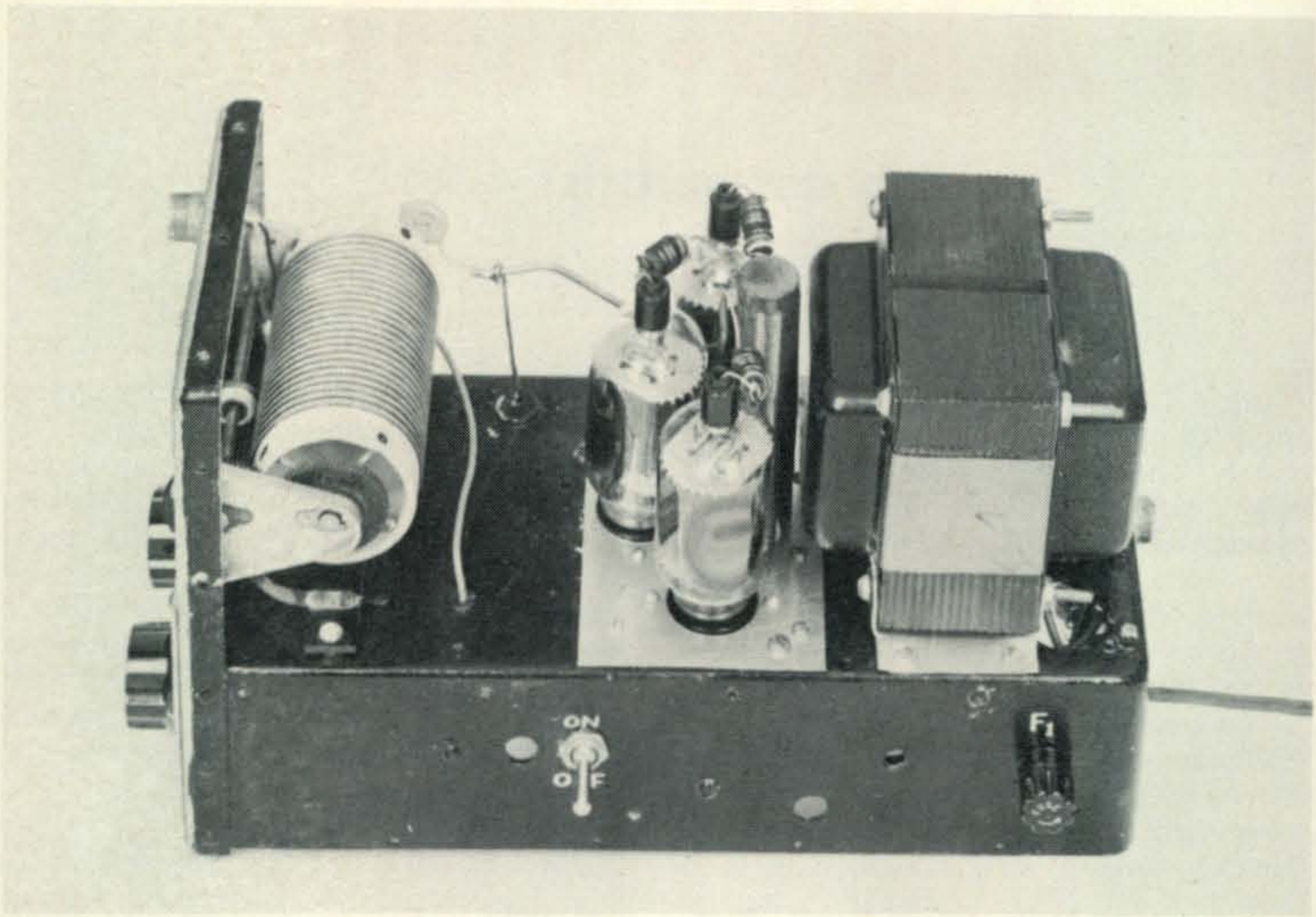
Testing

Checking out of the unit is done with the tubes in place, no input signal and no antenna connected. A zero to 500 ma meter is inserted in the negative leg of the power supply output as shown in fig. 1. With no input or load the current reading should be between 50 to 90 ma. If it is not, the values of the 1K and 3.3K bias voltage divider resistors may have

Front view of the ARC-500 linear. The controls are self-evident.

*2823 Robson St., Indianapolis, Indiana 46201.

See page 102 for New Reader Service



Interior view showing the positioning of the three 6JE6 tubes.

to be adjusted. The higher the plate voltage the higher the bias required. If the plate voltage is less than 600 volts, no bias will be needed.

If the procedure outlined above checks out you can then feed a signal in. Connect a dummy load and tune up your transmitter for a low power output, enough to drive the linear up to 200 ma or so. The tune up procedure is the same as for any amplifier of this type. You will find that the entire coil is used for 75 meters, about half for 40 meters and one fourth for 20 meters.

After observing the settings of the coil and tuning capacitors for each band enter them in the chart mounted on the front panel of the ARC-5.

You may now connect the antenna and using the above settings tune for maximum output with maximum drive from the s.s.b. transmitter. The plate current should not go any higher than 600 ma and the final adjustment of the TUNE control should dip the plate current between 500 and 600 ma.

Prolonged tuning will cause the plates to turn red and so should not be extended more than 20 seconds with 5 minute intervals for cooling. An s.w.r. bridge can be used as a power indicator. The meter can then be removed and all future tune ups accomplished using the s.w.r. bridge to read maximum forward power.

General

The parts used are not critical and may vary as much as 30%. The idea is to substitute where possible to keep the cost down. Using all new parts the cost was $29.30 and it took fifteen hours.

If more power is needed add a few tubes, if you can find the room. When you get those forty over S9 reports, tell them that your linear cost you less than thirty bucks and see if they believe you. ■

THE ARC-500 LINEAR

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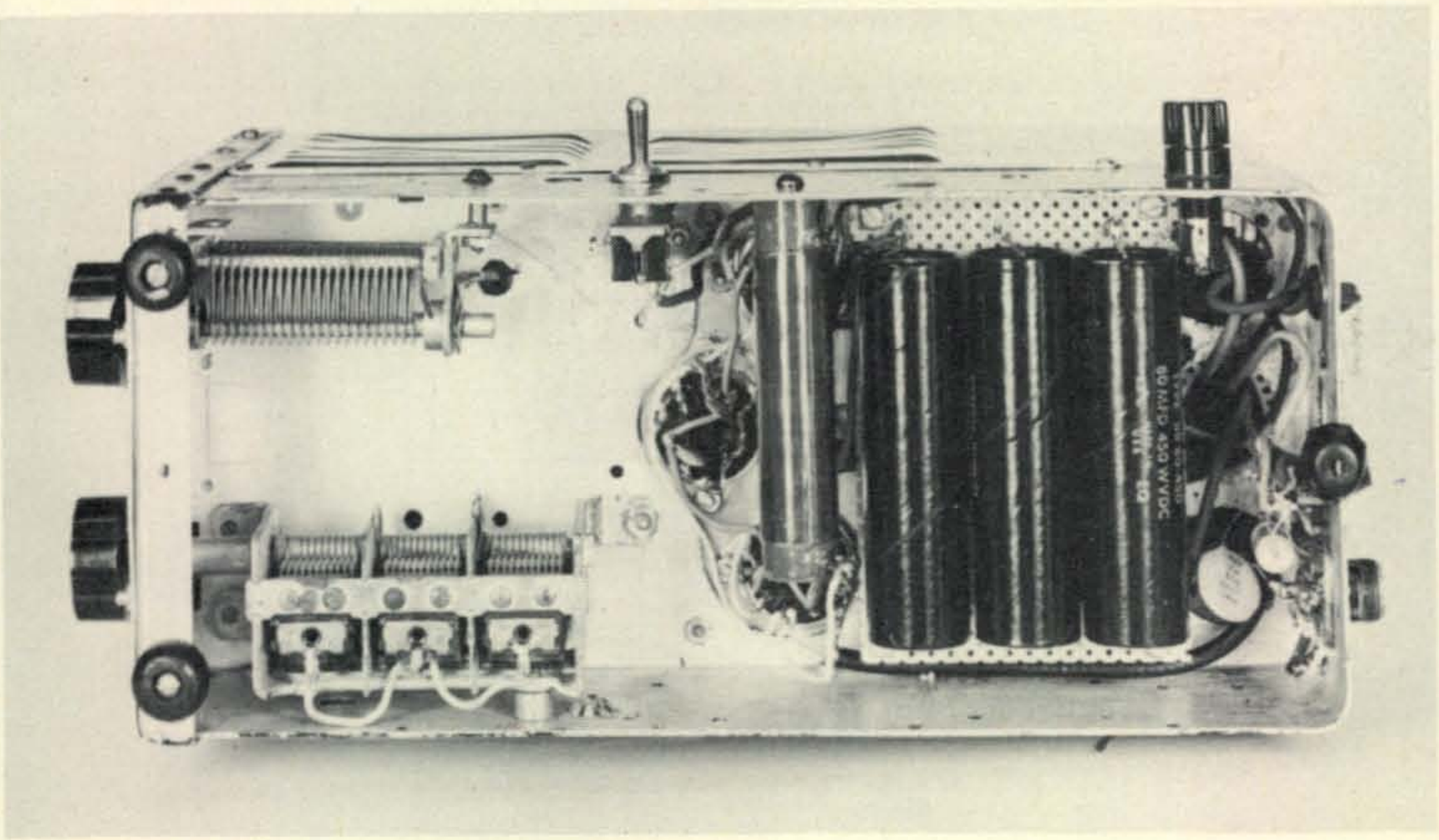

Bottom view of the linear showing the filter capacitors and output capacitors.

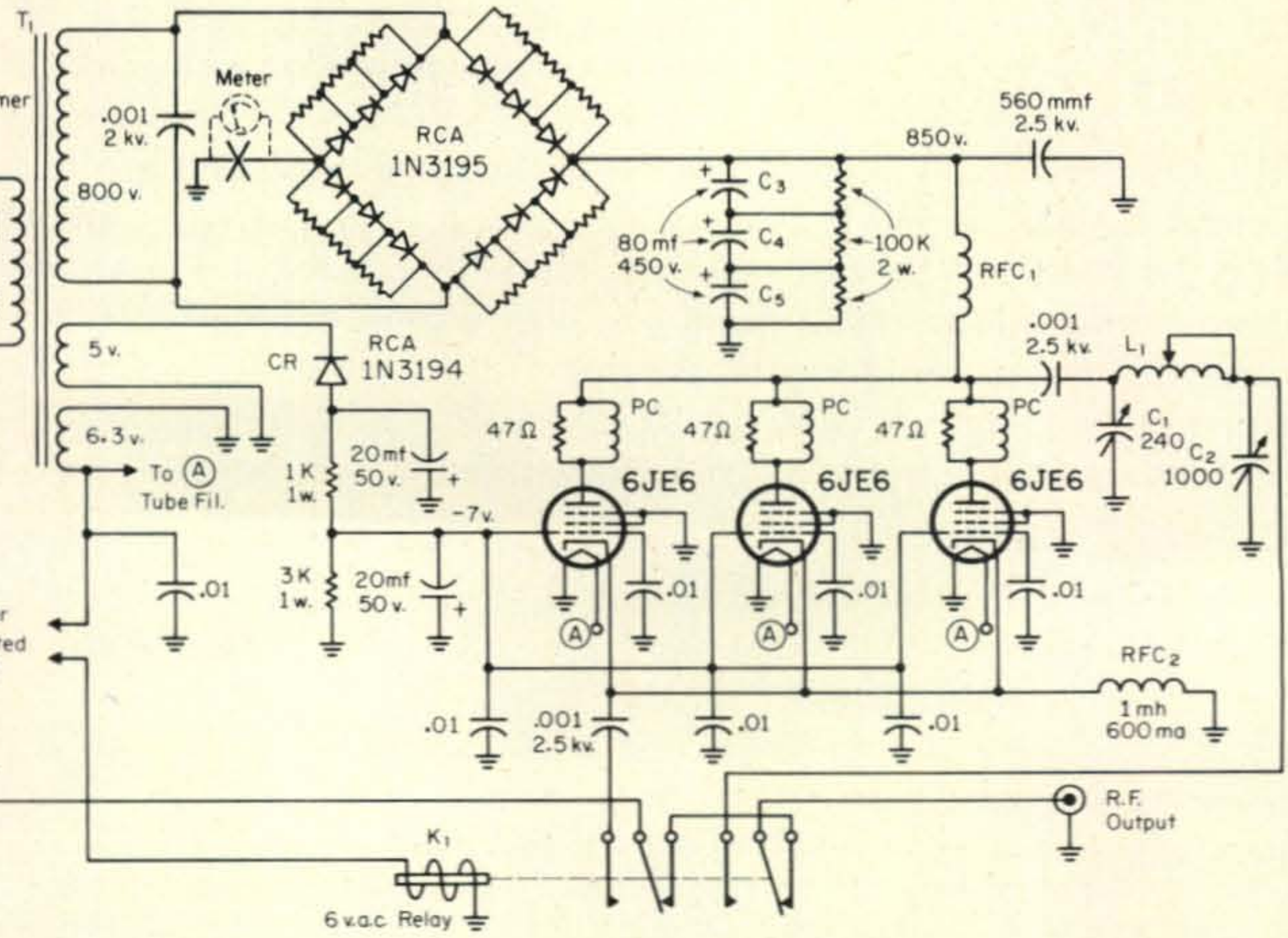

Fig. 1—Circuit of the ARC-500 linear for 80, 40 and 20 meters. The resistors paralleling the diodes are 330K, 1/2 watt each. Japanese type 1S315 diodes can be substituted for the RCA types if it is more economical. All capacitors with values greater than one are in mmf except for electrolytics which are indicated by polarity markings.

C_2—1000 mmf, three section broadcast variable paralleled.
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AN 80 METER DIPOLE

BY JOHN A. HOUSER,* WB2GQY

This 80 meter dipole can fit in sixty-five feet of space and will load out on 40, 20, 15 and 10 meters as well.

THE writer is a member of that group that seems to predominate the amateur fraternity. He has very little real estate for antennas and likes to work the 80 meter band, a bad combination.

It has been pretty well established that a resonant 80 meter dipole *has* to be around 117 feet (for 3.5 mc operation) to 134 feet (for 4.0 mc operation) or, as is the general practice, one cut to 125 feet for mid-band, which will be about 8 feet too short for the high end, and 8 feet too long for the low end of the band.

It has also been variously mentioned that if you can get this 125 feet of wire up somewhere, even in the shape of a Z, an L, or a V, as long as you have the full 125 feet, the antenna will resonate in the 80 meter band.

If one has but confined space, perhaps just wide enough to get up two poles 65 feet apart, what does one do? Folding the antenna wire back on itself is *out*, as partial cancellation of the wave will occur. The trick is to get 125 feet of wire in a 65 foot run of narrow space.

Much has been said and written about land conservation, water conservation, and now even air conservation—but who has seriously considered space conservation?

The writer tried rather unsuccessfully to resonate a shortened 80 meter antenna by means of some of the methods listed: putting loading coils at each end of the 65 foot run; using vertical drop sections off the ends of the antenna; and many combinations including loading coils at the ends of the vertical dropped sections. All worked to some degree, if one can suffer a 10 to 1 v.s.w.r. and call it a bargain. To a perfectionist, radiating about 35% of the transmitter power is far, far from a near perfect setup.

Finally, the writer came to the conclusion he just *had* to get 125 feet of antenna wire in the 65 foot space available. Space compression, that's the only answer. So he set to work to compress 125 feet into 65 feet. There is only one way to do it and that is by making a spiral coil out of the wire.

Coiling

Take 2 feet of #14 wire, wind it around a 3/8" wood dowel, and space the turns about 3/4" from each other. In this way the two feet of wire can be wound onto 1 foot length of the dowel.

Now one is not likely to be able to find 65 feet of 3/8" wooden dowel around anywhere,

*28 Washington Street, Rensselaer, N.Y. 12144.

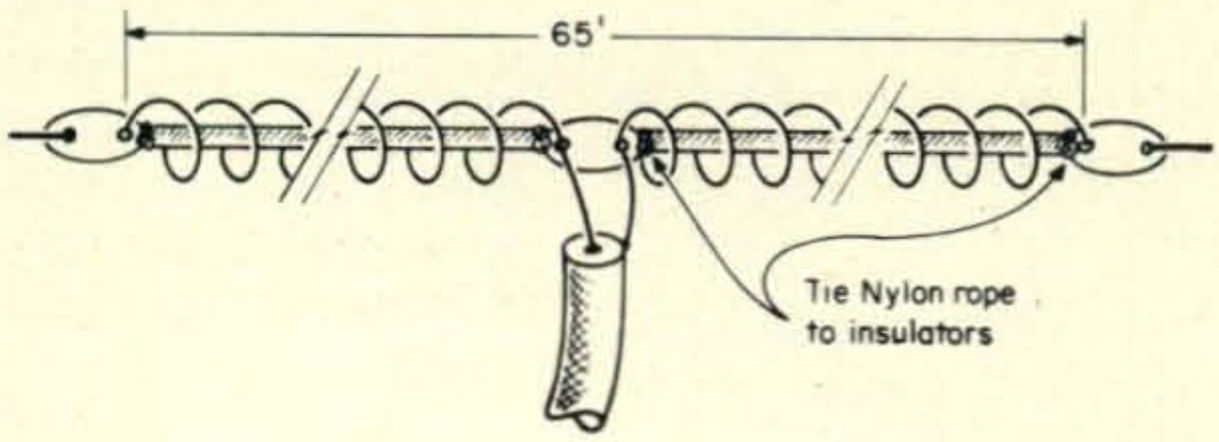
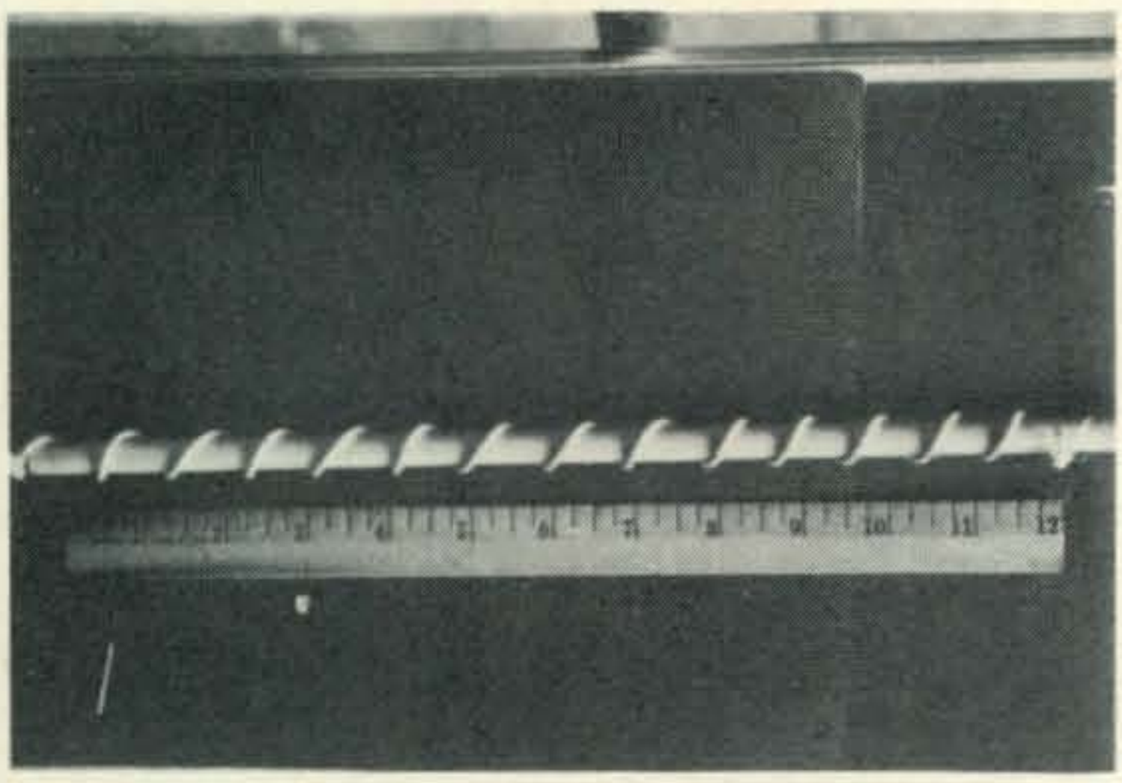


Fig. 1—Two 48' hanks of 3/16" nylon sash rope cut to the proper length supports 125' of coiled # 14 wire. The dipole is fed by a length of RG8/U coax. This antenna will load on 80, 40, 20, 15 and 10 meters.

See page 102 for New Reader Service



View of a 12" length of 3/8" dowel with two feet of #14 wire wrapped around it.

so something which would substitute for the dowel, be a near-perfect insulator at high frequencies, and still allow for the coiling of the wire had to be found.

Immediately the thought occurred, "Why couldn't the new type nylon rope be used?" Nylon is a good insulator, the rope could be secured with the section-strands coiled around each other, and the only remaining question was if the spaces between the twisted strands would approximate 3/4" between turns.

A trip down to the local hardware store was in order. The largest diameter nylon twisted rope they had was called 1/2". Nothing to do but buy a 2 foot section, bring it back to the lab and start coiling 2 feet of wire on 1 foot of rope, following the groove of 1 of the 3 strands which compromise the twist. We end up with 17 inches of rope instead of the desired 12 inches. Won't work. Didn't feel too badly about it,(because this rope is 24¢ per foot, which is too expensive for a ham, anyway.

Now, what's the cheapest nylon rope? It's called sash cord, comes in 48 foot hanks, for $0.98 per hank. This is more like it, even though one has to buy two hanks for the antenna. The diameter is about 3/16", but my, is this stuff strong!

Back to the original idea. Wind a section of wire on the 3/8" wood dowel, spacing 3/4" between turns. Then fish the rope through 2 feet of the spiral by means of a 2 foot piece of wire wound around the end of the rope for a snake. Wind 2 feet more, fish again, and soon to the end.

Cheap, but efficient. When finished, loop the ends of wire and rope through the center and end insulators, hook up the RG-8/U feedline, raise the antenna, and we're in business on 80 with a 65 footer.

Performance

Into the rig to test it out. Heard a CQ from Buffalo, N.Y., which is about 300 air miles from this location. Answered and he came right back with a 349. Not bad considering this was off the West end of the antenna which points E and W. The second QSO was with Arlington, Va. which is about 450 miles south, broadside to the antenna direction.

Loading on both 80 and 40 with just the transmitter (a TR-3) barefoot, with line hooked directly to it, was no problem. The s.w.r. on 80 is higher than on 40, but due to surrounding buildings and trees more so than antenna itself. The antenna is barely 20 feet from ground, which is another detracting factor in regard to both DX and s.w.r. On 20 the first QSO was with N. Carolina, about 600 miles on short skip. The loading was also OK, and the s.w.r. about 2.8, actually a little lower than that on 80 and 40. As the s.w.r. did not vary appreciably all across the 3 bands, the writer feels that this type of antenna, while it may not be particularly the meat for the DX hound, will actually give satisfactory performance over the 3 bands, which up to now has been considered quite difficult in a single dipole. While it was not thought originally that it would turn out to be a 3-band antenna it has turned out to be so and it would seem to be a little more economical to use 1 antenna for multi-band operation if feasible.

Undoubtedly, if enough hams construct this type of antenna, some are bound to find some improvements which may increase the efficiency—but if one intends to use it, as the writer does, on 80, 40, and 20, these should be checked on all 3 bands to determine that an improvement on one band does not detract from the operation on the other two. However, this experiment seems to indicate that a little ingenuity in the application of some slightly-known theory and a little work can sometimes lead to rather unexpected results. ■

See page 102 for New Reader Service

VARIABLE A.F. BANDWIDTH FOR THE HW-100

BY JOHN ABBOTT,* W6ZOL

THE Heathkit HW-100 has become a popular transceiver because of its nominal price and good performance. However it does have some shortcomings, the most notable of which are:

1) Poor receiver response in the c.w. mode of operation;

2) A fatiguing characteristic of the receiver audio output to "ring" slightly at about 1400 cycles;

3) The annoying fact that when headphones are inserted in the front panel jack the speaker is not completely silenced;

4) The volume of the c.w. monitoring tone is too great, causing additional operator fatigue; and

5) The tuning mechanism is poor.

Corrections

Item 5 has been well covered in the March 1969 issue of *CQ* magazine.[1]

Item 4 can be taken care of by changing the value of R_{326} at pin 1 of V_{15} (fig. 1) from 1 megohm to 8.2 megohms, or to a value between 1 and 8.2 megohms that produces a tone level suitable to the individual.

Item 3 is no problem in the HW-100's sister rig, the Heathkit SB-101, since a headphone jack is used with contacts to disconnect the speaker. Figure 1 shows the modified schematic, changing the HW-100 audio output circuit to that of the SB-101. It is a simple matter to do the rewiring. A two conductor non-shielded "speaker wire" can be run from the rear of the chassis to the front phone jack by threading it along where the cable harness is run. The new phone jack is a Switchcraft Stereo "Littel-Jax" type 14B, connected as shown in fig. 1. When the headphones are inserted, the speaker is grounded; when they are removed the speaker is connected to the 8 ohm output transformer tap.

Item 2 can be corrected by mounting a 10K 2 watt carbon resistor across the amplifier side of the audio transformer, T_{301}, as shown in fig. 1. This resistor was mounted by its leads on the bottom of the audio amplifier printed circuit board, and tends to load and broaden the response of the audio amplifier, while at the same time reducing its gain and tendency to "ring."

Item 1 was taken care of, as shown in fig. 1, by switching a 0.09 mf ceramic capacitor, a 0.02 mf ceramic capacitor, or an open circuit across the 10K resistor installed to correct item 2. This switching gives the operator three receiver response curves to choose from, one for c.w. and two for phone, as shown in fig. 2.

The switch (Oak Miniature Phenolic Shorting, type F, 2 section, 2 pole, #399-324F) was installed on the front panel midway between the tuning dial window and the "S" meter, at the same level as the top row of knobs on the left panel. A matching knob was obtained from Heathkit.

It is essential that twin conductor shielded wire be used to come from the audio circuit

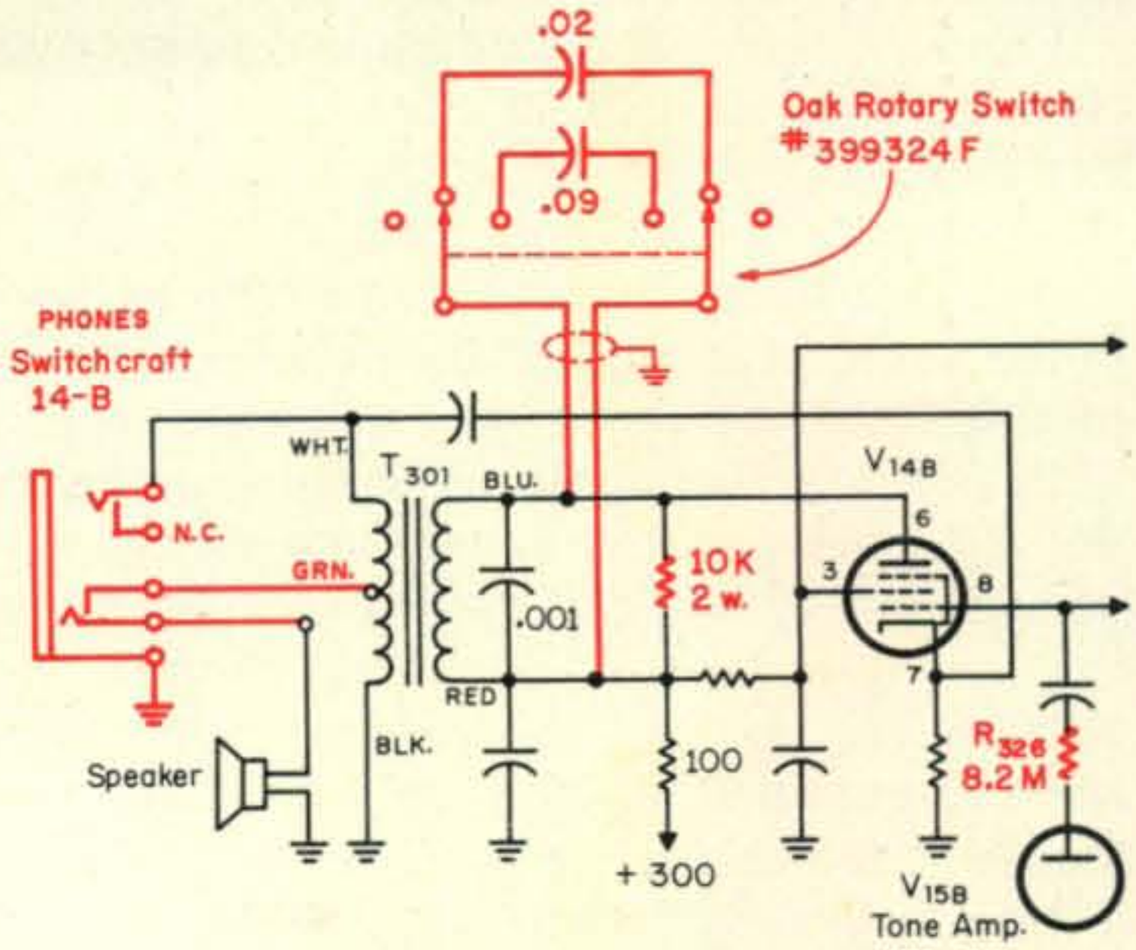


Fig. 1—Modifications made to the audio section of the Heathkit HW-100 are shown above and described in the text.

*24012 Avenida Crescenta, Valencia, Calif. 91355.

[1]Kirsch, Paul J., "The Two & Two Dial For The HW-100," *CQ*, March 1969, p. 47.

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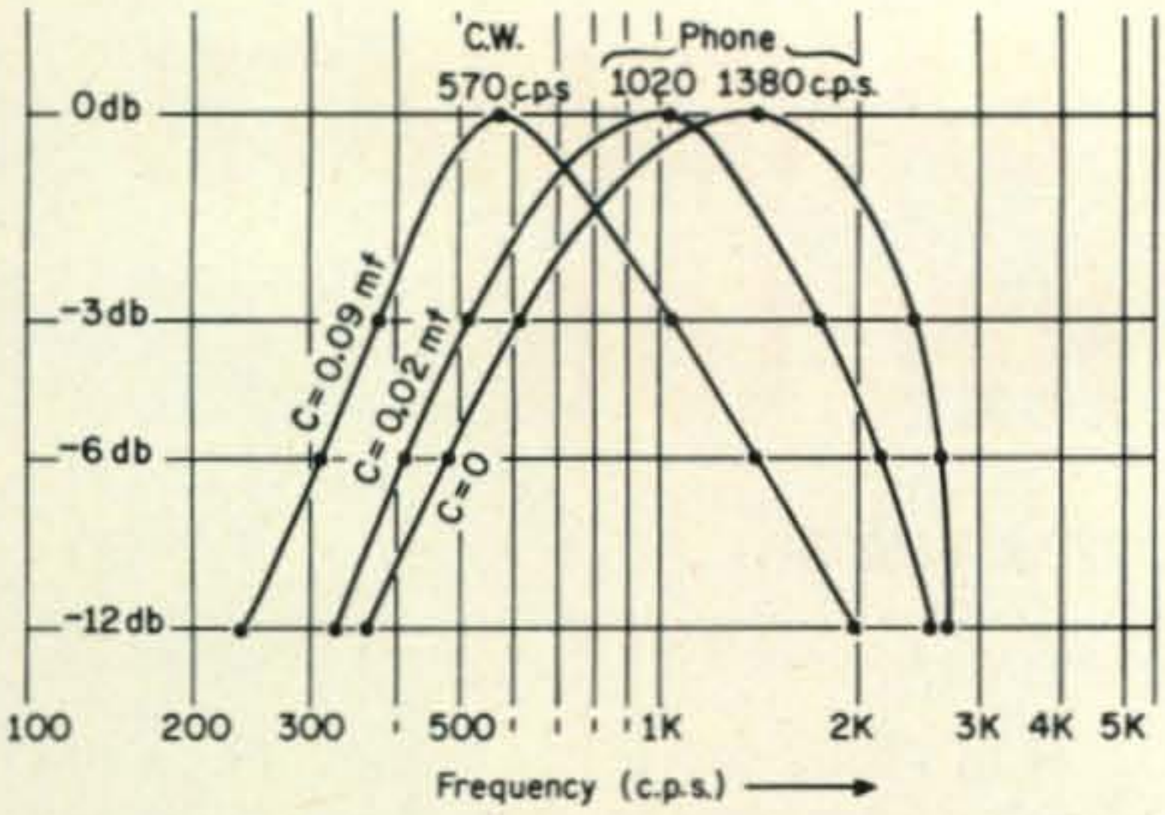

Fig. 2—Audio response curves for the Heathkit HW-100 shows the effect of the audio bandswitch.

board to the front panel. If it is not, 60 cycle a.c. may be induced on the leads and hence appear on the receiver audio output.

The shielded wire was routed through a hole in the audio circuit board to the top side of the chassis, after being grounded at a nearby lug. It was then routed around the large electrolytic capacitor on the audio circuit board, along the side of the frame to the front panel. Grounding for the shield was obtained on the PTT-VOX-CAL switch terminals located below the new variable bandwidth switch.

Conclusion

Figure 2 shows that three 3 db bandwidths can be selected: 1) 380 to 1020 c.p.s. for c.w. and, 2) 510 to 1700 c.p.s. or, 3) 620 to 2400 c.p.s. for phone. These curves were obtained by tuning through an r.f. signal inserted into the receiver at its antenna terminals and measuring the resulting audio output at the speaker terminals.

It is the author's experience that the 510 to 1700 c.p.s. bandwidth is most preferable on phone, but there are times when the 260 to 2400 cycle bandwidth increases signal readability. The 380 to 1020 c.p.s. bandwidth represents a range of frequencies most preferred for listening to c.w. signals and provides rejection of high frequency noise. ■

TRANSISTOR REVERSE POLARITY PROTECTION

BY RONALD L. IVES*

IN the October, 1969, issue of *CQ*[1], Bill Scherer presents an entirely workable circuit for protecting transistors from "backward" power connections, and gives some useful constants for this application.

Figure 1 shows three additional protective circuits, developed in an effort to make certain types of military equipment "fool-proof, WAC-proof, and Colonel-proof."

In (A), a series diode prevents current flow in the wrong direction. If the power supply is reversed, the equipment just doesn't work.

In (B), a series diode prevents damage to the equipment if the supply polarity is reversed, and a lamp and diode in series across the line give visual indication of misconnection. A buzzer, blasting cap, or other effectve annunciator may be substituted for the lamp, if desired.

In (C), the equipment is isolated from the line by a bridge rectifier, so that no matter how the supply is connected, voltage to the load is always of the correct polarity.

Constants depend upon the circuit voltages and currents. Series diodes (silicon recommended) should have a c.c.s. rating about 1.5 times normal circuit current for "immortality." Shunt indicator or annunciator should have a voltage rating about that of the supply. Fuses are recommended at strategic points. Replacement fuses are very much cheaper than replacement transistor assemblies. ■

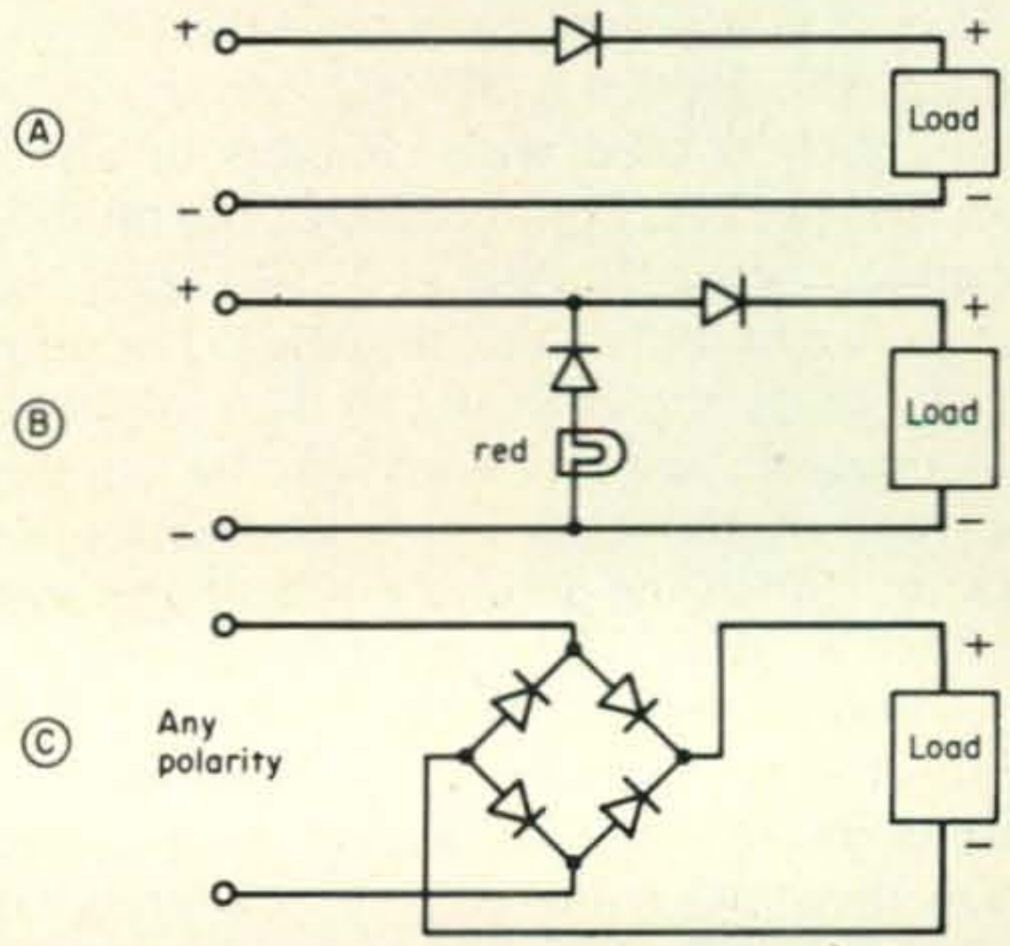

Fig. 1—Three methods of protection against reverse application to transistorized loads. (A) series diode. (B) Series and shunt diodes with a reversal indicator and (C) a bridge circuit that always connects the input correctly.

*908 North Humphreys Street, Flagstaff, Arizona 86001.

[1]Scherer, W., "Q & A Column," October 1969, p. 74.

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A RECEIVER AUDIO COMPRESSOR

BY SSG CORTLAND E. RICHMOND,* W1CEJ

If you've ever worked a net where it was necessary to keep one hand on the volume control you know that even modern a.v.c. systems don't really level out all signals. Here is a small additional circuit that will end your earaches. It is an a.v.c. system itself but with a difference; it sets a maximum audio level which will not be exceeded. On my receiver I was able to vary a test signal from 10 microvolts to 10,000 microvolts, a change of 60 db, while the audio output varied from 100 milliwatts to 151 milliwatts, a change of only 1.8 db.

Circuit

Referring to fig. 1, the circuit uses one FET as a series attenuator controlled by a d.c. voltage derived from the audio output. A variable resistor, R_3, permits adjustment of the compression level. The audio output signal is sampled at the speaker lead and a portion of it is taken off R_3 to T_1, which steps up the low impedance signal to several volts. This higher level signal is rectified by CR_1 and filtered by C_1 and R_2, then fed to the FET gate. Diode CR_1 is so connected as to cause Q_1 to conduct less as the audio output becomes greater, which tends to hold the output constant. Resistor R_1 furnishes a d.c. ground for the drain of Q_1

Components

Some notes on parts selection: I used a 2N3820 for Q_1 as I had a few. A different FET can be used, but it should be of the symmetrical type so that both positive and negative half cycles will be equally attenuated. If an N-channel FET is used CR_1 and C_1 will have to be reversed. Resistor R_1 serves to keep Q_1's drain or source[1] at ground potential for d.c.; it may not be necessary, and if used should have a high enough value to prevent loading of the audio line. I got all my parts from the junk box, so the values shown may not be optimum. One value that should be individually selected is the bleeder resistor, R_2. This determines the attack/decay rate of the system. I used a 20 microfarad capacitor for C_1 and picked a value for R_2 that resulted in an agreeable characteristic, 22K. This gives a time constant of 0.44 seconds, which seems to be a good compromise for c.w., s.s.b. and a.m.

Transformer T_1 is a line to grid transformer, although the one I used had a 5 ohm primary to accomodate a dynamic mike. The impedance of T_1's primary shouldn't be too much greater than the receiver's output impedance, so maybe a vacuum tube output transformer would do.

Adjustment

Adjustment may be done in two ways: the first is to tune in the strongest signal you will

[*Continued on page 86*]

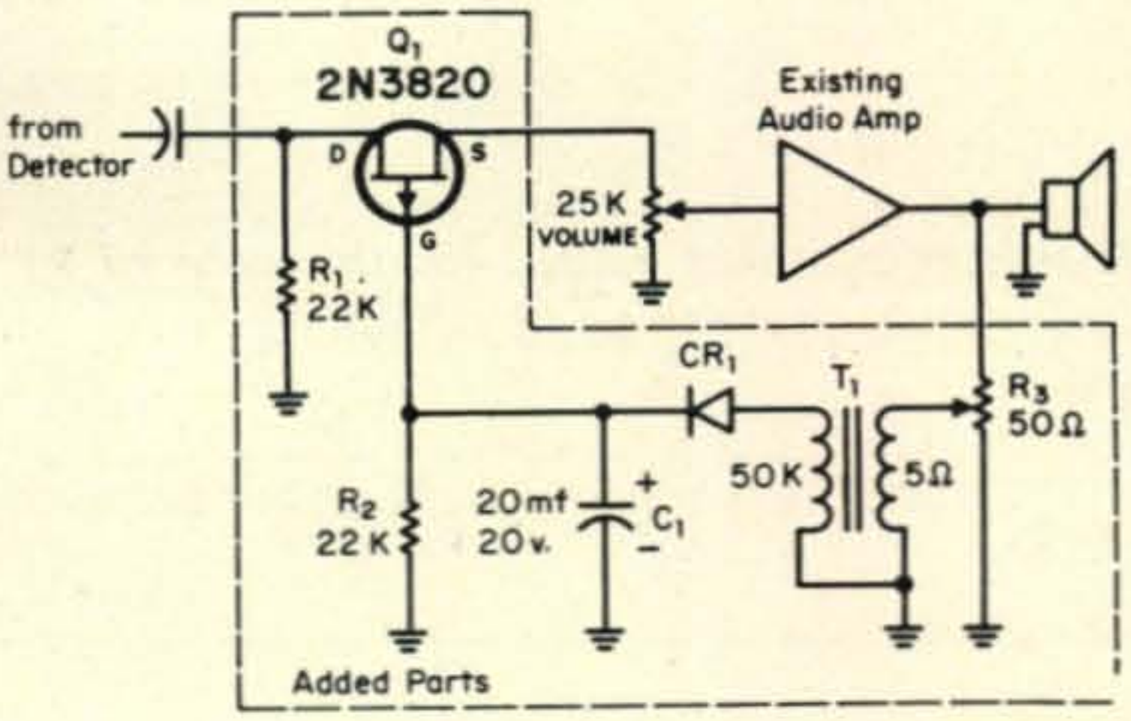

Fig. 1—Circuit of a compressor using a single symmetrical FET. Source and drain terminals of Q_1 may be connected in either way. The value of the volume control will vary for different receivers and will not affect the operation too greatly. A 25K value was used in the receiver modified here.

*Command Aircraft Company, APO San Francisco 96530.

[1]In this circuit the position of the source and drain are interchangeable as long as a symmetrical type of FET is used.

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CONVERT S.W.R. INTO WATTS

BY LARRY R. HOUGHTON,* K8ZVF

As an operating ham you undoubtedly are using an s.w.r. bridge for measuring the amount of mismatch between your transmission line and antenna. Even if you don't have such a bridge, you know that unless the transmission line impedance is exactly matched to the antenna impedance, r.f. power is lost. Since s.w.r. bridges indicate *ratios* of impedance mismatch, we have come to think in dimensionless terms of what is an acceptable s.w.r. and what is a bad s.w.r.

We know, for example, an s.w.r. of 1:1 is perfect; all power sent to the antenna, except for inherent line losses, is radiated. Most transmitters are designed to tolerate at least a 3:1 s.w.r. The question is, how much *power* is reflected for a given s.w.r.? In other words, how inefficient is given transmission line/antenna mismatch?

This question sent me hustling back to the books. There I found the equation for s.w.r. in terms of forward and reflected power, *P*f and *P*r:

$$S.W.R. = \frac{1+\sqrt{\frac{P_r}{P_f}}}{1-\sqrt{\frac{P_r}{P_f}}}$$

If this equation is solved for the ratio of *P*r to *P*f or the percentage of reflected power, we get:

$$\%\ Reflected\ Power = \frac{P_r}{P_f} = \left(\frac{SWR-1}{SWR+1}\right)^2$$

From this equation, the percentage of reflected power can be found for any s.w.r. Multiplying the forward power by this number gives the amount of reflected power due to the impedance mismatch:

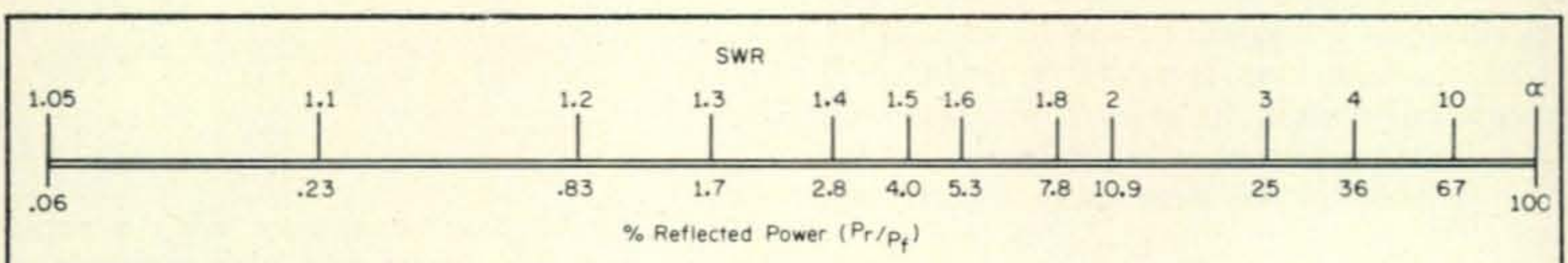
$$Reflected\ Power = P_r = (\%\ reflected\ power)(P_r)$$

Using this last equation, various percentages of reflected power have been worked out for s.w.r.'s up to 10:1 (see nomograph). Thus, if you are putting 100 watts, *P*f, into a transmission line with an s.w.r. of 1.5:1, the percentage of reflected power, *P*r, is 4.0%. Forward power multiplied by this percentage is (100 watts) (.040)=4.0 watts. This gives you a better indication of just how much power is lost, rather than a dimensionless ratio.

The prime requirement for a calculation like this is that you know the actual power you're putting into the transmission line. Naturally a power meter in the line would be ideal. If you have a chance to borrow one, do so. If not, you'll have to resort to estimating *P*f by knowing the d.c. power input to your final amplifier and its efficiency. You might contact the manufacturer or check the transmitter's specifications. Heath is one company that specifies power input.

If you're not too fussy about cutting into your copy of *CQ*, clip the nomograph and tape it to your s.w.r. bridge for ready reference. It'll add a bit more meaning to your next s.w.r. reading. ■

*3385 Middlebrook Road, St. Joseph, Michigan 49085.



Nomograph for converting s.w.r. into the % of reflected power. Note that for an s.w.r. of 3:1, 25.0% of the power into the transmission line is reflected. To determine the actual power in watts move the decimal point two places to the left and multiply this by the forward power, *P*f. For example if *P*f = 100 watts, *P*r = 0.25 × 100 = 25 watts.

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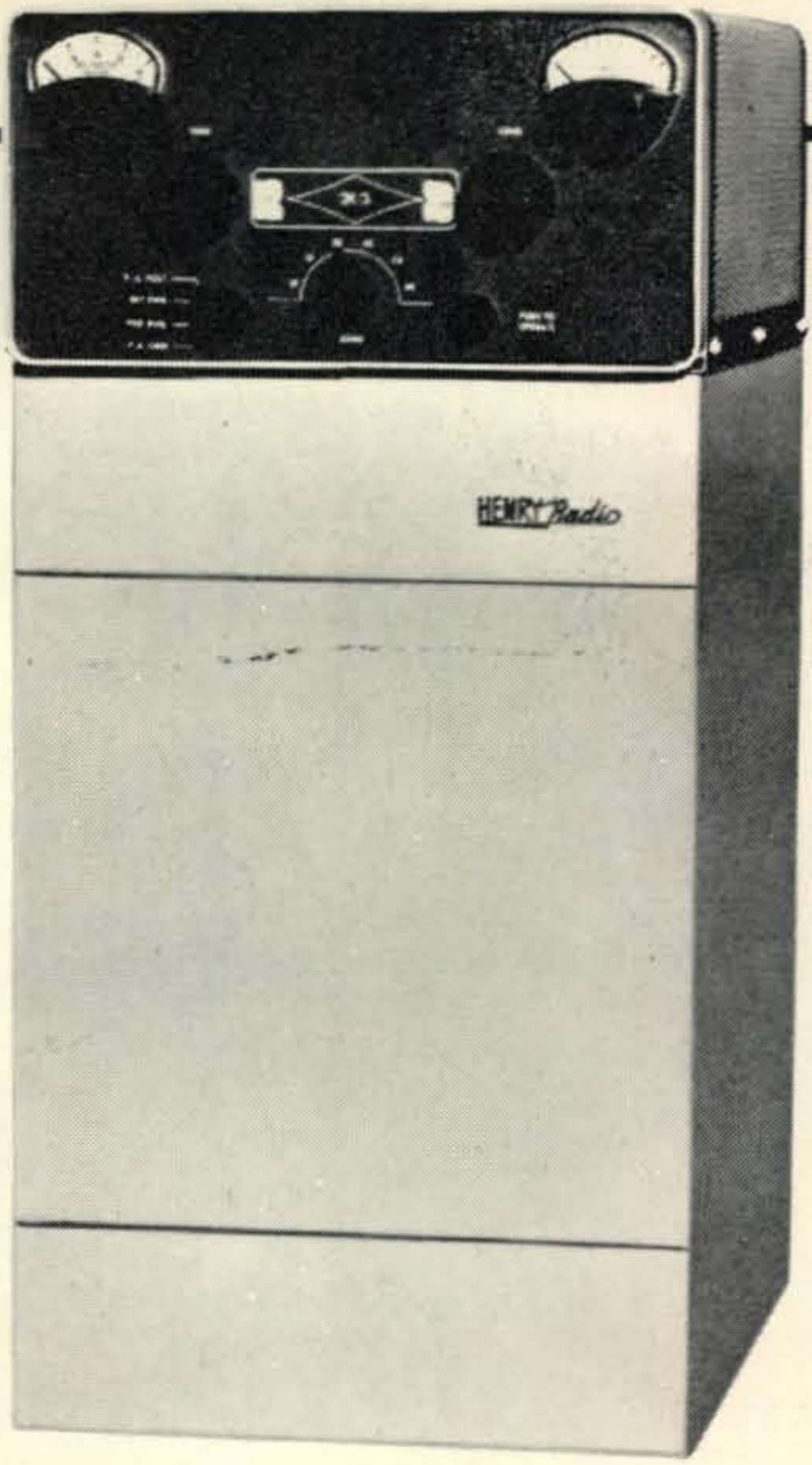
the 2K-3



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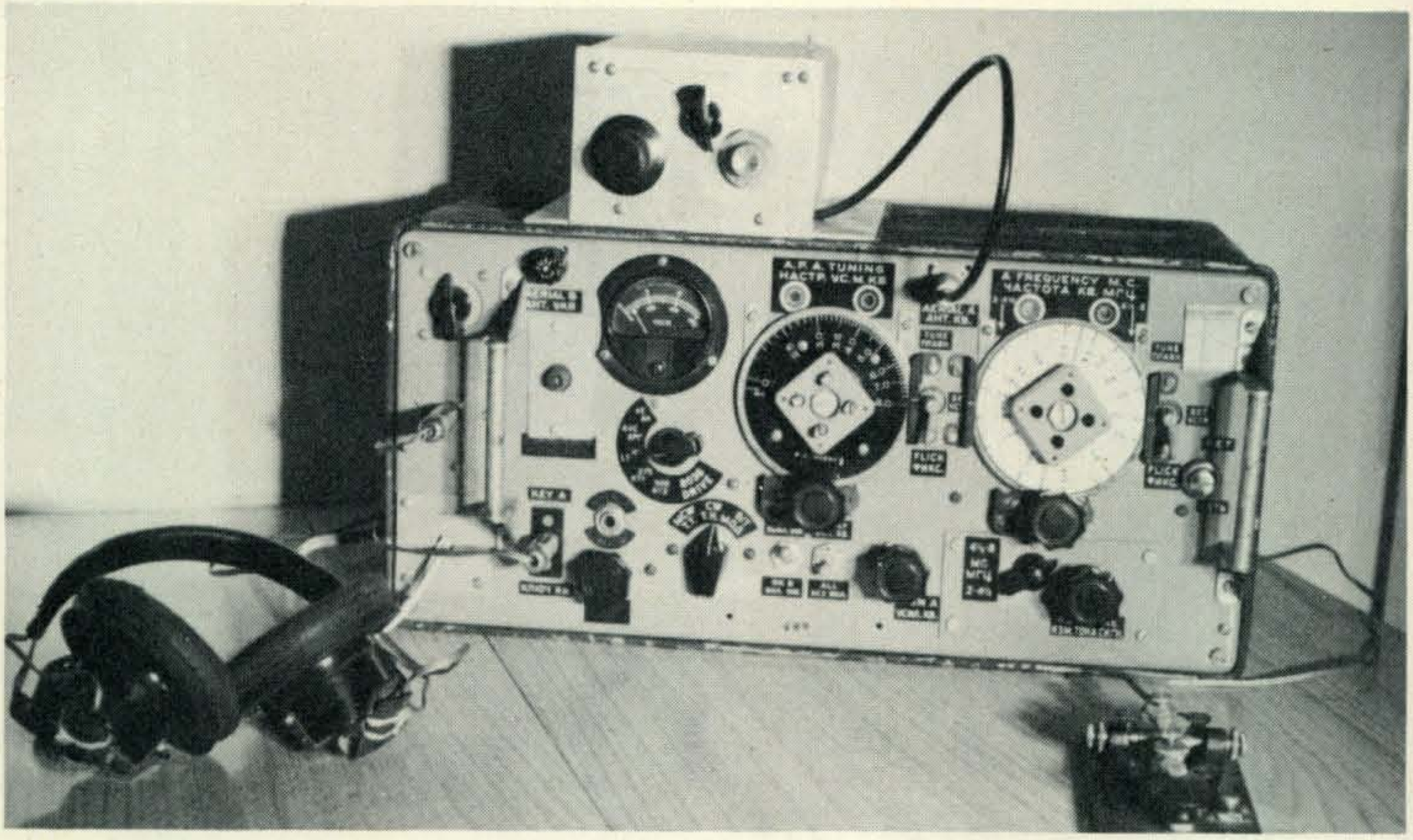

Front view of the converted No. 19 Mark II set with a wide range antenna coupler.

IMPROVED PERFORMANCE FROM THE NO. 19 SET

BY SAM KELLY,* W6JTT

AFTER using my converted No. 19 set on a few portable operations, it was obvious that several changes could be made to greatly improve the performance and convenience of operation. The original antenna coupling circuit was designed strictly for coupling to a 12 foot whip, while I usually wound up trying to load in to a random length of wire. Bandpass was poor, especially on 40 meters. The set tended to chirp under certain loading conditions, and the a.m. feature was useless.

On the asset side, the set was cheap, rugged, and compact enough for truly portable operation. The following modifications can be made in a few hours and will result in greatly improved performance.

Keying and Bias

A complex bias control system was originally required to get adequate performance with control grid modulation. Since the a.m. feature was worthless, the bias system was no longer needed. C.w., performance can be improved by removing the components associated with the 6H6 bias regulator and rewiring the final amplifier bias circuit as shown in fig. 1. Using a keying relay eliminated the +275 volts on the key and also cured a peculiar problem caused by the final amplifier oscillating when receiving high level signals.

Tuning Range and Bandspread

The set can be modified for optimum operation on either 80 and 40 meters, or on 160 and 80. Either modification is simple, but the easiest one for beginners is the 80/160 meter modification. This is because it is possible to wind up transmitting 900 kc away from the desired frequency at 7 kc unless you have checked the buffer tuning with a grid dip oscillator or wavemeter.

*12811 Owen Street, Garden Grove, California 92641.

[1]Kelly, S., "Converting the No. 19 Set, "*CQ*, May 1969, p. 25.

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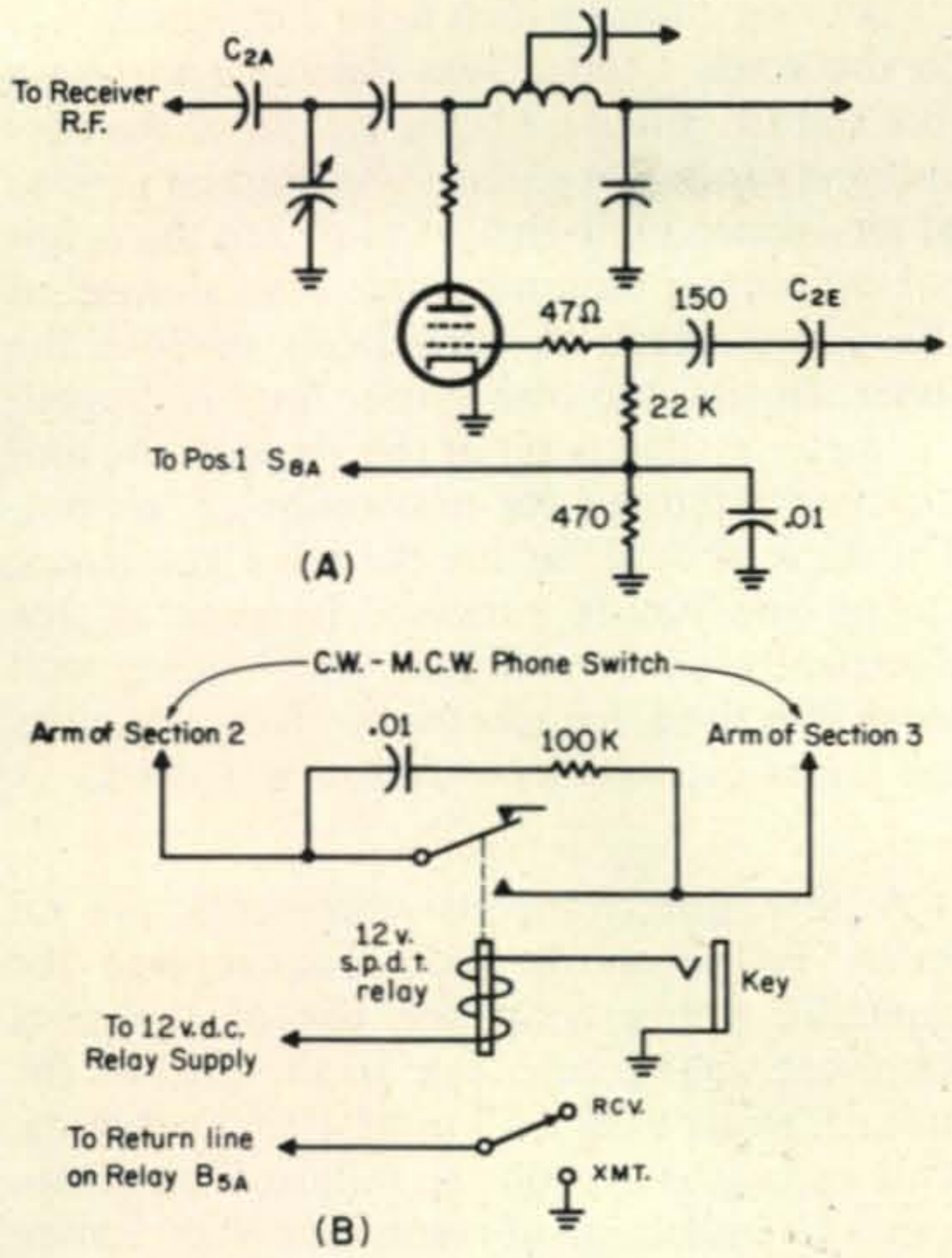

Fig. 1(A)—Modified bias circuit for the No. 19 Set. The following components have been removed: R_{1C}, R_{1D}, R_{43A}, R_{7G}, R_{7D}, R_{15A}, R_{15B}, R_{42B}, C_{15M}, R_{19A}, C_{15C}, C_{34A}, C_{2D}, R_{1E} and C_{15D} and replaced with the above circuit. Capacitor C_{2A} must be replaced with a 50 mmf, 1000 volt mica. (B) Modifications to the keying circuit include the addition of a 12 v.d.c. relay as shown above.

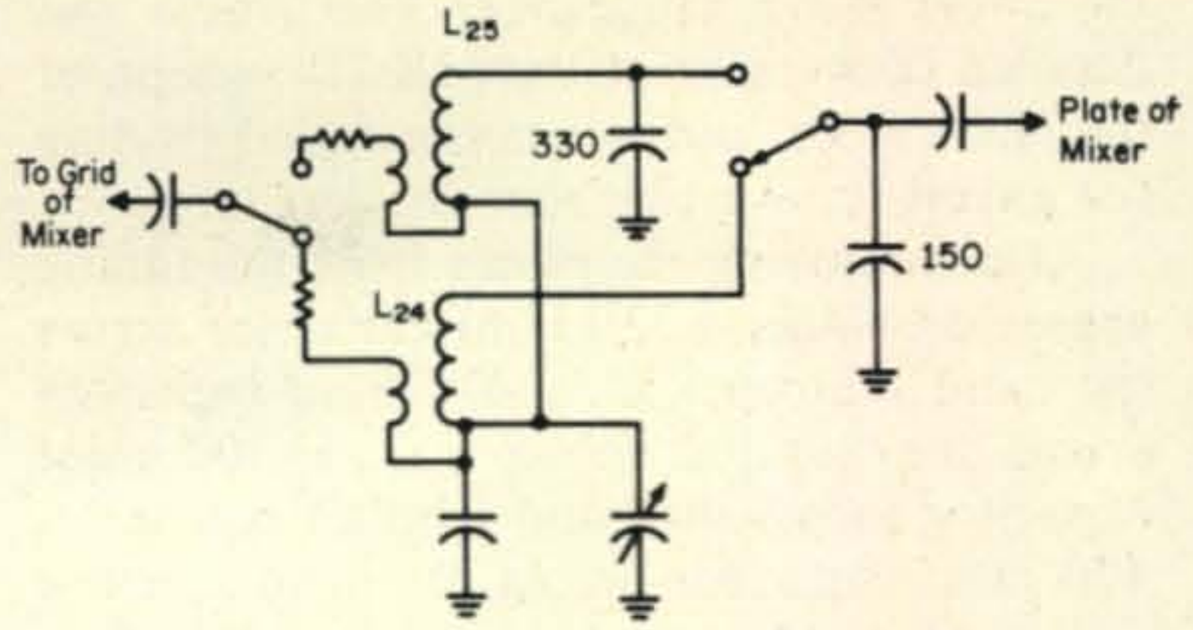

Fig. 2 — Receiver oscillator modifications for operating the No. 19 set on 80 and 160 meters.

The first step is the same for either modification. This is increasing the bandspread by removing plates from the main tuning capacitor (4 sections). Remove the set from the case and remove the three tubes next to the tuning capacitor. Cut through the web that holds the plates together three plates back from the front panel in each of the four sections. Peel the web from the remaining plates using your diagonal cutters. Remove all but the three plates in each section. This requires a bit of skill. I found it easiest to wiggle each plate back and forth with a soldering aid until it was loose then removing it by pulling it straight out with a strong pair of pliers. After removing the plates, trim the spacing bar to remove rough edges.

Modification for 40 and 80 Meters

Switch to band 2 (4.5-8 mc). Solder a 22 mmf capacitor across the 4.5-8 mc oscillator trimming capacitor. Set the main tuning capacitor 3/4 open (about 7.0 mc on the dial) and couple in a 7.15 mc signal. Adjust the receiver oscillator trimmer (band 2) until the signal is received. Switch the meter switch to DRIVE. Key the transmitter and adjust the RF DRIVE and BUFFER TUNE capacitors for maximum drive. Use a Wavemeter or Grid Dip Oscillator to be sure the transmitter is tuned up on 7.15 mc. Open the key and peak the receiver signal using the 4.5-8 mc receiver r.f. trimmer.

Now switch to band 1. Set the tuning dial to 2.0 mc. Solder a 130 mmf capacitor across the 2-4.5 mc oscillator trimmer. Couple in a 3.5 mc signal and adjust the trimmer until it is received. Peak using the 2-4.5 mc receiver r.f. trimmer. Peak the mixer and buffer capacitors (C_{10} E & F), located below the chassis, for maximum r.f. drive.

Modification for 80 and 160 Meters

This conversion was inspired by Jake, WB-2PAP, who sent me an article by G3TKR in

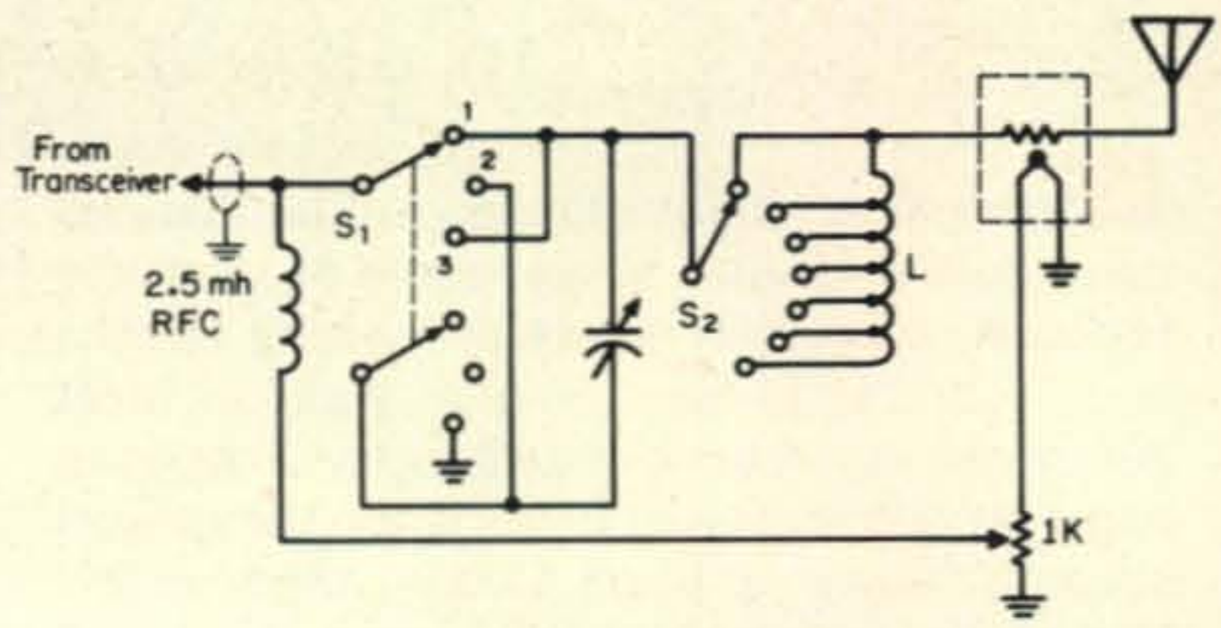

Fig. 3—Circuit of an antenna tuner designed for use with the No. 19 set. The switch positions for S_1 are 1 — Loading Coil Only; 2 — Series Capacitance; 3—Parallel Capacitance. Switch S_2 is a tap switch from a BC-375E tuning unit. The thermocouple, *Tc*, can be obtained from the antenna r.f. ammeter of an ARC-5. Inductor *L* is made up of 15 turns of Air Dux 2006T and tapped every other turn.

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the *Short Wave Magazine*.[2] The article was detailed conversion of the MK III version of the No. 19 Set, and is recommended reading for anyone converting that version.

After removing the plates from the tuning capacitor, solder a 330 mmf capacitor across the band 1 mixer coil, a 470 mmf capacitor across the band 2 mixer coil, a 300 mmf capacitor across the band 1 buffer coil and a 470 mmf capacitor across the band 2 buffer coil. Add the capacitors as shown in fig. 2 to the receiver oscillator coil. With this modification band 1 coverage will be approximately 1.8 to 2 mc and band 2 will cover 3.5 to 3.9 mc. Connect an additional 100 mmf transmitting grade capacitor in parallel with the plate tuning capacitor. Repeat the alignment procedure outlined in the 80/40 conversion, only this time peak the drive and receiver r.f. capacitors at 1.9 and 3.7 mc.

After completion of the conversion, make a new dial from a piece of art board or manila folder and calibrate it using an LM or 221 frequency meter.

Antenna Tuner

The original variometer incorporated an r.f. sensing circuit which fed a d.c. signal back on the coax. I felt it was desirable to retain this feature. Figure 3 is the circuit of the new antenna tuner. The circuit was built on a piece of aluminum plate drilled to match the original variometer mounting holes. An aluminum shield was made to completely enclose the tuner. In use, the transmitter final is dipped, the meter switch is set at the AE position, and the tuner adjusted for maximum r.f. output. The tank should be checked for resonance during the tuning process. In general, for electrically short antennas the loading coil alone was used, for electrically long antennas the series capacitance position was used.

General

A few miscellaneous comments are in order. To be on the safe side, replace the capacitor going from the top of the final amplifier tuning capacitor to the grid of the first r.f. stage with a 50 mmf 1000 volt mica. This capacitor is prone to failure. The symptom is no indication of resonance when tuning up on 40 meters.

Before replacing any glass tubes with their metal equivalents check the shield pin (pin 1). In most cases this pin has been used as a tie point for the +275 volt line. You can get quite a thrill by simply plugging in a metal tube. ■

[2]Raven, D.J., "More About the 19 Set," *Short Wave Magazine*, March 1969. 55 Victoria Street, London, S.W. 1, England.

WELCOME COMMITTEE FORMED FOR FOREIGN AMATEURS VISITING NEW YORK

BY GEORGE PATAKI,* ex-YO2BO

EVERY year, many foreign radio amateurs come to the United States, some of them for business, others for study or visiting friends and relatives. These amateurs want to meet American amateurs as much as the American hams try to meet local hams when they travel abroad. Many of these DXers know a few W and Ks, having had QSOs with them, but there is a real need for a center where every visiting foreign amateur can make some useful contacts.

I am myself a foreigner; I know how much I wished to meet American amateurs and how happy I was when I was invited by some of them to see their shack or to visit their radio clubs.

I would like to ask for volunteers for our program in the New York City area. Anybody who thinks they will enjoy welcoming foreign amateurs should drop me a letter, giving his address, phone number, profession, hobbies, time of availability and any information which may be helpful in organizing this program.

At the same time, foreign amateurs intending to visit New York City are invited to conact our welcoming group by writing me in advance and phoning me as soon as they get to New York City. ■

*34-24 76th St., Jackson Heights, N.Y. 11372. Telephone: 212-639-3195.

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ALFRED VAIL

THE MAN BEHIND THE "MORSE" CODE

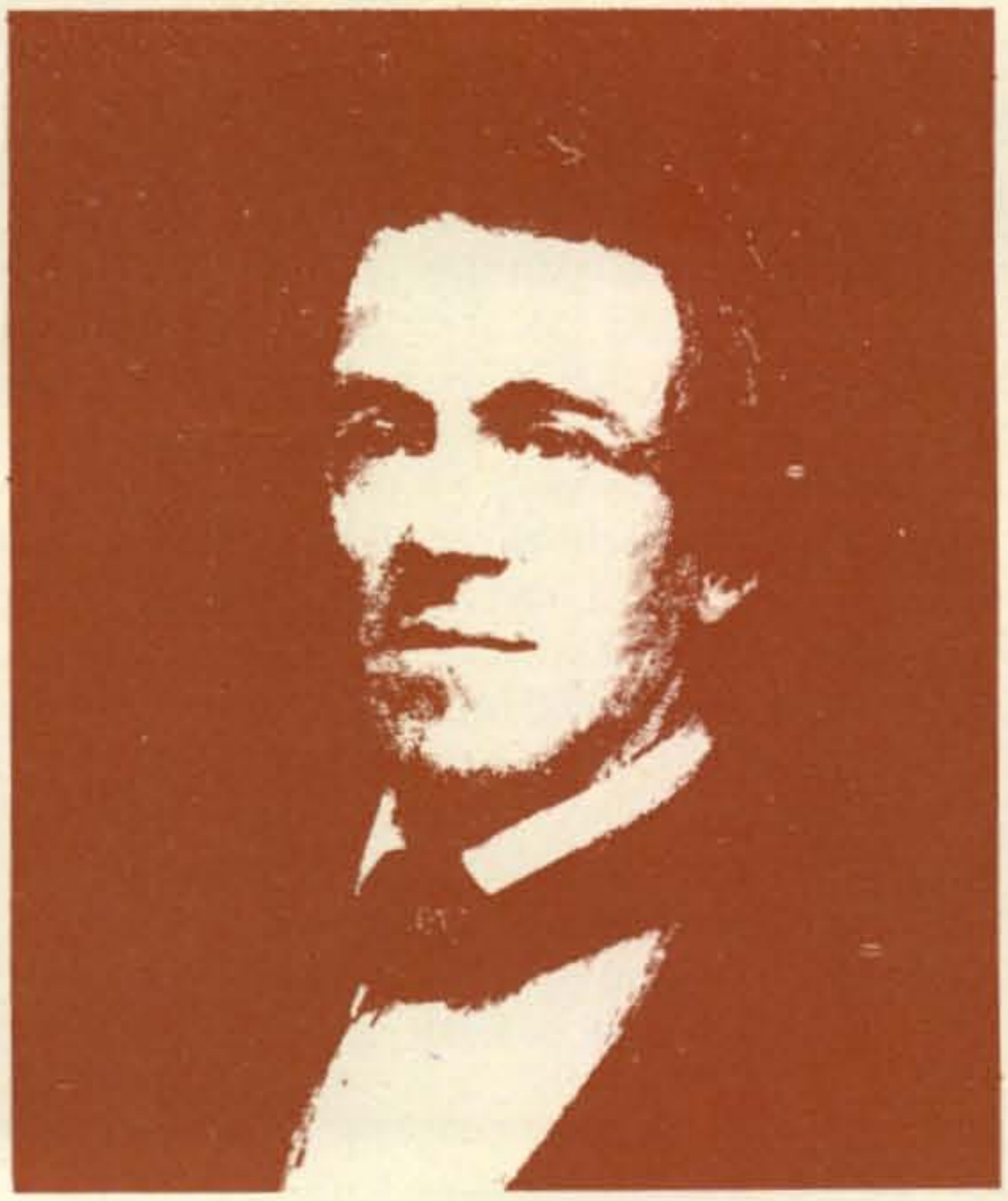
BY ALAN M. DORHOFFER,* K2EEK

As a precursor to this article, let me clarify my interest and background in writing it. *73* for Dec. 1969 carried an article on Alfred Vail written by W. Edmond Hood,[1] a contributor to our magazine. This article is in no way designed to plagiarise or corrupt his work. I do feel, however, that Mr. Hood has oversimplified the series of events leading to the invention of the electro-magnetic telegraph and to the development of the so-called Morse code. In doing so, a distorted picture arose which this article is intended to clarify.

I first began this article over a year ago, and have been aware of the existence of Alfred Vail for slightly over three years. The January 1967 issue of *CQ*, contained an article on the Phillips Code,[2] concerning itself with a method of copying code devised some 85 years ago for use on manually operated telegraph lines. An illustration for the article was a photo of a telegraph receiver used by Alfred Vail at the Baltimore end of Morse's original telegraph line during the Washington to Baltimore trials of 1844. Upon close examination of the photo, the name Alfred Vail can be seen stamped in the base of the receiver. My first thoughts were, who was Alfred Vail and how did he fit into the invention of the telegraph? Checking some of my old college history books revealed that nothing is mentioned of the existence of an Alfred Vail and the only other reference to someone connected with the Washington to Baltimore trials was "a friend".

My curiosity was peaked, but nothing seemed to connect anyone with the telegraph except Samuel Finley Breese Morse. The importance of Alfred Vail seemed an academic point at that time and so I let the matter slide into a cubby-hole marked For Future Reference.

In the beginning of April, 1969, I received a news release inviting me to attend a Press Preview of the "Birthplace of the Telegraph," the newly restored home and mill of Alfred Vail, partner and co-worker of Samuel F. B. Morse, in Speedwell Village, Morristown, New Jersey on April 23rd. The name rang a bell and another bit of information on Alfred Vail (his partnership with Morse) came my way. The news release also mentioned the existence of an Alfred Vail (N.J.) Chapter of the Morse Telegraph Clubs, Inc., which to



Alfred Vail

*Managing Editor, *CQ*.

[1]Hood, W. Edmond, "Did Samuel Morse Really Invent the Telegraph," *73*, Dec. 1969, p. 10.

[2]Pyle, Howard S., "Do you Know the Phillips Code?," *CQ*, Jan. 1967, p. 55.

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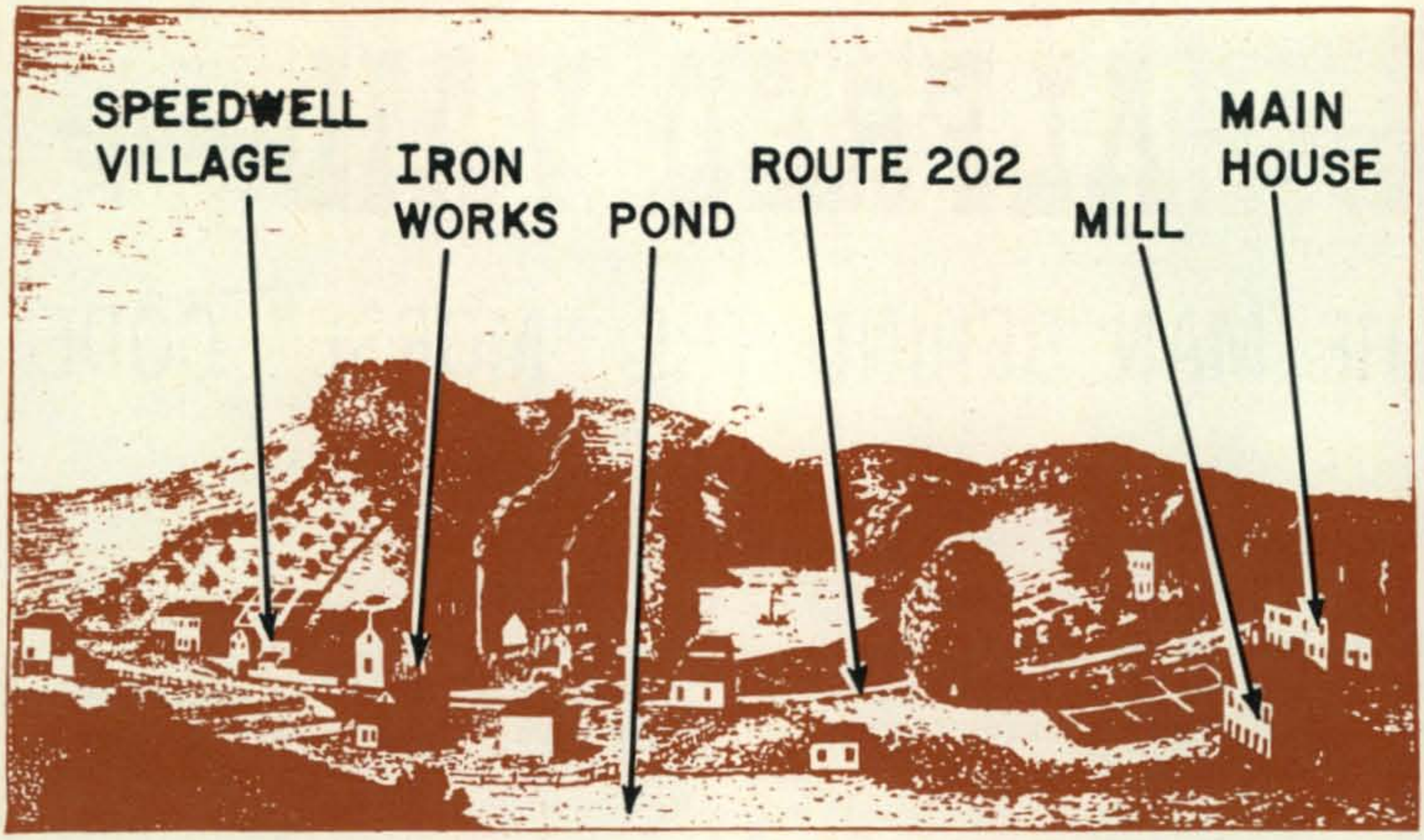

Fig. 1—A view of the Vail family holdings in the year 1837. To the extreme left is Speedwell Village, coming left you can see the Speedwell Iron Works with chimneys smoking. The center portion of the engraving depicts some of the smaller buildings and the pond in the foreground which turned the mill wheel and supplied water to the Iron Works. To the extreme right is the family home with gardens in front and the mill in the lower right corner. The road passing through the property is now New Jersey Route 202, with Morris Plains to the right and Morristown to the left of the Vail property. Although little remains of the Iron Works, save some crumbling foundations, the main house and the mill are in a good state of restoration and have been dedicated as a historical site open to the public.

my thinking made Alfred Vail a distinct somebody instead of just "a friend."

I left Long Island quite early in the morning on April 23rd, armed with hastily gathered instructions on just how to reach Speedwell Village. The name itself conjured up images of a museum type reconstructed village full of tourists and meandering groups of grade school children soaking up a days culture. Speedwell Village is really a village, quite small, and located between Morris Plains and Morristown, New Jersey, on Route 202, an old narrow winding road shown in the 1830 line drawing of the Vail property (fig. 1). I drove right through the village without realizing it and had to double back, finally stopping to ask directions of a local gas station attendent who knew of the Vail home and pointed back to a road bending up a hill. Just below the hill's crest stood the Vail home. Doubling back, I turned onto a gravel driveway whose entrance contained a mail-box marked with some name other than Vail. The site had nothing to indicate that this was the home, or had been the home of the Vail family. I parked next to a large obviously freshly refurbished home—old, but how old I couldn't say.

I was met at the door by several ladies of the local historical society and shown the lower level of the house which was bare of furniture. (the upper level of the house was closed as this was the residence of the caretaker whose name appeared on the mailbox.) They pointed out that the refurbishing was the first step in a much larger program of restoration. After assuring me that several of the ladies were indeed descendants of the Vail family, they directed me towards the mill where I was to see the actual area in which Alfred Vail worked and experimented with the telegraph. A reconstruction of the original apparatus was there plus an elaborate display of newer equipment supplied by Bell Telegraph Laboratories. It was indeed very impressive.

My hosts informed me that the property had been donated by a building contractor who had purchased the surrounding property for apartment houses. They supplied further details about the Vail family and of the Speedwell Iron Works which Alfred's father owned and operated on the property. Jotting down several pages of notes finished my morning and I left to return to Long Island.

I began this article in May with the notes

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and information I recalled from my trip, but it still lacked the solidity of illustrations and the little details that tell who a man was and where he fit into history. Combining this material with my previous notes, I put the project aside for a while longer.

In August 1969, while attending an antique sale in Port Washington I happened across a copy of *The Century Illustrated Monthly Magazine* dated April, 1888, and there on page 924 was the story of the telegraph and Alfred Vail. The line illustrations used in this article are from that magazine.

That coincidence was soon followed by another bit of information, quite unexpected, on Alfred Vail. While editing the USA-CA column for September 1969, I learned that when county hunter Merle A. Green, W6-HVU entered the Army in 1920 he was stationed and received his training as a military telegrapher at Camp Alfred Vail, now known as Fort Monmouth, the renowned Army signal and research installation. Making a second trip to New Jersey, I visited Fort Monmouth, where I learned that a Signal Corps camp was set up on the edge of Freehold race track on June 17, 1917. On September 15, 1917, the name was officially changed to Camp Alfred Vail in honor of the New Jersey inventor who worked in early telegraphy. August 6, 1925, the camp was redesignated Fort Monmouth in honor of the fallen of the Battle of Monmouth, Freehold, New Jersey, on June 28, 1778.

Here I was then, a walking expert on Alfred Vail who in a few short months had accumulated a considerable amount of information on a man neglected by almost every organized source of recorded history. I may have belabored this lengthy introduction but it seemed important to convey the sources of my information and to explain the breadth and zeal of this article. The telegraph and the "Morse" code have an amazing history which cannot simply be boiled down nor given cursory semi-accurate treatment.

Clearly, from the material gathered, there is quite a bit to Alfred Vail, far more than Mr. Hood suggested in his article, and certainly far more than has been previously recorded.

The Development Of The Telegraph

History, the text-book kind tends to be negligent in many aspects of recorded events. Whole episodes are never recorded, are altered, or simply adapted to a convenient

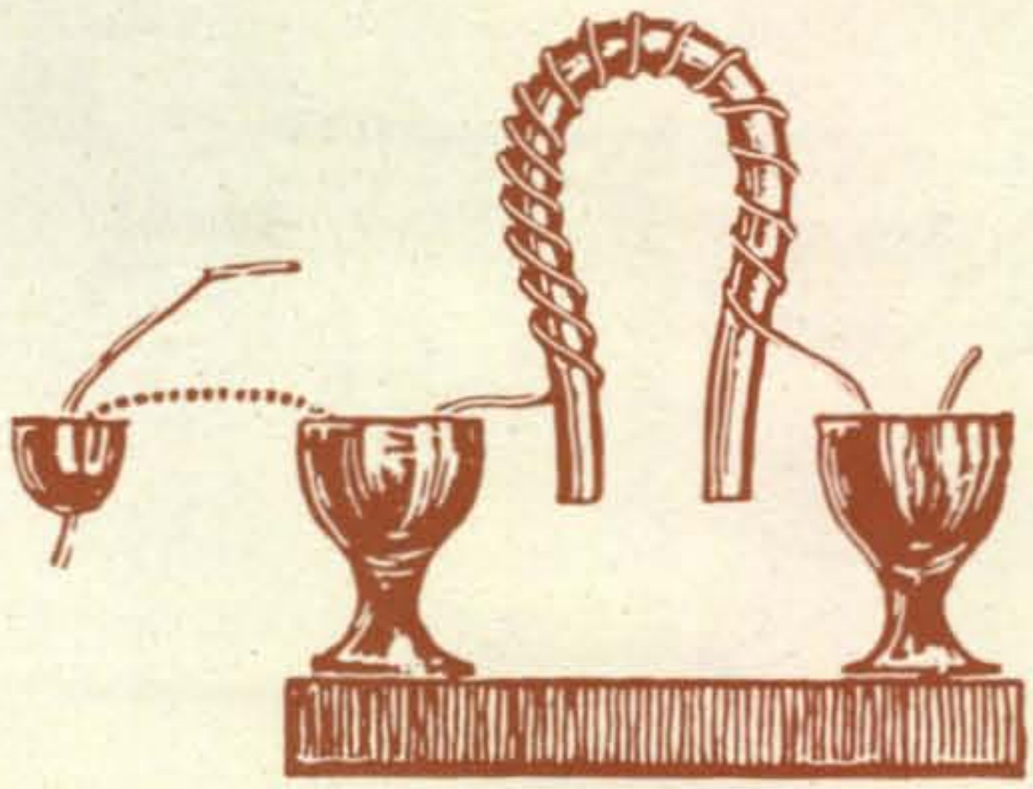

Fig. 2—The basic Sturgeon electro-magnet originally devised in 1825.

form. This is the story of one such episode, the electric telegraph and the Morse code.

Check any history book and you will find that Samuel Finley Breese Morse (1791-1872) invented and developed the electric telegraph and Morse code. Some books go as far as saying that the renowned historical artist, Morse, while returning from France aboard the packet *Sully*, recorded in his sketchbook a device for receiving messages at a distance by means of electro-magnetism. This event took place in 1832, and is important as a starting date for Morse's entry into the world of recorded scientific history.

Our story actually begins in 1825 when an Englishman by the name of Sturgeon devised the first electro-magnet (fig. 2). With no electronics distributor to go to, Sturgeon formed an iron rod in the shape of a horseshoe, coated it with varnish for insulation and then wrapped bare wire around the rod. The turns had to be spaced out as not to touch adjacent turns since insulated wire had yet to be conceived. By applying a slight voltage from a crude battery, Sturgeon had an elecromagnet. Due to the limited number of turns of wire and the single-cup wet cell batteries, the magnet was not very strong but is was an electro-magnet.

By 1827, the Sturgeon electro-magnet appeared in scientific circles in America and is reported to have been known about by Morse who dabbled in scientific experiments. The next name that crops up in relation to the electro-magnet is that of Professor Joseph Henry.

Professor Henry provided the first practical use for the electro-magnet when in 1832 he demonstrated at the Albany Academy a device for sending messages at a distance

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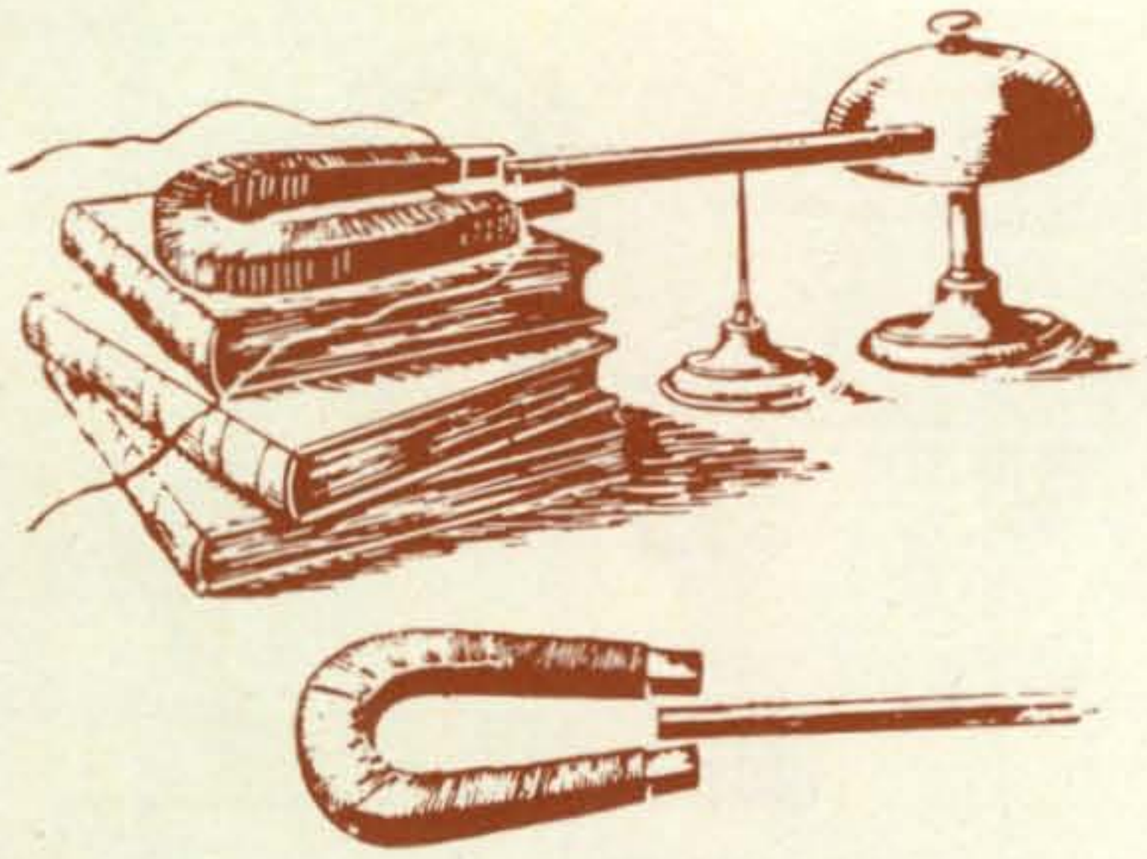

Fig. 3—Professor Joseph Henry's telegraph apparatus, first demonstrated at the Albany Academy in 1832.

(through wires) by means of the electro-magnet. It was Henry who reasoned that in order to increase the strength of the magnet one had to increase both the size of the battery and the number of turns of wire on the rod. It would also be Henry who would establish the need for, and practicability of insulated wire. The Henry apparatus, fig. 3, consisted of a horse-shoe magnet in a horizontal plane and a permanently magnetized steel bar with its North pole placed in the opening of the horse-shoe. The steel bar was balanced on a pivet, and at the free end stood a small bell. When the horse-shoe magnet was energized, the North end of the bar would swing toward one end of the horse-shoe while the other end would strike the bell. The demonstration was carried over a one mile length of wire stretched through several rooms of the large hall. By making and breaking contact with the battery supplying voltage to the magnet, discernible information could be transmitted by the number of times or the sequence of bell ringings. Historically then, this would have to be considered the first working telegraph.

Henry published his findings that year (1832) in the *American Journal of Science* and went on to other things. Professor Henry is little noted for this "first" but rather well known for his theories and work on inductance, the unit of which bears his name: the Henry.

It is at this point that the first inconsistency in Morse's prowess as an inventor and scientific experimenter occurs. Morse, who was familiar with the Sturgeon electro-magnet and other experiments conducted here, simply missed reading one of the leading journals of 1832 and in a sudden inspiration conceived his telegraphic device spontaneously, later that same year. He was to say later that he "was not aware that anyone had even conceived the idea of using the magnet for such a purpose [before him]."

The Morse apparatus proved to be an elaboration of the Henry design. It relied on the action of the permanently magnetized steel bar to produce a response when energized by the horse-shoe magnet. Although the principle is the same, Morse's electro-magnet and power source were considerably smaller than Henry's and rather similar to those of Sturgeon.

Later in 1832, Morse constructed a telegraph based on his "sketchbook design." It was a vertical wooden frame that supported a traversing pendulum-like arm which acted as Henry's steel bar. The frame was made out of a canvas frame for one of Morse's paintings. A pencil was affixed to the end of the arm which marked a strip of paper beneath it as the arm was energized. The paper strip moved through a series of rollers and provided a sort of "read-out tape." Instead of making and breaking the battery contacts manually, Morse fashioned a moving type-composing stick which held special type slugs with pointed projections. This type composing stick with its type was rolled between two battery contacts and the pointed type projections made and broke electrical contact in a prescribed pattern. At each "make" contact the arm would energize and the pencil would scribe a spike on the paper. When the contact was broken (between projections) the line would return to a base line which produced a graph like strip of paper similar to an electro-cardiograph. The number of spikes recorded on the paper determined the letter or word transmitted and the paper itself served as a permanent record of the transmission. Morse went as far as to create a new numerical dictionary to use with his machine. From 1832 to 1837, the Morse telegraph remained virtually the same. Figure 4 is an early mechanical drawing of the Morse telegraph and fig. 5 shows the type slugs and a sample of a recorded message. Figure 5 is a facsimile of a drawing done by Alfred Vail who we are about to meet.

Enter Alfred Vail

During 1835, Morse accepted a Professorship in the Literature of the Arts and Design at the University of the City of New York.

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Two years later, the events of Congress and a new acquaintance would shape a whole new life for him.

In March, 1837, the House of Representatives passed a resolution requesting the Secretary of the Treasury to report upon the propriety of establishing a "system of telegraphs for the United States." In an effort to gather information for his report, the Secretary issued a circular requesting all available data on research and feasability. A copy reached Morse and provided the impetus for renewed effort on his telegraph. The government then, as now, represents a source of income and notoriety, both of which appealed to Morse. Unfortunately, Morse had been unable to engineer any improvements during the past five years and the apparatus was crude and ineffectual past several feet.

Morse enlisted the aid of Professor Leonard D. Gale, head of the University chemistry department. It would be Professor Gale who would supply the technical knowledge to construct the batteries and the laboratory space for Morse. He also suggested to Morse that the magnet be enlarged as per Henry's findings. (Professor Gale had'nt missed Henry's articles). Besides supplying the technical knowledge which Morse evidently lacked, Gale was a great source of encouragement. Gale's major failing was in that he never entered into a formal agreement with Morse and was discarded later on in an economy move by Morse.

On Saturday, September 2, 1937, Professor Gale arranged for Morse to hold a demonstration of his telegraph at the University. Among those present was a young graduate from New Jersey, Alfred Vail. Vail had graduated the year before in hopes of entering divinity school and pursing a career in the Presbyterian ministry. Due to poor health he was unable to follow this through and so remained at school to find some other field he could enter where in an altruistic sense he could serve mankind. It was pure coincidence that he chose to attend the demonstration.

Before we have Alfred Vail actually meet Samuel F. B. Morse, let us consider his backgrourd. Alfred Vail was the elder son of Judge Stephen Vail, proprietor of the highly prosperous Speedwell Iron Works, Speedwell, New Jersey. The iron works had forged the main shaft of the *Savannah*, the first steam ship to cross the Atlantic. The Iron Works also forged the tires, axles, and cranks for America's first locomotives and as such represented a great source of wealth for the Vail family. Judge Vail's land holdings were considerable and the family home was splendidly appointed. The grounds contained large greenhouses, gardens, a private pond and mill, and other buildings besides the iron works to complete an aura of gracious living. All of this wealth was impressive in a year marking the depths of a great economic depression.

Alfred Vail grew up working in the iron works learning the rudiments of engineering and demonstrating a unique ability for mechanical and scientific matters. Although his father wished Alfred and his brother George to continue on in the family business,

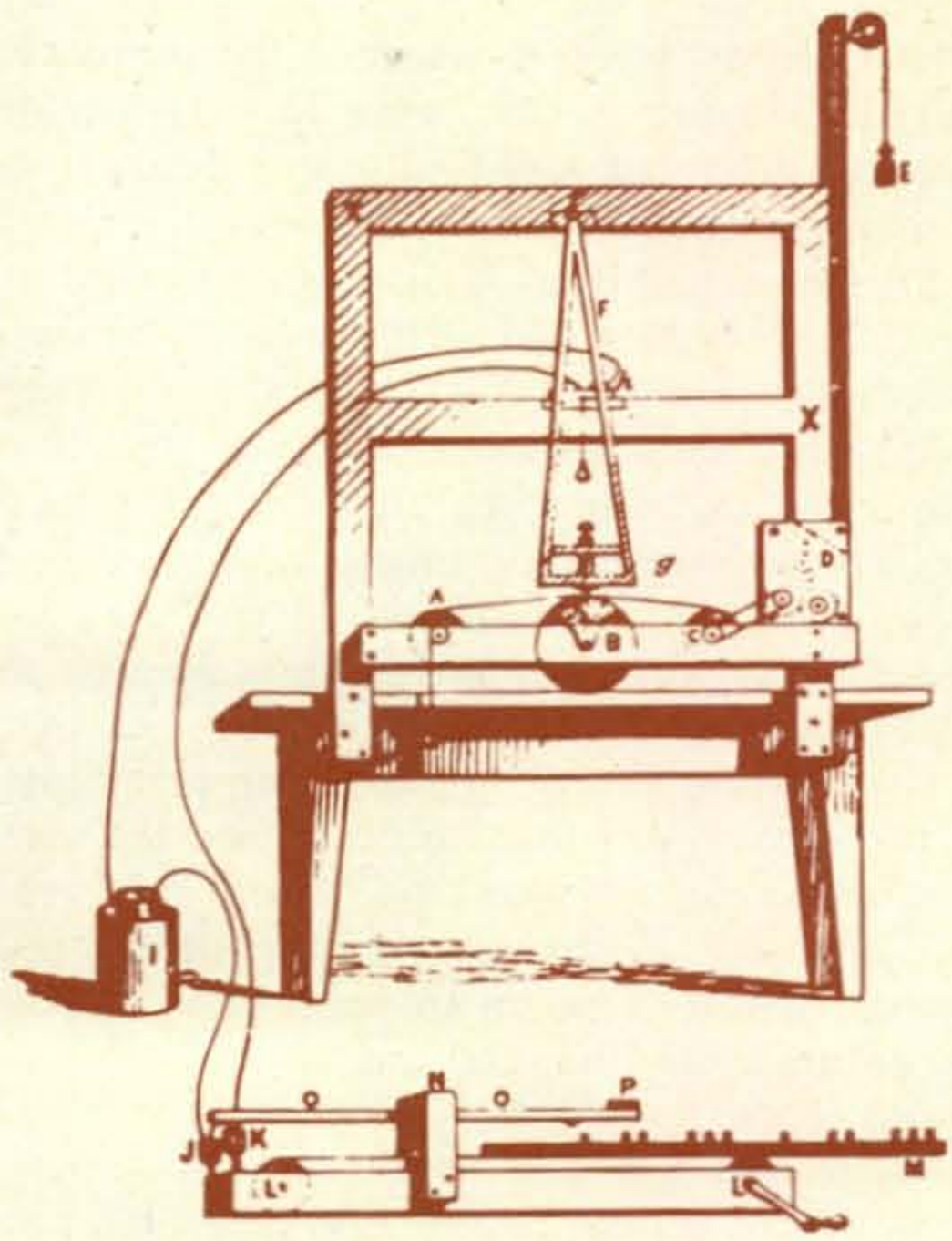

Fig. 4—Morse's basic telegraphic instrument as of 1837. This is a reproduction of the drawing supplied with the original patent application. Two points of the diagram are of immediate interest, (I) and (L,). The power source (I) was a single cell battery with one set of plates and had been originally designed with the other equipment in 1832. In five years nothing had been added or radically modified to the design in order to make it work better. The method of transmission, (L,M), was a point that Morse was fixated upon and one that initially blocked Vail's progress. Part (M) is a type composing stick which held "telegraphic type" which moved via crank (L) and interrupted the circuit in a prescribed pattern.

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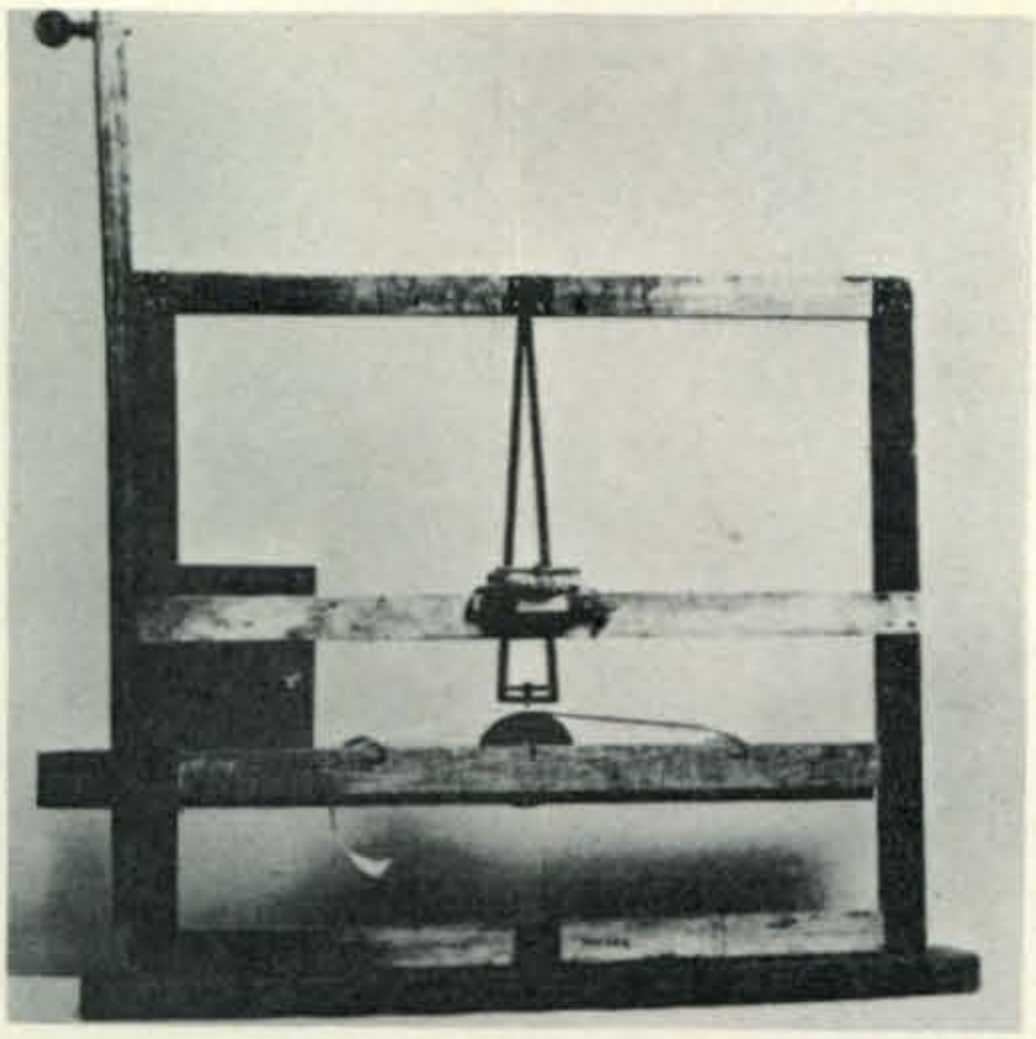

An actual view of the Morse telegraph system described in fig. 4.

Alfred elected upon a career in the ministry. Alfred, it would seem, came to that fateful meeting prepared spiritually and financially to meet Samuel Finley Breese Morse.

To say that Alfred Vail was impressed at the demonstration would be a gross understatement. He was mesmerized. In what could only seem moments, young Vail had found all that he had searched for and hoped for. The demonstration might have very well been arranged for Vail, as years later he would recall the exhuberant state he was in after gazing at the equipment and write that in that instant he had grasped the principles of the device and that he could see the vast benefits to all of mankind. With this zeal and intensity it was not to difficult for the former divinity student to press upon Morse the promise of financial aid and support in future work.

Judge Stephen Vail who was considerably more practical than his son and whose money was actually involved had Alfred bring Morse down to Springwell that weekend to meet him and see the telegraph firsthand. After inspecting the machine and listening to his son and Morse, Judge Vail too was convinced of the tremendous potential of such a device. He agreed to advance the sum of two thousand dollars in order to secure a patent and to start construction of a model that could be placed before Congress. Though normally not a lot of money for the Vails, the two thousand dollars investment during a depression represented a sizable risk. On September 23, 1837, a formal agreement was reached making Alfred Vail a twenty-five percent owner of the Morse telegraph and giving him an interest in all foreign patents that might arise. Alfred was to supply not only the money, but his engineering skill and a place to conduct further experiments.

In late September of 1837, Alfred Vail set up a workshop on the second floor of the grist mill on the family grounds at Springwell. He was assisted by a young apprentice mechanic from the iron works, William Baxter. Baxter was to record most of the events of these early days in his diary. The two men set about to construct a model of Morse's telegraph based on the original 1832 design. Morse stayed in New York and prepared a description of the device to submit with his patent application which he did on October 3, 1837. He divided the telegraphic system into six essential areas clearly defining the limits of his invention. They were:

1. A system of signs, by which numbers, and consequently words and sentences, are signified.
2. A set of type, adapted to regulate and communicate the signs, with rules in which to set up the type.
3. An apparatus called the port-rule, for regulating the movement of the type-rules, which rules, by means of the type, in their turn regulate the times and intervals of the passage of electricity.
4. A register, which records the signs permanently.
5. A dictionary, or vocabulary of words, numbered and adapted to this system of telegraph.
6. Modes of laying conductors to preserve them from injury.

It is important to note that Morse's system was numerical and not alphabetical as we know it today. There was no telegraph "key" mentioned, and the only unique factor of the device was its ability to retain a permanent record (via a long strip of paper) of the message.

The next two months brought about the first of many changes in the original Morse design. Alfred Vail replaced the pencil recorder with an ink recorder in order to eliminate repeated pencil sharpening. He next began to follow up on Professor Gale's suggestion of increasing the size of the magnet. Since there was no source of insulated wire or actual need for it at the time, Alfred happened on milliners wire. Milliners wire was used in the manufacture of ladies bonnets and was cotton covered. Vail and Baxter

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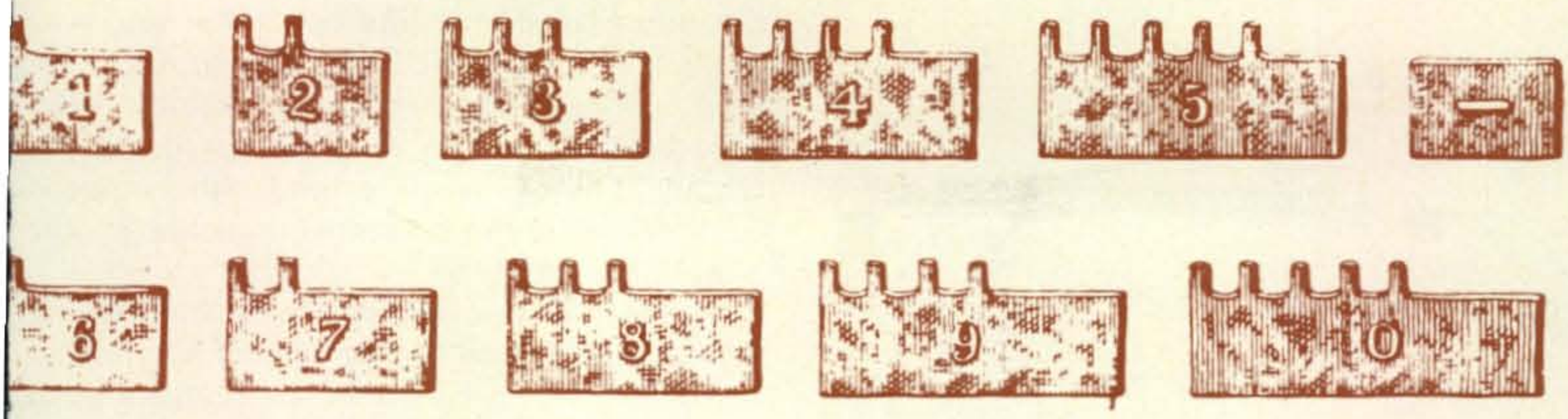
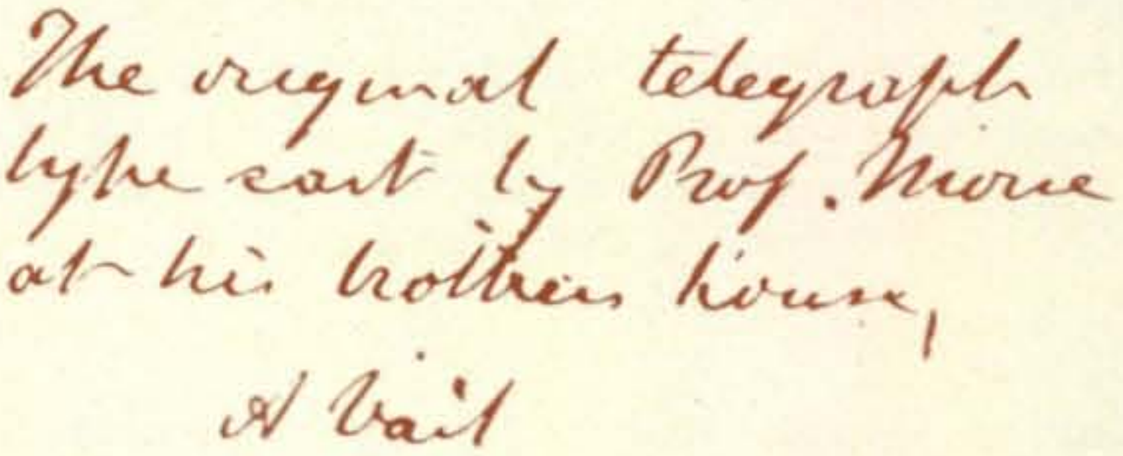


Fig. 5—Initially Alfred Vail worked with "telegraphic type" such as shown in Vail's drawing above. Each slug had a numerical value and corresponded to Morse's numerical dictionary. The graph below Vail's signature is a typical message sent with the Morse system and would provide the permanent record of the transmission.



soon exhausted all local sources of milliners wire in their creation of larger magnets, and probably started a new women's fad of sagging bonnets.

While working with the new ink recorder, Vail realized that the traverse arc of the Morse recording arm would often splatter the ink in all directions during and rapid movement such as increasing the speed of sending. Redesigning the apparatus, he come up with an arm that had vertical movement which did not spill the ink from its container. Unfortunately, it did not produce the characteristic Morse graph, it merely produced a series of dots and dashes as the pen moved up and down making contact with the paper. William Baxter wrote in his diary of this event:

"Alfred's brain was at this time working at high pressure, and evolving new ideas every day. He saw in these new characters the elements of an alphabetical code by which language could be telegraphically transmitted in actual words and sentences, and he instantly set himself at work to construct such a code. His general plan was to employ the simplest and shortest combinations to represent the most frequently recurring letters of the English alphabet, and the remainder for the more infrequent ones. For instance, he found upon investigation that the letter *e* occurs much more frequently than any other letter, and accordingly he assigned to it the shortest symbol, a single dot (.). On the other hand, *J* which occurs infrequently, is expressed by dash-dot-dash-dot (—.—.). After going through a computation, in order to ascertain the relative frequency of the occurance of different letters in the English alphabet, Alfred was seized with sudden inspiration, and visited the office of the local Morristown newspaper, where he found the whole problem worked out for him in the type-cases of the compositors.

"In this statement I have given the true origin of the misnamed 'Morse Alphabet,' the very foundation and corner-stone of a new system, which has since become the universal language of the world."

The first public demonstration of the telegraph system came about on the 10th and 11th of January, 1838. The people of Morristown were invited to attend a public demonstration at the grist mill where the actual first message was sent through three miles of wire coiled about the second floor workshop in the mill. With Mr. Morse at one end, and Alfred at the other, the first message in "Morse Code" was sent.

The first message was devised by Judge Vail as a trial of the system and to avoid either his son or Morse having prior knowledge of its content. The actual first message sent then was "A patient waiter is no loser" which Morse translated as Alfred sent. After this successful test, Alfred Vail and Morse set out on a tour with the equipment. They showed the now sophisticated equipment in New York at the University where they met, and then on to Philadelphia at the Franklin Institute and finally wound up in Washington towards the end of February.

Once in Washington, the two men met with the Hon. Francis O. J. Smith, then Chairman of the House Committee of Com-

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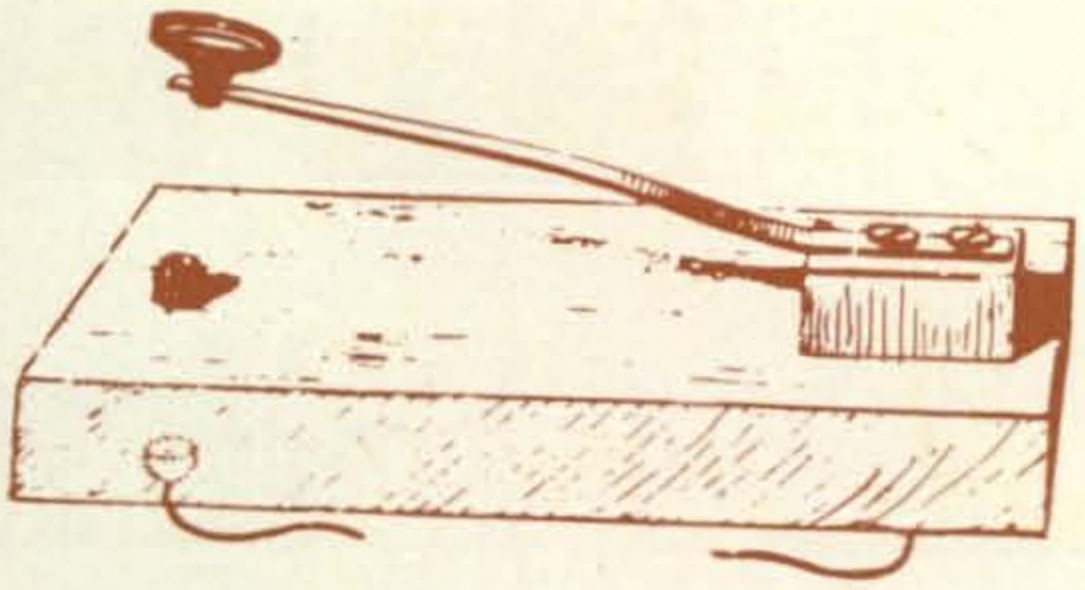

Fig. 6—After Alfred Vail forced the abandonment of the "telegraphic type" and instituted his dot/dash system he devised the simple and now familiar telegraph key.

merce. Morse had begun correspondence with Smith late in September after he and Vail became partners in the hopes of selling the idea to the government or perhaps to get further finances. Smith arranged for a meeting of the House and assured every members presence. He was completely convinced that the plan had merit and saw the potential for considerable amounts of money to be made from the telegraph. In short order he had made himself the third leading expert on the telegraph, besides Vail and Morse. As it appears that Morse capitalized on Vail, it must be said that Smith took an equal measure from Morse. Smith, trained in law, and as one historian extends himself, "inherited little more from his father, a tavern keeper in New Hampshire, than a tremendous capacity for work and an unusually facile mind."[3] Besides the basic evidence of the operating equipment, Smith had hedged his bet with reports drawn from the Franklin Institute on the merits of the telegraph as presented by Morse and Vail. Smith then spared no effort in making sure the demonstrations were a success so that when Morse and Vail were finished, he was instruted by his superiors to draft a Bill appropriating money in the amount of thirty thousand dollars to construct an experimental line between Washington and Baltimore.

The relationship between Morse and Vail had become rather rocky with Morse referring to Vail as "my mechanical assistant" and Alfred continually writing of his mistreatment to his brother George. George on the other hand was like his father and was more business minded than his brother. He kept writing back that it didn't matter what Morse called him as long as Alfred got the money. George by this time had acquired part of Alfred's interest in exchange for more financial help.

As Morse was involved with suppressing Alfred Vail, Smith had persuaded Morse that he himself was needed and so became a third partner offering little money, but rather his knowledge of law and business, plus whatever influence he had. He resigned his seat in Congress and officially became their legal advisor. With that came another one-eight share from Morse nad an equal amount from Vail.

In May 1838, Smith and Morse left for Europe to secure foreign patent rights on the telegraph, leaving Alfred Vail to return to Springwell to continue making improvements on the equipment. Alfred had paid for everything to date. He had brought the telegraph from the crude wooden frame that Morse had built to a relatively sophisticated piece of equipment including the development of the code bearing Morse's name, plus the concept of a hand telegraph key, which was to be first used in a test in 1844 (fig. 6).

Smith returned to the United States in November 1838 leaving Morse in Europe until the following April. Congress had not voted on the money due to other interests of the time, including a notorious Presidential campaign followed by seemingly endless political footballing, and didn't get around to taking up the request for money until December 1842 when Morse once again applied for the thirty thousand dollars. On March 3, 1843, the money was finally voted on and approved by President John Tyler.

Miss Annie Ellsworth, daughter of the Commissioner of Patents personally came to Morse's Washington hotel to inform him of the Presidential signature. It had been a close fight since most Congressmen felt that they were spending money on things they didn't understand. The vote in Congress was 89 to 83 in favor of the telegraph bill with seventy congressmen failing to vote. The President had signed the bill after midnight and early that morning Miss Ellsworth delivered the news to Morse who had actually anticipated defeat. In gratitude for the good news, Morse told Miss Ellsworth that she could dictate

[*Continued on page 90*]

[3]Thompson, Robert Luther, *Wiring a Continent*, Princeton University Press, Princeton, New Jersey, 1947, p. 13.

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Could The Licensing System Be Used To Improve The Overall Performance Of U.S. Amateurs?

BY JOHN B. JOHNSTONE, K3BNS AND JOHN A. ATTAWAY, K4IIF

INCENTIVE licensing has been with us for a year and a half now and most active amateurs have formed opinions either pro or con. On one extreme is the self-righteous type who regards the present system as the perfect solution to all our problems. In his opinion anyone who is critical of the new regulations is automatically branded as lazy. On the other extreme is the fellow who considers incentive licensing to be a plot by the new left to destroy amateur radio entirely. The truth probably lies somewhere in between, certainly no convincing proof of its effectiveness has yet been shown.

As an opener let's look at the results to date. In his analysis and appraisal of incentive licensing on pg. 60 of the March 1970 issue of *QST*, Everett G. Henry, W3BG, chief of the Amateur Division of the FCC, states that in November, 1969 an established 5.3% of the operators having access to the 80, 40, 20, and 15 meter bands held the Extra class License. In other words, of the total number of Conditional, General, Advanced, and Extra class operators, only 5.3% were Extras. This is a rather gloomy statistic which won't impress either industry or the military. Possibly the incentive reward being offered at the present time is at fault for not attracting more hams to the higher grade licenses, and an alternative—such as distinctive prefix call signs—would be more effective. Many present holders of the Extra class license gave up call signs of many years and rushed to the new 2-letter calls as soon as they were offered. Neither has our entire approach been of any inspiration elsewhere in the world. No other country has followed our lead. In fact, Japan has taken the opposite approach and created two new lower classes of licenses.

For this discussion, we are willing to concede that a general upgrading of the amateur radio service would be desirable. However, this upgrading should be within more practical and significant confines than are presently being employed. In other words, we think that incentive licensing can work if it is made relevant to all the aims and purposes of the amateur service, not just restricted to an arbitrary testing system which discriminates against the old timers and the fully committed individuals with 60-80 hour work weeks. (For a review of the 5 basic aims and purposes of the amateur service see the article on pg. 64 of the January 1970 issue of *CQ* or else review FCC regulation 97.1, Basis and Purpose of the United States Amateur Service.)

To accomplish such an objective will require that the amateurs themselves assume the burden of proof that individual operators are performing satisfactorily toward these objectives. A national organization of amateurs sponsoring a program that provides an objective measurement of one's participation and contribution to the amateur radio service in terms of emergency communications, public service, international goodwill, etc., would not only offer a method for implementing this idea, but would demonstrate to the critics of the service that all of the objectives are being met.

Could our American Radio Relay League handle this job? While those who consider our League non-representative and ineffectual may scoff at the idea, it may be just the challenge that could snap it out of its bureaucratic doldrums. It would vastly increase the import-

K2BNS is a member and past president of the Frankford Radio Club and the Penn Wireless Association, and is a life member of the American Radio Relay League. He has held the Amateur Extra Class License since 1965. K4IIF is DX Editor of *CQ* Magazine, a life member of the American Radio Relay League, and holds the Advanced Class License.

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ance of our League and thus encourage wider participation. It is our opinion that it would be wiser to build upon the current League programs than to start from scratch, since the League is the sponsor of the majority of the major amateur radio programs.

The system that we envision would use applicable portions of existing League programs, augmented with new programs designed to fill in the gaps, as a means of verifying to the FCC that an applicant for a higher class license has met certain minimum requirements that are responsive to the purposes of the service. He would submit documentation provided by the League to prove that he has reached, or has maintained, his individual proficiency in operating; and that he has, and can, participate in the service functions. Implied in this system is the requirement that U.S. amateurs could, through a national organization, develop and negotiate with the FCC responsible programs for the public good.

Simply passing one test would not entitle an amateur to hold a higher class license forever. Each time he renewed his license he would be required to demonstrate that he continues to qualify in the higher category. This would not impose additional examinations at each renewal since participation in the programs would earn the necessary verifications.

Some will scoff at our suggestion on the grounds that FCC would never share its regulatory prerogatives with a private organization, not even ARRL. However, in his article cited above, W3BG states that "The realization of the objective of incentive licensing can come about only through the joint efforts of the amateurs and the Commission. . . . Objectivity on the part of amateurs will do much to demonstrate that they are deserving of the spectrum space now available to them." What could be more objective than a willingness to share the responsibility for providing criteria to truly measure the performance of an amateur in fulfilling the basic purposes of the service?

To illustrate how this system might be designed, consider how it could be applied to the present licensing structure: The Novice and Technician class requirements would not be affected since they are designed for specific limited objectives. Also, the General class requirements would remain unchanged and continue to be the cornerstone of amateur radio. To progress above the General class would require the applicant to take a technical examination, as with the present system, plus submit verification of his performance in the other areas of amateur radio as well. For the purposes of this illustration, we will assume that holdovers from previous licensing structures would receive equitable credit. At the time of renewal, the higher class licensee would be required to submit verification of his ability to perform in all of the areas, including the technical, in order to retain his Advanced or Extra ticket. Otherwise, he would revert to the General class until such time as he could obtain the verification.

The programs to be developed would permit the amateur to have a broad choice in the activities in which he could select to participate. It would have to accomodate a spectrum of individual circumstances and interests. To demonstrate how this might be quantified, some examples follow:

Advanced Class Emergency Service Requirements

(2 out of 3 necessary)

1. Demonstrate preparation for emergency operation, (power, equipment, etc.).
2. Participate in the Amateur Radio Public Service Corps, (AREC, RACES, etc.)
3. Participate in ARRL Field Day.

Extra Class Emergency Service Requirements

1. Meet the requirements for the Advanced Class.
2. Supply communications during a real emergency or participate in a simulated emergency test.

Additional general service requirements could include some of the following:

Advanced Class

(4 of 6 required)

1. Conduct the FCC exam for a Novice or Technician class applicant.
2. Hold an ARRL leadership post.
3. Hold an ARRL station appointment.
4. Contribute an article to *QST, CQ, 73, Ham Radio,* or other recognized amateur radio magazine.
5. Pass traffic.
6. Be active in an ARRL affiliated radio club.

Amateur Extra Class

(No. 1 plus 3 of the other 4)

1. Meet the requirements for the Advanced class.
2. Instruct a class of candidates for the Novice license.
3. Hold office in an ARRL affiliated radio club.
4. Contribute a second article to a recognized

[*Continued on page 89*]

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CALIBRATE YOUR OWN D.C. METERS

BY JOSEPH P. FINCUTTER,* K3STU

Part II

Part I of this two part series discussed the theory of the Potentiometer and Volt Box. Part II covers the principles of the Standard Resistor, the construction techniques for all three units and their application.

THE second installment begins with a discussion of the theory of the Standard Resistor. Its need is for the accurate measurement of current now that the Potentiometer and Volt Box can provide an accurate voltage.

Standard Resistors

Now how can we measure current accurately? Let us again resort to Ohm's Law, where $E=I\times R$. Since we have a Potentiometer with which we can measure in the zero to 2 volt range, we need a 'resistor' through which we can pass current and then measure the voltage drop across it. We need a resistance of known value, a Standard Resistor. Then we can use Ohm's Law to derive the value of current accurately.

What is a Standard Resistor? Well, first let us examine some of the characteristics of a resistor which could affect our measurement. In fig. 6, R represents the actual value of resistance and Ra and Ra$_1$ represent the resistance of the leads between points A and B and the actual resistance element. The values of Ra and Ra$_1$ are only important when they are a reasonable percentage of R. For example, let us assume that they are 0.001 ohms each and R is 100 ohms. Then they represent only 0.002% of R and can be neglected. However, if R were 1 ohm, then they would represent 0.2% of R and must be considered, or at least compensated for in our measurement work.

Also we must consider the effects of temperature (external) changes; current carrying limitations (internal temperature); moisture and/or humidity changes; voltage limitations; *etc*. But since we do not expect very high degrees of accuracy and we will not be working in a laboratory environment and more than likely with ±1% resistances, every precaution we can take with respect to the above characteristics will be to our advantage.

Figure 7 shows the schematic of a 4 terminal Standard Resistor. Normally current flows through Ra, R, and Ra$_1$ and, the Potentiometer is corrected across the "E" terminals; the "I" terminals would be inserted in the circuit in which the current is to be measured. A Standard Resistor is used primarily in making current measurements; however, with a sufficient number it would be very possible to use them in bridge circuits for measuring other values of resistance via the ratio method.

Referring to fig. 7, it is very easy to see that the effects of Ra and Ra$_1$ are greatly reduced, if not eliminated in a 4 terminal resistor since the voltage drop is measured across the R. Normally the effects of Ra and Ra$_1$ are negligible in a 4 terminal resistor of 100 ohms or higher. With values of 10 ohms and lower they become more troublesome when making high accuracy measurements. Commercially made Standard Resistors are all of the 4 terminal variety and come in values of 0.001, 0.01, 0.1, 1.0, 10.0, 100,

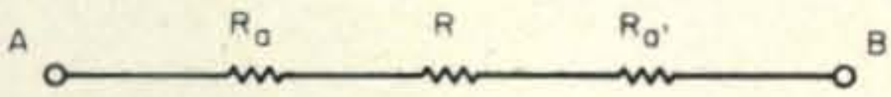

Fig. 6—Basic resistance showing the lead resistances Ra and Ra$_1$ which could affect critical measurements.

*5620 Alta Vista Road, Bethesda, Md. 20034.

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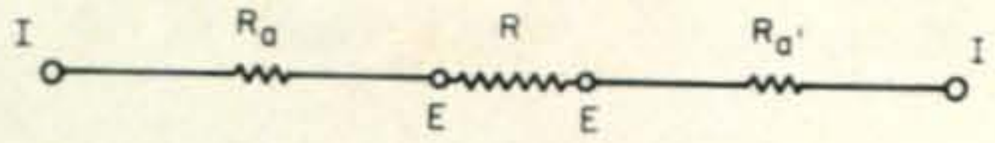

Fig. 7 — The addition of two more terminals creates a four terminal Standard Resistor, the standard form for commercial units.

1000, *etc.*, and they are expensive and would only be used in calibration laboratories. However, if you are interested in checking the "accuracy" of current meters (with very few exceptions all meters are current meters) a good, stable Standard Resistor *is required*.

Now how de we get a cheap, yet adequate Standard Resistor? Well, we could buy, for example, a 1000 ohm ±1% resistor for a reasonable price. But then we would know only that the value was somewhere between 990 and 1010 ohms. And, other factors pertinent to stability such as temperature and humidity would also be included in our "degree of uncertainty". Fortunately there is "safety in numbers". Supposing we take 10 resistors of 10,000 ohms ±1% and put them in parallel. This will give us an equivalent resistance of 1000 ohms ±0.1% since we not only divide the nominal value by 10 but we get this advantage with the tolerance as well. So now we know that our Standard Resistor is somewhere between 999 and 1001 ohms. Additionally any change in one of the resistors is considerably reduced by the other nine. Also temperature effects on all 10 in parallel will be one tenth of what they would be individually.

From an economic standpoint, metal film or deposited carbon ±1% resistors cost about 55¢ each up to a quantity of 24, but reduce to 28¢ each for quantities of 25 and up. So since we need at least 10, they would cost us $5.50 minimum and we would have to be satisfied with the values as picked from the box. For $1.50 more ($7.00) we could buy 25 and select the 10 resistors closest to the nominal value and therefore have a Standard Resistor with a value closer to the value we want. Very probably we could build two Standard Resistors from this lot of 25 resistors and have 5 to put in the junk box and the 2 Standard Resistors would have cost only $3.50 each.

Now I have given you facts and figures on a 1000 ohm Standard Resistor which is very adequate for use in calibration of meters with a 1 milliampere full scale current. For a 1 volt readout on the Potentiometer, it would take a 100 ohm resistor for a 10 milliampere meter, a 10 ohm resistor for a 100 milliampere meter, a 1 ohm resistor for a 1 ampere meter, and so forth, either up or down. So you can build Standard Resistors to suit your needs based upon the above theory.

Construction

I will not attempt to provide definite constructional details because I hope that any of you who might be interested in building these valuable test instruments will have various and sundry items available in your workshops that will be satisfactory. With a little ingenuity I'm sure that you can assemble them in a satisfactory manner. I have provided some pictures which will help to explain the methods I have used. The important thing in construction is a high quality of mechanical workmanship together with soldered connections that are nothing less than excellent.

Once I was satisfied with the design of my circuit, I started collecting the various items that I needed, and once collected, I proceeded to plan the layout. Then with some idea of the space (volume) required I selected an available wooden box in which to put them. I hope that in the following paragraphs I can provide you with some "do and don't" advice.

Potentiometer And Volt Box

I found it most convenient to mount both of these items inside the same box since both, in a majority of cases, are used together in making voltage measurements and incidentally since I had a hardwood box that would house both conveniently. The following points are worthy of your consideration:

1. I followed the circuit diagram (fig. 3) for the Potentiometer, except for one slight change. I selected a single pole three position switch for S_2. The extra position was used for a connection to "*B*" on the Volt Box. And I connected "*C*" on the Volt Box to the common terminal on the Potentiometer. This provided me with the capability of "standardization" of the Potentiometer to the reference cell, measurement within the 0-2 volt range directly, and measurement of higher voltages through the Volt Box, merely by changing switch positions.

2. I used a metal panel as a mounting plate for all of the mechanical and electrical/electronic components. It is insulated from the circuitry. This eliminates problems of possible short circuits and provides for another

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type of measurement use for the Potentiometer (not within the scope of this article).

3. R_1 is a 10 turn Helipot with a linearity tolerance of $\pm 0.1\%$. One with a linearity of $\pm 0.05\%$ would have been better, but I didn't have one. The dial mechanism is a typical turns counter type of dial.

4. R_2 is a wirebound rheostat of 5000 ohms. The value is not critical as long as there is sufficient resistance to limit the current to about 1 to 2 or 3 milliamperes through R_1. The dial mechanism to turn this rheostat should be of the vernier type, but does not have to be a marked dial. It is difficult to null the meter in the s position unless the change in resistance per degree of turn is small. (I had a 3 turn pot which I found very satisfactory.)

5. Batteries B_1 and B_2 are mercury cells and I chose Mallory Type ZM-9. I use three in series for B_1 and one for B_2. I had occasion to check about 25 of these cells and found that all were within the range of 1.456 and 1.457 volts. I chose one that was only 1.450 volts as the reference cell. I could have used an Unsaturated Standard Cell for the reference cell, but decided on the mercury cell because I wanted portability. I now use my Standard Cell as a reference cell to maintain an overall accuracy check on the Potentiometer. There are many other combinations of batteries that might be used.

6. Not having a satisfactory momentary switch for S_3 I fabricated one from some contacts from a broken relay and a small spring-loaded push button. This provided large contacts which provided good electrical connection.

7. Bare #14 copper wire was used for the interconnections between components, shaped to fit the layout of parts.

8. Banana jacks are used for all external connections to the circuitry. The common 5-way posts could also have been used. I don't recommend pin-jacks.

9. I mounted the nominal values of resistors on one side of a phenolic board and the "paralled adjustment values" on the back side for the Volt Box.

10. Although I used a "tape embosser" to make the labels for my equipment, I would recommend that the "instant type" dry lettering be used. It will give a more professional appearance to your equipment.

Standard Resistor Construction

For the particular work that I had in mind for my own shack, I chose values of 100, 1000, and 10,000 ohms as the values for which I would have the most need. Based on the "safe" number of 10 resistors in parallel, I found that a 'minibox' with dimensions of 5¼" long by 3" wide by 2⅛" deep would provide room for the 10 resistors, two mounting plates, and two 5 way binding posts. Here are some items for consideration:

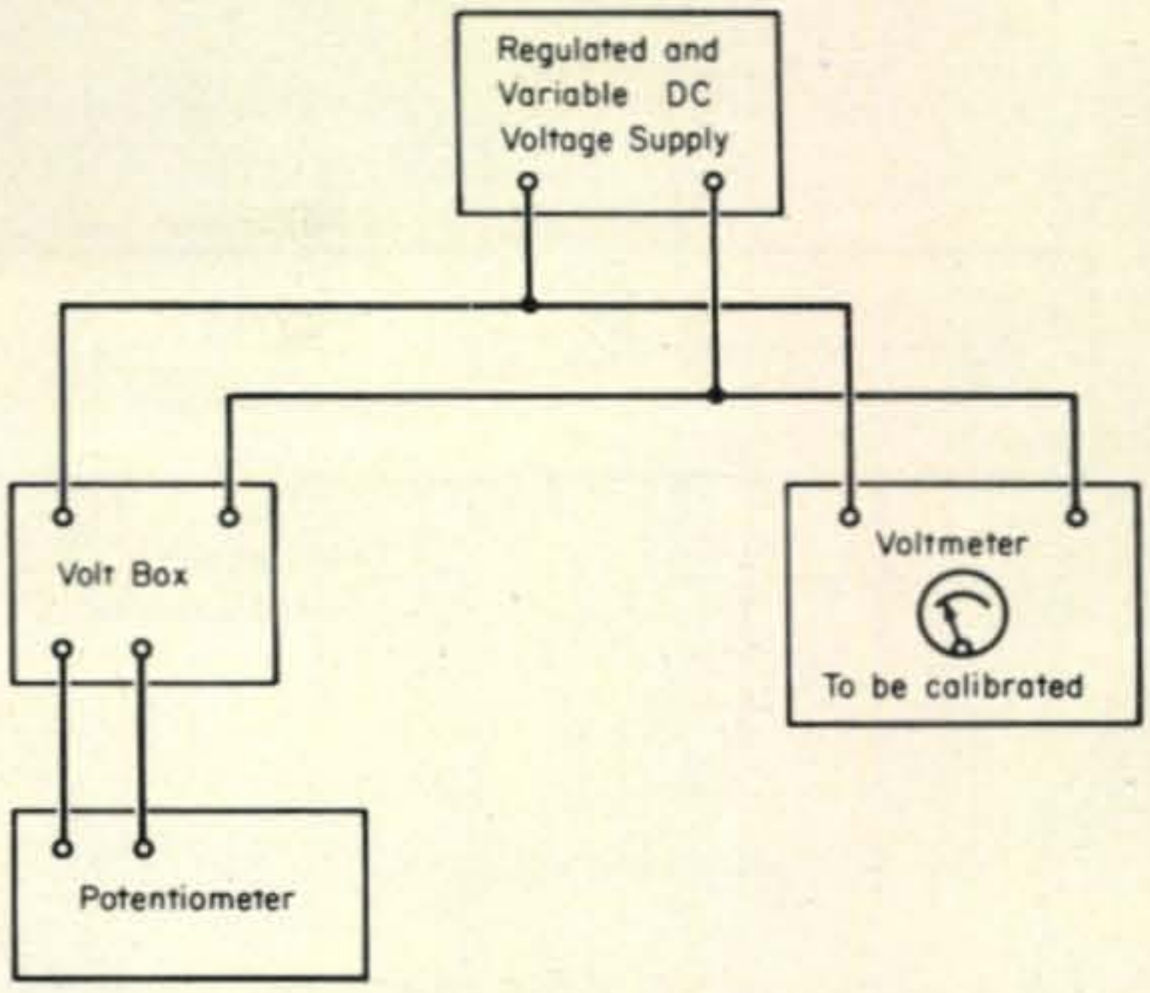

Fig. 8—Basic set up of the equipment to calibrate a voltmeter.

1. Since these resistance values would not require 4-terminal connections, for good accuracy and precision, I chose a good quality 5 way binding post. (Although there are several manufacturers of this item, the cost difference is immaterial, possibly 5 cents each; but the best quality items should be purchased.) These posts give you several choices of connectors for "voltage" and "current" connections.

2. I could go on at length about the manner in which to mount the 10 resistors. Much will depend upon the resistors you chose to use. One of my units is made with resistors with pigtails. I placed the resistors in a neat stack, bound them tightly with tape and then proceeded to "twist" the leads to form a good mechanical contact and then soldered a terminal to the bundle. On another my resistors had threaded studs on the end. With these I had to form two brackets from thin brass. In these brackets, holes were drilled to space the resistors evenly and to mount them. (Be careful in drilling the holes so that you will have clearance for the resistors.) I then mounted the brackets and/or the 5-way terminals on a piece of plexiglass or lucite that was just small enough to fit inside the flanged part of the minibox. In the same part I punched

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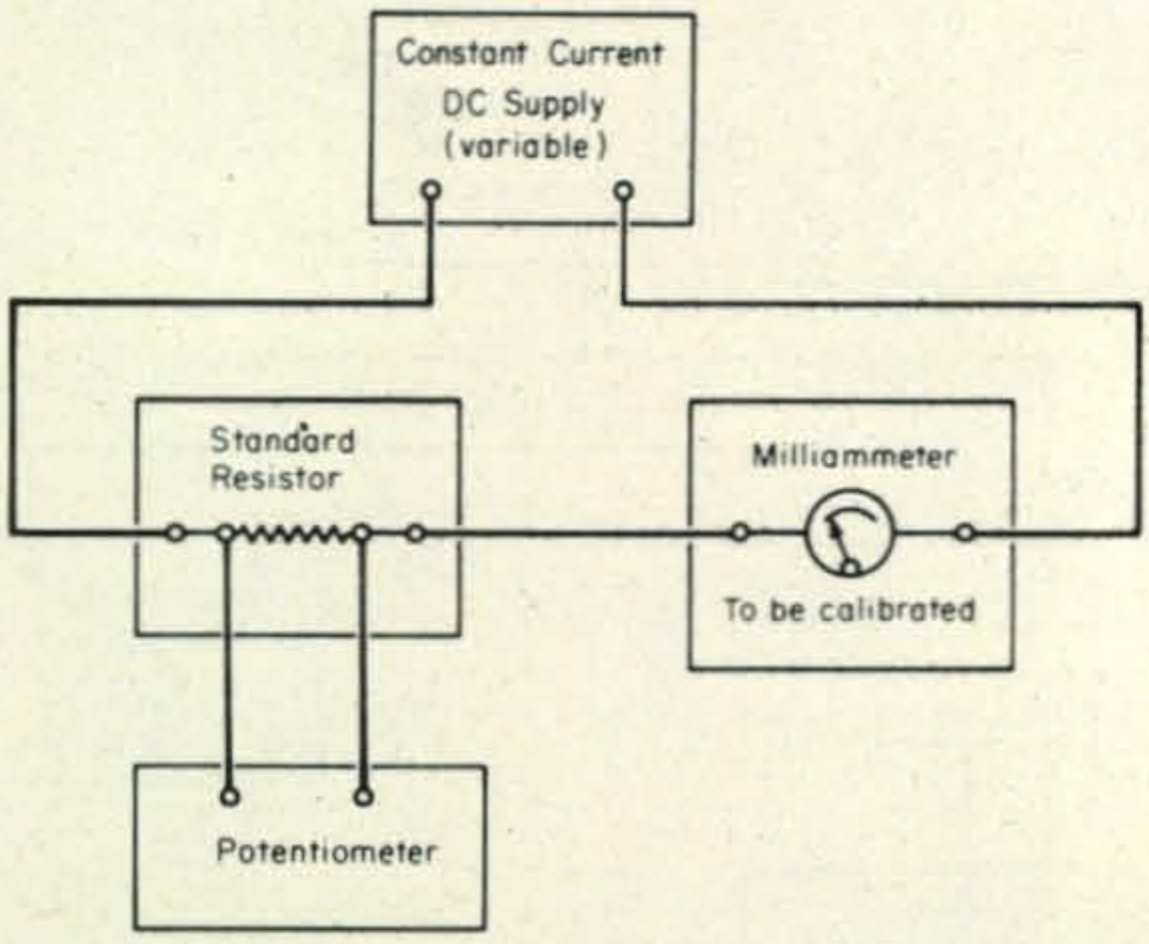

Fig. 9—Basic set up of the equipment to calibrate a milliammeter.

two holes with a chassis punch for clearance for the 5 way posts. The assembly is held in place in the minibox with machine screws in each corner of the plexiglass and the minibox.

3. Since the Potentiometer and Volt Box were mounted in a nice hardwood box, I was lucky enough to have another matching box of the proper size to hold my three Standard Resistors. Inside the cover of the box I mounted a piece of graph paper on which to record the values of the "resistors" each time I calibrate them. This gives me a "running record" of their values and I can watch the change that takes place with age.

Voltage Measurements

In the THEORY portion of this article I covered the operation of the Potentiometer in detail, and I would suggest that you reread that portion to become familiar with the basic operating procedure. However, here I want to point out a few additional ideas on operation:

1. Low values of voltage, between 0 and approximately 2 volts are measured directly with the Potentiometer (no Volt Box). Equation (2) does not specify any particular point for D_1. Therefore you could choose any point on R_1 (dial setting) for the Standardizing operation; and the measuring operation would give you D_2. Should we establish a D_1? It's up to you. I established "500" as D_1, and that means that it is equal to the voltage of my reference cell which is 1.45 volts. This means that if I'm measuring a voltage above 1.45 volts, D_2 will be greater than 500 and if the voltage is less than 1.45 volts, D_2 will be less than 500. Knowing where to set the dial for D_2 is very helpful in reaching a null and it reduces the wear and tear on the meter. Without going into a lot of mathematical details on how I did it, I made a chart for the inside of the top cover that gives me voltages versus dial settings for D_2 (with D_1 at 500) and this eliminates a lot of mathematics each time a measurement is made. This chart also includes the "multiplication factors" for each jack on the Volt Box.

2. It would be very beneficial to go back to the STANDARDIZE position after each measurement to insure that the point D_1 had not changed during the measurement because of battery B_2 discharge or some inadvertent movement of the current adjusting rheostat, R_2.

3. If you wanted to measure a voltage of approximately 0.5 volts, then it would be better to "Standardize" around 800; then your measurement would fall around 275. In any event I have made all my measurements within the middle 80% of the range of R_1 and found that I could get good repeatability (precision). An additional point to remember is that the Potentiometer has infinite input resistance at null, and, therefore no resultant circuit loading.

4. Voltages above 2 volts are measured with the Volt Box and the Potentiometer. Remember that the input resistance (loading) changes with input tap, and, therefore, circuit loading will effect your measurement. Since the ratios that you built into the Volt Box are fixed, the voltage to the Potentiometer will always be between 0 and 2 volts. So whatever you measure on the Potentiometer must always be multiplied by the Volt Box ratio (for example; $\times 100$) Equation (2) is changed, as follows:

$$E_x = E_{std} \times D_2/D_1 \times Multiplier \qquad (4)$$

where the Multiplier is the Volt Box ratio for the particular tap used.

5. Figure 8 shows the interconnection diagram for equipment used to calibrate a d.c. voltmeter. The variable voltage d.c. supply should be a stable unit. The procedure is simple. Vary the output voltage of the supply so that the meter to be calibrated reads full scale. Since the Volt Box is in parallel with the meter being calibrated, the same voltage is applied to it. Now, measure the voltage on

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AMATEUR TELEVISION IN PORTUGAL

BY VASCO FELIX*, exCR6MN

AMATEUR television has recently started in Portugal. The first two-way contacts were made by Levy A F G Carvalho, CT1IH-TV and Roberto Charters de Azevedo, CT1NB-TV.

The Portuguese authorities have approved new regulations which makes things considerably easier for amateurs operating mobile and portable. They have also licensed the two ATV stations, working on 625 lines, CCIR standards, and using a video frequency of 431.25 mc plus audio on 2 meter a.m.

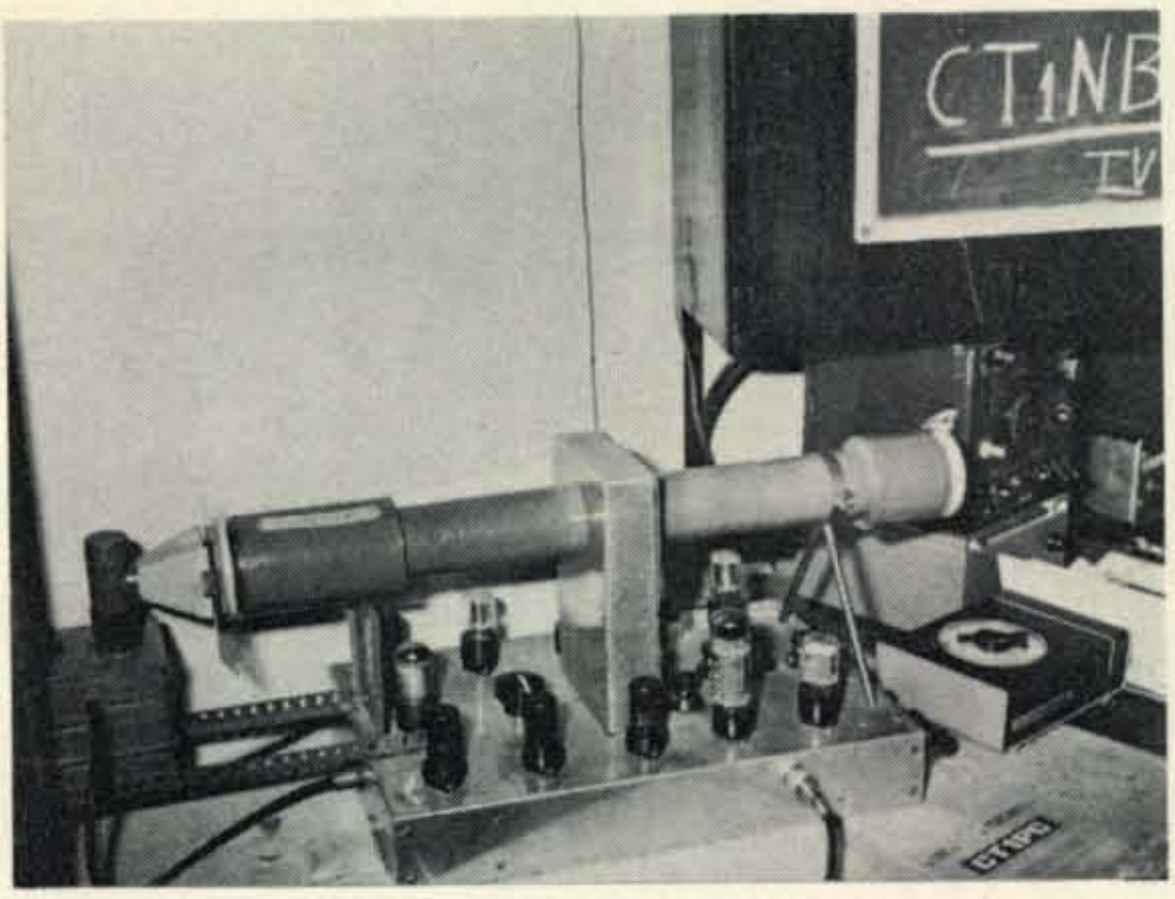
Roberto, CT1NB-TV made the first tests with a nineteen year old camera, a flying spot scanner. The camera was built in 1951 and based on an earlier article in QST.[1] Roberto's version used a 5AP7 CRT and a 931A photo cell to show slides. During the first tests he used slides of his XYL.

With initial testing completed, Roberto completed a newer camera based on the W. E. Parker circuit. It uses a RCA 7038 vidicon. The modulator was designed by DJ1GQ, and uses four EL86's in parallel grid modulating the QQE 06/40 (5894) final.

The station includes two TV receivers; an Italian Autovox with a modified u.h.f. converter and a portable Sony with converter. The antenna used for the first two-way contact was a dipole, with reflector, and fed with 72 ohm coax. CT1NB-TV is now using a 48-element colinear array.

Amateur television in Portugal will be very active in the near future, with many stations operating regularly on the "third channel," as it is called by Portuguese newsmen. As this was being written, Mario Ferreira, CT1BF is putting together a color ATV station based on the German PAL system. He has completed the camera and the monitor and needs to finish the transmitter.

This is but a brief glimpse into ATV in Portugal. As more develops, and more amateurs get involved with ATV, the scope of experimentation will broaden widely. ■



The 19 year old flying spot scanner used in the first Portuguese ATV tests.

Roberto Charters de Azevedo, CT1NB-TV, tunes up the ATV transmitter. It is briefly described in the text.

This is Levy A F G Carvalho, CT1IH, as he was seen on the Sony portable TV used to monitor the first two-way ATV contact in Portugal.

*Est. de Benfica-713-20-Frente, Lisbon 4, Portugal.

[1]Sherman, J. B., "A Receiver for the New Amateur Television System," *QST*, June 1940, p. 38.

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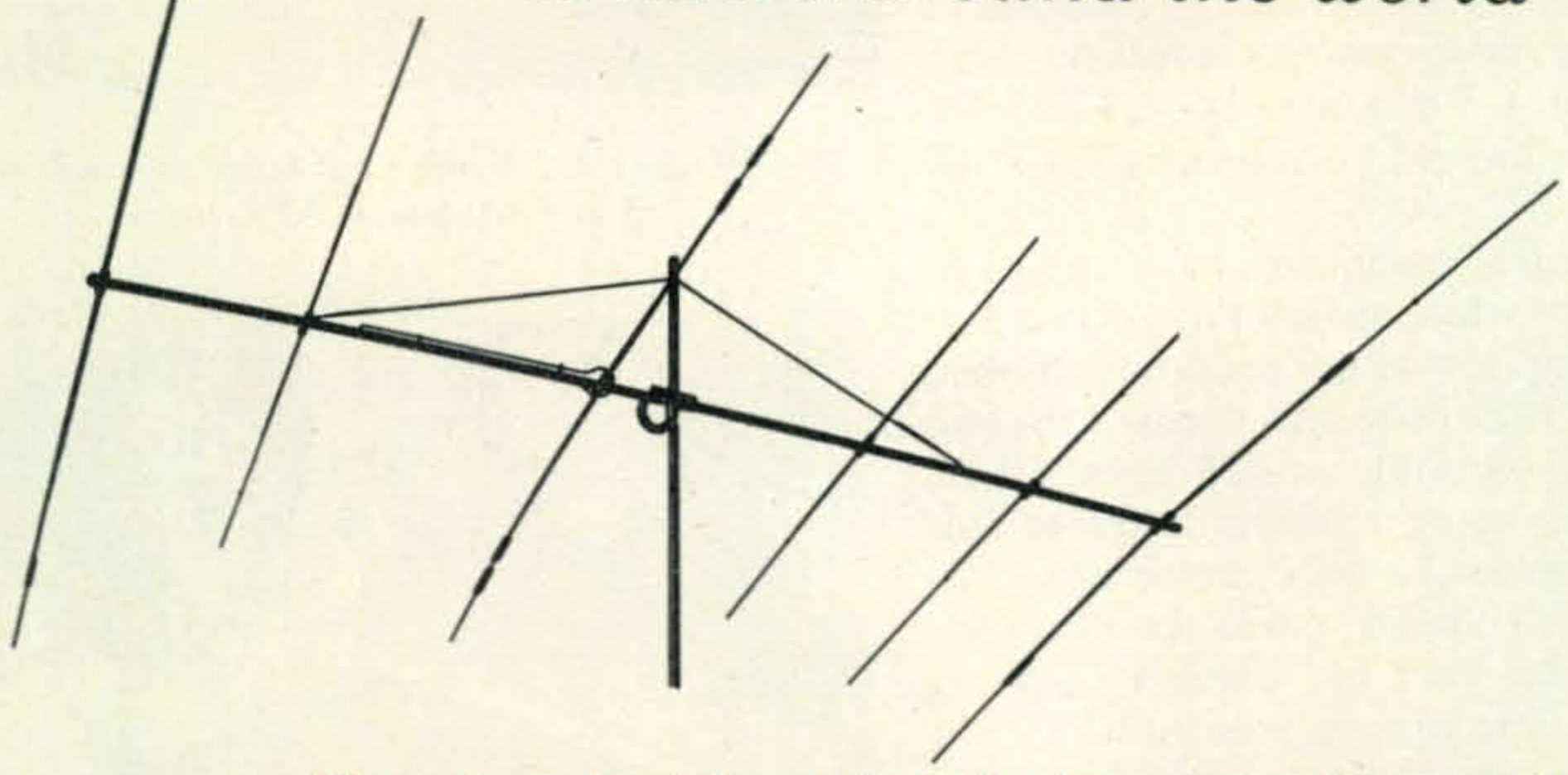
The voice of

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 the antenna, using charts supplied in the manual, to **substantially** outperform any other antennas made.
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CQ Reviews:

The Heathkit SB-220 Linear Amplifier

BY WILFRED M. SCHERER,* W2AEF

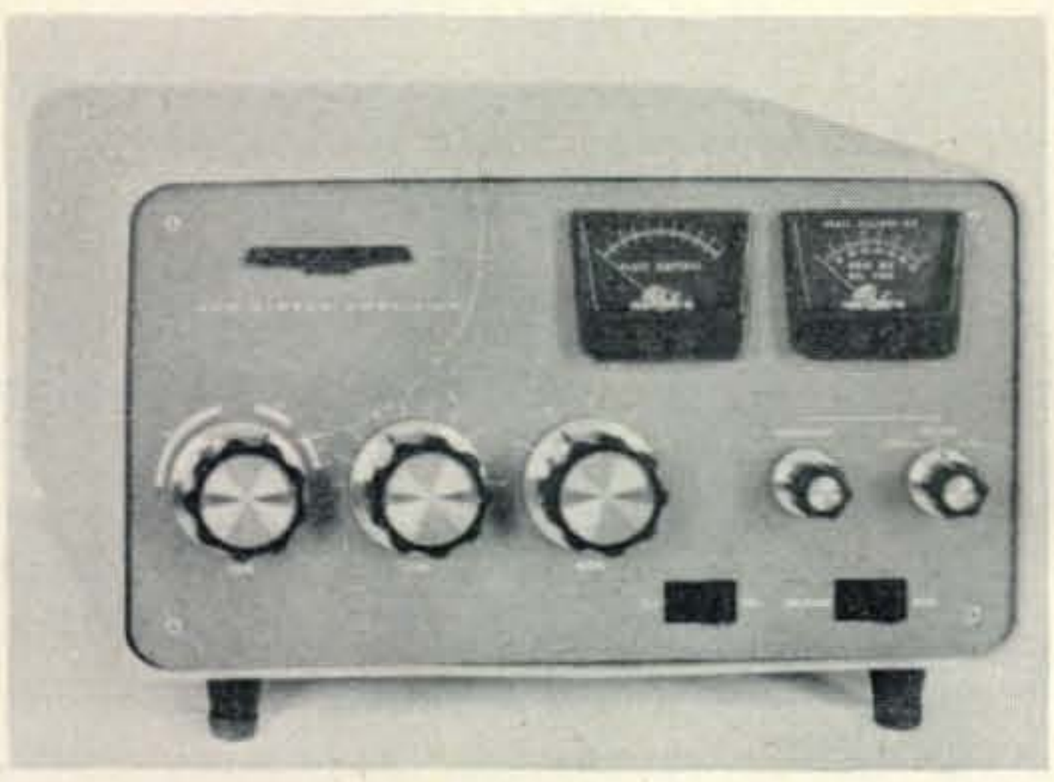
THE introduction of the Heathkit SB-220 Linear Amplifier has elicited many requests for a review concerning it, so here we go.

Supplied in kit form, the SB-220 is a relatively low-cost job, yet one that provides fine performance on the 80-10 meter amateur bands with 2000 watts p.e.p. input for s.s.b. and 1000 watts d.c. input for c.w. and RTTY. This is obtained using exciters capable of producing 100 watts of drive.

Input circuits are broadbanded and variable output loading is provided for matching to 25-100 ohm loads. It is a completely self-contained table-top unit with a built-in power supply designed for operation from 120/240 v.a.c., 50/60 c.p.s., sources. It also is well compacted into a package only slightly larger than its popular little brother, the SB-200 1 kw job.

Other features include grounded-grid circuitry using two Eimac 3-500Z triodes in Class B, forced-air cooling, zener-controlled bias, a.l.c., antenna-transfer relay, instantaneous transfer between exciter-only or linear-amplifier operation, low- and high-power positions for 1 or 2 kw operation, circuit breakers for overload protection, full-time plate meter plus second meter switchable for indicating grid current, relative output power or plate voltage.

*Technical Director, *CQ*.



The Heathkit SB-220 2 kw Linear Amplifier.

Circuit Data

Referring to the schematic at fig. 1, the grounded-grid circuitry used in the SB-220 is quite conventional. With the tube filaments maintained above r.f. ground by means of the usual bifilar-wound ferrite-core filament choke, cathode drive is applied through a separate fix-tuned pi-network for each band, ensuring high efficiency and low distortion. The latter is enhanced by a specific degree of negative feedback realized by the r.f. choke/capacitor combinations at the tube grids. Parasitic suppressors at the tube plates contribute to the inherent stability of the amplifier.

The r.f. input and output circuits are band-switched. The loading for the Pi-output circuit is controlled by a variable capacitor, allowing operation into 25-100 ohm non-reactive loads or those otherwise presenting an s.w.r. within 2:1.

Power Supply

Two separate transformers are used in the power supply, each with two primary windings that may be connected in parallel or in series for 120 or 240 volt operation respectively. The separate primary windings on each transformer are connected in parallel with the corresponding windings on the other transformer. A 10-ampere circuit breaker is installed in one leg of each primary-circuit setup.

One transformer furnishes plate power using a full-wave voltage doubler with a string of 7 silicon rectifiers in each leg. Filtering and dynamic regulation is obtained with eight series-connected 200 mf electrolytic capacitors, resulting in a total capacitance of 25 mf. Voltage-equalizing/slow discharge resistors are installed across each capacitor.

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The primary windings on the transformer have taps that enable a plate-potential choice of 2000 or 2500 volts (under load) to be had for either 1 or 2 kw operation.

The other transformer in the unit is a low-voltage job that furnishes 5 v.a.c. from one secondary for filament power; with another secondary used to provide 120 v.d.c., obtained with a half-wave silicon rectifier, for cutoff bias, an a.l.c.-threshold potential and relay-operating power.

An unusual twist is that the bias is a positive potential that is applied in series between the filament-transformer center tap and ground. This places the grounded grids at a negative potential with respect to the tube filaments (or cathodes) in a manner similar to that realized by the use of self bias from a cathode resistor. In this case, however, no current need be drawn by the tubes in order to produce the necessary voltage drop across a cathode resistor. The bias thus completely cuts off the tubes and more effectively holds them quiescent for eliminating tube noise during receive or standby periods.

On transmit, the transfer relay removes the cutoff bias and applies a fixed operating bias of 5.1 v.d.c. to the filament-transformer center tap. This potential is obtained from a Zener diode (D_1) operating from the 120-volt bias supply. A stable bias and low idling current for the tubes is thus ensured.

Metering

The plate-current meter functions as a voltmeter that indicates the voltage drop across R_1 which is produced by the plate current through the resistor, since it is in series with the h.v. negative return to the filament transformer. R_2 is the multiplier resistor.

When the other meter (multi-meter) is switched to read grid current, it is placed across R_3 which is in series with only the *grid* return to the filament transformer.

For relative output readings, the r.f. output is sampled through R_7-R_8 and rectified by D_3 to produce a d.c. component for actuating the meter. A sensitivity control allows the meter to be adjusted for the desired area of scale readings.

Plate-voltage readings are obtained from a sample of the high voltage derived from a low-value resistor, R_4, at the negative end of a separate h.v. bleeder.

A.L.C.

A d.c. a.l.c. voltage is obtained by rectifying a portion of the r.f. drive applied to the tube cathodes. This is accompiished with D_2 and voltage divider R_5-R_6. C_1-C_2 are frequency-compensating capacitors for uniform voltage division on all bands.

The a.l.c. threshold is set by a positive voltage from the bias supply applied to D_2 cathode. This reverse-biases the diode into non-conduction, until the r.f. drive voltage exceeds the threshold voltage which has been preset for the point just below where the drive would be high enough to cause the amplifier to be overdriven and thus flattop on modulation peaks.

Since the a.l.c. operation hinges on the r.f. drive *voltage*, it is not dependent on even a bit of overdrive or some grid current before it takes hold, as is the case with conventional systems used in most class AB_1 exciters.

Transfer Circuits

Transfer between exciter-only or linear-amplifier operation is handled by a relay with three sets of s.p.d.t. contacts. The relay is powered by the internal supply, as previously explained, and is actuated by the exciter through normally-open contacts on the exciter control relay which ground the circuit on transmit. One set of the SB-220 relay contacts transfers the bias, as also formerly described. The other two sets of contacts switch the antenna and the exciter output and amplifier input and output as needed for each method of operation.

Power is available for the transfer relay only when the SB-220 power switch is at ON, as are the filament and plate power. The tube filaments are instant-heating and since the rectifiers also are instantaneous in operation, transfer between exciter-only or with linear-amplifier operation is thus immediately available, simply by placing the power switch at ON or OFF as the need dictates.

Construction

The SB-220 is built on a large chassis with the r.f. section in a shielded enclosure at one side and the power-supply components at the other side. The tubes are located at the rear of the r.f. section where they plug into ceramic sockets mounted flush with the chassis deck. The usual air-flow glass chimneys are not used. At the rear wall of the enclosure is a motor with a large-diameter six blade fan that provides forced-air cooling. The air is drawn in from the back and is directed from the rear at the tube envelopes, but the perforated holes at the sides and top of the enclosure and a

See page 102 for New Reader Service

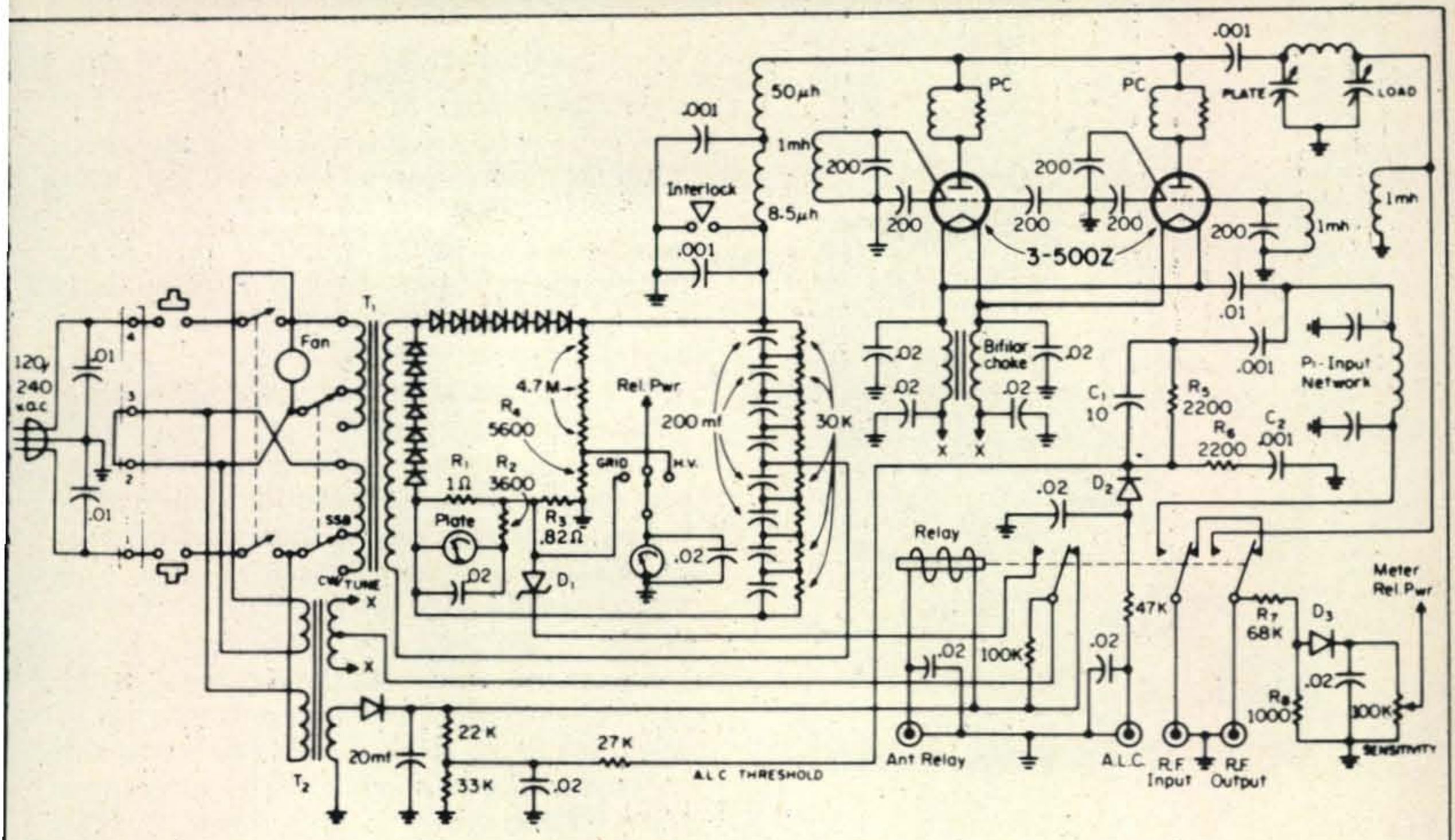

Fig. 1—Basic circuitry for the SB-220. See text for details. Bandswitching is not shown.

baffle plate on the cover are so arranged that the air flow through the compartment is such that relatively uniform cooling is provided all around the tube envelopes. The fan blades also extend below the chassis deck through a cutout and thus some airflow occurs through holes in the sockets to provide a degree of cooling at the tube-pin seals.

The plate-tune capacitor is wide-spaced, while the dual-section loading capacitor is the larger-size broadcast-receiver type. Both capacitors are ceramic-insulated. The bandswitch is a ceramic type with dual contacts. The low-frequency portion of the tank inductance is wound with #14 wire on a fiberglass form. The 15 and 10 meter section is self-supporting and wound with 3/16"-diameter silver-plated tubing.

A mechanical grounding switch (referred to in the manual as an interlock) is mounted on the interior of the amplifier enclosure. It consists of a short metal rod installed on a feedthrough insulator for the high-voltage which goes to the plate choke connected to the end of the rod. A strip of spring brass, attached to the adjacent side wall is so placed that the strip rests against the metal rod. The B-plus circuit is then short-circuited to ground. When the cover is installed, an insulated stud pushes the spring away from the rod, thus removing the short. The setup thus provides operating-personnel protection, whenever the cover is removed, by grounding the h.v. line and immediately discharging the filter capacitors or shorting any high voltage that may otherwise be present.

The plate bandswitch is ganged to another section located outside of one corner of the amplifier enclosure. This section switches the cathode-input circuits, the components for which are intstalled next to the switch deck. The power transformer and filter capacitors are mounted on the right side of the chassis deck.

A back panel, perforated side plates and cover completely enclose the assembly which is installed in a perforated-metal cabinet. Highly effective overall dual-shielding is thus provided.

Operation and Performance

It should be noted that the mechanical grounding switch is not an interlock in the true sense in that it does not lock out the application of any primary power and thus protects only operating personnel under certain conditions and not also the equipment itself. If primary power should be applied while the compartment cover is removed, allowing the switch to short the B-plus line, you can say goodbye to the silicon rectifiers, since there is no overload relay and the circuit breakers will not act fast enough. So, be sure to heed the related warning given in the manual.

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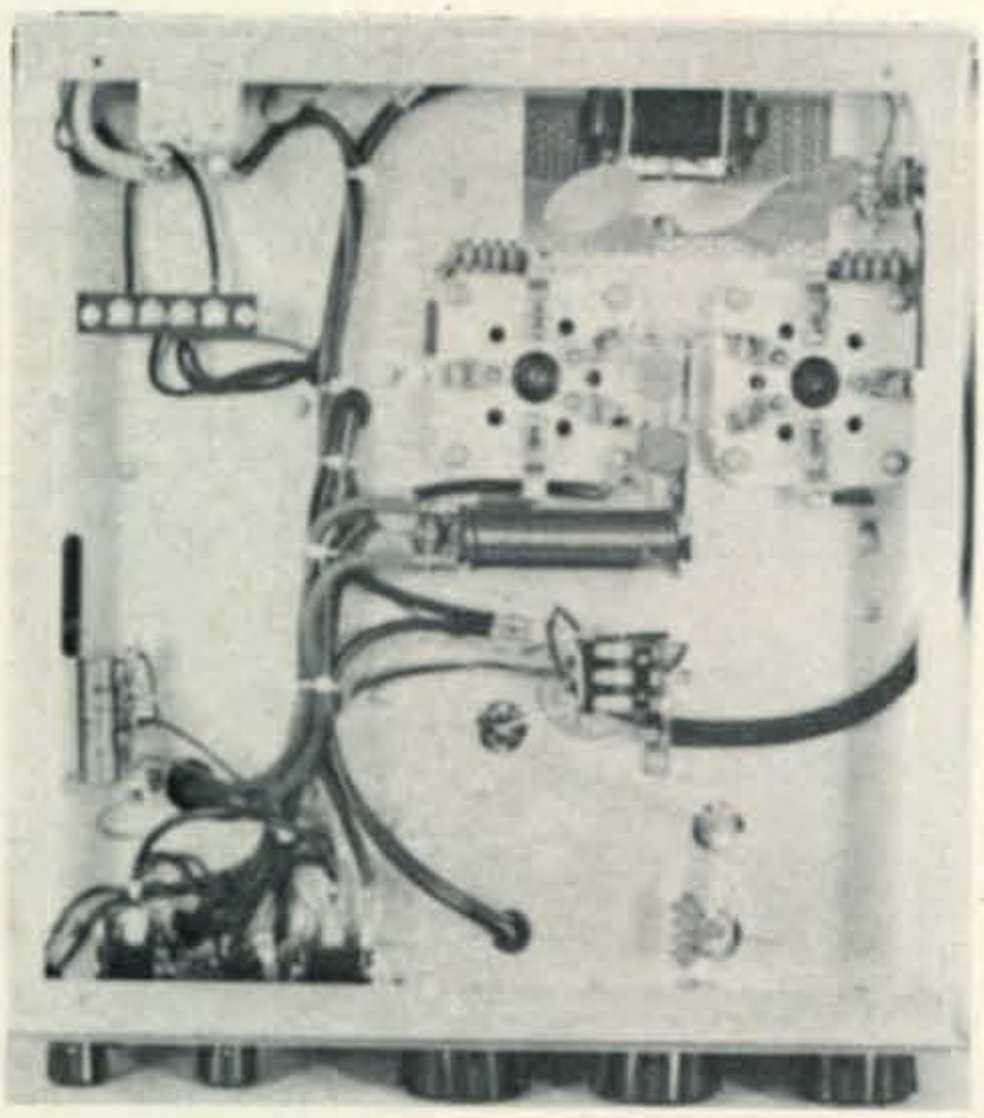

Bottom view of the SB-220. The filament choke is at the center. Near it is the relay, all the r.f. leads to which are run in coax The terminal board for 120/240 v. connections is at upper left.

The manual instructions are that tuneup be conducted using the low-power position which is designated for tuneup and c.w. S.s.b. operation is specified as then being available using either the low- or high-power position without necessitating retuning. However, there are several points not mentioned in the tuneup instructions which should be considered.

With tuneup into an antenna or during c.w. and RTTY operation, the maximum legally-permissable d.c. power input is 1000 watts. In this case it is determined by the *sum* of the input for *both* the *exciter* and the *grounded-grid* amplifier as discussed in the Q & A Column for this month.

Since most exciters producing the required 100 watts of drive run at an input of about 180 watts, the maximum allowable input at the amplifier itself then is approximately 820 watts (375 ma at 2100 v.) Under these conditions the power output for c.w. and RTTY with the SB-220 ranged from 525 watts on 28 mc to 600 watts on 3.5 mc. Running the same total d.c. input (sum of driver and amplifier inputs), but with only 50 watts drive and less exciter input (allowing the amplifier itself to run at about 900 watts) the output was about the same, but the grid current was less, making it easier on the tube grids.

Tuneup into an antenna under the maximum legal limitation of 1 kw will not, however, in either case provide optimum operation for s.s.b., as the amplifier then is too lightly loaded[1] and flattopping will easily occur, regardless of whether or not a.l.c. is used.

The job really should be done with a dummy load, allowing low-power tuneup to be made by loading the amplifier to slightly past the point where the output (indicated by the relative-power meter) starts to drop after the maximum point has been reached. This should be done with maximum drive from the exciter.

Under this condition, the d.c. input of the *amplifier* with a a monitored 100 watts of drive was found to be about 1400 watts with an average for all bands of 950 watts output and with grid current near 200 ma.

Switching over to the high-power position requires a slight readjustment for operation with more output, in which case a d.c. input of 1800 watts was had with an output of 1200 watts on 28 mc to 1300 watts on 3.5 mc with approximately 180 ma grid current. With 125 watts of drive the nominal d.c. input was 1950 watts with 1300-1500 watts output.

If a dummy load is not available, but where an oscilloscope (such as the Heath Monitorscope) can be set up for a trapezoid display,[2] an initial tuneup with carrier can first be made into an antenna at the legal power level. The adjusments may then be finalized by watching the trapezoid display while modulating with voice and conducting whatever retuning is needed for eliminating flattopping, while at the same time obtaining maximum peak output. This procedure will optimize tuning within the legal aspect; provided, the meter readings kick to *within* the 1000-watt input area.[3] Use of the scope while working into a dummy load and using a two-tone a.f. input signal, of course, is the ideal method for

[1]Also because the p.e.p. output from the exciter usually will be higher than the tuneup carrier, as will be the amplifier operating voltage due to the dynamic-regulation characteristics.

[2]Although it may be of limited aid, use of an r.f. envelope display of just the output is not recommended, since an accurate observation of amplifier flattopping (unless severe) will not be easily realized; plus the fact that proper amplifier adjustment could be confused by the exciter characteristics which also will be evidenced.

[3]In any event, tuneup into an antenna should be done as quickly as possible in order to avoid unnecessary interference.

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determining proper amplifier adjustment.

These tuneup procedures are not limited to use with the SB-220. As a general rule, they should be followed for making adjustments on any other linear amplifier.

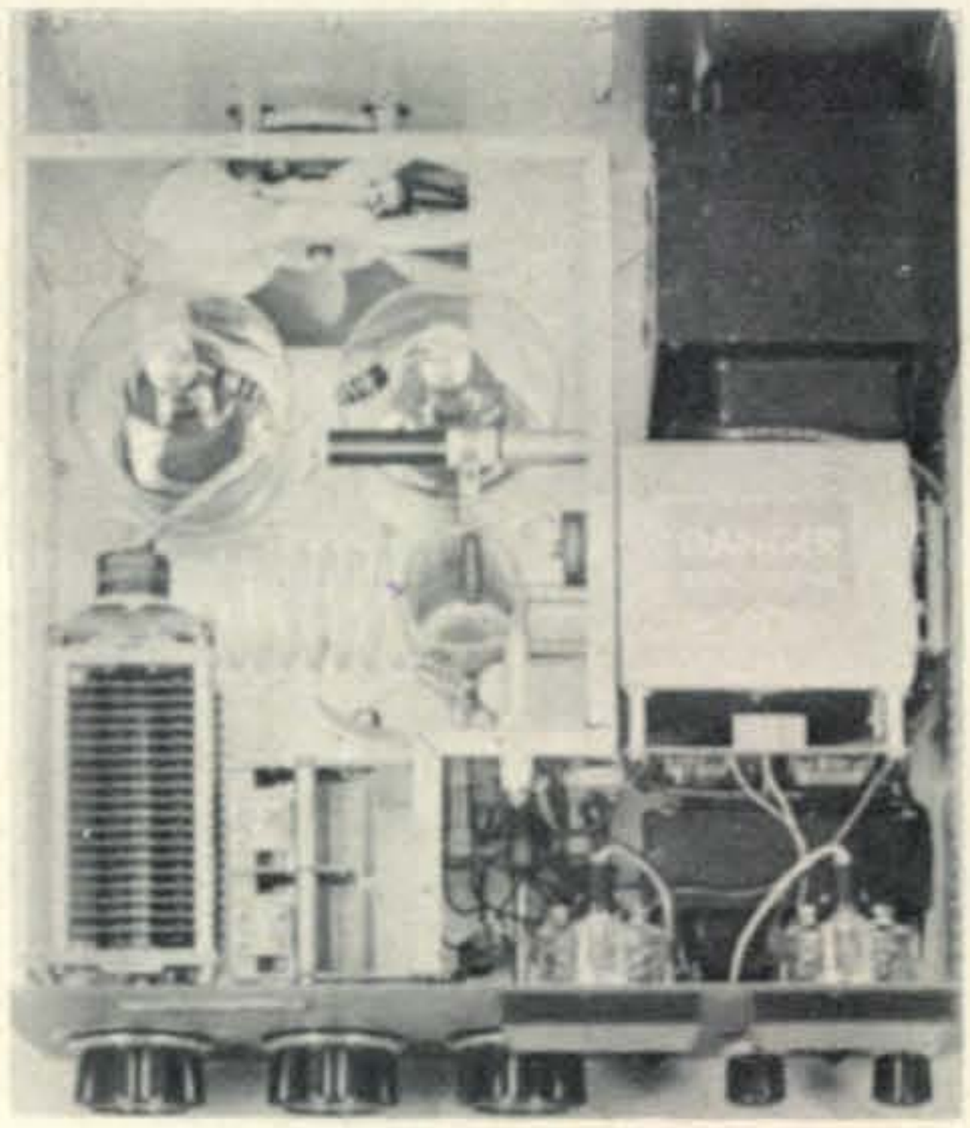
With tuneup conducted using any of the above suggested methods, operation with s.s.b. could then be had on low or high power with a clean signal and without flattopping while using up to 130 watts p.e.p. drive.[4]

The plate-voltage regulation under static (d.c.) conditions was found to be near 20%, but under dynamic conditions (during voice modulation) it is considerably better, due to the action of the filter capacitance, with the result that in both low- and high-power positions the p.e.p. in and out ran about 25% higher with modulating levels that kicked the meters for an indication of the legal average input of 1000 watts.

Using higher drive (up to 300 watts p.e.p.) the amplifier could be pushed to 3000 watts p.e.p. input with 2100 watts output without flattopping, even without a.l.c. Such operation, of course, should not be conducted, since the maximum-legal meter readings would be exceeded, as would be the manufacturer's equivalent rating of 2000 watts p.e.p.; however, this does attest to the capabilities of the SB-220 and its available reserve power that enables an exceptionally clean signal to be produced at the legal power levels.

This was further evidenced both by the linearity of a trapezoid display of the amplifier r.f. input vs. output and by a spectrum analysis whereby the 3rd-order distortion products (rated at −30 db or better) measured 35-37 db below the peak level of two equal-amplitude test tones at the rated power level. In this respect it should be kept in mind that the overall distortion cannot be lower than that produced by the exciter. Some exciters, particularly those using TV sweep tubes, may create distortion products of only 25 db or so down, which may be passed on by the amplifier, even though not produced by the SB-220 itself.

Although a.l.c. was not found a necessity for preventing flattopping after the tuneup precedures noted above, it is a desirable measure to employ for minimizing excessive drive that might otherwise shorten tube life.



Top view of the SB-220. The large cooling fan is behind the tubes in the r.f. section at the left in which the 10-15 meter tank inductor lies horizontally. The "interlock" grounding switch is at the right corner near the inductors. The electrolytic filter capacitors are under the "DANGER" label in the power-supply section at the right. They are held in plastic forms that insulate their cans from one another and ground, as well as preventing bodily contact with them.

During on-the-air operation and with bench tests, over a month's time, no adverse difficulties or overheating of components were experienced.

No particular problems arose with the assembly work which required 16 hours of time.

The duty-cycle ratings are: continuous with voice modulation at 2000 watts p.e.p. input with s.s.b.; continuous (maximum key-down 10 minutes) for c.w. with 1000 watts; 50% (maximum transmit time 10 minutes) for RTTY with 1000 watts.

With 120-volt operation the maximum current drain is 20 amperes, with 240 volts it is 10 a. For best operation a 240-volt line should be used. Our tests were conducted with 240 volts applied under load.

The size of the unit is 8¼" × 14⅞" × 14½" (H.W.D.) and it weighs 50 lbs.

The SB-220 Linear Amplifier is priced at $349.95 (kit, including tubes). It is a product of The Heath Company, Benton Harbor, Michigan 49022. —*W2AEF*

[4]The amplifier input impedance is a nominal 50 ohms. In some cases, particularly on the higher bands and depending on the input-line length, slightly retuning the exciter p.a. for optimum performance therefrom may be needed with linear-amplifier operation, due to a possible change in the reflected impedance or input s.w.r.

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DX

BY JOHN A. ATTAWAY,* K4IIF

YOU can find DXers in the most unusual places! During a recent trip to New Orleans I decided to drop in on one of the Crescent City's foremost DXers, Roy Alciatore, W5-RU. Guess what, this holder of WAZ, WPX, DXCC and over 100 other recognized DX awards turned out to be *THE* Roy L. Alciatore, Proprietor of New Orlean's most famous restaurant, Antoines.

Roy has been a ham since 1921. His first ambition was to go to sea as a shipboard radio operator. However, he needed money to buy some ham gear and his dad suggested he earn it by working at Antoines. He's been there ever since. The restaurant incidentally was founded by Roy's grandfather, Antoine Alciatore, in 1840 and has been in the family continuously from that time. DXers are always welcome, but let Roy know you're coming as there could be a line a block long out front.

Let's Go QRP

Are you looking for a new challenge? Do you ever sit in front of your rig, all 2000 watts PEP to a 4-element beam at 70 feet, and wonder if everything isn't getting too automatic? Maybe it's time to "set your own kind of style." The rapidly growing QRP movement may be for you. When you're running 2 watts or less those run-of-the-mill European and South American contacts can be a real thrill.

While everybody else has been concentrating on the highest power they can afford the QRPer's have been quietly going the other way. With very little fanfare they have built their own national club, the QRP Amateur Radio Club, with it's own journal, *The Milliwatt*, published by Mike Czuhajewski, Route #3, Paw Paw, Mi. 49079.

There are plenty of simple circuits around for QRP gear, but if you don't like building, K8BRX has a complete line of 200 milliwatt transmitting devices for very low cost. Write to him at D&B Electronics, RFD #5, Box 277A, Traverse City, Mi. 49684. The Ten Tec Co. of Sevierville, Tenn. 37862, has a fabulous array of completely self-contained QRP transceivers. See the excellent review on page 52 of the April issue of *CQ*.

De Extra

This month's De Extra is written by WAØ-OAH in reply to February's guest De Extra by W4FRO:

"When you printed W4FRO's comments re: The List and it's nemesis effect on DX I was at first shocked and dismayed. His reasoning was so contradictory and some of his insinuations so inflamitory that I wondered why you had printed it. After getting

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

Getting those WX3MAS QSLs out. Left to right are Al, WA3CXM, Rick, WA3GUL, Dave, WA3-LTM, and Bob, K3MAZ. This is just one day's receipt of cards. Who says people don't chase prefixes. *(Photo courtesy of K4DSN).*

CQ S.S.B. DX Honor Roll

W2TP	318	ZS6LW	308	W8BT	297	K9LUI	273
WA2RAU	318	G8KS	307	K8IKB	296	W6PTS	272
W9ILW	318	W2ZX	305	W8EVZ	293	W6RKP	272
W2RGV	316	W4OM	304	K8ONV	293	W8BVF	272
DL9OH	316	W4SSU	304	F2MO	292	G3NUG	270
W3NKM	316	PA0HBO	303	W2FXN	292	K9PPX	270
K6LGF	316	W6YMV	303	K1IXG	288	G3WW	269
KP4CL	316	KØUKN	303	SM6CAS	286	W9QLD	269
VK3AHO	315	OK1ADM	302	W2LV	286	K4GXO	268
WA2IZS	315	W2BXA	302	W6EUF	286	G2BVN	265
W6EL	315	W4IC	302	K8RTW	286	W2FXE	264
K6YRA	315	W6NJU	302	W9EXY	284	HP1JC	263
WØBW	315	G3AWZ	301	W3KT	281	W2MJ	261
I1AMU	314	G3DO	301	W1LLF	280	W8ILC	255
TI2HP	314	G6TA	301	W6UOU	280	CT1PK	254
WA8AJI	314	WA2EOQ	301	W3EWD	279	W6BAF	254
W4NJF	313	W3DJZ	301	W4RLS	279	K6CAZ	254
W4QCW	313	G3HDA	300	K4OEI	279	PAØSNG	252
W4OPM	312	VE3ACD	300	DL3RK	278	VE6TP	251
W5KUC	311	K1SHN	300	DL1IN	276	W1AOL	250
G3FKM	310	W9JT	300	K4HYL	276		
SM5SB	310	5Z4ERR	298	W7DLR	276		
XE1NE	308	K2DX	297	PZ1AX	274		

Any station who has not up-dated his countries total within the past year will be automatically dropped from the Honor Roll unless he contacts WA6GLD before July 1.

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over my initial anger I realized that you were right in doing so as it gets two schools of thought out into the open so that operating hams can make their own decisions.

"W4FRO seems to feel that Mr. Big Signal, the transceiver, and The List are kicking the ever-lasting B'jabbers out of any future DX-ing for any of us. This is not the case at all. It is those unusual, anxious-to-help-others people who take lists to pass to some DX operators that make it possible for little guys with peanut-whistle rigs to work some really rare ones—the rare ones that W4FRO feels should only be worked by linguists with stacked arrays, speech compressors, and California kilowatts.

"Further, W4FRO implies that all list takers are partial to friends and jealously protect their Honor Roll standing by ignoring the competition. This is a pretty serious thing to say as it reflects on a couple of very outstanding DX gals, as well as several other highly ethical OM's who take lists. It also may contribute to harassment on the bands.

"The problems are not caused by the takers. They go far afield to insure that everyone who wishes to be on the list has an opportunity. It is those who shut their ears and open their mouths who are the problem. They should remember that the other choice is always open to them. If they don't want to get on the list they can wait around until another op shows up from that QTH who doesn't object to pile-ups, and then get in and pitch to their heart's desire.

"My own feelings? W4FRO has a right to his opinions and his mode of operation, although his accusations are in my opinion totally unjustified. There is room for all of us. If you wait long enough and look hard enough the situation you like will develop. Pile-up or list, sudden golden contacts with a really rare one and no QRM—you name it. Me, I like 'em all, as my 260 confirmed in two years will testify. I'll get in a pile-up and whoop my self hoarse with the rest of them—or have heart palpitations to the point of an attack sitting on frequency waiting for a list to come up while the QRM builds, phone patches splatter all over the joint, QSB takes a swoop that makes my stomach sink, and then at the crucial moment someone starts calling CQ where I'm listening. Heck, I love it, and in spite of W4FRO's gloom I predict that DX will outlast all of us.

During a recent trip to the Azores, Glen R. Kurzenknabe, K3SWZ, had a chance to drop in and operate from the shack of CT2AA.

The WPX Program

S.S.B. WPX

488.....XE1FFW
489.....ZS3BP
490.....PY4KB
491.....WA9PRO
492.....DL3OM
493.....LU5DL
494.....I1BGJ
495.....K6SSN
496.....DL8TC
497.....JA1RWU
498.....UN1CC

C.W. WPX

1003.....OK2PE
1004.....TJ1AJ
1005.....WA3GNW
1006.....W2MLO
1007.....SP2LV
1008.....WA3CSF
1009.....KØEA
1010.....UA1IA
1011.....UC2SE
1012.....UW9PT
1013.....UA1BC
1014.....WA7FKV
1015.....WA3KSQ
1016.....WØCC
1017.....W4WSF

Mixed WPX

229.....WA6EPQ
230.....KØDEA

Phone WPX

188.....VK3BM
189.....K2OLG

VPX

20 (s.s.b.).....SM4-3958
21 (s.s.b.).....W4-10646

Endorsements

S.S.B.: SM7CSN–500, K2POA–450, YV3-KV–400, I1BGJ–400, WAØOAH–350, W2-LEJ–350, and K7RDH–300.

C.W.: W9FD–750, W9WCE–500, W2MLO –400, SP2LV–400, and KØDEQ–350.

Mixed: W4BQY–650 and WA6TAX–450.

Phone: CT1PK–850, W2LEJ–400, and K2-OLG–350.

80 Meters: DL1MD

20 Meters: SM7CSN and WA7FKV

10 Meters: K7RDH, K2OLG, and DL1MD

Asia: DL1MD

Africa: DL1MD

South America: W8LY

Europe: VE3AAZ

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Amateur Radio in Other Countries

This popular feature was omitted this month to make room for the rules of the *CQ* DX Awards program. It will be resumed next month with a story on amateur radio in India.

New Oversea's Checkpoints

The following have been added to the list of authorized checkpoints for *CQ* DX Awards:

PHILIPPINES—Dr. Edmundo A. Reyes, DU1-OR, President, Philippine Amateur Radio Association, P.O. Box 4043, Manila.

YUGOSLAVIA—Jozo Dell'Olie YU1NSN, Award Manager, Radioklub Beograd, P.O. Box 235, Beograd.

Rules for the CQ DX Awards

It has been our custom to print a listing of rules early in each year. However, there has been so much interesting news to print that we have postponed the rules several times. Now it looks as if we'll never run out of news so here are the rules anyway.

WAZ Rules

The WAZ Award will be issued to any licensed amateur station presenting proof of contact with the forty zones of the world. This proof shall consist of proper QSL cards to be checked by the DX Editor or verified at one of the authorized checkpoints for *CQ* DX Awards. Most of the major DX clubs of the USA and national amateur radio societies abroad can be authorized checkpoints if they clear in advance with K4IIF. If in doubt consult the DX Editor. Any legal type of emission may be used providing communication was established after Nov. 15, 1945.

1. The official *CQ* WAZ Zone Map will be used in determining zone boundaries.

2. Confirmations must be accompanied by a list of claimed zones showing the call letters of the station QSOed and the mode. The list should also show the applicant's name, call letters, and complete mailing address clearly.

3. All contacts must be made with licensed, *land based*, amateur stations working in authorized amateur bands.

4. All contacts submitted by the applicant must be made within a 250 mile radius of the original location.

5. Any altered or forged confirmations will result in permanent disqualification of the applicant.

6. Continued use of poor operating ethics will result in disqualification of the applicant.

7. In addition to the conventional certificate for which any and all bands and modes may be used, specially endorsed and numbered certificates are available for phone and single sideband operation. The phone certificate requires that all contacts be two-way phone and the s.s.b. certificate requires that all contacts be two-way s.s.b.

8. If, at the time of the *original* application, a note is made pertaining to the possibility of a subsequent application for an endorsement or special certificate, only the missing confirmations required for that endorsement need be submitted with the later application.

9. Include with the application $1.00 or 8 International Reply Coupons to defray the cost of the certificate.

10. Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of this award shall be final.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes. Stations are listed with both net and gross prefix credits. The Honor Roll is based on the current *net* regardless of an operator's all-time gross prefix count.

MIXED

W4OPM	Joe Hiller	906/1025
W8LY	Michael Bakos	727/755
G3DO	D.A.G. Edwards	721/775
K1SHN	Chuck Banta	680/702
W3PVZ	Joseph Olnick	646/667
W8ROC	Fred Riecks	645/650
I1SF	Serafino Franchi	643/657
W4IC	George Mack	643/700
WA5LOB	James Edwards	634/640
WA6EPQ	Larry Brockman	617/656
YU1AG	Djura Borosic	614/704
W8KSR	Jon Hodgin	609/612
W4BQY	G.B. Fisher	595/652
W8GMK	John Marhefka	592/611
DL1MD	Heribert Rechl	557/557

SSB

W4OPM	Joe Hiller	807/900
W4NJF	Gay E. Milius	744/760
DL9OH	Karl Muller	650/651
WA5LOB	James Edwards	627/627
G3DO	D.A.G. Edwards	622/645
HP1JC	Juan Chen	601/603
K1SHN	Chuck Banta	581/601
K2POA	Arthur Johnson	580/600
I1AMU	Alfonso Porretta	559/599

CW

W4OPM	Joe Hiller	812/892
W8KPL	William Simpson	734/853
W8LY	Michael Bakos	731/802
DL1QT	Helmut Baumert	698/720
VK3AHQ	Henry Denver	697/704
G2DM	F.D. Cawley	598/665
VE4OX	D.E. McVittie	579/614
W8GMK	John Marhefka	562/578
YU1AG	Djura Borosic	569/656
K1SHN	Chuck Banta	565/603
K1LWI	Wendell Boyden	549/574
I1SF	Serafino Franchi	545/554

PHONE

G3DO	D.A.G. Edwards	708/734
CX2CN	Samuel Barreiro	574/608
F2MO	Michel Dort	536/552
I1SF	Serafino Franchi	520/525

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11. All applications should be sent to the DX Editor, P.O. Box 205, Winter Haven, Florida 33880.

12. Zone Maps and/or WAZ applications are available from the DX Editor or from *CQ* for a self-addressed stamped envelope or self-addressed envelope and 1 IRC.

The following list of zones is presented as a guide. Any questions will be decided by the zone map.

Zone 1. Northwestern Zone of North America: KL7, VE8-Yukon, the VE8-Northwest Territories Districts of Makensie and, Franklin, and the islands west of 102° including Victoria, Banks, Melville, and Prince Patrick.

Zone 2. Northwestern Zone of North America: VO2-Labrador, that portion of VE2-Quebec north of the 50th parallel, and a portion of the Northwest Territories-VE8 east of longitude 102°. The latter includes part of the District of Franklin and the islands of King William, Prince of Wales, Somerset, Gathurst, Devon, Ellesmere, Baffin, and the Melville and Boohtia Peninsulas.

Zone 3. Western Zone of North America: VE7, W6 and the W7 states of Arizona, Idaho, Nevada, Oregon, Utah, and Washington.

Zone 4. Central Zone of North America: VE3, VE4, VE5, VE6, the W7 states of Montana and Wyoming, WØ, W9, W8 (except W. Va.), W5, and the W4 states of Alabama, Tennessee, and Kentucky.

Zone 5. Eastern Zone of North America: FP8, VE1, VO1, that portion of VE2-Quebec south of the 50th parallel, VP9, W1, W2, W3, the W4 states of Florida, Georgia, South Carolina, North Carolina, and Virginia, and the W8 state of West Virginia.

Zone 6. Southern Zone of North America: XE and XF.

Zone 7. Central American Zone: FO8-Clipperton, HP, HR, KS4, KZ5, TI, TI9, VP1,TG, YN, and YS.

Zone 8. West Indies Zone: CM/CO, FG7, FM7, HH, HI, KG4, ITP4, VP2, VP5, VP7, KC4-Navassa, PJ2M/FS7, PJ2E, PJ2S, and YVØ-Aves.

Zone 9. Northern Zone of South America: FY7, HK, PJ2 PZ, VP3/8R, VP4/9Y4, and YV.

Zone 10. Western Zone of South America: CP, HC, HC8, and OA.

Zone 11. Central Zone of South America: PY and ZP.

Zone 12. Southwest Zone of South America: CE.

Zone 13. Southeast Zone of South America: CX, LU, VP8, and all Antarctic prefixes.

Zone 14. Western Zone of Europe: CT1, CT2, DJ/DL/DM, EA, EA6, EI, F, G/GB, GD, GI, GM, GW, HB, HL, LA, LX, ON, OY, OZ, PA/PI, PX, SM/SL, ZB2, and 3A2.

Zone 15. Central European Zone: FC, HA, HV, I, IT, IS, OE, OH, OK, SP, UA2, UP, UQ, UR, YU, ZA, ZB1/9H1, 9A1.

Zone 16. Eastern Zone of Europe: UA1, UA3, UA4, UA6, UA9-Bashkir & Chkalov, UB5, UC2, UN1, and UO5.

Zone 17. Western Zone of Siberia: UA9-Sverdlovsk, Chelyabinsk, Komi, Jurgan, Molotav, Omsk, Tyumen, plus UH8, UI8, UL7, and UM8.

Zone 18. Central Siberian Zone: UA9-Novo-

Father Leo, YN4LGS, relaxing at the rig. This OM is now activating the new HT prefix on occasions. *(Photo courtesy of W4LRN).*

The S.S.B. DX Award Program

100 Countries

618.....JA1RWU
619.....WB6KGG
620.....VE3IR
621.....DJ8OT
622.....K6SSN
623.....K3SWZ
624.....WA7FFS

200 Countries

196.....KH6GLU
197.....ZE1JE
198.....W4FUM
199.....WA2CCF
200.....DJ1CG

300 Countries

50.....PAØHBO
51.....W6NJU

The WAZ Program

S.S.B. WAZ

765.....JA1RWU
766.....WA6WXP
767.....K6KQN
768.....JA7DY
769.....OH3NY
770.....UA2KBD
771.....I1DEZ
772.....W8HXR
773.....WB6UJO
774.....W6VNH
775.....PAØHBO
776.....W9DDL
777.....DL9MC
778.....VE4AS

C.W.—Phone WAZ

2860.....W4UF
2861.....K6HN
2862.....WØBE
2863.....W4CRW
2864.....W7RI
2865.....VK2AND
2866.....UA3KAO
2867.....UB5ND
2868.....UB5QA
2869.....UA1CE
2870.....UW9OP
2871.....UA6KOD
2872.....WA6GRQ
2873.....OZ7FP
2874.....W5GTW
2875.....K3OLG
2876.....K6TWT
2877.....9M2LN
2878.....EI3S
2879.....LZ1KAA
2880.....WB6KIG
2881.....K1KNQ
2882.....YS1AG
2883.....ZP5EC
2884.....LZ1KPG
2885.....YU1BKL
2886.....I1PER
2887.... ....DL8JE
2888.....OK3CGP

Phone WAZ

438.....LA8WF
439.....WB6UDC
440.....W4NBV

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On the right is Mike Cureton, W4NEN, with Bill Barbee, WA5ZXG, to his left. They are standing in front of the San Vito Italy Amateur Radio Club's station, I1DFL.

sibirsk, Tonsk, Kamerovo, and Altai; UAØ-Keasnoyarsk, Irkutsk, Chita, Bruyate Mongolia, and Dickson Island.

Zone 19. Eastern Siberian Zone: UAØ-Khabarovsk, Amur, Yakutsk, Primorsky, Sakhalin Island, Wrangel Island, and the Soviet Kuriles.

Zone 20. Balkan Zone: JY, LZ, OD5, SV, TA, YK, YO, ZC4/5B4, and 4X4.

Zone 21. Southwestern Zone of Asia; EP, HZ, MP4, 9K, VS9 (except Maldives and Socotra), YA, YI, 4W1, UD6, UF6, UG6, and AP-West Pakistan.

Zone 22. Southern Zone of Asia: AC3, AC5, CR8, 4S7, VU (except Andaman and Nicobar Islands), 9N1, and AP-East Pakistan.

Zone 23. Central Zone of Asia: AC4, the BY provinces of Sinkiang, Kansu, and Hinghai, JT1, and UAØ-Tanna Tuva.

Zone 24. Eastern Zone of Asia: BY (except the provinces in Zone 23), BV, CR9, and VS6.

Zone 25. Japanese Zone: HL/HM, JA/KA, and KR6.

Zone 26. Southeastern Zone of Asia: HS, XV, XW, XZ, 3W8, and VU2-Andaman and Nicobar Islands.

Ron Benatti, WN1JMP, winner of WPNX Award No. 14. WPNX is CQ's DX Award for Novice's only. All you Novice DXer's who have worked 100 prefixes get in touch with WA6GLD for an application.

Zone 27. Philippine Zone: DU, KC6, and KG6.

Zone 28. Indonesian Zone: CRØ, VR4, VK9 (except Nauru, Norfolk Is., and Christmas Is.), VS1, VS4, VS5, ZC5, 8F, and 9M.

Zone 29. Western Zone of Australia: VK6, VK8, and VK9-Christmas Is.).

Zone 30. Eastern Zone of Australia: VK1, VK2, V3, VK4, VK5, VK7, and VKØ-Macquarrie Is.

Zone 31. Central Pacific Zone: KB6, KH6, KJ6, KM6, KP6, KW6, KX6, VK-Nauru, VR1, VR3, and ZM7.

Zone 32. New Zealand Zone: FK8, FO8, (except Clipperton), FU8/YJ, KS6, VK9-Norfolk Is., VR2, VR5, VR6, ZK1, ZK2, ZL, and 5W1.

Zone 33. Northwestern Zone of Africa: CN2, CN8, CT3, EA8, EA9, 3V8, and 7X.

Zone 34. Northeastern Zone of Africa: ST, SU, and 5A.

Zone 35. Central Zone of Africa: CR4, CR5-Guinea, EL, TU, TY, TZ, XT, ZD3, 5N2, 5U, 5V, 6W8, 9G1, and 9L1.

Zone 36. Equatorial Zone of Africa: CR5-Sao Thome, CR6, EAØ, TJ, TL, TT, TN, TR, 9Q5, 9U5, 9J, ZD7, and ZD8.

Zone 37. Eastern Zone of Africa: CR7, ET2, ET3, FL8, 6O1, 6O2, 5H3, 5X5, 5Z4, and 7Q7.

Zone 38. South African Zone: ZD9, ZE, and ZS.

Zone 39. Madagascar one: FB8, 5R8, FR7, VQ8, VQ9, and VKØ-Heard Is.

Zone 40. North Atlantic Zone: LA-Jan Mayen, LA-Svalbard, OX, TF, and UA1-Franz Joseph Land.

The UA9 and UAØ Zones are sometimes rather hard to determine. However, the DX column in the August, 1968 issue, pg. 82 has a handy table to use in locating stations in these zones.

WPX Rules

The general rules 3-11 of the WAZ Award also apply to WPX where appropriate. In addition, the following other rules specific to WPX must be followed.

1. All applications for WPX certificates and endorsements must be submitted on the official application form CQ 1051. This form can be obtained free by sending a self-addressed stamped envelope to the DX Editor. It is highly desirable to use business size envelopes, 8½ × 11 inches, for this purpose.

2. All call letters *must* be in strict alphabetical order.

3. All entries *must* be clearly legible.

4. Use separate application for each endorsement, and be sure to specify whether your certificate is mixed, c.w., phone, or s.s.b.

5. For additional WPX credit list only additional calls.

6. Include with application $1.00 or 8 International Reply Coupons (IRCs) for certificate. A self-addressed stamped envelope or self-addressed envelope with 1 IRC should be sent for endorsement stickers.

Certificates are issued for the following categories and numbers of prefixes: MIXED–400; C.W.–300; PHONE–300; S.S.B.–200.

Contacts between a s.s.b. station and an a.m. phone station will be accepted for the phone certificate. Cross-mode contacts between CW

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and SSB/Phone will not be valid for WPX.

Endorsements are issued for each 50 additional prefixes submitted. Band endorsements are available for working the following numbers of prefixes on the various bands: 1.8 mc–35; 3.5 mc–150; 7 mc–250; 14 mc–300; 21 mc–300; 28 mc–250.

Continental endorsements are given for working the following numbers of prefixes in the respective continents: North America–126; South America–88; Europe–146; Africa–80; Asia–68; Oceania–51.

Cards need *not* be sent but *must* be in the possession of the applicant. Any and all cards may be requested by the DX Editor or the Committee.

The definition of prefixes will be as follows:

Prefixes

1. The 2 or 3 letter/numeral combinations which forms the first part of any amateur call will be considered the prefix.

2. Any difference in the numbering, lettering or order of same shall constitute a separate prefix. The following would be considered different: W2, WA2, WB2, WN2, WV2, K2 and KN2.

3. Any prefix will be considered legitimate if its use was licensed or permitted by the governing authority in that country.

4. A suffix would designate portable operation in another country or call area and would count only if it is the *normal* prefix used in that area. For example, K4IIF/KP4 would count only as KP4. However, KP4XX/7 would NOT count as KP7 since this is not a normal prefix. Suffixes such as /M, /MM, /AM /A and /P are not counted as prefixes. (See also rule #5).

5. All calls without numbers will be assigned an arbitrary ∅ plus the first two letters to constitute a prefix. For example, RAEM counts as RA∅, AIR is AI∅, UPOL is UP∅. All portable suffixes that contain no numerals will be assigned an arbitrary ∅. For example, W4BPD/LX counts as LX∅ and HB9XYZ/PX counts as PX∅.

6. WPX is intended to be a pleasant past-time and not a contest for "blood". All legitimate prefixes will be counted. For example, if you have both a VP4 card and a PY4 from Trinidad, both will be counted.

WPX Honor Roll

In addition to the 4 categories of WPX certificates, a WPX Honor Roll is maintained with a separate listing for c.w., s.s.b., mixed, and phone. Applications may be obtained by sending a self-addressed stamped envelope to WPX Manager, Jerry Hagen, WA6GLD, 5031 Arroway Ave., Covina, Calif. 91723. The rules governing admission to the Honor Roll are as follows:

The WPX HONOR ROLL recognizes those operators and stations that maintain a high standing in confirmed, current prefixes. The rules, therefore, reflect the belief that Honor Roll membership should be accessible to all active radio amateurs and not to be unduly advantageous to the "old-timers." With the exceptions listed below, all general rules for WPX apply toward Honor Roll credit.

The WX3MAS group gave many happy prefix chasers a new one. Here is Bob, K3MAZ, operating and Dave, WA3LTM logging. *(Photo courtesy of K4DSN).*

1. Only current prefixes may be counted toward WPX HR standings; these prefixes to be listed and updated annualy in *CQ* or available from the WPX Manager.

2. Special Issue prefixes, *i.e.*, 3C, 4A, OF, etc. will be considered current during their existence and for five years after the date of last issuance after which time they will be deducted as credit for Honor Roll standings.

3. Honor Roll applicants must submit their list of current pefixes separate of their WPX applications. Forms are available for this purpose and their use is highly recommended. WPX HR applications may be gotten free by sending a self-addressed stamped envelope (or 1 IRC) to the WPX Manager. A separate application must be made for each mode.

4. A filing charge of $1.00 is required for each original application.

In addition to the regular WPX Awards, *CQ* has 2 specialized prefix awards which follow the same general rules as WPX. These are the WPNX Award for Novices only, and the VPX Award for Short-Wave Listener's only.

WPNX: The WPNX Award can be earned by Novices who work 100 different prefixes prior to receiving a higher class license. The application may be submitted after receiving the higher license providing the actual contacts were made as a Novice. Prefixes worked for the WPNX Award may be later used for credit toward the WPX Award.

The rules for the WPNX Award are the same as for WPX except that only 100 prefixes must be confirmed.

VPX: The VPX or Verified Prefixes Award can be earned by s.w.l.'s who possess QSL cards

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Propagation

BY GEORGE JACOBS,* W3ASK

THE present sunspot cycle, which reached its peak value and began to decline during November, 1968, appears to have reached a plateau. For the last six months for which smoothed sunspot numbers are available (April through September, 1969), solar activity remained practically constant between a level of 106-107. This means that solar activity this coming summer may run a little higher than originally anticipated.

Typical summertime propagation conditions are forecast for the h.f. amateur radio bands during June. Optimum frequencies for DX propagation are expected to be somewhat *lower* during most of the daylight hours, and somewhat *higher* during the late afternoon, early evening and nighttime hours, than they were earlier this spring.

Short-skip openings, up to distances of at least 1300 miles, are expected to increase considerably on all h.f. bands as a result of more frequent, more intense and widespread sporadic-E ionization.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1970. Short-skip predictions for June, for distances between 50 and 2300 miles, and from Hawaii and Alaska to the mainland, appeared in last month's column. Instructions for the use of this month's DX Charts may be found directly below the "Last Minute Forecast" which appears at the beginning of this column.

The following is a brief description of propagation conditions expected on each amateur h.f. band during June, 1970. For specific times of DX openings, refer to the Propagation Charts on the following pages. See the "Last Minute Forecast", at the beginning of his column for a forecast of general day-to-day propagation conditions expected during June.

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

LAST MINUTE FORECAST

June 1, through Aug. 15, 1970

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: June 5, 8, 11, 14, 24, 26. July 2, 8, 11.			B-C	C
Normal: June 2, 4, 6-7, 9-10, 12-13, 15, 19-21, 23, 25, 27, 30. July 1, 3-7, 9-10, 12, 15.	A-B	B-C	C-D	D-E
Below Normal: June 1, 3, 16, 18, 22, 28-29. July 13-14.	C	D	D	E
Disturbed: June 17.	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 June 15, 1970 through Aug. 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.

10 Meters: A sharp seasonal decrease is expected in DX propagation conditions on this band during June and the summer months. While considerably fewer openings are expected, some fairly good ones still should be possible to southern and tropical areas during most of the daylight hours. Frequent short-skip openings, between distances of approxi-

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mately 750 and 1400 miles, are expected during June.

15 Meters: This should be the optimum band for DX openings during much of the late afternoon and early evening hours. Good-to-excellent DX openings are forecast to most areas of the world during the daylight hours, with excellent openings expected to tropical and southern regions well into the evening hours as well. Numerous and widespread short-skip openings, over distances between approximately 600 and 2300 miles are forecast from shortly after sunrise, through the hours of daylight, and into the early evening hours.

20 Meters: The band is expected to remain open to one DX area or another practically around-the-clock during June. It should be the best band for DX openings during the early evening hours, and through the hours of darkness and the sunrise period. Exceptionally high signal levels are expected during periods of optimum conditions. Numerous and widespread short-skip openings are expected over distances ranging between 350 and 2300 miles. During the late afternoon and early evening hours propagation conditions should be optimum for both short-skip and DX openings, resulting in an exceptionally high level of interference.

40 Meters: DX conditions on this band are expected to decline during June because of a seasonally high noise level, and the fewer hours of darkness in the northern hemisphere. Some fairly good openings, however, should be possible to many areas of the world during the hours of darkness and the sunset and sunrise periods. Excellent daytime short-skip openings are forecast for distances between 150 and 750 miles, with nighttime openings extending out to the short-skip limit of approximately 2300 miles.

80 Meters: High static levels and few hours of darkness are also expected to restrict DX openings on this band during June, but some fairly good ones should be possible to some areas of the world during the hours of darkness and the sunrise period. Excellent short-skip openings are forecast during the daylight hours over distances ranging between 50 and 250 miles. During the hours of darkness, the short-skip range should extend out to approximately 2300 miles.

160 Meters: Intense solar absorption during June will prevent ionospheric reflection during most of the daylight hours, with openings limited to a groundwave range of generally less than 50 miles. After sunset, short-skip openings should be possible up to approximately 1200 miles. Occasional openings beyond this range may be possible on some nights, during periods of lower than usual static levels. What little chance there is for a DX opening during June, should take place during the hours of darkness and the sunrise period.

V.h.f. Ionospheric Openings

June is generally a good month for v.h.f. ionospheric openings. A sharp seasonal increase in sporadic-E ionization is expected during the month, which should result in some fairly frequent 6 meter short-skip openings over a range of 1000 to 1400 miles. During periods of widespread ionization, two-hop 6 meter openings may occasionally be possible up to distances of approximately 2300 miles. An occasional 2 meter short-skip opening, between approximately 1200-1400 miles, may also be possible during periods of intense sporadic-E ionization. Short-skip openings are most likely to occur between 9 A.M. and 1 P.M., and again between 5 P.M. and 9 P.M. local standard time, although they can take place at all other times as well Refer to "V.H.F. Ionospheric Propagation", appearing in the November, 1969 issue of *CQ* (page 37), for a do-it-yourself method for predicting v.h.f. sporadic-E short-skip openings.

Trans-equatorial (TE) scatter openings are expected to fall off considerably during June, but an occasional one might be possible between 8 and 11 P.M., local standard time, on long north-south paths which cross the geomagnetic equator at approximately right angles. TE openings favor locations in the southern region of the USA, with openings unlikely during June into more northerly areas.

No major meteor showers are forecast for June, and very little auroral activity is expected. Check the "Last Minute Forecast", since whatever auroral propagation may be possible during June is most likely to occur on those days forecast to be below normal or disturbed.

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich has published the definitive monthly mean sunspot numbers for 1969. These are the final numbers that will be entered into the

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record book. Generally, there is little difference between the provisional numbers reported each month and the definitive numbers reported at the end of the year. During 1969, however, some significant differences were noted, for which the Observatory has not as yet given an explanation. The following are the definitive numbers reported, compared with the provisional numbers for 1969.

1969	Definitive	Provisional
Jan.	104.4	104.5
Feb.	120.5	120.9
Mar.	135.8	138.5
Apr.	106.8	105.2
May	120.0	120.0
June	106.0	102.1
July	96.8	87.9
Aug.	98.0	90.9
Sept.	91.3	81.0
Oct.	95.7	89.9
Nov.	93.5	87.8
Dec.	97.9	93.8

The higher definitive values for the last seven months of 1969 result in somewhat higher smoothed sunspot numbers than had been reported previously. The following are the latest values of 12-month running smoothed sunspot numbers based on the 1969 definitive monthly values.

1969	
Jan.	110.0
Feb.	109.6
Mar.	108.0
Apr.	106.4
May	106.2
June	106.0
July	106.0
Aug.	106.9

A monthly mean sunspot number of 102 is reported for March, 1970. This results in a smoothed sunspot number of 106, centered on September, 1969.

A smoothed sunspot number of 94 is forecast for June, 1970.

Propagation Book

I am often asked to recommend a good text book on h.f. radio propagation. One that discusses theory in a relatively simple manner, and one that tells how to use propagation data for predicting band openings. In the past my recommendation has usually been Stanley Leinwoll's excellent soft-covered book entitled "Shortwave Propagation". I have recently been informed, however, that this publication is now almost completely sold out and will not be reprinted. I suggest that readers of this column try to obtain copies at their local bookstores or through amateur radio outlets, before the book goes out of print. It will probably be several years before another text of this quality will be available. The book is published by John F. Rider Publishers, Inc., New York and sells for $3.90.

If you have difficulty locating a copy, I have several available. Send a check for $3.90 to my home QTH at 11307 Clara Street, Silver Spring, Md. 20902, and I'll send one off postpaid.

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

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

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

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

CENTRAL USA TO:

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

[*Continued on page 84*]

See page 102 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

June	5-8	CHC/FHC/HTH QSO Party
June	13-14	ARRL VHF QSO Party
June	13-14	Oregon QSO Party
June	13-15	New York State QSO Party
June	14-20	Massachusetts Radio Week
June	20-21	Bermuda Phone Contest
June	27-28	ARRL Field Day
June	28	WAB VHF Phone Contest
July	4-5	Venezuela Contest
July	18-19	Colombia Contest
July	18-19	Bermuda C.W. Contest
July	25-26	County Hunters C.W. Party
Aug.	1-2	Romania Contest
Aug.	8-9	DARC WAE C.W. Contest
Aug.	8-9	Ohio QSO Party
Aug.	29-30	All Asian Contest
Sept.	12-13	DARC WAE Phone Contest
Oct.	10-11	RSGB 28 mc Phone
Oct.	17-18	Boy Scouts "Jamboree"
Oct.	21-23	YL C.W. Anniv. Party
Oct.	**24-25**	**CQ WW DX Phone Contest**
Oct.	24-25	RSGB 7 mc C.W. Contest
Nov.	4-5	YL Phone Anniv. Party
Nov.	7-8	RSGB 7 mc Phone Contest
Nov.	8	OK DX Contest
Nov.	**28-29**	**CQ WW DX C.W. Contest**

Oregon QSO Party

Starts: 2000 GMT Saturday, June 13
Ends: 2400 GMT Sunday, June 14

This year's QSO party is sponsored by the Portland A.R.C. There are no time or power limits, and the same station may be worked on different bands and modes for QSO points.

Exchange: QSO nr., RS/RST and QTH. County for Oregon; state, province or country for others.

Scoring: Each completed QSO counts one point, except on 160 or if it's RTTY, then it's worth 5 points. Oregon stations multiply QSO points by the number of states, provinces and countries worked. Out-of-state stations will use Oregon counties for their multiplier. (max. of 36)

Frequencies: 1975-2000, 3560, 3900, 7060, 7260, 14060, 14280, 21060, 21400, 28060, 28600.

Awards: Certificates to the high scoring out-of-state single operator stations, and the top three and first multi-op station in Oregon.

Logs go to: Marty Kirk, WA7JMA, 5209 N. Amherst, Portland, Ore. 97203. Mailing deadline is June 30th, include s.a.s.e. for results.

New York State QSO Party

Starts: 1700 GMT Saturday, June 13
Ends: 0100 GMT Monday, June 15

This party is again being sponsored by the South Shore A.W.S. Use all bands and modes and the same station may be worked on each band and mode for QSO points.

Exchange: QSO nr., RS/RST and QTH. County for N.Y. stations; state, VE provinces or country for all others.

Scoring: One point per QSO. N.Y. stations use states, provinces and countries for their multiplier. Out-of-state stations use N.Y. counties. (Max. of 62)

Frequencies: 3560, 3900, 7060, 7225, 14060, 14250, 21060, 21300, 28060, 28600.

Awards: Certificates to the top scorers in each N.Y. county, and each state, VE province and country. (min. eligible score for awards 100 points, 50 for DX including KH6 & KL7)

Mailing deadline July 31st to: Frederick Lobdell, K2VGR, 32 Elmwood St., Valley Stream, N.Y. 11581. Include a large s.a.s.e. if results are desired

Mass. Amateur Radio Week

Starts: 0001 GMT Sunday, June 14
Ends: 2400 GMT Saturday, June 20

This period has been proclaimed as Amateur Radio Week by the Governor of Massachusetts

If you fulfill the following requirements you will earn a Certificate of Recognition signed by the Governor.

1. Mass., work 16 other Mass. stations.
2. New England, 8 Mass. stations.
3. Rest of U.S., 5 Mass. stations

*14 Sherwood Road, Stamford, Conn. 06905.

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4 DX, (inc. KH & KL) 2 Mass. stations.

Use any band or mode and exchange a signal report, your county and state. Indicate date/time and frequency in your report.

Applications must be received no later than July 31st, include a #10 s.a.s.e. and send to: Bill Holliday, WA1EZA, 22 Trudy Terrace, Canton, Mass. 02021.

The Mass. cities and towns contest is being held during the same period.

Exchange: Signal report, city or town, county and state.

Scoring: One point for each Mass. city or town worked. (may only be worked once) Multiply total by Mass. counties worked. (max. of 14)

Awards: Certificates to winners in each state and country. (min. of 10 points)

Entries must be received by July 31st and go to: Warren Baker, W1DFR, 66 Redford Street, Mattapan, Mass. 02126.

Bermuda Contest

Phone: June 20-21 C.W.: July 18-19
Starts: 0001 GMT Saturday
Ends: 0200 GMT Sunday

This the 11th anniversary of the contest will be commemorated by the inclusion of the United Kingdom in the contest.

Activity therefore will be between the U.S., Canada, U.K. and Bermuda. The W/Ks and VEs can work the U.K. and VP9s only. U.K. stations can work W/Ks, VEs and VP9s only.

Phone and c.w. are separate contests with separate awards, and participation is for single operator stations only.

Exchange: RS/RST report plus the QTH. State for U.S., province for VE, county for the U.K. and Parish for the VP9s.

Scoring: Each completed contact 3 points. The multiplied is determined by the number of Bermuda Parishes worked on each band. (A max. of 9 for each band, 3.5 thru 28 mc)

Awards: A Trophy to the overall winner on each mode. Certificates signed by His Excellency The Governor of Bermuda, to the winners in each call area in the U.S. and Canada, and each U.K. country. (G, GC, GD, GI, GM, GW)

The Trophies will be presented to the winners at the Annual Banquet of the Radio Society of Bermuda to be held on October 22nd. Transportation and accommodations for a week's stay will be provided by the Society.

All contestants must compute their own score and check log for duplications. A signed declaration that rules and regulations have been observed and your name and address in BLOCK LETTERS is also requested. Logs go to Contest Committee, Radio Society of Bermuda, P.O. Box 275, Hamilton, Bermuda, and received no later than August 15th.

Parish abbreviations: DEV, HAM, PAG, PEM, SAN, SMI, SOU, GEO, WAR.

This is the World Telecommunications Day Trophy that will be awarded to the country with the highest average of points of its top ten contestants. The contest took place on May 16th and 17th and was covered in last month's Calendar. Mailing deadline for your log is June 30th. So get those scores in and win this beautiful Trophy for the U.S.A. I'm sure the ARRL will find an appropriate spot to display it.

Venezuela Contest

Starts: 0000 GMT Saturday, July 4
Ends: 2400 GMT Sunday, July 5

This is the annual phone only contest sponsored by the Radio Club Venezolano commemorating the anniversary of Venezuela's independance.

Use all bands 10 thru 80. There are three categories, single operator, both single and all band, and multi-operator, single transmitter and multi-transmitter.

Exchange: The RS report plus a three figure contact number starting with 001.

Scoring: One point per contact, 2 points

See page 102 for New Reader Service

Results WAEDC 1969 Phone Contest

United States

K1HVV	**81510**	W3CRE	13034	**W9EXE**	**15792**
K1THQ	**58596**	WA3HGV	5868	OH1XO	
W1UYU	40651	W3MDJ	646	/W9	4020
WA9NSR		WA3JYV	532	**WAØEMS**	**15876**
/1	37524	**WA4VIY**	**7050**	**WØPAN°**	**5375**
W1DTY	24250	**WA4CCW°**	**6698**	KØEKR	2520
W1DO	22102	WB4EKY	4048	WAØVBV	2500
W1VPY	21555	WA4SVH	3078	WAØUCU	1584
W1ESN	1156	K4MG	1926		
WB2SQN	**77211**	W4WRY	1330	**No. America**	
W2DKM	**58158**	W4KMS	748		
DL7KX		**W5JAW**	**11088**	**KL7MF**	**9310**
/W2	38828	W5LZZ	4128	**KZ5II°**	**4865**
WA2BHJ	20874	W5OJZ	800	**HP1JC**	**22388**
WB2ZGI	13916	W5QNQ	128	CO2DC	1704
W2FCR	10896	**K6AHV**	**37759**	**VP9BK°**	**19635**
W2LEJ	7676	K6SVL	5488	**KP4DCR**	**10710**
W2CP°	**6478**	W6DGH	1575	VE1AIH	1691
WA2YCA	4290	K6SDR	390	**VE3GCO°**	**27984**
W2STM	1568	WB6WHM	351	**VE3KZ**	**14600**
W2CKR	704	W6JPH	242	VE3BRE	2109
WA2DKV	20	K7WWR	208	VE3DNR	153
W3GM	**103269**	**W8HXZ°**	**18816**	VE4ZX	2320
		W8NXF	**5184**	VE5TO	1660
		WA8VRB	1232	VE6GN	1311

BOLD denotes certificate winners. (°) winners using less than 200 watts.

if it's with a YV station.

Multiplier: A multiplier of one for each country, YV call area and USA call area, on each band.

Contacts: *Stations in Americas:* With YV's, other American countries and the world. *Stations in other continents:* With YV's and other American countries only.

Logs: All times in GMT, indicate the multiplier only the first time it is worked and use a separate sheet for each band. Include a summary sheet showing the scoring and your name and address in BLOCK LETTERS.

Awards: A certificate to each station with the following number of contacts. *Americas:* Wih 10 YV's and 10 other countries. *Other continents:* With 5 YV's and 5 other American countries. (s.w.l.'s with 50 different confirmed stations) A remittance of $1.00 or its equivalent in IRC's is requested for each award application. (It's a beautiful certificate)

There are also Trophies and medals for the leaders in each category.

Entries must be postmarked no later than Sept. 1st and they go to: Radio Club Venezolano, Independance Conest, P.O. Box 2285, Caracas, Venezuela.

Colombia Contest

Starts: 0001 GMT Saturday, July 18
Ends: 2359 GMT Sunday, July 19

This is also an annual Independance contest, in this case commemorating Colombia's independance.

Work HK's as well as other DX, using all bands, 10 thru 80 on both c.w. and phone.

Exchange: The conventional RS/RST report plus a progressive 3 figure QSO number starting with 001. The HK's will include their district number in their report.

Scoring: *Stations in the Americas:* 3 points for each HK contact, 1 point for non-HK.

Stations in other continents: 5 points for HK and 1 point for non-HK contacts. The multiplier will consist of the sum of HK district and different countries worked on each band. Final score, total QSO points times the sum of the multiplier from all bands.

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

Awards: Certificates to the top scorers in each category in each country. There are also awards for the continental winners and the world leader.

You are expected to compute your score, check for duplicates and accuracy. Include a summary sheet and your name and address in BLOCK LETTERS.

Mailing deadline is September 30th to: Independance of Colombia Contest, P.O. Box 584, Bogota, Colombia.

Editor's Notes

The basic rules for the "Worked All Britain" contests will be found in the April CALENDAR. They are the same for all their contests.

I finally received the rules for the USSR Phone contest that took place last month. Since the mailing deadline for logs was May 25th, no purpose would be served if they were published now. Basically the rules were the same as those of previous USSR contests.

Ben Lazarus, W2JB

Last month amateur radio and I lost a long time ally and true friend, Ben Lazarus, W2JB. Ben was a dear personal friend with whom I worked professionally until he retired for over 25 years. He was also an original member of the Contest Committee and served actively until recently when he gave up due to failing health. He was well known among the senior organizations, VWA, OOTC and QCWA since his radio activities covered a span of almost 60 years. Only those who knew Ben personally can appreciate what a pleasant, honest and unselfish fellow he was, a gentleman at all times. He will long be remembered for his contribution to amateur radio. The ranks of the pioneers is growing thin. Rest in Peace Ben.

73 for now, Frank, W1WY

See page 102 for New Reader Service

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

Legal Power with Grounded-Grid Amplifiers

A discussion that often comes up among amateur-radio operators is that concerning the maximum-permissible legal-power input with a grounded-grid linear amplifier.

The legal limitation for an amateur transmitter with carrier, whether it be for tuneup, c.w., RTTY or a.m., is 1000 watts plate-input. The FCC regulation regarding the determination of the transmitter input involves the plate-input power to the tube or tubes supplying power to the antenna.

With a grounded-grid amplifier, a portion of the driving power also is transferred to the antenna circuit. Since this power is supplied by the tube or tubes in the exciter, the plate-input power to the exciter must be added to that of a grounded-grid amplifier for determining the power input of the transmitting equipment as set forth above.

For example: In the case of a typical exciter that produces 100 watts of drive with a plate power input of 180 watts, for operation with a carrier the amplifier input would be limited to 820 watts (820 + 180 = 1000 watts) to satisfy the legal restriction.

As for s.s.b. operation, the requirement is that the average plate input during modulation must not exceed 1000 watts as indicated by a plate-voltage meter reading times the plate current indicated at the point to which the plate-current meter kicks on voice peaks (using a meter of a specific time constant or damping factor). Just as with the other modes of operation with a carrier, the average meter reading for the exciter input must be added to those of the amplifier for determining the total input power.

The actual peak power under these conditions will depend on the voice characteristics, the microphone and the frequency response of the transmitter. In some cases the average 1000-watt indication may allow a peak input of only 1800 watts, while in others it may go as high as 2500 watts.

If you're using some form of compression or clipping, whether it be an r.f. or a.f. type or a.l.c., the average reading will tend to go higher, necessitating cranking down the modulation level to satisfy the legal restriction, so you might not gain as much as expected in the way of "talk power" from the use of such expedients.

Tuneup for s.s.b. usually is done with a carrier from the exciter, but unfortunately when this is conducted into an antenna within the legal limitation of 1000 watts total input, the amplifier in many cases will not be properly adjusted for optimum performance with s.s.b. modulation.

It also should be noted that tuneup into an antenna must be done in as brief a time as possible, in order to avoid unnecessary QRM. For this reason and for optimum performance, tuneup preferably should be conducted into a dummy load.

When a dummy load is not available and optimum tuneup for s.s.b. with a high-power linear must be made into an antenna, a satisfactory method for doing so within the legal limits will be found under "Operation and Performance" in the Heath SB-220 Linear Amplifier Review presented elsewhere in this issue. Additional suggestions related to proper tuneup are also given thereat.

Electric Blanket QRM

QUESTION: One of the most annoying things I can think of is the hash from an electric blanket. These are most pleasant things to have on a cold night, but when the XYL takes an afternoon nap, the noise from her blanket in my receiver is fierce. It affects all the bands (10-80 meters) and I presume it affects the entire spectrum. Any ideas on a remedy?

ANSWER: In respect to the electric-blanket QRM, this is caused by sparking at the contacts on the internal thermostat of the blanket. A defective thermostat usually will produce an almost continuous arcing; whereas a good thermostat will make and break contact only intermittently as the need calls for more or less heat.

If your problem involves a continuous clatter, which seems to be the case, the thermostat most likely is defective. This would call for a new blanket or one of a different manufacture.

*Technical Director, *CQ*.

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Outside of this you might try using a brute-force line filter at the 117-volt service outlet. If this alone does not provide a satisfactory solution, add a braided shield over the line cord and ground it, but be sure to cover it with a protective insulation such as Scotch electrical tape.

Heath HG-10B V.F.O. on 3.2 mc

QUESTION: I have a Heath HG-10B v.f.o. that "defies" modification for MARS frequency coverage. I am trying to modify the 80-meter circuit so that it will go down to 3.2 mc. I added capacitors "here and there" and finally got it down to 3.2 mc, but the output was too low to drive my DX-60 and it was not stable. I then tried additional capacitors with an extra inductor in series with the same unsatisfactory result. The best I can figure is that not only do I need a resonant circuit at 3.2 mc, but the L/C ratio also has to be some critical amount. What do you suggest?

ANSWER: Referring to fig. 1, one of the changes you made (according to an attached diagram) was the addition of 200 mmf across C_3-C_4. This reduces the circuit impedance to where there is insufficient coupling at the series-tuning capacitor. Low output or instability can then be the result.

By adding 47 mmf (zero-temperature coefficient) across the tuning capacitor or the trimmer capacitor for the 3.5 mc band, the v.f.o. will tune from 3.2 to 3.5 mc with good stability and no loss of output; in fact, the output at 3.2 mc will increase by about 25% over the normal amount.

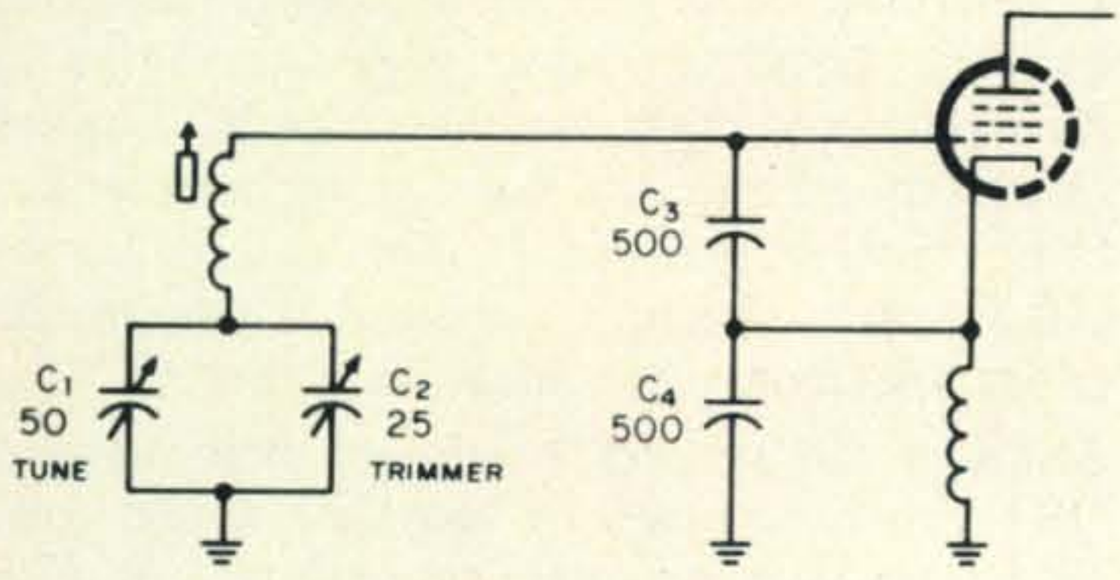

Fig. 1—Simplified tuned circuitry used in the Heathkit HG-10B V.F.O. Getting the unit to function on 3.2 mc (using the 80-meter band) by resonating the tuned circuit with additional capacitance from grid to ground results in low output and instability, because the circuit impedance is then lowered to the point where insufficient coupling is obtained at C_1-C_2. To do the job satisfactorily, 47 mmf should be added across C_3 instead.

This, of course, will alter the normal coverage of the 3.5 mc range, but you can mount a small ceramic switch on the rear apron to cut the new capacitor in or out and thus maintain the desired coverage in each case.

Source of Noise QRN

QUESTION: I have been receiving heavy QRN on my transceiver. Since I got a beam, I have found that the noise comes from the northeast. What is causing it and what can be done about it?

ANSWER: Since the source of the noise evidently is from the northeast as indicated by the beam antenna, it may be due to various factors in the N.E. area, such as machinery or other electrical apparatus in a factory, appliances in a home particularly those with a defective thermostat, neon signs, powerlines or defective pole transformers.

If the trouble appears to be caused by power lines, contact your local power company. If it appears to be from one of the other sources, contact the persons involved toward finding a solution which may involve repairing of defective equipment, installing anti-noise measures such as line filters, etc. If this fails or if cooperation is not forthcoming, send a complaint to the FCC.

Toroid Winding Data for Deluxe 40673 Converter

QUESTION: Regarding the article "Deluxe 40673 Converter" in February 1970 *CQ*, page 46, please furnish data on the core dimensions and frequency range used at T_1; also the wire size used. I should like to substitute an Ami-Tron Associates core if possible.

ANSWER: The data for the toriod inductor used in the 40673 Converter is as follows:

T_1—30 mc toroid, 12" o.d., 5/16" i.d., 18 turns #26 enamel wire continuous winding with taps at 3rd and 7th turns.

The tap numbers are indicated at the schematic diagram, fig. 1 in the article. As for the core. The Ami-Tron Associates type SF will do the job.

Appeals

We have a request for a manual on the LaVoie Model LA-19 oscilloscope. Any reader able to oblige, please contact Phil Hensley, WA9OYO, 218 E. Sheridan Place, Lake Bluff, Illinois 60044.

Another appeal is from Forst Wilson,

[*Continued on page 88*]

See page 102 for New Reader Service

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE June, "Story of The Month" is about George R. Caron, W1EQ.

George R. Caron, W1EQ

Born in Rhode Island in 1899, George moved to his present QTH (Danielson, Conn.) in 1900 where he has continued to maintain residence.

George became interested in radio in September 1912, when he and two other boys bicycled to a neighboring town to see some wireless equipment operated in a telegraph office. Shortly thereafter the three built spark transmitters and diligently practiced the code. Little was known about licensing requirements, in those days, so most signed their initials. As money was scarce, their equipment was rather crude. The Electro Importing Company was their source of galena, molybdenite, phones and such things.

All haming ceased when WW1 broke out and it was about six years before George got back on the air with his first license about 1921.

An interest in motorcycle racing pushed ham radio into the background for awhile.

In 1927 George and "Wink" were married and now have two children, yes a girl and a boy now 40 and 39; and seven grandchildren.

Most of his life was spent in the textile industry, having started in it right after finishing high school in 1916. Later he attended the Rhode Island School of Design to specialize in the spinning end of the business. He learned to operate all machinery associated with the cotton textile industry and took part in extensive modernization programs.

In 1958 a transfer to Lewiston, Maine kept George busy there until 1962. Three days after the completion of the liquidation of the Continental Mills, he was in Boca Raton, Florida opening an office for his company who decided to develope a large tract of land, formerly a Zoo known as Africa, U.S.A., into a beautiful residential section. This kept him busy for five and one-half years and in 1966 George again returned to the home in Danielson which he had retained throughout the years.

Upon retirement, an interest was developed in the USA-CA Program and he immediately started checking his collection of about 40 years of QSL's to see if they covered 500 countries. It was quite a shock to find only a few over the 300 mark, so some time was spent in bringing that total up to the required 500, and that's when the fun started. George had quit chasing DX when his total reached the 309 mark.

Golf is actually the major hobby (starting

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

USA-CA HONOR ROLL

3000

K8BHG	42

2500

WØYLN	69
K8BHG	70

2000

ZL1KG	98
WØYLN	99
K8BHG	100
W6JHV	101

1500

WØYLN	131
K8BHG	132
W6JHV	133

1000

WØYLN	196
K4TBN	197
K8BHG	198
WA6OTV	199

500

W1GOG	775
K7CUY	776
WØYLN	777
UV3GM/UA3KBO	778
WA6OTV	779

FLASH

New Special Honor Roll
All 3079 Counties!
#22–Merle A. Green, W6HVU 3-4-70.
(See STORY/FOTO *CQ* Sept. 69)
#23–George R. Caron, W1EQ 3-23-70.
#24–Lee R. Brooks, Jr., K8BHG 3-25-70.

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W1EQ, April 1, 1934.

W1EQ, 1969.

back in 1926) and it keeps one in good physical condition, and at 70 George is living proof of this. A game he greatly enjoyed was when he met Carl Reed, WØKZZ in Melbourne, Florida, but no one will tell the results of that game, but they are still great friends, so the score could not have been too lopsided.

The rest of this issue of *CQ* could be filled telling about George's many trips and the experiences on them, but he has had the pleasure of visiting Arne, W8DCD; Paul, W4YWX and Jim, WA4AFP plus all those he met in Fayetteville, N.C., including the wonderful hosts, Bill, K4ISE and Andy, K4BXU.

County Hunters who have visited George include, Jack, W9CNG; Al, K5HKG; Eddie, K4LSP; and many of the nearby group, and a nice visit was had with Floyd, K7WQJ when he was in New York City in December.

George feels (as do *many* others) that the County Hunters are the finest group of people in ham radio and he is looking forward to meeting many more July 4th at the Convention in Knoxville, Tenn. He is most anxious to see Roy, WA5OCG who visited him many years ago as a boy, George would also like to thank him in person for the many counties given and especially for Foard to complete Texas.

The rig is still the same KWS1—75A-4 combination that has been in use since 1956, and now the Galaxy GT-550 added for the car.

The equipment shown in use in 1934 consisted of the famous *QST* Tritet Oscillator driving a Raytheon RK28 into a pair of Taylor T155s. Receiver was the old National HRO and the antenna was a Mims Signal Squirter, the first commercially multi-element beam produced for ham use.

Our records show that W1EQ received USA-CA-500-#104 June 26, 1962. December 22, 1967 1000 #122 and 1500 #66 were issued. USA-CA-2000 #58 and 2500 #41 were sent February 19, 1969. He applied for USA-CA-3000 award #32 November 22, 1969 and qualified for the Plaque for All 3079 Counties March 23, 1970, #23.

As this is being written, George and Wink are mobiling to Florida for a few weeks, so it is obvious that we will continue to enjoy having W1EQ and W1EQ/M checking into the NET. May he have many more years of golfing and hamming.

As you can see, March was another big month with three more qualifying for All 3079, #22 for Merle Green, W6HVU; #23 for George Caron, W1EQ; and #24 for Lee Brooks, K8BHG. I am sure there will be at least two more qualifying by the time you read this.

Lee Brooks, K8BHG, who finally caught up on his paper work, also won a Mixed 3000 award, a 2500 award endorsed All Phone, as well as 2000, 1500 and 1000 awards endorsed All 14 mc A3A.

Clyde Stottlemyre, WØYLN (NOT the Yankee pitcher) took time out from mobiling, NCS and also time from his new job with Antennas, Inc. to qualify for USA-CA-2500 Mixed and USA-CA-2000, 1500, 1000, and 500 endorsed All A3A.

Roy Needham, ZL1KG was issued a USA-CA-2000 award endorsed All phone. This is the first 2000 award issued to a station outside of USA and Canada. Through the courtesy of Paul, W4YWX, I hope to feature, Roy in a "Story of The Month" in September *CQ*.

John Nelson, W6JHV won USA-CA-2000 and 1500 awards. John has the reputation of going out of his way (I mean way out) to pass out needed counties and has given several their #3079!

Mike Greenway, K4TBN applied for a

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USA-CA-1000, incidentally Mike has moved around a bit and if you need his QSL he is now at Rt. 2, Box 355, Elberton, Ga. 30635.

Wilber Wilhelm, WA6OTV was issued a Mixed 1000 award and a 500 award endorsed All 14 mc A3A.

Geo Slade, W1GOG in a round about way applied for a USA-CA-500 Mixed award, and Ray McGrath, K7CUY was issued a 500 award endorsed ALL PHONE.

Awards

The K2PFC/2 Award: This award will be issued to anyone for working K2PFC/2 in 50 or more New York Counties. This award on parchment paper issued free for complete list of times and dates of the QSOs plus s.a.s.e. or if you desire the Award mailed flat (not folded) also include 25¢. Apply to Duane H. Harris, K2PFC, 9 Bennett St., Canisteo, N.Y. 14823.

The Capitol Hill Amateur Radio Society W3USS Award: Issued for one QSO with W3USS which operates 10-40 meters using 1 kw on s.s.b. and c.w. The Novice rig is also in operation with appropriate power. All equipment is on loan from the club members. The operating room is in the basement of the Old Senate Office building where over half of the Senators have their offices including the Senate Majority Leader, the Minority Leader, and the President pro tempore. The antennas are atop the building some 120 feet above the ground. Send your QSL and s.a.s.e. (#10, the standard size) to The Capitol Hill Amateur Radio Society, P.O. Box 73, United States Senate, Washington, D.C. 20510.

Notes

A well known mobileer and at least 6 other fixed stations on the NET were cited by the FCC for noncompliance with section 97.87 (A) of the FCC rules and regulations—failure to identify properly as prescribed. And for noncompliance with section 97.63—failure to confine radiated upper sideband inside the authorized amateur band limit. My idea of complying with 97.87 is that every fixed station should identify, at the end of his QSO with the mobile, the mobile and himself, and the mobile at frequent intervals should identify himself and one of the stations he works. Regarding the 97.63 citation, they were measured as being on 14348.5, so they were too close to the edge.

Regarding the QRM complaint item that I hope appears in May *CQ* as well as in the

K2PFC/2 Award.

Independent County Hunter's Newsletter of Bing Miller, WØGV—well further investigation indicates that the "LID" hat belongs on W6KVH and not the County Hunters. Apparently, by accident, we have landed on their phone-patch frequency of 14345, but when they complained and we apologized and moved off, they followed us and refused to accept our apology and actually did some *deliberate* QRMing. Although I am most sympathetic to phone patching for our service men and women overseas, there are other aspects to this, first off, NO ONE owns an amateur frequency, and I have many friends who do these phone-patches, but they use the special frequencies assigned to our Military Services outside the ham bands. Some stations connected with the use of 14345 have been heard bragging how they enjoy chasing the County Hunters off any frequency.

Speaking about Bing Miller, WØGV, I hope someone will quickly continue with the ICH Newsletter that Bing is about to give up.

Sad to report the loss of another friend on March 25th, Ben Lazarus, W2JB. His many friends at WHN, *CQ*, and those all over the world who knew him for his hard work with the *CQ* Contest Logs will miss him and send condolances to his widow, Rose.

How was your month? 73, Ed., W2GT.

W3USS Certificate.

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

THE latest goodie on the surplus scene is the AN/PRC-40, a Navy hand-carried, wide-band (15 kc) frequency modulation transceiver covering 132-152 mc. This set has seen action in Viet Nam, and has gone through at least three modifications, and is now being retired because of a disconcerting habit of exploding mercury batteries. Presumably the surplus crowd will use a more reliable power source than the original batteries, which may blow up due to internal pressure at a critical point in the charge level as exhaustion is approached. The word I get is that by recharging the batteries before they run totally dead, the hazard may be avoided.

Chief Andy Anderson, at NSS, tells me that there are two major configurations of the PRC-40, a hybrid, using subminiature, instant-heater 6526 tubes in the final of the transmitter section, and an all-transistorized, better-shielded version.

Figure 1 is a photo of the unit, which weighs in at about 5 pounds, less batteries. The controls are simplicity itself, and the set is fairly rugged, despite its light construction. The circuit is constructed on printed-circuit boards forming plug-in modules that are easily changed, if one has the spares.

Quite a few PRC-40 sets are turning up in MARS channels, obviously a good place for them, and one excellent matching of surplus material to the proper need. Others will be in civilian surplus dealers' hands, presumably, in a short time.

The specifications include output of one to two watts from the transmitter, giving a nominal range of two miles. Stability is rated at plus or minus .0025 percent over a range of −22 degrees to +140 degrees—obviously better under a more normal temperature range. Sensitivity is 1 microvolt for 20 db quieting.

The antenna is a wire quarter-wave whip, cut to the appropriate frequency, since the RT-507/PRC-40 is a single-channel set.

The receiver has an output of 300 milliwatts, a first intermediate frequency of 8.5 megacycles and a second i.f. of 300 kc for reasonably good selectivity.

Figures 2 and 3 are the receiver and transmitter section schematics of the tube/transistor hybrid model of the set.

The original dry batteries supplied 1.5, 7.5 and 75 volts, d.c., while the all solid state sets used 15 volt mercury batteries.

The transmitter uses phase-modulation, incidently. Third overtone crystals in the 41.1-47-7 mc area are required, using the formula:

$$F = \frac{\text{incoming frequency} - 8.5}{3}$$

where F is the third overtone of the crystal, and all frequencies are in megacycles.

The second converter crystal, Y-202, should be 8200.00 kilocycles.

Most Navy or Marine Corps PRC-40's are pre-set at the factory on 136.56 mc or 150.90 mc. To put one into the amateur 2-meter band, the crystal must be changed, and L1, L2, L3 of module Z-205, and C-1 of Z-206, L1, C5, and C2 of Z-204, C1 of Z-202 and C2 of Z-203 realigned, in the receiver. In the transmitter, C1 and L1 of Z-101 and L1, L2 of Z-104 and L1 of Z-105 require alignment. In addition, the antenna must be re-cut to the proper length. If you have a 150.90 mc set, you'll probably have to replace the whip to

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

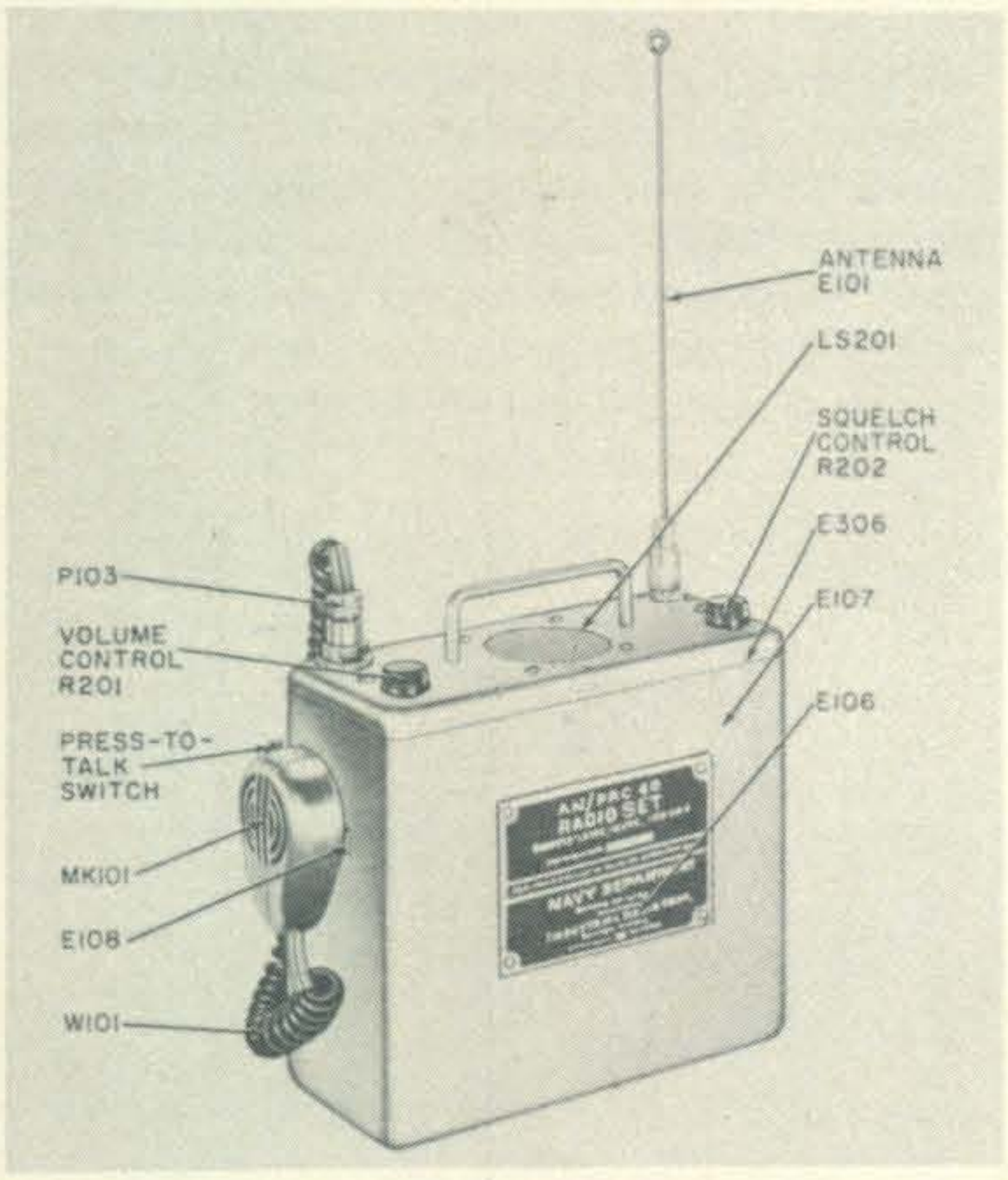

Fig. 1—The AN/PRC-40 transmitter.

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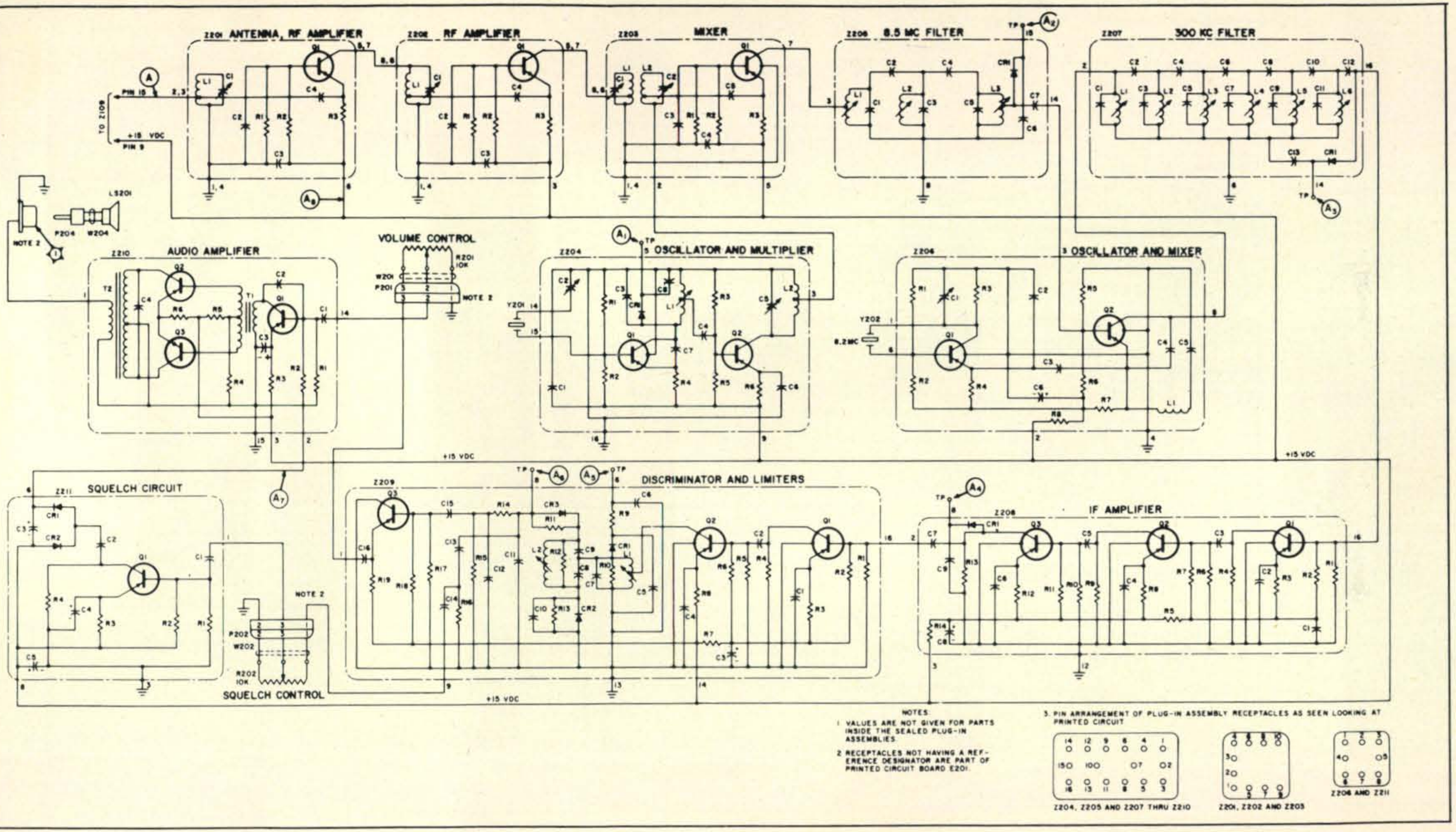

Fig. 2—Receiver portion of the AN/PRC-40.

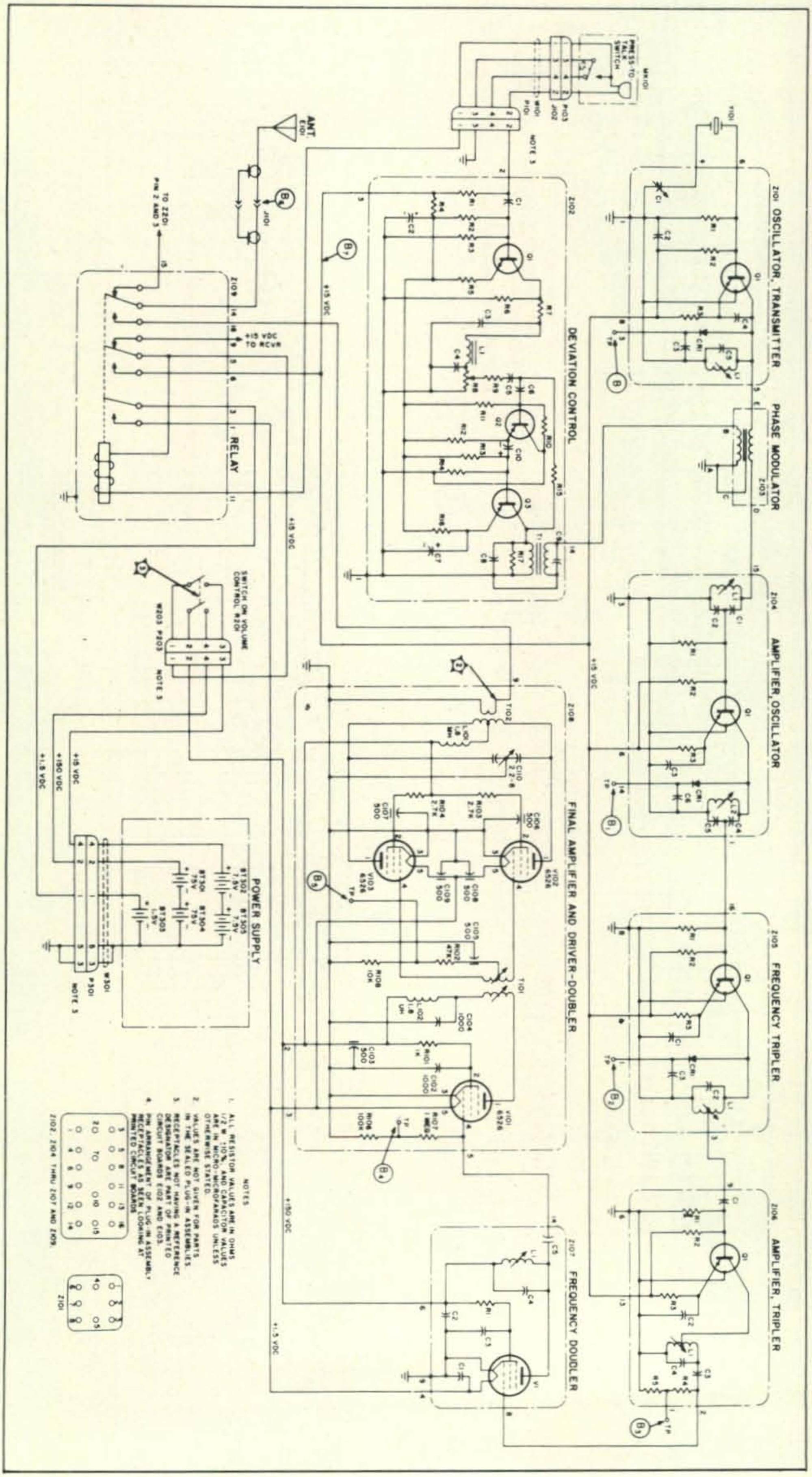

Fig. 3—Transmitter section of the AN/PRC-40.

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get to 2-meters. For a low-frequency set, just cut off the appropriate amount. Including the protective loop at the tip, a 144 mc antenna should measure 19$\frac{8}{64}$ inches and a 148 mc whip 18$\frac{36}{64}$ inches.

That's about it; the manual on the PRC-40 is NavShips 93339. Just remember: don't let the mercury batteries run too far down or you might become the Mad Bomber of your neighborhood.

More On Disposal

The details of that General Accounting Office study of the Military Affilliate Radio System have finally leaked out. G.A.O. looked only at the Fourth Army Area, and the Navy's MARS operation centered on New Orleans. Predictably, the accountants found a lot of non-communications gear being dumped on MARS, some of it the same stuff the Defense Department was buying somewhere else in its gigantic supply system.

One interesting aspect was a tabulation of the stuff that the top surplusers in Fourth Army had acquired. Six members at Fort Sam Houston had piled up in a three-year period, material that cost the U.S. $1,481,063. Apparently it was not all obsolete $50,000 radar sets, either. Even at inflated military prices, a haul of that size could represent 2,100 R-390-A receivers, or more than 1,000 Model 28 Teletype machines. One of the lucky Texas members, G.A.O. said, had gotten material worth $957,000. Another drew 40,000 pounds, valued at $80.000, little of which was apparently accounted for later.

Let me make it plain that I have no grudge against MARS, which is basically an excellent organization. They are no worse than other quasi-military groups that are given fairly casual access to military excess, though the distribution seems to have been spotty, at best. I have had quite a bit of mail on the subject of late, and calls from all over the country, almost all of it favorable, on my expose' of some of the MARS situation. There are obviously far more people who have not been on the gravy train than the number who have been handed their choice of the goodies.

There are other agencies which do the same sort of thing. A Navy electronics chief told me of working with a southern reserve unit that had three new frequency meters stashed away in their supply room at the same time that his ship was unable to draw

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one for operational use through Navy channels. He suggested, he related, that the meters be sent back to the Navy, but the reserve commander said no, "we have 'em and we're keeping them."

In one MARS giveaway I saw not so long ago, an acre of blacktop at Bolling Air Force base was covered with new FM radiotelephont gear for cannibalizing by members, before it was ruined by the weather.

But perhaps the tragedy of the waste that went on in MARS is that the number of members who were allowed to draw so much costly material was a small fraction of the 23,000 amateurs who participate in the volunteer work, and who never got to draw equipment they needed to get stations on the air to actively participate in MARS work. ■

Propagation [*from page 71*]

TIME ZONE. PST (24-Hour Time)

WESTERN USA TO:

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

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

Letters [*from page 9*]

talked myself out of taking the exam by blaming my problems on the League or the FCC or anyone else. Neither have I fallen into a rut, wallowing in my self pity, whimpering like a child who doesn't get his own way. How about some more of you start looking at this incentive licensing like realistic men and women, instead of children.

It is only through our work in the public service, through the self improving effects of incentive licensing and through cooperating and helping one another that we will prove that we deserve our bands once more. Only in this way will we continue to enjoy this fascinating and rewarding hobby which we know as amateur radio.

R. J. Hendrickson, WB2APX
Wildwood Crest, N.J.

C.W. Spotting [*from page 26*]

pushbutton method may be an even more desirable way to go about it even if you don't have the noise-blanker. To put your set back to original condition, just buy a new emblem to replace the one you drilled through and you are ready to trade or sell with no unsightly marks on the front of the set. ■

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Compressor

[*from page 35*]

have to listen to and open the gain control for maximum undisorted audio, then turn the compression control, R_3, to give a comfortable output. I did this using a signal generator and an audio wattmeter for the results given in the first paragraph. The second method is to tune in a weak or normal signal, adjust the gain for a slightly high level and then bring down the output with the compression control. Using this method a 60 db change in input resulted in a 3 db change in output.

Performance

Results on the air completely justify the time put into this little gadget; covering an s.s.b. net, I am able to listen to stations ranging from 500 yards to 200 miles away without touching the volume control. Checks with an oscilloscope show a small amount of phase shift and distortion below 500 cycles which isn't bothersome in a communications receiver anyway, and at a modulating frequency of 1 kc it is necessary to run 0.1 volts r.f. input before distortion shows up. ■

D.C. Meters

[*from page 54*]

the Potentiometer, Using equation (3), calculate the voltage. Other points on the meter scale will be calibrated in the same manner.

Current Measurements

Figure 9 shows the interconnection diagram of equipment for current measurements. The current from the supply is common to a Standard Resistor and the meter to be calibrated. You must choose a value of Standard Resistor that will give you less than 2 volts at the full scale current of the meter. The procedure is simple. Adjust the current through the Standard Resistor and the meter to full scale on the meter. Then measure the voltage drop across the Standard Resistor with the Potentiometer. Using Ohm's Law, the current will be equal to the measured voltage divided by the value of the Standard Resistor used. Again, you can also check other points on the meter in the same way. I will call your attention to a previous article[1] for information on Accuracy, Precision and Circuit Loading. It will be helpful here, I'm sure.

Conclusion

I hope that I have developed interest in a few basic principles of electronics and in

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See page 102 for New Reader Service

their application to calibration of meters, or, in the basic principles of measurement accuracy. I intentionally stayed away from giving constructional details because I did my best to use what was available in my shack/workshop when I built my calibration equipment. Although I don't have daily use for this equipment, it is amazing how many times it is taken off the shelf and used. Although Standard Resistors were explained in terms of current measurements, why not use them to check an ohmmeter? If you enjoy building and experimenting, you can't be without good "measurement equipment" because *"you can't make what you can't measure because you don't know when you've got it made!"* ■

Q & A [*from page 76*]

4160 Lakewood Ave., White Bear Lake, Minnesota 55110. He desires data on inductors (except for 3.5 mc) for the Central Electronics 10B S.S.B. Exciter.

SB-620 Scanalyzer for R.F. Monitoring

QUESTION: How may I convert a Heathkit SB-620 Scanalyzer for use as an r.f. monitor on a transmitter?

ANSWER: Data on converting most oscilloscopes for use as r.f. monitors was given in last month's Column; however, use of the SB-620 for this particular application (r.f. envelope displays) might be impractical due to the high persistence of the c.r.t. screen.

DX [*from page 67*]

showing that they have verified the correct numbers of prefixes as specified in the WPX rules. Applications are handled by WPX Manager, Jerry Hagen, WA6GLD.

S.S.B. DX Award Rules

The *CQ* SSB DX Awards are issued to promote international good will and DX competition among amateurs using 2 way single sideband. *Separate CQ* SSB DX Awards are listed for 100, 200 and 300 countries confirmed.

Applications

1. Applications should be submitted on the official *CQ* SSB Award application form 1067. This form can be obtained by sending a self-addressed stamped envelope to the CQ SSB DX Award Manager.

2. QSL cards must be clearly marked 2 × SSB or SSB and must be listed in alphabetical order by prefix. Claims for 100 countries must be included in the first application.

3. QSL cards must be verified by one of the authorized checkpoints for *CQ* DX Awards or

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must be included with the application. *IF* QSL's are sent directly to the *CQ* SSB Award Manager, sufficient postage for first class return of QSL's to the applicant must be included.

4. Any altered or forged confirmations will result in permanent disqualification of the applicant.

5. Fair play and good sportsmanship in operating are required for all amateurs working towards *CQ* SSB DX Awards. Continued use of poor ethics will result in disqualification of the applicant.

6. A fee of $1.00 or 8 IRC's to defray the cost of the certificate and handling is required for each award.

Country Status

1. The ARRL Country List will constitute the basis for *CQ* SSB DX Award country status. Deleted countries will *not* be valid for the *CQ* SSB DX Award. Once a country has lost its status as a current country, it will automatically be deleted from our records.

2. All contact's must be with licensed land based amateur stations working in authorized amateur bands.

3. Decisions of the *CQ* DX Awards Advisory Committee on *ANY* matter pertaining to the administration of this award shall be fiinal.

CQ SSB DX Honor Roll

1. The Honor Roll will list all stations with a total of 250 countries or more.

2. To remain on the Honor Roll, a station must update his country total annually. Applications for *CQ* SSB DX Awards or the Honor Roll should be submitted to: *CQ* SSB DX Award Manager, Jerry Hagen, WA6GLD, 5031 Arroway Ave., Covina, Calif. 91722.

QSL Information

DL5DY–W/K/VE/VO qsl via W9WCE, 56262 Peppermint Rd., South Bend, Ind. 46619. Others via the bureau.

DX1HM–To VE4OX, 647 Academy Rd., Winnipeg 9, Manitoba, Canada.

ET3USA–c/o VE3IG, 287 Kathleen Ave., Sarnia, Ontario, Canada.

FM7WF–W/K/VE to W4OPM.

HI.9VX (April 2, 1969-March 31, 1970)–Via W4ZXI.

HO11E–To W2CTN.

HO9FC/MM, HP9FC/MM, & HP9FC/VP9–c/o VE1ASJ, P.O. Box 51, St. John, N.B., Canada.

KR6WK (Nov., 1968–May, 1970)–Via WA3-GVQ, Box 105, Jamestown, Pa. 16134

OA4DX (March-May, 1969)–To K4OD, 9304 Hamilton Dr., Fairfax, Va. 22030.

ON Bureau–The Belgian Union of Radio Clubs (UBRC), Post-box 224, Brussels 1000. Belgium handles QSLs for all Belgium amateurs and swls, both members and non-members.

OX3BL–R. Riddel, 2412 South Bowen Rd., Arlington, Tx 76010.

PA9TK–c/o DJ6TK, 5308 Rheinbach, Franz-Schubert Str. 5, Germany.

PJ9JR–Via W3ZKH, 214 Indian Spring Dr., Silver Spring, Md. 20901.

TF2WKF–c.w. qso's to WAØGQI, s.s.b. qso's to TF2WKP.

TY6ATE–c/o W4WHF, 255 Suntan Ave., Sarasota, Fl. (There are reports of someone pirating TY6ATE. There is no WA3 QSL Manager.)

VP2MY–Via W1IXL, RFD 1, Goffstown, N.H. 03045.

ZD5R–To VE4OX, 647 Academy Rd., Winnipeg 9, Manitoba.

ZD8DB–c/o WØEZT, 1640 Syracuse St., Denver, Colo. 80220.

ZD9BP–Via VE1ASJ

4X4AE–To WA2FJW, 501 Harcourt Drive, Elmira, N.Y. 14904.

8P6AY–Not via W4OPM.

8P6CC–Not via W4OPM.

73, John, K4IIF

Amateur Licensing [*from page 50*]

amateur radio magazine.

5. Regular participation in a recognized traffic net.

In the area of operating proficiency the following requirements would be worthy of consideration:

Advanced Class Operating Requirements

(2 out of 3 required)

1. ARRL code proficiency award at 15 w.p.m. or higher.
2. Participate in Sweepstakes making at least 10,000 points.
3. Earn the Worked All States award.

Extra Class Operating Requirements

(No. 1 plus 2 of the other 4)

1. Meet requirements for Advanced Class.
2. ARRL code proficiency award at 20 w.p.m. or higher.
3. Participate in Sweepstakes making at least 50,000 points.
4. Earn WAS on a single band.
5. Earn Brass Pounders League award.

Requirements in the area of enhancing international goodwill could be as follows:

Advanced Class

(3 of 4 required)

1. Earn DX Century Club award.
2. Earn Worked All Continents award.
3. Participate in an ARRL or *CQ* DX contest earning at least 10,000 points.
4. Have QSO's of at least 15 minutes duration with amateurs in at least 10 different countries.

Extra Class

(No. 1 plus 2 of the other 4)

1. Meet requirements for Advanced class.
2. DXCC endorsement to 200 countries or earn *CQ's* WAZ award.
3. Participate in an ARRL or *CQ* DX Contest earning at least 50,000 points.
4. Be QSL Manager for a DX station or participate in group management of an ARRL QSL

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Bureau.

5. Have QSO's of at least 15 minutes duration with amateurs in at least 20 different countries.

We believe that such a system would offer a viable method to significantly improve the overall performance of U.S. amateurs. It offers many attractive side benefits, such as a method of periodically incorporating the changes that occur in all of the areas of amateur radio, providing definitive answers to the critics of the service, and being relative to the basic purposes of its existance. We think that amateurs will support a responsible system and that they would be anxious to assist in its formulation and development. ■

Alfred Vail [*from page 48*]

the first dispatch on the completed telegraph line from Washington to Baltimore.

Alfred Vail was placed in the position of being the assistant and superintendent of the machinery department of the telegraph to be constructed. Smith, who had returned to his home state of Maine, somehow was awarded the contract to install the pipes below ground that would hold the conductors. This was in accord with Morse's earlier concept and patent application. While at a local newspaper office, the *Maine Farmer,* where Smith was now Editor, Smith met Ezra Cornell, who had come seeking publicity for a patent plow he was promoting through the state. Cornell who was later to found Cornell University, like Vail, had a unique mechanical ability and grasp of engineering. Smith saw in Cornell the answer to his question of how to lay the pipe and so immediately hired Cornell to design the equipment which dug the trench, laid the pipe and covered it all in one process. Unfortunately after the machine was completed in August and extensive tests were conducted through October the insulation covering the wires broke down and the underground system was put aside in favor of poles.

Cornell and Vail set up the system of poles that linked the Supreme Court chamber in Washington to the railroad depot on Pratt Street in Baltimore. The familiar glass knob type insulators used on telegraph poles was another of Cornell's contributions. On Friday, May 24, 1844 at 8:45 A.M. Samuel F. B. Morse kept his promise to Annie Ellsworth and sent her message "What hath God whought" some forty miles to Baltimore where it was received by Alfred Vail. The telegraph now was a reality and a key to the future of this country.

The further history of the telegraph, and many of the details that could not possibly be included here, makes unbelievable reading. The double-dealings, the law suits, the out and out chicanery give today's organized crime something to strive for since they couldn't hope to duplicate it.

Conclusion

To say that Morse couldn't have perfected the telegraph alone is speculation. He had some mechanical and scientific training in his schooling. He and his brother, Sidney, had developed a water pump and held a patent on it. His voyage on the *Sully* put him in contact with a fellow passeneger, Dr. Charles T. Jackson who was fully capable of devising a telegraph and held considerable knowledge of electro-magnetism and the Sturgeon magnet. The two men engaged in lengthy conversations throughout the voyage. Perhaps Morse picked his brain, but in any event, Jackson was one of the many who later sued Morse. It is obvious that Morse indeed picked brains and promoted people to his own needs, but he in turn met his match in Smith. Morse and Smith became bitter enemies and fought continually until their death. Due to considerable litagation involving who invented what, and money matters, the unholy partnership stood together behind Morse and faced their adversaries together. Morse took the credit, telling Vail he would make it up to him later on. Alfred Vail died before the patents lapsed and hence I guess Morse never saw the need to give Alfred his recognition after that. Even though they all made money with the idea, I cannot consider Morse as the dynamic force behind a financial complex and the inspiration or model of aggressiveness that Mr. Hood suggests. From the files of letters and notes of all the principals that have been preserved, it seems that more than half are devoted to building up Mr. Morse's ego and trying to push him on. Morse was however very fortunate to come in contact with many people who were talented in one way or another and through a series of coincidences they banded together to bring a telegraph system to fruition.

The closing point, and the idea behind this article is to bring perspective to us as amateurs that we have Alfred Vail to thank or blame for the "Morse code" and the telegraph key. ■

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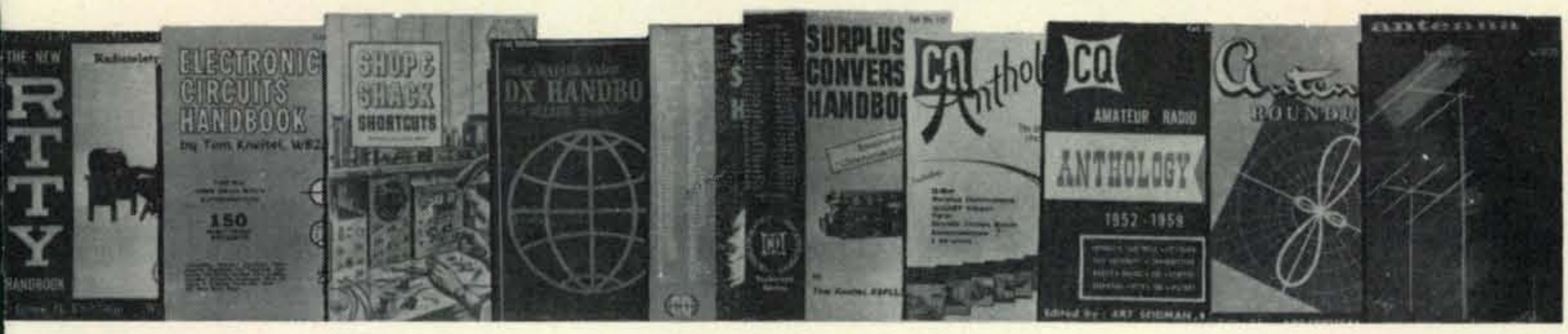

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See page 102 for New Reader Service

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THE GALAXY GT-550 TRANSCEIVER

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FREQUENCY COVERAGE: Crystals supplied for 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 28.0-29.0 mHz. Optional crystals may be installed for other 10 meter coverage. A solid-state VFO operates, without switching, in the range of 5.0-5.5 mHz at all times. Double regulation and temperature compensation makes this VFO extremely stable. An illuminated dial with over 12 inches of linear bandspread. Primary dial calibration marks of 5 kHz. Smooth vernier dial provides 72:1 vernier tuning for ease of operation.

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A MUST FOR EVERY DXER

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SALE: Lafayette HA-350 Receiver with speaker, mint condition; $85.00. R. Brinkerhoff, 120 Newton Street, Fredonia, N. Y. 14063.

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THANKS for Response to Ad. Too many replies to answer. 14AVQ was sold the first day. Will sked anyone needing Mo. for 5 band WAS. W0MXE, Oak Grove, Knob Noster, Mo. 65336.

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WANTED: 50 ft. or above crank-up tower. Br. Gerald Malseed, Calvert Hall College, Towson, Maryland. 21204.

WANTED: Transceiver and P.S. Must be mint condition and fairly priced. Fred Martin, 202 Kenny Street, Fayetteville, New York. 13066.

WANTED: Power Transformer and Manual for Eico Scope Model 470. S. H. Rice, WB8FIL, R. No. 1, Maysville, Kentucky. 41056.

SELL: Lab Instrument. Weston AC Ammeter 0-10 and 0-20. 5 inch square, model 433, Best offer. W2ASI, 15 Kensington Oval, New Rochelle, N. Y. 10805. (914) NE3-7077.

FOR SALE: AMECO BIU SWR Bridge Indicator $15.00; CESCO CB-52-C Ant Test & Power Output, $15.00; Precision E-200 Sig. Gen., $35.00, All F.O.B. R. Wendel, 160-20 Grand Central Pkwy., Jamaica, L. I., N. Y. 11432.

LINEAR: CE600L, Broadband no tune! 6 bands incl. 160M only 20W. drive $190. J. Taylor, W-2OZH, 1257 Wildflower, Webster, N. Y. 14580.

FOR SALE: Teletype Model 15 pageprinter with table Unit is newer version with holding magnets and sync. motor. Very good operating condition. $75.00 or best offer. M. Persson, WA0GYQ, 1724 Fairview Avenue, Cloquet, Minn. 55720.

SELL: Conar Model 400 Novice xmtr, excellent condx, $20. J. G. Swaney, 10403A 46th Ave., Apt. 105, Beltsville, Maryland. 20705.

DIDI—DUM—DUM—DIDI: One of America's great resources is now available. Complimentary issue yours free! SASE to: "Didi-dum-dum-didi," 12040 Redbank Street, Sun Valley, Calif. 91352.

SALE: Regency ATC-1 converter 80-10m-$28.50, Dow Key 12v relay, $6.50, Argus 822-T movie camera, $129.00. F. Strickhausen, 715 Tyler, No. 36, Topeka, Kansas. 66603.

FOR SALE: NCX—5 with power supply and speaker console, $275.00. K4—DXY area code 813-7333225, or write 503 Baywood Drive, South, Dunedin, Florida. 33528.

WANTED: Wireless gear also old radios, tubes, parts, magazines, etc. Circa before 1929. Will pick up. J. Vanicek, 3313 Lowe Avenue, Chicago, Illinois. 60616.

FOR SALE: Gonset 2 meter side winder SSB & A.M. Transceiver, A.C. Supply. All Transistor cept finals. New cond. No activity here. Cost $467.25. Sell: $189.00. Harold D. Mohr, K3ZHZ, 5670-Taylor Rd., Gahanna, Ohio. 43230.

SELL: N—E 14—20At counter with H—P 526A plug-in $250; NEW Marion HM2 elapse time meters. Make offer. Robert Ireland, Pleasant Valley, New York. 12569.

SBE 34. New, Warr. $334.00. WANT 51S1, PR 30, or Measurements 80 Sig. Generator. KWM.2 Needing repair. F. L. Baker, Box 546, McComb, Ohio. 45858.

WANTED: Old Crosley X or XJ battery radio and 1924, 1925, or 1926 list U. S. Broadcast stations. W7KE, 1109 S 2, Hamilton, Mt. 59840.

SELL: S22 R Hallicrafter Sky Rider Marine receiver, Needs repairs, $10.00 FOB. W. C. Holder, 1000 West Alden Avenue, Valdosta, Ga. 31601.

HAM TRANSFORMERS Rewound, Jess Price, W4CLJ, 411 Gunby Avenue, Orlando, Fla. 32801.

BIRD 4 1/2" METER for No. 43 Line Sections, $20; 432 MHz AM Xmtr, $75; Pair 5894 Tubes $5.00 each; Trade list VHF/UHF SASE. W4API, Box 4095, Arlington, Virginia. 22204.

FM, 2 Meter, GE Voice Commander Portable. Xtals for 146.34 T, 146.94 R. $100 plus postage. WA5WGO, 4911 Western, New Orleans, La. 70122.

FOR SALE: Complete NRI FCC First Class Commercial license course, $20 ppd. Sever, 612 Lindy Lane, SW, North Canton, Ohio. 44720.

SELL: Johnson Viking Challenger Xmitter—$45. Lafayette HE30 receiver with HE 56 converter—$50. Krakauer, WB2DKF, 199 S. Allen Street, Albany, New York. 12208.

FOR SALE: SX—130 rcvr & speaker in mint condition. Johnson Messenger 100 CB unit with xtals in mint condx. Best offer takes them. Bruce A. Rahn, WB9ANQ, 1511 East Main St., Little Chute, Wisconsin. 54140.

LOOK—1521A General Radio Graphic Level Recorder, Rack Mount, w/manual, Practically new, only $470. Q. Mushik, Rt. 1, Guys, Tenn. 38339.

WANTED TO BUY: VLF receiver 10—500 kc. W6AKM, 1289 Glen Eyrie Avenue, San Jose, California. 95125.

See page 102 for New Reader Service

FOR SALE: W. E. 1344 (215A), $2.50 each. UV 200 Radiotron. Brass base, $5.00. 301A Cunningham Brass Base, $5.00. WE D86327 $2.50 each. VT2, $5.00. UX120-UX199—CX299—CX220, $1. Ep. All FOB. Douglas, 2254 Pepper, Concord, California. 94520.

MISSIONARY: Needs CCTV camera. Training relig. bcsters. Wes Miller, HB9AOY, Seminary 8803 Ruschlikon, Switzerland.

COLLEGE BOUND: Must sell SX-111, Hammarlund S200 spkr., $140; DX-60A, $65; or best offers. All in excellent condx. Jim McCarthy, WA6PGY, 47 Dapplegray, Rolling Hills, California. 90274.

COLLINS 75S3 in perfect condx. $450. Homebrew Auto-keyer with pwr supply & speaker, $13.50. Hla Oung Ex XZ2AD, 115 Sudden St., Watsonville, California. 95076.

FOR SALE: RTTY, Model 15 KSR, Model 14 TD. Model 14 typing Reperf less KB. All gud cond. All sync motors. R. Sipe, K8SDQ, Bx. 157, Willshire, Ohio. 45898.

FOR SALE: Lampkin 105-B Freq. Meter, $125.00; Lampkin Model 111 PPM Meter, $75.00; Lampkin 205 A Mod. Meter, $150.00 (Quad-scale); TS-497B Sig. Generator, $140.00; RCA Oscilloscope, W)-56A, $60.00. G. Richard Cartledge, K4FGX, Rt. 4, Noble Drive, Abbeville, S. C. 29620.

SALE: TS-352-F, $130; MN-26 DF Receiver Complete, $42; HP 460A Wide Band Amplifier 20kcs-100 mcs, $45; Heath B-1 Balun, $6; Narco VMA-1 VHF Receiver 108-123 mcs, $12. Brown, 45434 North Fig, Lancaster, California. 93534.

WANT: 600L and 50 foot crank-up tower. T. Hoitenga, K8NGV, 26496 W. Six Mile, Detroit, Michigan. 48240.

WANTED: HQ145 (A)X. Need not work. State condition. State price. E. Jeltrup, 27A Lincoln Place, Ossining, New York. 10562.

SWAP: BC-348, LM-10, ARC-5. NEED: G.D.O., Q-Mult., Electronic Switch, Two'er, etc. T. Gosman, 143 Roxton Road, Plainview, N. Y. 11803.

MATCH BOX: Johnson 275 watt with SWR Bridge, Directional Coupler. Handles all popular transceivers. $65.00 or best offer. Howard Hecht, WA1LWD, 96 King Street, Bridgeport, Ct. 06605.

WANTED: Schematic for leader Superotor Control box series SHC 2 B4 control for model 100 Superotor Antenna Rotator. A. M. Gus Goings, WA4CPL, P. O. Box 1195, Tavares, Fla. 32778.

FOR SALE: Factory-sealed 30L-1 516F-2, 15% off. 30L-1 (used), $350-$375. 312B4, $135. 312B-5, $275. Squires-Sanders, SS-1R, SS-IV, SS-1S; factory-reconditioned March, 1970, $550. 302C-3 wattmeter, $70. HRO-50, Model "B" Slicer, ABCD coils, $175. James W. Craig, 29 Sherburne Avenue, Portsmouth, New Hampshire. 03801.

6'er: $25, 6M Conv-$15, BC—645—$15, RCH Rcvr 80kc-25mc, $75, H-P swr meter, $15. Pulse Gen-$25, K2OVS, Jay, (516) 584-7951.

SB—500 2 meter Transverter wired for 10 meter exciter. Aligned and ready to go. $150. W8TXX, Box 1111, Benton Harbor, Michigan. 49022.

FOR SALE: RME 45 Communications Receiver. Has all 5 ham bands, vernier Dial, Xtal Selectivity. Can be adapted for SSB. First $40 takes it and speaker. Write, WB4KVN, Ron Pelrine, P. O. Box 2214, Burlington, North Carolina. 27215.

WANTED: Underwood mill with WU type for copying code. W6BLZ, 528 Colima Street, La Jolla, California. 92037.

WANTED TO TRADE: HW—22 for HW—12. SASE for long list of equipment. H. A. Johnson, 6305 Redbird Terr. Dr., Clinton, Ohio. 44216.

SALE: NEWTRONICS CLIFF DWELLER ANTENNA, Model CD—40—75 & 75 feet control Cable. $75. WA0ILV, Fr. Miller, Clarkson, Nebraska. 68629.

WNTA: SX—96, HQ—100 or similar G. C. Rcvr. Write info. and send to J. Damiano, Det 313 HQ CMD USAF AMT APO N. Y. 09401.

SB—200 FOR SALE. Perfect condition. $190.00. New SPAIR Set Tubes, $20.00. R. C. Vail, 2514 Birch Drive, Richmond, Ind. 47374.

SELL: COAXIAL FITTINGS. BNC. UG—88U, UG—260U, UG—262U 15 cents. UG—290U, 10 cents. Type N. UG—21B/U, 40 cents. UG—27B/U, 55 cents. List of others, SASE. Ken Maas, Burlington, Wisconsin. 53105.

WANTED: H010; Xtal Calibrator, QST, CQ, 73 Binders. Tom Dornbak, 19W167 21st Place, Lombard, Illinois. 60148.

STEAL: Perfect SX—117, HT—44, PS—150—AC; 10 CW Xtals: $350. W3BQN, Rt. 2, Annapolis, Maryland. 21401. (301) 757-2637.

FOR SALE: MP—1 Mobile Power Supply with 351D—2 Mobile Mount, $115.00. 4CX25B NEW, $13.50. John Sypek, 311 Montgomery Street, Chicopee Falls, Mass. 01020.

WANTED: Kodak 35mm slide projector lense. Ektanon 7", f3.5 W2FZE, 1269 Chestnut Street, Roselle, New Jersey. 07203.

CANADIANS: Complete amateur equipment service by fully-equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alta., Canada.

FOR SALE: HQ-170 RX $169.00. HX-500 TX $225.00, NC-57 RX $25.00, 4-1000A linear w6 extra tube & pwr supply, $200.00. Tubes new 2 each 4—400 $75.00, 4—250 $50.00, 4—125A $30.00, 4—65 $20.00, 4x250B w/socket $50.00, Used 4—1000A $50.00, WRL 6 mtr Txcvr $30.00. You pay shipping. James C. Kaufman, W7UMH, 517 Valley Drive, Burns, Oregon. 97720.

CLEANING SHACK: SASE for list of tubes, meters, transformers, misc. Want Capacitor Analyzer, VTVM. W5MWM, 3240 Dartmoor Drive, Dallas, Texas. 75229.

FOR SALE: KWM—2, 312B—4, 516E—1, 516E—2, D—104 AND Crystals for 3.4—30Mcs with ESSCO Factory designed compatible RTTY TU and AFSK unit. $1360 COMPLETE. J. Brink, POB 3734, Fayetteville, North Carolina. 28305.

SALE: BC—1335, BC—1267—A, BC—683, BC—923, BC—924, $20 each. BC—604, BC—659—K, ARC—5, Mod., $10 each; APN—4, $35. W6NHT, 1700 Pine--Martinez, California. 94553.

FOR SALE: HW—32—A SSB Transceivers, $250. W2GJJ, Chris Vinson, 2796 Larkspur Street, Yorktown Heights, N. Y. 10598.

MOTOROLA FMRU1. 150 MC F.M. Rec. W/AC P.S. $15, Elmac PMR-8 Rec. B.C. to 52 MC $45--Hickok 605A Tube Tester, $5. W. J. Davis, 4434 Josie Avenue, Lakewood, California. 90713.

WANTED: Hi or Lo Band Hammarlund Outercom. 60 FM units. Rudolph, 743 Berryville Winchester, Virginia. 22601.

28 KSR Table and Floor Console Cabinet for sale or trade. Need 28 ASR TD Base and Keyboard also 8 level equipment. D. C. Harrington, 1620 Gardenia Avenue, N. E., Fridley, Minn. 55421.

WORKED SOUTH AMERICA CERTIFICATE: Work all 13 countries. Send $1 and confirmation to HCITH, Box 583, Quito, Ecuador, S. America.

SHAWNEE AMATEUR RADIO ASSOCIATION (SARA), Hamfest, August 2, 1970, Herrin City Park, Herrin, Illinois. 62901.

FOR SALE: QST 1946—1967 at 15 cents each. Misc. copies of CQ, 73's and Ham Radio. 15 cents each. Inverter, 6 volts to 115 at 85 watts. $10. E. Wagner, 6307 East Gate Rd., Monona, Wi. 53716.

FOR SALE: KNIGHT T-60 & HUSLER 4-BTV VERTICAL wid one pair of Radios 40—10 mtrs. Pick up deal. $50.00. Great condx! WA9WVJ, Gregory Young, 7527 So. Morgan, Chicago, Illinois. 60620. VI6-0547.

NEED: Gonset G—66 Rec., power supply for G-77 tranx. and manual (will photo-copy and return) for both. Advise price and condition. Ken Wilhelm: Rt. 4, Box 807, Eugene, Oregon. 97405.

SELL: Hallicrafters SR—150, mobile and AC pwr. supplies. mobile rack, and mike. $300/offer. WB-6WJR, 3090—26th Avenue, San Francisco, California. 94132.

3—400Z Linears, several models, $150—$280 available. SASE for details. $1.00 if photos wanted. K8TBW, Rt. 4, Fostoria, Ohio. 44830.

FOR SALE: Johnson Match Box 275 watt with SWR Bridge. Excellent condition. Will handle all popular transceivers. $65 or best offer. Howard Hecht, 96 King Street, Bridgeport, Ct. 06605.

WANTED: CE100V or 200V with factory 160 meter coils. W2CVW, 13 Robert Circle, So. Amboy, New Jersey. 08879.

SELL: 3KVDC 1 amp Solid State Pwr Sup, $85. 4—1000A, $20, Fil Xfmr 7.5 V 21 amp, new 4—250A $10. Lee Nelson, K6BTT, 18822 Chase St., Northridge, California. 91324.

See page 102 for New Reader Service

WANTED: Rescue Squad needs donation of good Lo—Band FM Equipment, such as GE Progress Line both mobiles and base. Ship to: Bill Dunn, Winchester Rescue Squad, Millwood Avenue, Winchester, Virginia. 22601.

NEED: DC power supply for SBE—33. Would like SB2—DCP if possible. Please write: Bill Clearfield, WA0IMY, 2594 South Colorado Blvd., Denver, Colorado. 80222.

WANTED TO TRADE: All construction plans and courses adv. in POP ELECTRONICS. Don Brittons, Howards, Etc. 1 for 1 trade. Joe Wegner, P. O. Box 262, Glendale, Cal. 91209.

DRAKE T4X, Serial 12758 w/o Power Supply, $315.00 or best offer. WA6FJL, 10609 Chaney Ave., Downey, Ca. 90241. PH: (213) 862-3645.

SELL OR TRADE: Lafayette HA—500 and Johnson Challenger for SSB Transceiver or best offer. George Groff, WN2LJO, RD number 2, Pine City, New York. 14871.

FOR SALE: CQ (51—66), QST (47—67) and 73 (61—65) magazines @ 5 cents each, plus shipping. Send list of desired issues and SASE for prompt reply to Lockheed Employees Radio Club, 2814 Empire Avenue, Burbank, California. 91504.

GENEROUS HAMS!!?! Please help new H.S. Radio Club. Need equipment to get on air. WN1MFB, 44 Washington Street, Shrewsbury, Mass. 01545.

ANTENNA SPEC. 2 m. base loaded whip $15.00, Little Giat 20—40 m Beam $20.00 FOB, BC221 T & AC pwr and calibration Book $45.00 FoB. Basham, Cave Junction, Oregon. 97523.

WANT: Used 3 element Tri-Bander; Thunderbird or Jr., TA-33 or Jr. LaVern Smith, 3104 Catherwood, Indianapolis, Indiana. 46226.

FOR SALE: SB101, SB600, HP23A. A-1 condx. $425.00, plus shipping. WA9WEC, 852 W. Hawley, Mundelein, Illinois. 60060.

WANTED: Printed circuit board sketches for IC Frequency Counter in Nov. 1968 73 Magazine. A. Barry, W4GHV, 538 East Samford Avenue, Auburn, Alabama. 36830.

BIRD No. 43 Watt-meter Elements—Wanted to buy —Send list of sizes and price for units in working condition only. C. Simmons, 5024A Idaho, Plattsburgh, New York. 12903.

4CX1000 Linear Amplifier 80—10 with P.S. Will run 2500 volts at 1 amp. $175.00. K7OSK, P. O. Box 248, Colfax, Wn. 99111.

DX-100, complete w/mike, X-tra tubes & VFO. $45. HQ-170, w/clock, spkr, blanket & Tecraft 2-meter conv. 160—2 meters. X-lint. $150. W6-NFW. P. O. Box 61, San Juan, Batista, Ca. 95045.

FOR SALE: Valiant $85. SX-111 $100., and HT-40 $50. All plus shipping. Want to correspond with QRP OPS. WA2APG, 27 Hearle Drive, Pequannock, New Jersey. 07440.

FREE, FREE. Trade your construction plans Adv. in POP ELECTRONICS for another. Don Brittons, Howards, Etc. 1 for 1 trade. Joe Wegner, P. O. Box 262, Glendale, California. 91209.

SELL: NEW ELECTRIC SOLDERING IRONS AMER. BEAUTY 550 w. $7.25; HEXICON 100 W. $2.90. FOB Burlington, Wisconsin. 53-105 Ken Maas. W9AZA.

VK6 BOUND Sell 4 CX300 A linear & power supply components incl. Eimac, Jennings, Etc.... SASE for list. Best offer. K6QGE, 675 South 10th St., San Jose, California. 95112.

TRADE two used 4X250B's with new Eimac sockets & Jennings UCSL 500 for new 4—65A with socket. K6QGE, 675 S. 10th St., San Jose, California. 95112.

SELL: TWO REC. TRANS. RT—159B/URC4 121.5—243.0 MC. WANT PAIR OF 250THs or 4—1000A. WILL TRADE. Bill Wickboldt, 1824 Sims Avenue, St. Paul, Minnesota. 55119.

40 METER BEAM: 2 element, Hy-Gain 402BA. Good condition, $85.00. John Stransky, 1142 Flintlock Road, Diamond Bar, California. 91775. Telephone: (714) 595-0224.

WILL BUY ANYTHING in Ham equipment and parts, Test Gear. If price is right, W4AIS, 300 Thornwood Drive, Taylors, S. C. 29687.

HW-12, HP-23, Xtal Cal. Never mobile, $100.00. T. Hoitenga, K8NGV, 26496 W. Six Mile, Detroit, Michigan. 48240.

MUST SELL: Eico 720/722 VFO and HR-10B/ filter. Mint cond. First $150.00. WA3MUL, 7454 Ruskin Road, Philadelphia, Pennsylvania. 19151.

WANTED: Old Battery operated radios, crystal sets, early wireless equipment made prior to 1926. Need not be in working condition. McKenzie, 1200 West Euclid Avenue, Indianola, Iowa. 50125.

FACTORY WIRED IMW-25 for less than kit price. $69.00. Excellent condition. Cal Enix, W8EN, Bx. 474, White Pigeon, Michigan. 49099.

SX111 $75; HA350, $50; Ranger, $50; DSB 100 w/vfo es ant ry, $50; Gonset Super 6, $20; 1750V/ 1A xfmr, $20; ship collect. VESTER, K6CS, Telephone: (805) 495-7883.

SELL: Collins KWM2 A, with PM2 AC Supply, $850.00; CC2 Carrying Case, $50.00; Complete CP1 Crystal Pack, $240.00. Package, $1100.00. All prices firm; no trades. John Fearon, 3384 Peachtree Rd., N. E., Suite 705, Atlanta, Ga. 30326.

CLEANING HOUSE! Motorola 41V—AC Base on 146.76 mc. ATV Camera & Monitor. 6 Mtr Motorola desk console (BY). Rack mounted twin 75 watt transceivers with C.D.R.'s. Send S.A.S.E. for list. K5VYY/5, 3728 Wilkie Way, Ft. Worth, Texas. 76133.

HANDY-TALKY, $10.00; HT-32, $100.00; Thermofax, $25.00; WANT: SX-73, tunable VHF, telescope. 3-page list, SASE please. WA9DYE, 114 Lakeview, Milwaukee, Wisconsin. 53217.

PENFRIEND WANTED (male or female)--In New Zealand or Australia. All letters will be answered. John D. Ray, A6494, 9 Albion Hill, Loughton Essex, England.

FOR TRADE for light plane. 120' crank-up tower complete Collins S Line, 2000 pep. WA5BMM, J. Lundy, Box 26, Deming, New Mexico. 88030.

FOR SALE OR SWAP: Laboratory Test equipment-garage full: Hewlett Packard UHF Signal Generators, $25.00 each, Oscilloscope-storage-type. 5" screen-Similar to Tecktronix, $250.00, etc. Stereo equipment, casette recorder/playback units, car and home types. Cameras, etc. Send for list. Murray Marcus, 11 Eldridge Street, East Northport, New York. 11731.

MOTOROLA 41V Utility Base (110V AC); 6 mtr and 2 mtr Pocket Receivers, Battery charger; Repeater, Twin 150 mc 75 watt out in 6 Rack; Much more, Send SASE for list. K5YYY, 3728 Wilkie Way, Ft. Worth, Tx. 76133. Tel: (817) 292-5211.

NEED: Gonset G—76 for parts— Any Condition. K3DTL, Art Prutzman, 31 Maplewood Avenue, Dallas, Pennsylvania. 18612.

FOR SALE: Tested and in perfect working order but never used: 1 SB301, 1 SB401, and 1 SB600. $500.00 for complete package and will pay shipping charges in U.S.A. W5MN, P. O. Box 1835, El Dorado, Arkansas. 71730.

FOR SALE: Hallicrafters HT—32A mint, $195.00, Original owner, R. H. Cherrill, W3HQO, 1405 New Rodger Road, Bristol, Pennsylvania. 19007.

SELL: APR—4 rcvr., .038—1GH3, $50; BC 221—AI, $40; Micro—Match SWR meter, $15; RCA VTVM gd; $15. K8AGO, 15030 Bradner Road, Plymouth, Michigan. 48170.

PARTS BOARDS— $2 each. 4 boards, $5. 10 bds., $10, PPD. Send SASE for detailed listing. Ken Morey, 803 West Sixth, Pittsburg, Kansas. 66762.

SELL OR TRADE: Hewlett Packard 560 A Digital Printers, $100. Kintel High Gain DC Amplifiers, Models 112A and 111BF. Make offer. Trammell, 1507 White Oak Ct., Martinsville, Va. 24112.

See page 102 for New Reader Service

WANTED: Hammarlund Model HX—50 with 160 mtrs., in good condition. Peter Turbide, K1VGR, 42 Washington St., Newburyport, Mass. 01950.

BUY/SELL: Pay cash for KWM2 that malfunctions or consider one that works. Collins 51J3 Will trade for 2KW linear or sell. Galaxy V—Mk3 w/ac or w/dc sell or trade. W0BNF, Box 105, Kearney, Nebraska. 68847.

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

GALAXY GT550 & AC400 Supply For Sale. Will consider your gear in trade. W4UHO. R. Leis, 1300 Milton Street, Clearwater, Fla. 33516.

CLEGG 22'er: $145.00. National NCL2000, $395. Both extra clean. Harold Greene, 211 Circuit, Hanover, Mass. 02339. (617) 878-1256.

TO BUY: X-ceiver, 10—80 Mtrs. Drake, Swan, National, Galaxy, TO SELL: Johnson II and VFO, 10—160 Mtrs, $85. Hickock-Sig Gen, $35. Royal Office Typewriter, $35. All in excellent condition. WA9FIW, 1129 North Knight Avenue, Park Ridge, Illinois. 60068.

FREE NOVICE AND GENERAL COURSES Available to LA-area people. Send S.A.S.E. to Lockheed employees Radio Club (2814 Empire Ave., Burbank, California 91504) for Data Sheet & Application.

FOR SALE: BC—939, BC—614E, LS—3, BC—342, 1—107, HQ—129X, BC—457, ARC—5, ART—13, W3FGE, 8—E Southway, Greenbelt, Md. 20770.

SELL: HA—6, HA—2, Plus Power Supplies, mint condition. No shipping. $200 each combination. R. J. Shull, 12349—36 N.E., Seattle, Wn. 98125.

SELL: Complete 6—Meter Station, HA460, 5 El. Beam. Alliance Rotor and Control's plus cables, Mike and Headset. All excellent. Write WB4BYJ, 310 Noel Road, Orange Park, Florida. 32073 or Phone 264-2609. FOB.

WANTED TO BUY: Galaxy V mark 2 or 3 Transceiver or other good transceiver, also NC-183D or Hammarlund HQ-140 or 140X Receiver, in good condition. R. Dorough, W5DPN, 117 Pecan St., Terrell, Texas. 75160.

FOR SALE: Heathkit Mobile Rec. Model HR/20. HP/20 P.S. $75.00 Both. M. Kaplan, 23038 Lanark Street, Canoga Pk., California. 91304.

SELL: German, Grundig 525 line close circuit TV. Complete with Violicon and all cables and 12" Monitor. As well as Synchgenerator, in all 40 tubes. Power supply electronic regulated. Monitor needs some work. Asking $150.00 or swap for mobile station. H. K. Schwill, 723 Plainfield Avenue, Berkeley Hts., N. Y. (201)322-8867.

WORLD RADIO's used gear has trial-guarantee terms! 22'er—$129.95; 66'er—$99.95; 99'er—$69.95; KWM2A—$749.95; 350 late — $289.95;—400 & 420 VFO — $279.95. Free "Blue Book" list for more. 3415 West Broadway, Council Bluffs, Iowa. 51501.

SELL: Two'er $35, Six'er with P.T.T. Mobile 12 VDC only $40, Vocaline Transceiver on 432 $20, 6 mtr DSB Transmitter, $30, 8 mc VFO $20, Larry Jack, 3 Barry Avenue, Bay Ridge, Annapolis, Maryland. 21403.

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

SELL: Hallicrafter SX122 General Coverage Receiver. One year old. Perfect condition. $150. Wright, 222 24th Drive, Cedar Rapids, Iowa. 52403.

QSLS. SECOND TO NONE. Same day service. Samples 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah. 84015.

88 mh Toroids, uncased, 5/$1.50, 255 A relay, $2.30; socket, .75, PP48, E. W. Evans, 220 Mimosa Lane, Paducah, Ky. 42001.

HT.46 OWNERS. I have a brand new HA-16 VOX. Will sell for $17.00. A. Ellis, W8PBO, 45265 Fairchild Road, Mt. Clemens, Michigan. 48043.

WANTED: Davco DR-30, late model, mint condition. Also looking for NCL 2000 linear. Quote price and condition. Bud Fischer, W7IOR, 4163—40 N. E., Oak Harbor, Wn. 98277.

ALLIED A-2515 Solid State amateur receiver, brand new. Original carton, $79.00. H. L. Greene, 211 Circuit St., Hanover, Mass. 02339.

FOR SALE: Gonset G-76. AC & DC Power Supplies. Mint condition. Write to: Henry M. Samplin, P. O. Box 147, Rockaway Pk., N. Y. 11694 or Call: (212) NE 4-1073.

WANTED: ANTIQUE RADIO TUBES, DeForest triode Audion, spherical envelop, Deitzen Midget, Marconi-Osram, Leiben-Riez relay, Margo dollar detector, DeForest "Singer" candelabra base. W9-LHG, 610 Monroe Avenue, River Forest, Illinois. 60305.

EVANSVILLE, IND. HAMFEST, 4H Grounds (Highway 41 North 3 miles) July 12, 1970. Air Conditioned, Swappers/Hams/Families Welcome.

SELL: 75S-3, speaker, manual, spare tubes: $400. KWM-1, power supply, speaker, manual, tubes: $300. 34-24 76th Street, Queens, New York. 11372. Telephone: (212) 639-3195.

SELL: SX100 rcvr; Adventurer xmtr w/xtals and VFO; SWR indicator; 24hr digital clock. SASE for details. K2MFY, 2 Nutley Court, Plainview, New York. 11803.

FOR SALE: DRAKE R4A rcvr recently factory-aligned. Mostly all new tubes. Real red hot. Excellent condition, $275.00. Manual and carton. Doc Ganter, WA4PFE, 375 E. Merritt Ave., Merritt Island, Fla. 32952. PH 1-305-452-4354.

WANTED: Up-to-date roll chart for "Precision" Tube Master, series 10-12 tube tester. WA5QFV, Route No. 2, Box 82, Bowie, Texas.

WANTED: To buy, borrow. TM11—290. G. Jerochim, 3732 SW 99th St., Seattle, Washington, 98126. WA7DDT.

SELL: Heath HW-17 with latest modif. & H.B. Mobile Supply. $120.00. FOB D. J. Platsis, WA6-DBR, 2161 Menzel Pl., Santa Clara, Calif. 95050.

GALAXY MK2: X-ceiver AC400 Supply, Xtal Calib—VOX— 300 cycle filter, Speaker Console-Manual. Original Cartons. Best offer? WA9TLO, Joe, 13 North Grace, North Aurora, Ill. 60542.

FOR SALE: 75 A-4, No. 4856, 2.1, 3.1, 6.0. Very good condition, and very clean. Vernier knob. $350.00 cash, Garry Owen, 3005 Edgewood, Roswell, New Mexico. 88201.

VHF: GONSET III Linear Amp—$50. WANTED: 11 El Telrex 6 m Beam. C. W. Sudds, 3635 Olin Avenue, Omaha, Nebraska. 68105.

NEW: Black Hawk SSB Filters. 2.7 kc selectivity @ 4990 K.C. $8.00 postpaid, including schematic. Glenn Lay, W7ADS, 109 N. Grandview, Yakima, Washington. 98902.

HEATHKIT Mohican Receiver Wanted—For parts—Any condition. K3DTL, Art Prutzman, 31 Maplewood Avenue, Dallas, Pa. 18612.

JOHNSON 6—2 Mtr Converter, 26—30 Mc IF, Built in Pwr Supply, Factory assembled, manual, $35. W2FNZ, 61 Silverside, Little Silver, New Jersey. 07739.

FOR SALE: $30. TRI-BAND THREE EL BEAM-HORNET TB600 — F3VN/W2 Ramsey, New Jersey. 07446. (201) 327-7670.

FOR SALE: Gonset G-76 80 thru 6 mtr xcvr and AC power supply. Vy gd cond. First $125 tkaes it. Jim, W2FEX. Tel: (609) 428-6577.

WANTED: Stereo amplifier and equipment. For sale: TX—1 Heath Apache xmtr. Write: Eugene Gascho, R.R. no. 2, Pigeon, Mich. 48755.

NEW B24 Mini Beam. Never unpacked $45.00. Richard Hennis, 3409 Sevier Drive, No. Little Rock, Arkansas. 72116.

MODEL 15 Page Printer/Base, W2JAV Teleprinter, Stoner Rt-1. A-1. Need Ham 'M' Control unit, Antennas Or. WBHEZ, Downey, California. 90242.

See page 102 for New Reader Service

SELL: TR44 Rotator, control box and cable. $40.00. WB2YRU, Al Povol, 3538 Centerview, Avenue, Wantagh, New York. 11793.

SWAN 500C with 117 x A.C. supply and Vox, $500.00. EICO 717 Electronic Keyer, $45.00. Hammarlund HQ 170c, $150.00. All excellent condition. Drake W—4 Wattmeter new, $43.00. F. Colella, 105-18 131 Street, Richmond Hill, L. I., New York. Phone: (212) 641-2559.

SELL: SB-301/401, TR-3, DC-4, RV-4; Wanted: R4B, T4XB. R. Nevers, 1591 Norwich-N.O. Tpke. Uncasville, Conn. 06382.

GONSET G150 New 2M AM $75, mobile com---- plete SR160 DC pwr, mount w/ant $195; RAO/ NC156 $35; T4X unused $300. Art Ford, 120 Church St., Northport, N. Y. 11768.

SELL—TRADE: QST 65-69, CQ 68-69, Bendix BC 221-M Freq. Meter. Want HR—10, HW—16, or offers. A. M. Fox, Box 895, Greeley, Colorado. 80631.

SELL: QST complete from 1934 plus most issues back to 1930. $100. Cannot ship. W6PNO, 2700 Neilson Way, Santa Monica, California. 90405.

FOR SALE: Sound Meter, H. H. Scott, Model No. 450 incl. 805 Contact Microphone, $95. A. H. Bott 340 South 24th Street, Quincy, Illinois. 62301.

UTC Radio Beam Filter (CW Filt.) $4.75. HV Guitar w/new strings, Microscope—Needs wrk; W/t's. Wat u got? WN4OVR, Star Route, Northport, Alabama. 35476.

WANT: Terminal unit. AN/TGA—1, Also B &W 850 tank, Vacuum variables with drives, W4AIS, 300 Thornwood Drive, Taylors, S. C. 29687.

WANTED: DC-4, 12 Volt Supply for Drake TR-4. Ray Edwards, K11GH, 83 Lovers Lane, East Lyme, Connecticut. 06333.

HAM TV: Interested hams in Northeastern Pennsylvania, contact K3DTL, Art Prutzman, 31 Maplewood Avenue, Dallas, Pa. 18612.

SELL: CQ's from 48, QST's from 45, twenty-five cents, postpaid. Can quote earlier years. Erv Rasmussen, W6YPM, 164 Lowell Street, Redwood City, California. 94062.

GONSET 77A Mobile/Base Transmitter 80-10 AC/ DC Good working order. FIRST $25 takes it. WA2DYP, 123 East 4th Avenue, Johnstown, New York. 12095.

FOR SALE: HT41 Kilowatt amplifier all bands and 2 extra Rectifier Tubes $150.00 or best offer. Also want 80 meter Transceiver and have QST and CQ and 73 magazines for sale. Call or write L. M. Covey, K1JAR, 238 Jenness Street, Lynn, Mass. 01904. Phone: 592-1657 or 745-5464.

HAVE PRECISION TOOLS: Dial Gages shop optics; give away prices or swap transceiver. SASE for list. W2PYB, R. E. Blakely, 72 Rumford St., Depew, New York. 14043.

SELL: Drake 2—B w/2—BQ, Marauder HX—10 Warrior HA—10, Model 19/w/TU, 2 El 3 X Quad, much more misc. SASE for list. WA8QBJ, 6305 Redbird Terr., Clinton, Ohio. 44216.

MOTOROLA PT P33—DDC—111OAR high split mint $300. WA3AAD, Steve Gansky, 1423 Hagysford Road, Narberth, Pennsylvania. 19072.

WANTED TO BUY: Transceiver in good condition priced right. Prefer Galaxy, Swan, Drake or Heath. R. Dorough, W5DPN, 117 Pecan Street, Terrell, Texas. 75160.

SELL: Hallicrafters HT—44, with power supply, perfect condition, $180— You pay shipping--. WA6KGP, 5691 Mt. Acara Dr., San Diego, California. 92111.

HEATH HW—12A w/mike, mint $90. Swan 410 VFO $80 RTTY Model 15 Printer, $75. You ship. Frank Connelly. WA7GWL, Rt. 7, Box 1503, Bremerton, Washington. 98310.

40th ARRL West Gulf Division Convention— July 17, 18, and 19, Orange, Texas. Come by car, plane, or boat, but come to the fun, fellowship and entertainment. A bargain you can't afford to miss. Registration $8.50. Orange Amateur Radio Club, Box 232, Orange, Texas. 77630.

WANT coil sets A, D, E, AC for HRO—50T. Will buy or swap prod. det. module for HRO—50/60. Write John, WN4NNW, 3439 Blackburn, Chamblee, Georgia. 30341.

EARLY VACATION? Then tear up that ticket to Tahiti. There'll be more fun at the ARRL Hudson Division Convention. October 17—18. Hilton Motor Inn, Tarrytown, New York. Exhibits, Lectures, Contests, Gabfests, New York Sightseeing, Fun. QSL Hudson Amateur Radio Council, c/o Larry Strasser, 3591 Bainbridge Avenue, Bronx, N. Y. 10967. No charge for a suntan.

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

160 METER MATCHVERTER resonates any 40 or 80 meter inverted vee/dipole on 160 meters. Handles 250 W PEP. $29.95 Post-Paid. TOP BAND SYSTEMS, Dept. 1, 5349 Abbeyfield, Long Beach, California. 90815.

Beckman 4910 DVM. AC converter, spare chassis. Excellent Beckman demonstrator, Trade for Tektronic scope. Best offer. Several digital frequency counters, parts. Sundtek, 131 Allen Ave., Springfield, Oregon. 97477.

20 A exciter, pair 4 — 125's homebrew linear JT—30 Mic. Asking $200.00, Will ship. WB5AFY, 4108 Bismarck, Vernon, Texas. 76384.

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.

FOR SALE: BC—344 D, 150—1500 KC. BC 342—J, 1.5—18 mc. Both need work. Elmac PS2V, PSR6 Power Supplies, AF—67 65 watt VFO Rig, PMR6 A Rcvr, DX-35, Make offers. Manuel Greco, Atlantic Highlands, N. J. 07716.

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.

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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.

LOUISIANA. SX101A, $189; Navigator, $85; SBE-33, $189; SB2DCP, $40; BC348, $65; Pick up only. Deliver reasonable distance. K5MVN, 113 Woodcrest Circle, New Iberia, La. 70560.

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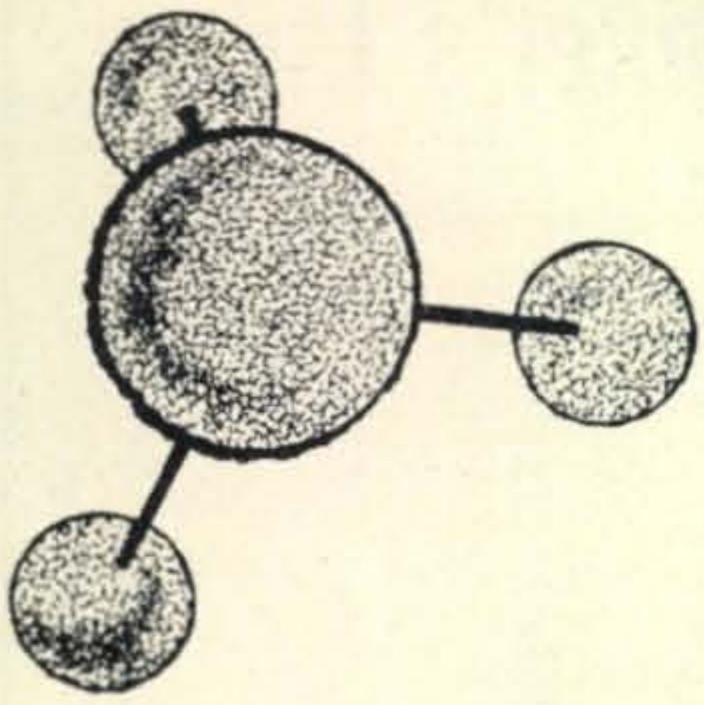

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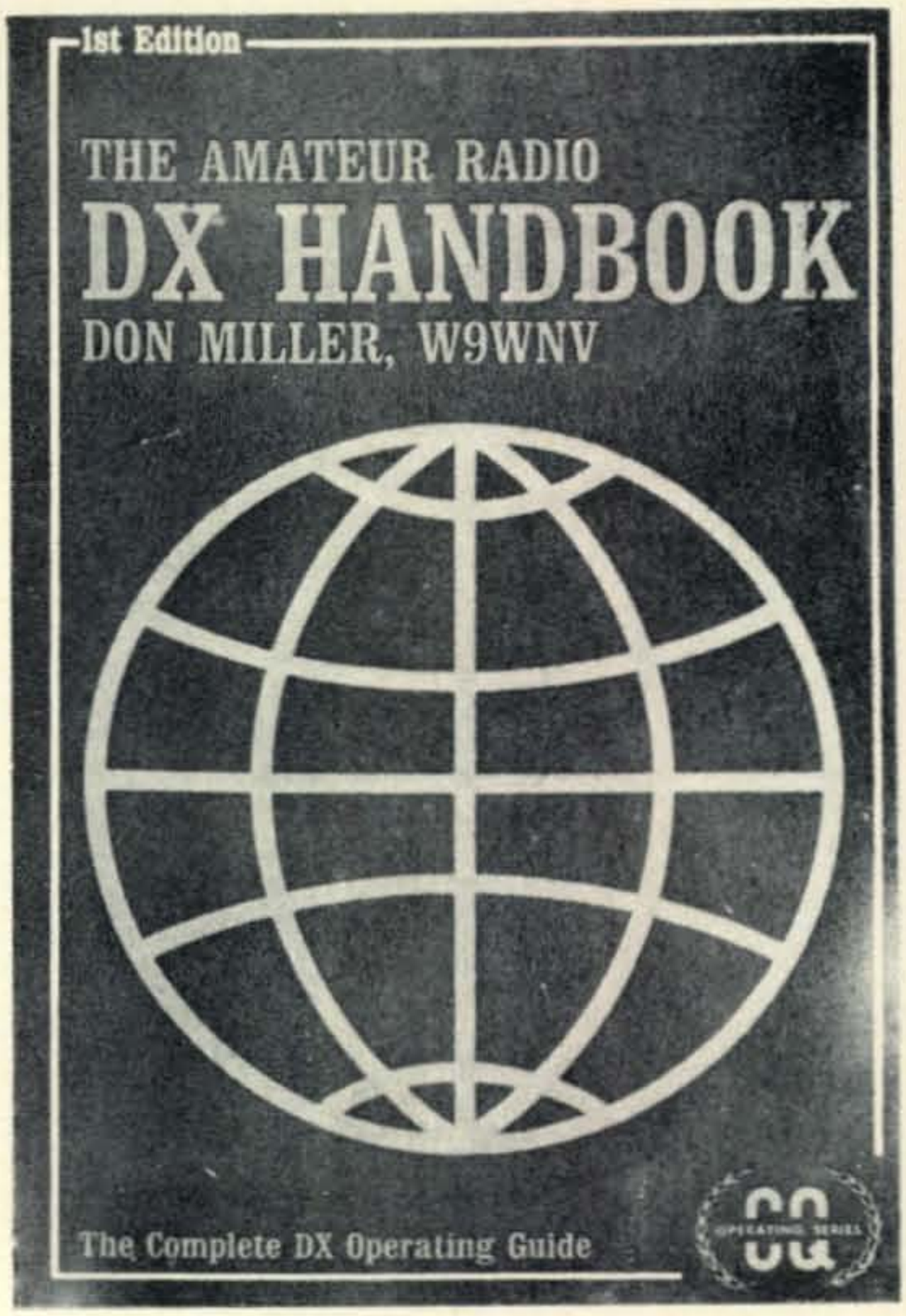

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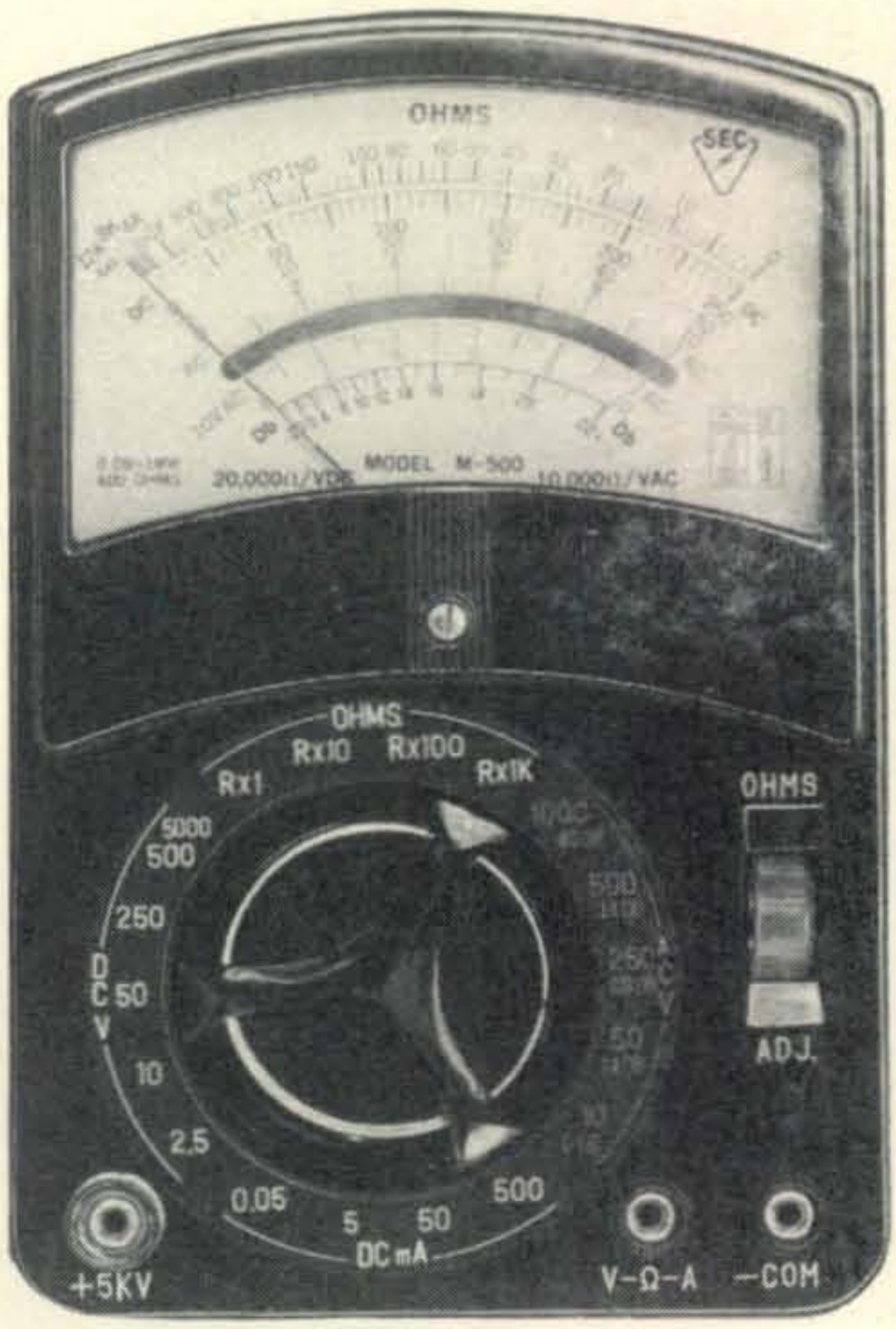
Hams require the 5000 volt DC range and competition even at substantial increases in price do not give this range. Audio buffs will find the 0-40 db scale invaluable. Consider this meter sensitivity - on the low current scale 50 microamperes will fully deflect the needle; just the thing when you want to balance discriminators in FM sets.

Midscale resistance range is 60 ohms so the wide 2 ½" scale permits accurate measurement all the way up to 12 meghoms. Dimensionally the illustration is about full scale 5 5/8" x 3 5/8" x 1 3/4" thick inclusive of rubber feet. Exquisitely crafted with a superb switch and of idiot proof design, the M500 is furnished with batteries and test leads at only $11.00 over the counter or $11.95 postpaid. Tell your boss about this beauty – order today.



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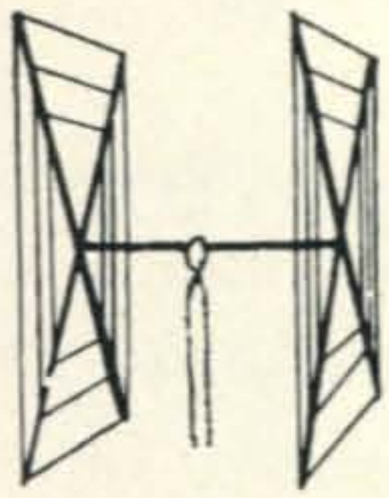
QUADS Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...



W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount: uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.: 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished): 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
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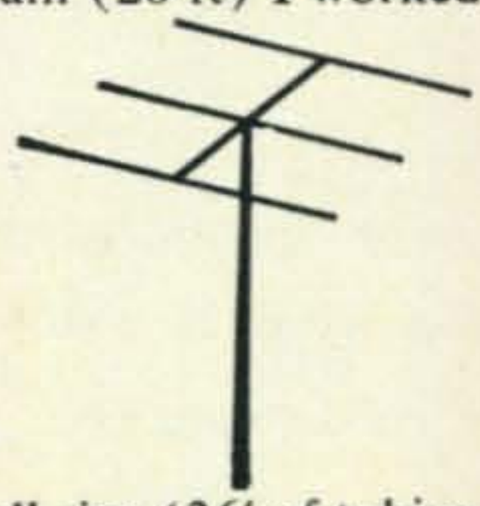
(all use single coax feedline)

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

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3 EL 20	27	7 EL 10	34*
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2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*		
5 EL 15	30*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

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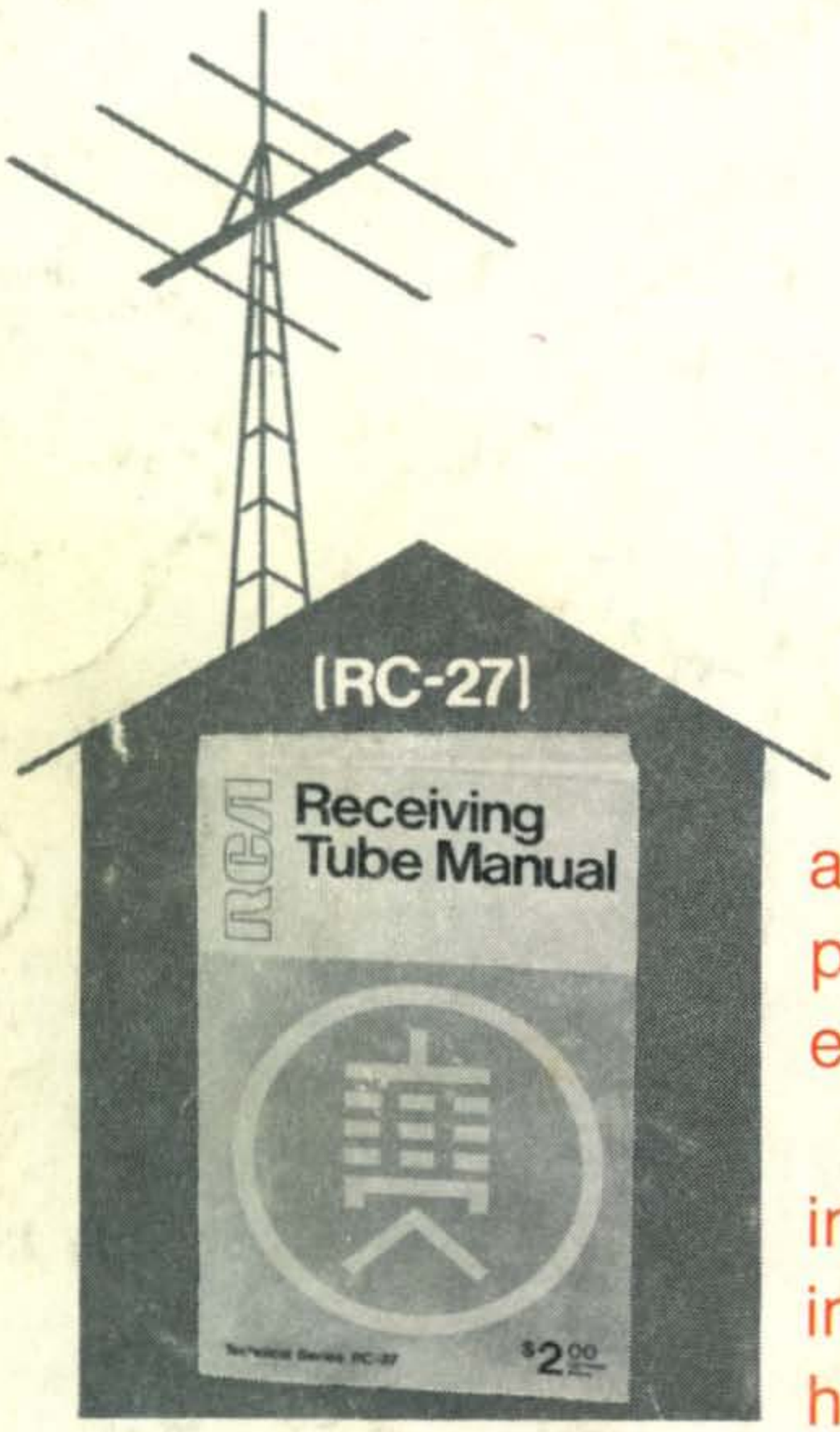

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