CQ

ICD

December 1970

75¢

A Simple Satellite Tracking Antenna System — page 42

The Radio Amateur's Journal

Introducing the New Heathkit® SB-303

the "303"... the new standard of performance in receivers

■ State-of-the-art solid-state circuit using 27 silicon transistors including 4 dual-gate, diode protected MOSFET's, plus 1 IC ■ Heath factory assembled solid-state Linear Master Oscillator for instant warmup, improved stability & more accurate tracking ■ A unique Heath design using 9 modular plug-in circuit boards ■ Receives USB, LSB, AM, CW & RTTY ■ Complete 80-10 M coverage plus 15 MHz WWV for exact calibration ■ 25 kHz & 100 kHz calibration markers ■ Front panel selection of antenna & power connections for up to two VHF converters with rear panel jacks built-in ■ Fast & Slow AGC selectable from front panel ■ Front panel selection of built-in 2.1 kHz SSB crystal filter or optional AM & CW crystal filters ■ Built-in, extremely stable solid-state power supply with circuit breaker protection ■ Speaker and/or headphone selection from front panel ■ Handsome SB-Series styling in a smaller package than the famed SB-301 ■ Easy, enjoyable assembly with the famous Heathkit manual.

The New Heathkit SB-303 . . . another hot performer in the world-famous SB-Series. The "300" and "301" were the choice of thousands because of their obvious performance superiority and value... and the new "303" delivers even more of both.

Advanced Design. A dual-gate MOSFET front end provides greater dynamic range and large signal handling capabilities with low distortion . . . new RF attenuator allows adjustment of receiver sensitivity to copy weak signals without danger of overloading on strong ones. An all solid-state circuit employing the latest in techniques and devices gives instant warmup, 100 Hz stability in 10 minutes and superior tracking. The exclusive Heath solid-state LMO with 1 kHz dial readout is factory assembled and aligned to assure peak performance and provide the smooth, linear tuning that's become a hallmark of all SB-Series gear.

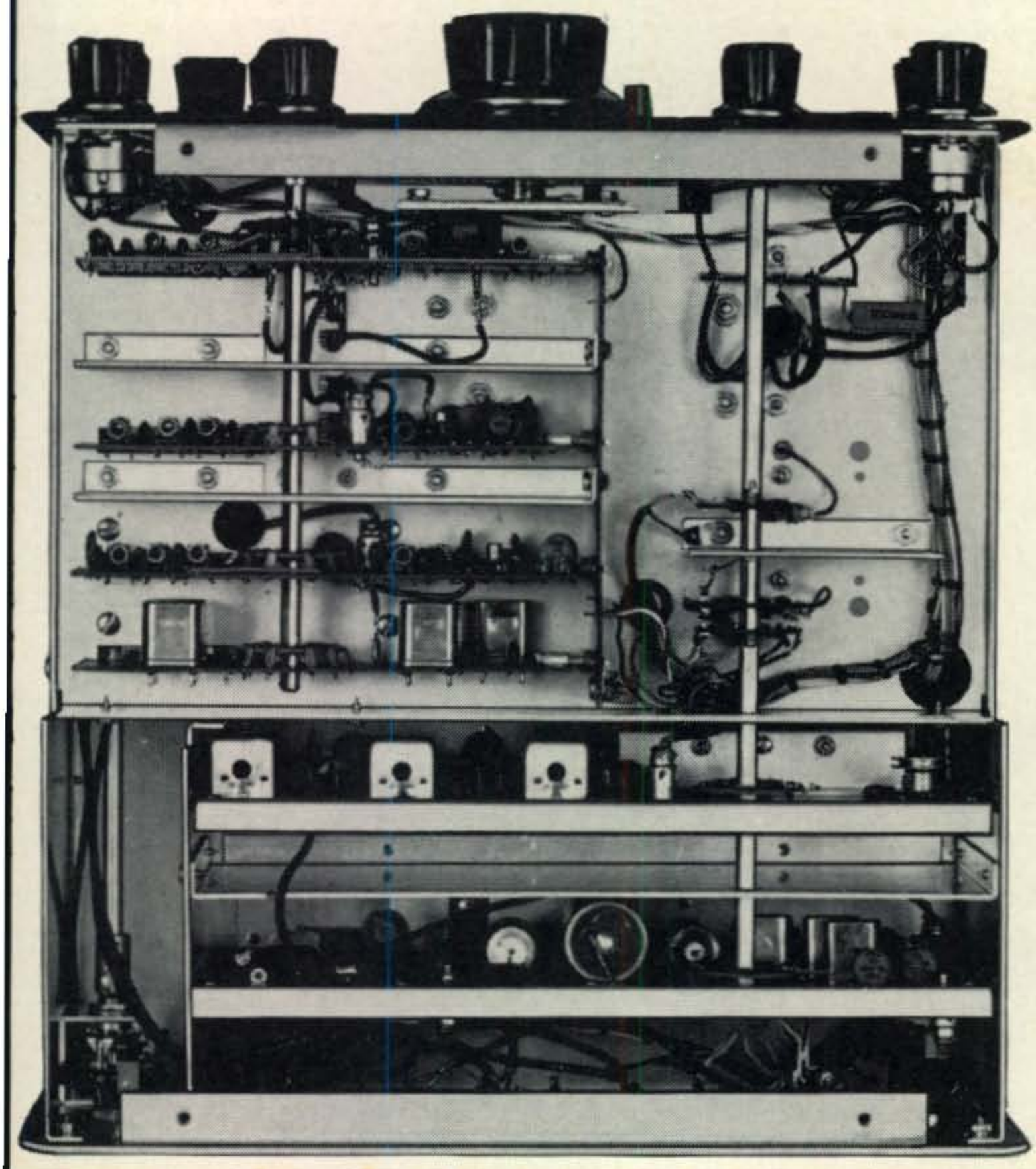
Compare The Performance Features. The new SB-303 offers all the features required for today's operations . . . and they're built-in, not added on later as costly options. The "303" gives complete SSB/CW transceive compatability with the famous "400" or "401". Three position AGC gives the versatility needed for different conditions: Slow limits the amount of background noise present between words and syllables for 5/9 copy . . . Fast position allows scanning large portions of the band without the AGC interruption that slow AGC would cause under this condition. To spot the new subband allocations quickly and simply, just turn the crystal calibrator to the 25 kHz position. Work the high bands? The "303" has antenna & power connections already installed for up to two VHF converters, and front panel switching eliminates cable changing. Spare sockets on the rear panel allow the "303" to be used with a wide range of famous Heath Station Accessories.

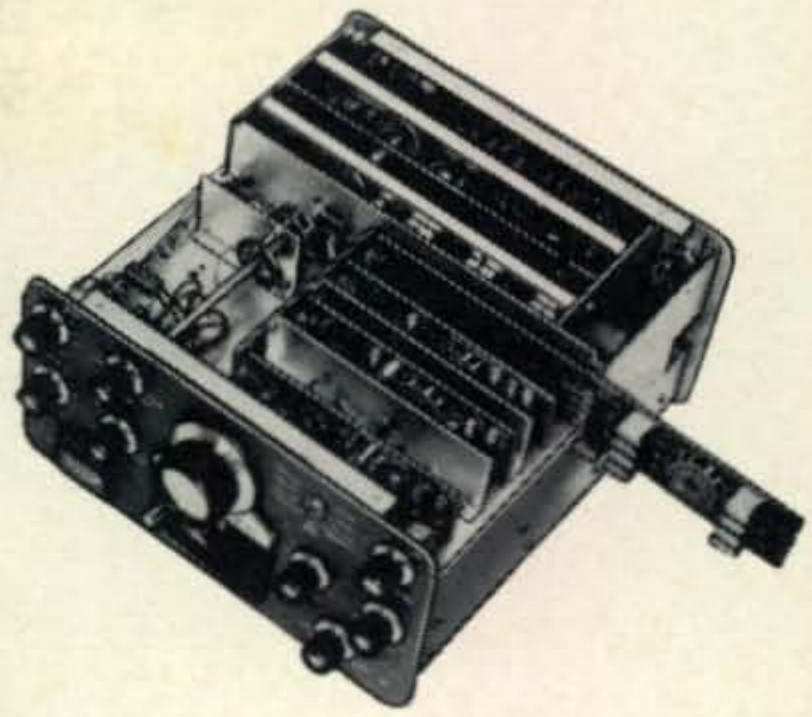
Compare the Specs. Most any receiver will do the job when the bands are hot... but you need good specs when the bands start to go — and the "303" delivers. Sensitivity: less than a quarter of a microvolt for 10 dB S+N/N. Selectivity: 2.1 kHz with the standard SSB crystal filter, and low cost optional filters for CW & AM can be selected from the front panel. Image Rejection: 60 dB or more. IF Rejection: 50 dB or better. Spurious Response . . . Dial Accuracy . . . AGC Characteristics . . . check *all* the specs. You'll see the SB-303 delivers more for a lot less than others.

New Construction Techniques mean faster assembly, less chance for error. Wiring harnesses and nine plug-in circuit boards combine to practically eliminate point-to-point wiring . . . and the special extender boards (see photo opposite) enable you to bring any board out of the compact chassis to check voltage and resistance readings without probing into tight spaces. And, of course, the famous Heath manual guides you a step at a time, with clear, concise instructions and giant fold-out pictorials.

Check Out The New "303". . . send for a free spec sheet and see how other receivers stack up for performance, value & price. Then order your new "303"... another FB piece of gear — from the Hams at Heath, of course.

Solid-State Amateur Receiver... $319.95*





Inside The New "303". When the Hams at Heath design gear, it not only looks good . . . it's easy to work on should you ever have to. Because of the compact design, we've innovated a special technique to make service and adjustment easy — extender boards. These special boards allow you to bring any board out away from the chassis . . . and patchcables supplied mean you can make checks and adjustments while the "303" is operating. Note the liberal use of shielding between circuit boards that contributes to greater stability and more rugged mechanical design.

Kit SB-303, 19 lbs. **$319.95***
SBA-301-1, optional 3.75 kHz AM crystal filter, 1 lb. ..**$20.95***
SBA-301-2, optional 400 Hz CW crystal filter, 1 lb. **$21.95***

SB-303 SPECIFICATIONS: Frequency Range (MHz): 3.5 to 4.0, 7.0 to 7.3, 14.0 to 14.5, 15.0 to 15.3, 21.0 to 21.5, 28.0 to 30. **Intermediate Frequency** (IF): 3.395 MHz. **Frequency Stability:** Less than 100 Hz drift per hour after 10 minutes warmup under normal ambient conditions. Less than 100 Hz drift for ±10% line voltage variation. **Frequency Selection:** Built-in Linear Master Oscillator. **Modes Of Operation:** SSB — Single sideband (suppressed carrier, with selectable upper or lower sideband). CW — Keyed continuous wave. AM — Amplitude modulated continuous wave. RTTY — Radio teletype (frequency-shift keyed continuous wave). **Sensitivity:** Less than 0.25 uV for 10 dB S+N/N for SSB operation. **Overall gain:** Less than 1.5 uV input for 0.5 audio output (single tone SSB). **AGC characteristics:** Blocking — Greater than 3.0 V CW/SSB/RTTY. Dynamic Range — Greater than 150 dB CW/SSB. **RF Attenuator:** Variable 0-40 db. nominal. **Selectivity:** SSB — 2.1 kHz @ 6 dB down, 5.0 kHz maximum at 60 dB down (crystal filter supplied). CW — 400 Hz at 6 dB down, 2.0 kHz maximum at 60 dB down (crystal filter available as an accessory). AM — 3.75 kHz at 6 dB down, 10 kHz maximum at 60 dB down (Crystal filter available as an accessory. RTTY — 2.1 kHz at 6 dB down, 5.0 kHz maximum at 60 dB down (uses SSB crystal filter). **Image rejection:** 60 dB or better. **If Rejection:** 3.395 — greater than 55 dB. 8.595 — greater than 50 dB. **Spurious Response:** All below 1 uV equivalent signal input. **Temperature Range:** 10°C ambient. **Dial Accuracy:** Electrical — Within 400 Hz after calibration at nearest 100 kHz or 25 kHz point. Visual — Within 200 Hz. **Calibration:** Every 100 kHz or 25 kHz. **Dial Backlash:** No more than 50 Hz. **Antenna Input Impedance:** 50 ohm nominal unbalanced. **Audio Response:** SSB — 350 to 2450 Hz nominal at 6 dB. CW (with accessory filter) — 800 to 1200 Hz nominal at 6 dB. AM (with accessory filter) — 200 to 3500 Hz nominal at 6 dB. RTTY — 1840 to 3940 Hz nominal at 6 dB. **Audio Output Impedance:** Matching Speaker — 8 ohm. Matching Headphones — Low impedance. **Audio Output Power:** 4 watts at less than 10% distortion. **Muting:** Open external ground at Mute socket. **Power Requirements:** 105 to 125 or 210 to 250 VAC, 40 watts maximum. **Front Panel Controls:** Main tuning dial; function switch; mode switch; band switch; AGC switch; converter switch; AF gain/power on-off; RF gain/speaker disable; preselector; noise blanker/off-on-threshold. **Circuit Board Controls:** IF/Audio — Bias adjust; meter zero; meter full scale. Power Supply/BFO — + 15 V adjust; 100 kHz adjust. RTTY — Wide Shift; narrow shift; CW shift. **Connections:** Rear Panel — Phones; HF antenna; VHF antenna #1, VHF antenna #2; mute; anti-vox; speaker; HFO out; LMO out; VFO out; CW shift; four spare sockets; 3-wire line cord socket; accessory socket: VHF Converter, + 15 VDC @ 25 mA, switched. RTTY Keyboard. **Cabinet Dimensions:** 12¼" W x 6⅝" H x 13" D. **Overall Dimensions** (with knobs & feet installed): 12¼" W x 7 1/16" H x 14" D. **Net Weight:** 15¾ lbs. **Note:** specifications measured with 120 VAC line voltage at 25°C.

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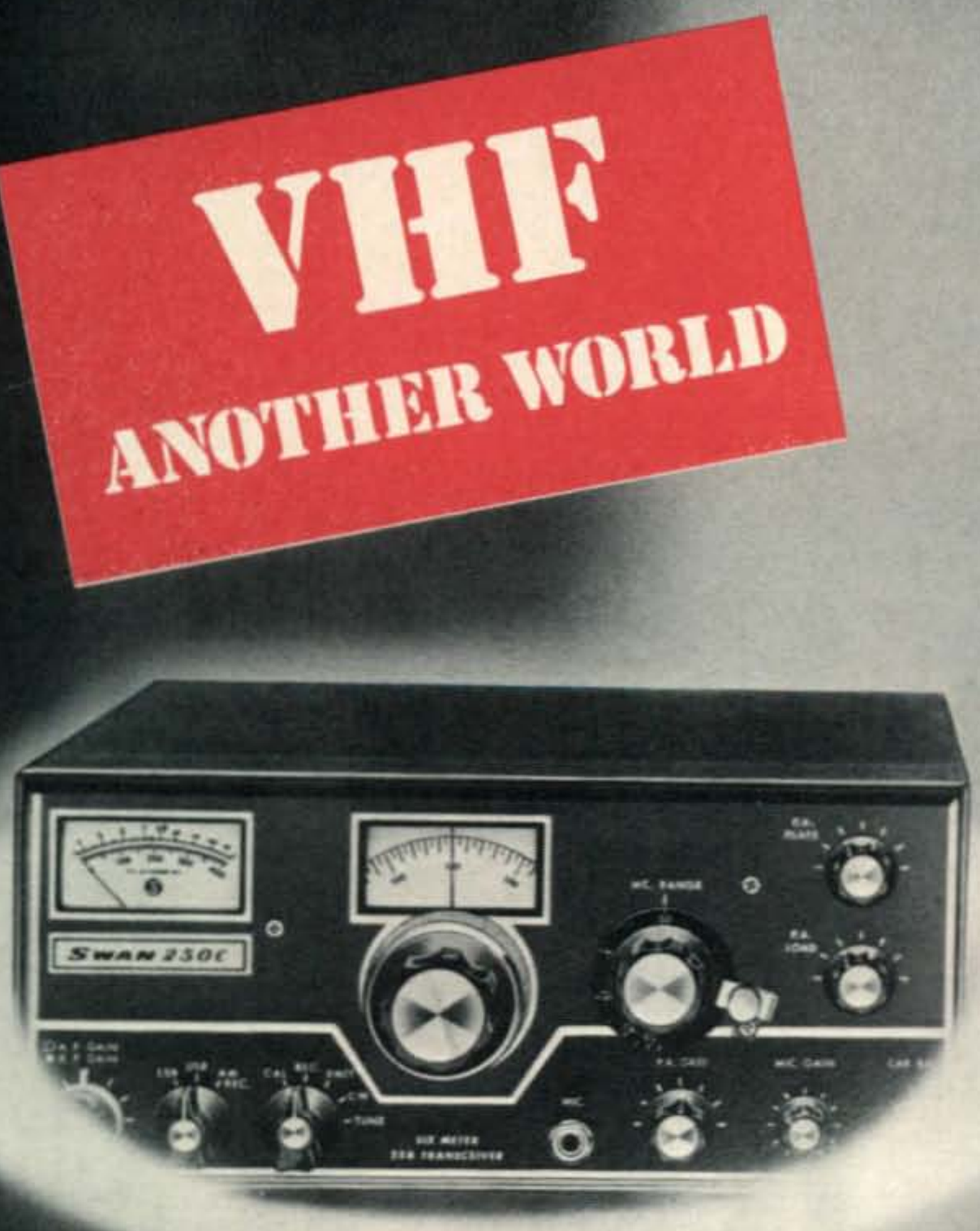

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The outstanding performance of our 250C and its 240 watts of P.E.P., are opening up greater activity and DX in the VHF spectrum. See our Swan 250C . . . it will put you in another world.

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CQ

DECEMBER, 1970 VOL. 26, NO. 11

The Radio Amateur's Journal

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DEPARTMENTS

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FOB Asbury Park, N.J.

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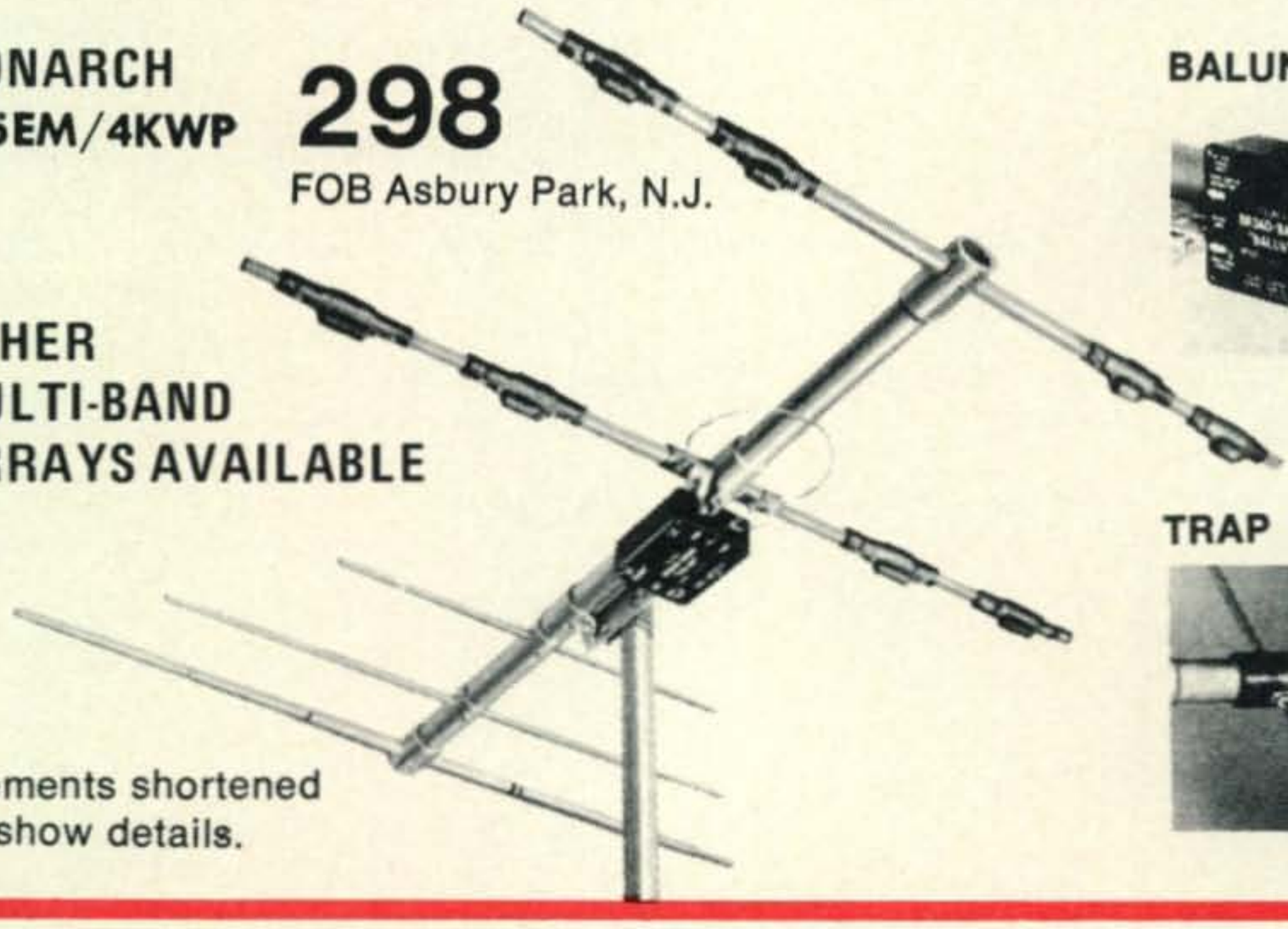

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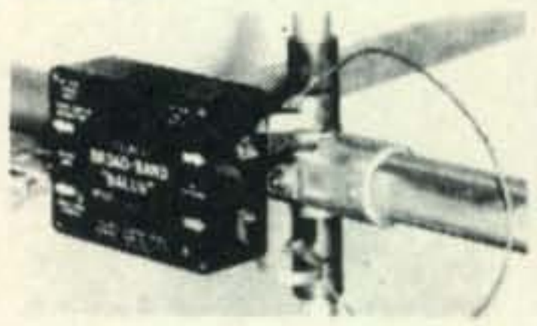

TRAP

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Mod. 15M317-	15 mtr. 3 el. rotary,	10 DB gain,4 KWP pow. rat.,	2 1/2"O.D.x17' boom $165.00
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Mod. 2M6C-	2 mtr. 6 el. array,	14 DB gain,300 W pow. rat.,	1" x 9' boom 18.50
Mod. 2M814C-	2 mtr. 8 el. array,	16.5 DB gain,300 W pow. rat.,	1.375"x14' boom 32.50
Mod. 6M5C-	6 mtr. 5 el. array,	13 DB gain,400 W pow. rat.,	1.5" x 16' boom 39.00

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ZERO BIAS

There's been a fair amount of chatter both on the air and in amateur publications about the apparent "hard nosed" attitude taken recently by FCC with respect to the use of an amateur station to perform certain functions which were previously assumed to be permissable. The questionable functions are those which have long formed the core of amateur radio's public service *raison d'etre,* namely handling Red Cross emergency communications, parade communications, Eye Bank networks, telethon collections, etc. FCC's "crackdown" has been greeted with great indignation and no small amount of confusion. "They can't do this to us," is the frequent cry, but the fact is that it's being done.

A most recent *QST* editorial, unfortunately, also took this tack in a statement ringing with bruised pride.

Our conversations with FCC spokesmen lead undeniably to the fact that under Section 97.39 of FCC's Rules and Regulations, handling traffic for *any* organization which itself does not qualify for an amateur station license is prohibited. To say, at this point, that we've never had Section 97.39 enforced in this manner, and therefore should not be enforced now is ridiculous, as is the allegation that to petition for a change in 97.39 would be shameful and self-incriminating.

The fact is that 97.39 has been enforced, and at the discretion of FCC can be enforced as much or as little as it deems necessary to maintain the amateur status of the amateur service. FCC has made it quite clear, however, that it is not its purpose to restrict the extent to which amateur radio can serve the public. What has happened is that a specific question was asked by an amateur organization, and a specific reply by FCC had to be given, despite the fact that the reply contradicted all sentiment and all intentions within FCC.

So what happens now? Do we simply stand fast and dare FCC to continue to enforce 97.39? Do we cease all public service activities which may be in violation of 97.39? Or do we petition to change 97.39?

The first choice is foolish and potentially dangerous to amateur radio as a whole and certainly dangerous to individual amateurs who may run the risk of legal difficulties and fines were they singled out for individual attention by FCC.

The second choice is certainly a safe one, but contradicts the natural desires and instincts of US amateurs.

The third choice is obviously the most logical and rational. FCC has stated in private conversation that it is unlikely to seek further enforcement of 97.39, particularly if a rule change is pending.

We are pleased to report that a rule change has been proposed by the Amateur Radio Section of the Electronic Industries Association. Now designated RM-1687, the proposal requests amendment of the Amateur Rules to permit the transmission of messages: for non-profit public service activities, concerning weather, highway conditions and accidents, reporting election results, coordinating public sporting events, parades, etc. and for the protection of life and property during any emergency. In short, the proposal requests that 97.39 be amended to specifically permit the public service functions amateur radio has long provided, while retaining the all-amateur nature of the amateur service, the original intent of 97.39.

CQ heartily supports RM-1687 and urges general amateur support. Let's not just stamp our feet and cry, "They can't do this to us." Let's change the rules so they can't.

73, Dick, K2MGA

OUR READERS SAY

A Secret Language

Editor, *CQ:*

Under one of your headings of "Random Thoughts" you pointed out the loss of ham suppliers and wondered where they had disappeared and what would happen in the future. I am new to the ham operation but I do know that to sell new equipment it is necessary to move the used but good equipment.

When you get a group which develops its own "language" they separate themselves from the normal people and also have a tendency to feel superior. This letter is not a complaint, but a suggestion. I have wanted some beginner's equipment but as I read your "Ham Shop" I find that it is mostly as unintelligible to me as my talking to you about 1231 assets, below the line deductions and Sub-S alternatives.

Might it not be a good idea to have one issue of the magazine a year or a brochure or a catalogue for the beginner who does not know the lingo of the used equipment advertised that would describe the items and their suitability for the Novice as well as the sophisticated operator?

If this were done, the newcomer would have a better chance of choosing suitable equipment and the experienced operator would better be able to move items he no longer needed. The information could also include a key that would be recognized by both the buyer and seller as to the condition. In this latter respect, I refer to the National Rifle Magazine advertising.

Possibly, if more used equipment were moved, more new equipment would be sold.

Howard F. Anderson, CPA
San Francisco, Calif.

Why the Slide Rule Works

Editor, *CQ:*

I suppose that you know why your procedure for finding the resonance frequency from the values of L and C, as described on page 55, *CQ* September '70, works. I couldn't rest until I had solved the mystery. The correct formula for the resonant frequency of an LC circuit (low resistance) is:

$$f = \frac{1}{2\pi \sqrt{LC}}$$

Your procedure substitutes $\sqrt{10}$, 3.1623, for π, 3.1416, thus:

$$f = \frac{1}{2\sqrt{10}\,LC} \quad \text{or} \quad \frac{0.5}{\sqrt{10}\,LC.}$$

This results in a usually negligible, built-in error; but an error nevertheless. The result is too small. It should be multiplied by the ratio which is 1.0066. This may be done rather easily by reading on the C scale opposite 5.03 on the D scale instead of exactly at 5.00.

Robert E. Stephens, W3MIR
Washington, D.C.

The Old-Fashioned Way

Editor, *CQ:*

I have just been reading the article on neutralization by Mr. Joseph Taschetta, W8IZH, in the January 1970 issue of *CQ*.

In his summary of the neutralization procedures he mentions a number of null indicators. Most of these have been proven to be unsatisfactory for a number of reasons; notably it takes quite a bit of power and/or voltage to activate them. For example, the neon bulb requires about 60 v. to fire it, the flash light bulbs require about a half ampere of current before you can light them up. The r.f. probe is, of course, much better and would be satisfactory. There is, however, an even better indicator which is not even mentioned, namely, the grid current meter.

Way back in the dark ages of ham radio, when everyone built their own rigs, it was quite common to incorporate a grid current meter permanently in the rig and, by proper use, it could be used to neutralize the final under what could be called dynamic conditions. In first tuning up a new final, it was common practice to disconnect the final d.c. voltage. Under these conditions tuning the final tank thru resonance the meter will give quite a kick if the final is not neutralized. If the neutralization procedure is continued until the kick is reduced to a minimum and then the high voltage is reconnected, the neutralization will most probably not be complete. If the plate circuit is detuned slightly, the grid meter will shown an increase on one side of resonance and a decrease on the other. By readjusting the neutralizing capacitor until the grid current increases on either side of resonance with final fully loaded, the final will be completely neutralized under dynamic conditions...

J.J. Frekot, W3CHH/KG6
Finegayan, Guam, M.I.

Equipment Stolen

Editor, *CQ:*

A Heathkit SB-301 receiver, owned by WA9TPV was stolen on August 8, 1970 from the club station of W9YT. The receiver was extensively modified, and may be identified by its tunable b.f.o., audio filter and five position a.g.c. switch. Anyone with information concerning this receiver, please contact WA9TPV in care of W9YT.

Please publish this as soon as possible. Besides the initial cost, many hours of labor were invested in this receiver. It appears that there is a class of amateurs far below the ordinary appliance operators: Those who won't even buy their own appliances! I hope this person enjoys winning his next contest with *my* receiver.

Scott Ellington, WA9TPV
21 S. Randall Ave.
Madison, Wisc.

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- **Complete package for . . .**

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Includes transceiver, two channels supplied, mobile mount, microphone, coax cable and antenna.

SPECIFICATIONS

General

Frequency Coverage	144-148 MHz
Number of Channels	12 Channels, 2 supplied Channel 1 Receive 146.94 MHz Transmit 146.34 MHz Channel 2 Simplex 146.94 MHz
Modulation	Frequency Modulation
Transmitter Control	Push-to-Talk
Power Drain	AC: Receive 6 Watts Transmit 50 Watts DC: Receive 0.5 Amps Transmit 4 Amps
Power Source	AC: 117 Volts Factory Wired 220/240 Volts 50-60 Hz DC: 13.5 Volts ±10%.
Dimensions	7⅞" W x 2¾" H x 10¼" D.
Weight	8¼ lbs.
Standard Accessories	Dynamic Microphone, Antenna, Connector Plug, AC/DC Cord

Transmitter

RF Output Power	10 Watts
Frequency Deviation	15 KHz maximum
Frequency Stability	±.001% or less
Spurious Radiation	Greater than —80 dB below Carrier
Frequency Multiplication	12

Receiver

Receiver Circuit	Crystal-controlled Double Conversion Superheterodyne
Intermediate Frequencies	1st 10.7 MHz, 2nd 455 kHz
Input Impedance	50 to 75 Ohms
Sensitivity	0.5 mV or less for 20 dB S+N/N ratio 1 mV or less (30 dB S+N/N ratio at 10 kHz deviation with 1 kHz modulation)
Intermodulation	Greater than 80 dB
Spurious Sensitivity	At 40 kHz separation
Audio Output	Greater than —80 dB 0.5 Watt with 10% or less distortion.

See at your distributor, or write for details . . .

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Announcements

Chicago, Illinois

The Chicago Amateur Radio Club, W9CAF, will hold a Ham Auction on Sunday, Oct. 25th, 1970 starting at 3 P.M. The location for the auction is St. Viator Hall, 3608 N. Kedvale in Chicago. For further information call CO 7-3724 or KI 5-3622.

International Music-Hams Club

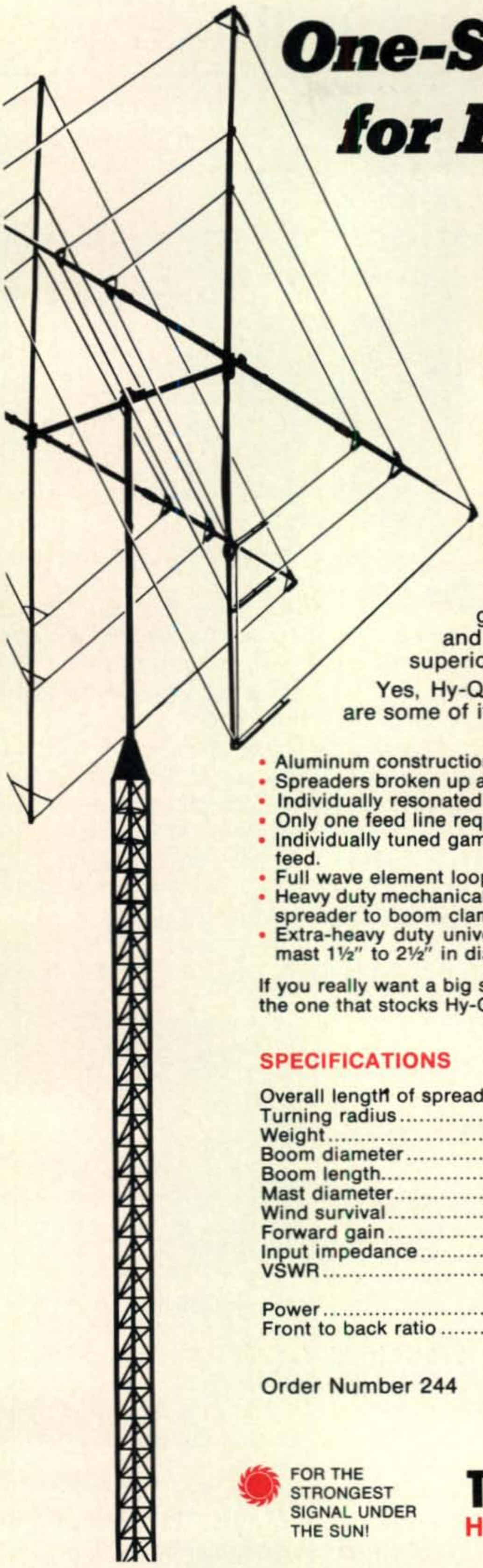
OZ7RF and K2PLT jointly announce the formation of the International Music-Hams Club (IHMC). All professional musicians who are also hams are invited to join. Initial activities include a weekly net and the offering of an attractive award for working five members. All professional musician-hams who are interested can write either Jan Williams, K2PLT, 63 Anderson Pl., Buffalo, N.Y. 14222 (US and possesions only) or OZ7RF, Borgbjervej 13, 2450 Copenhagen SW, Denmark (all other countries) for information on joining.

Special Christmas Callsign

The Delaware-Lehigh Amateur Radio Club of Bethlehem Pennsylvania announces that the special callsign, WX3MAS, will be placed on the air for one final period this Christmas season. Due to severe ice and snow with the resulting loss of several antennas the last time, the club didn't get to contact all those who waited. For this reason the club decided to reactivate the call again this year. Look for WX3MAS, The Christmas City Station, from 12/19/70 through 1/1/71. Transmissions will be on all bands, s.s.b., c.w. and RTTY. QSL via W3OK, 1719 Callone Ave., Bethlehem, Pa., 18017 with s.a.s.e., or IRCs for a special QSL.

Boston, Mass.

Eli Nannis, Chairman of the Awards Committee for the Federation of Eastern Mass. Amateur Radio Clubs (FEMARA) reports that Sylvester J. Connolly, W1MD, has been selected to receive the groups "Ham of the Year" award. W1MD who has been an amateur for more than 50 years was selected through hundreds of letters nominating him for the countless hours he spent handling traffic in emergencies plus the invaluable aid he gave during the earthquakes in South America. Time after time he has relayed information to obtain medicines and doctors advice for people throughout the world. Mr. Connolly will be presented with a plaque and a cash award at the ARRL National Convention in Boston on Sept. 26, 1970.



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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.
- Full wave element loops require no tuning stubs, traps, loading coils or baluns.
- 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

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

New Amateur Products

Regency 2 Meter F.M. Transceiver

REGENCY Electronics has announced a compact mobile f.m. transceiver for operation on 2 meters. The solid state Model HR-2 features 10 watt power output with operation on any of 6 transmit and receive channels in the band. Simple operator modification, however, can enable the unit to transmit and receive on any of 12 different duplex combinations. The transceiver is 2¼" × 5½" × 7¼" and comes complete with plug in microphone, mounting bracket, and built-in speaker. For complete details write to: Regency Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Indiana 46226 or circle 3 on page 98.

Rotron Catalog

A new 32 page *Quick Reference Catalog* containing useful information on the selection of fans and blowers, as well as descriptions of Rotron air moving devices and their applicable accessories is available from Rotron Inc. For a copy of the catalog write to: Rotron Incorporated, Woodstock, N.Y. 12498, or circle 2 on page 98.

It's rough keeping up with planar triode requirements.

Month after month, standards get stiffer. But even next year and beyond, our miniaturized planar triodes will still meet them. They provide greater power, higher frequency and more reliability than "standard" designs. Ceramic/metal construction stands up to high voltage, high frequency, high current operation. Large contact areas mean improved electrical and mechanical connections. Frequency stable anodes are standard. And extended interface arc-resistant cathodes let you handle more power.

Solderable terminals? We feature them. Pulse operation? Certainly. Switches? By all means.

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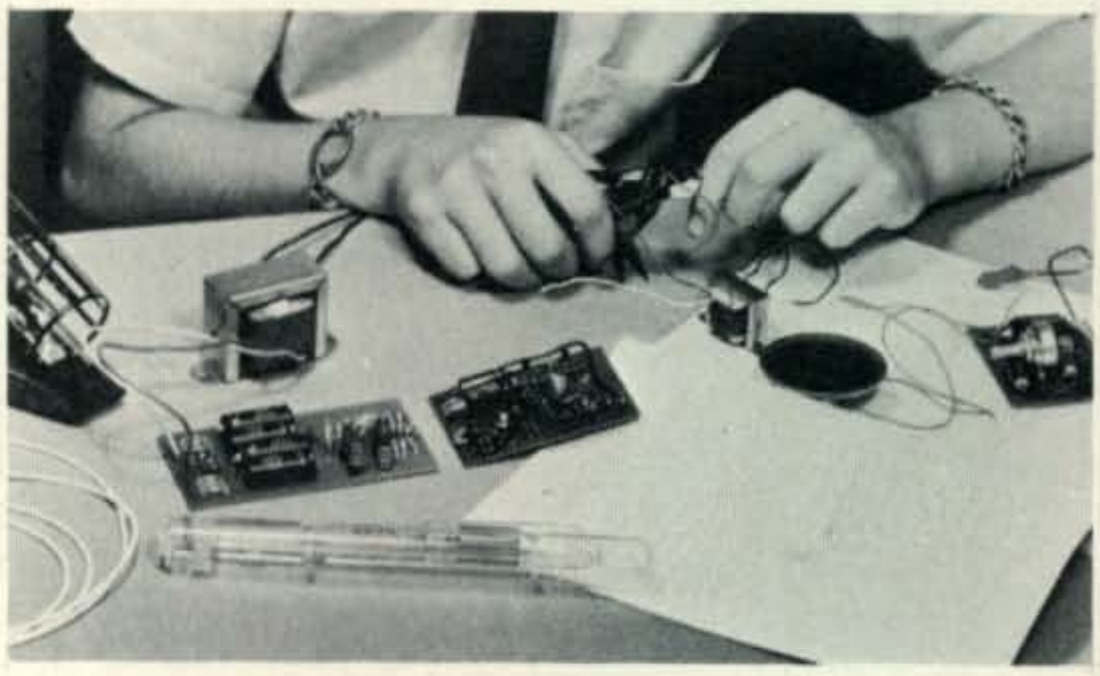

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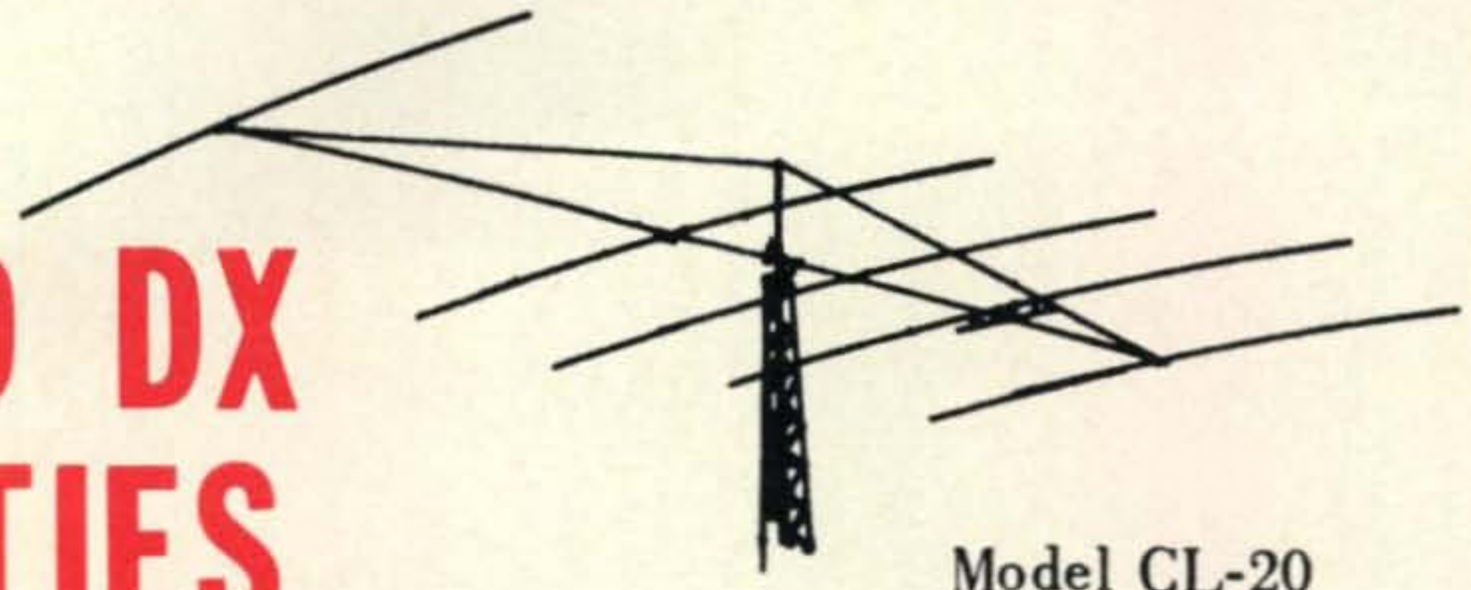

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- FEED POINT IMPEDANCE: 52 ohms.
- NUMBER OF ELEMENTS: 5. Aluminum tubing; 6063-T832.
- MAXIMUM ELEMENT LENGTH: 38 ft. 1½ in.
- BOOM LENGTH: 46 ft.
- RECOMMENDED MAST SIZE: 3 in. OD.
- TURNING RADIUS: 28 ft.
- WIND SURFACE: 18.7 sq. ft.
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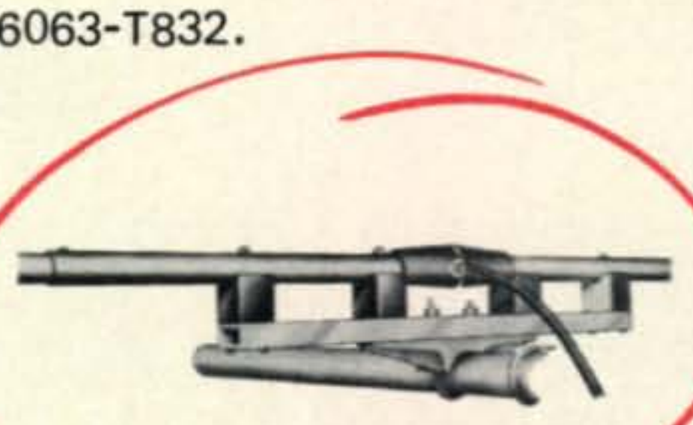

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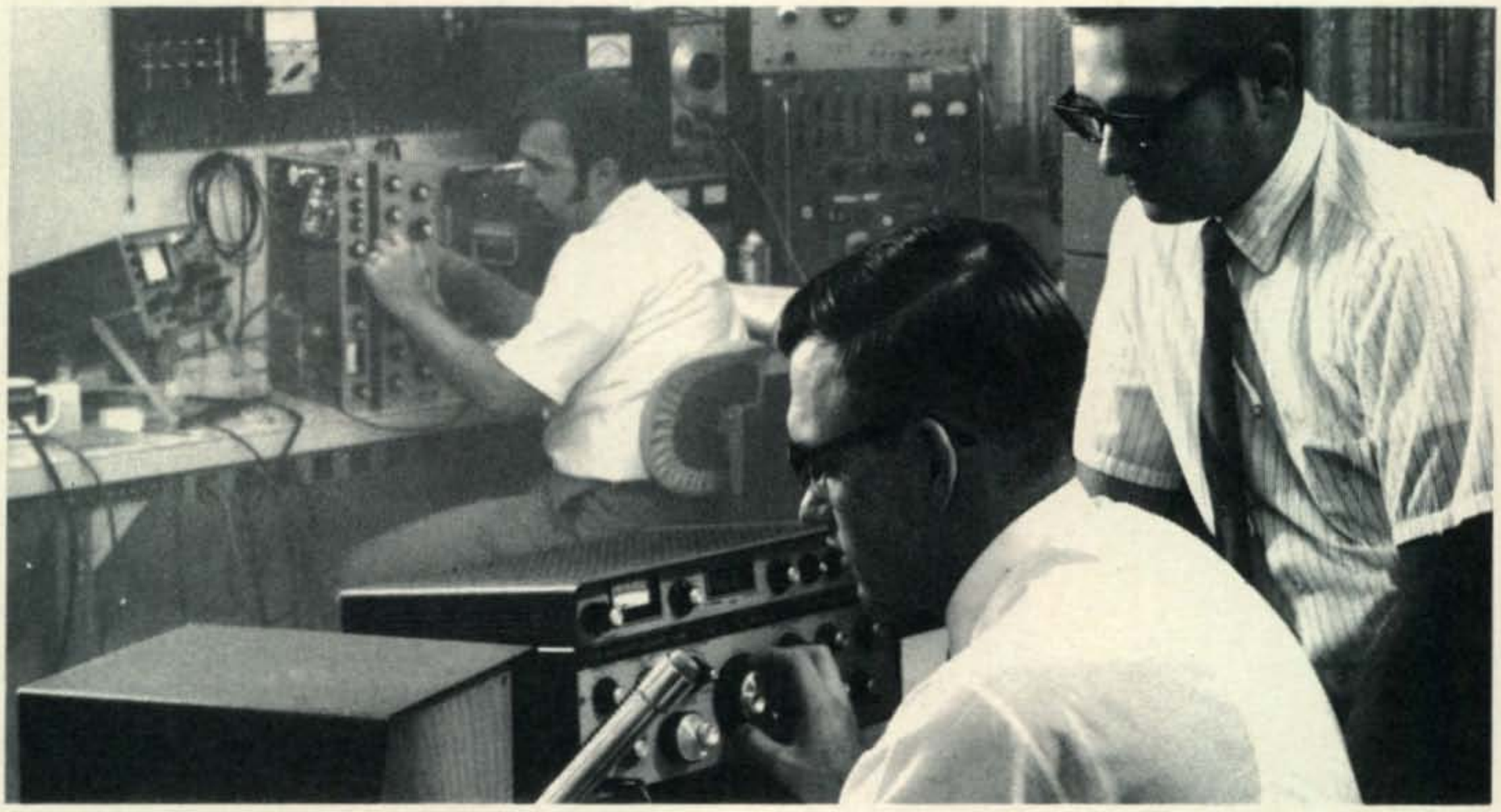

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A SOLID STATE COMMUNICATIONS RECEIVER

BY PIERO MORONI,* I1TDJ

TODAY it is possible to homebrew a solid state receiver which can compete with or even outperform commercial units. Compare the performance of this receiver to any commercial unit and see for yourself. The s.s.b. sensitivity for 10 db of S+N/N averages 0.2 microvolts and the receiver is still capable of receiving a 1 volt signal without overloading. The a.g.c. starts to work at 3 microvolts; at 0.3 volts the audio level has gone up 6 db which is not too bad for a 100 db change of input level.

The receiver also has excellent selectivity provided by a 2.8 kc Collins mechanical filter.

The power drain is 100 ma at 12 volts and so it can obviously be powered by dry cells.

Circuit Description

The receiver is a double conversion superheterodyne with a preselector that employs fets. The front end preselector can be tuned from 3.5 to 30 mc as in most of the present day receivers. The fet r.f. amplifier (a TIS34) is operated at a low gain for improved stability. The output of the r.f. amplifier is link coupled to the mixer, also a fet.

The crystal oscillator for the first conversion uses a bipolar transistor. Fundamental AT-cut crystals are used in a configuration that requires no tuned circuits. (See fig. 1.)

A double tuned circuit is placed between the first and second mixer to aid in the rejection of image signals which are only 500 kc from the wanted signal. The double tuned circuit also acts to isolate the first and second oscillator.

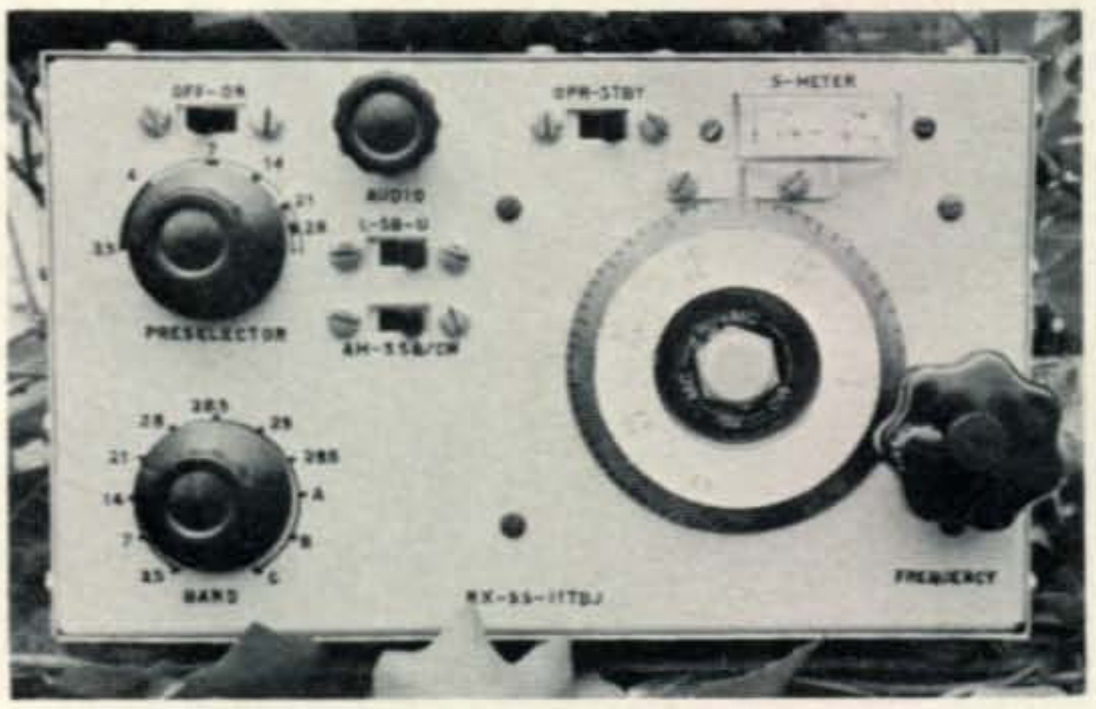
Tunable I.F.

The three section variable capacitor was taken from a surplus BC-455 and is used to tune the 3.5 to 4 mc input circuit to the second mixer and the 3.75 to 4.25 mc variable frequency oscillator. The second mixer, Q_4, is also an fet and the v.f.o. is a Colpitts oscillator that uses a bipolar transistor. A 9 volt zener diode regulates the input to the Colpitts crystal oscillator to insure good stability. In addition, it is necessary to use good quality components in the oscillator tuned circuit. NPO ceramic or silver micas are a *must*. The toroid coils used in the oscillator (L_7-L_{7A}) are quite stable and have a Q of 200. They can be replaced with a conventional cylindrical coil wound on a ceramic form.

Second I.F.

The second i.f. is at 250 kc simply because I had a 250 kc mechanical filter. If a 455 kc filter were available at the time the i.f. would have been 455 kc and the v.f.o. range shifted to cover 3955 to 4455 kc. The transformers are standard broadcast types tuned down to 250 kc by adding capacity.

The i.f. transistors are forward a.g.c. types



Front view of the complete transistorized multiband communications receiver. There are a minimum of controls and it presents an extremely neat appearance.

*Cascine, 1, 55010 Spianati, Italy.

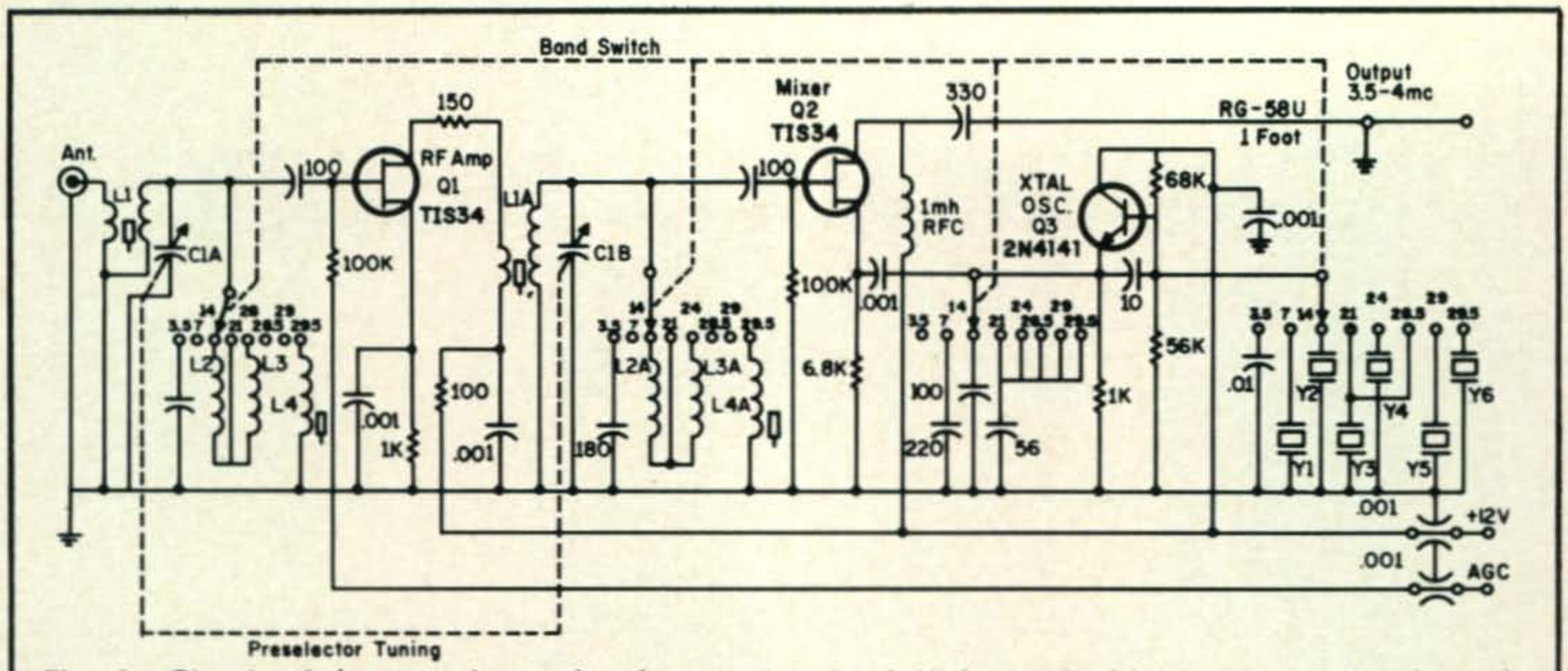


Fig. 1—Circuit of the preselector for the transistorized all band double conversion receiver. An alternate for Q_3 can be a 2N914.

C_{1A}, C_{1B}—Two gang variable, 495 mmf per section.

L_1—3.5 μh., 25t. #32 e. close wound on 7/32" dia. slug tuned form. 4t. link on cold end (or modified i.f. transformer as described in text).

L_{1A}—Same as L_1 but with a 3 turn link.

L_2, L_{2A} — 1 μh., 15t. #18e. close wound, 13/32" dia., air wound.

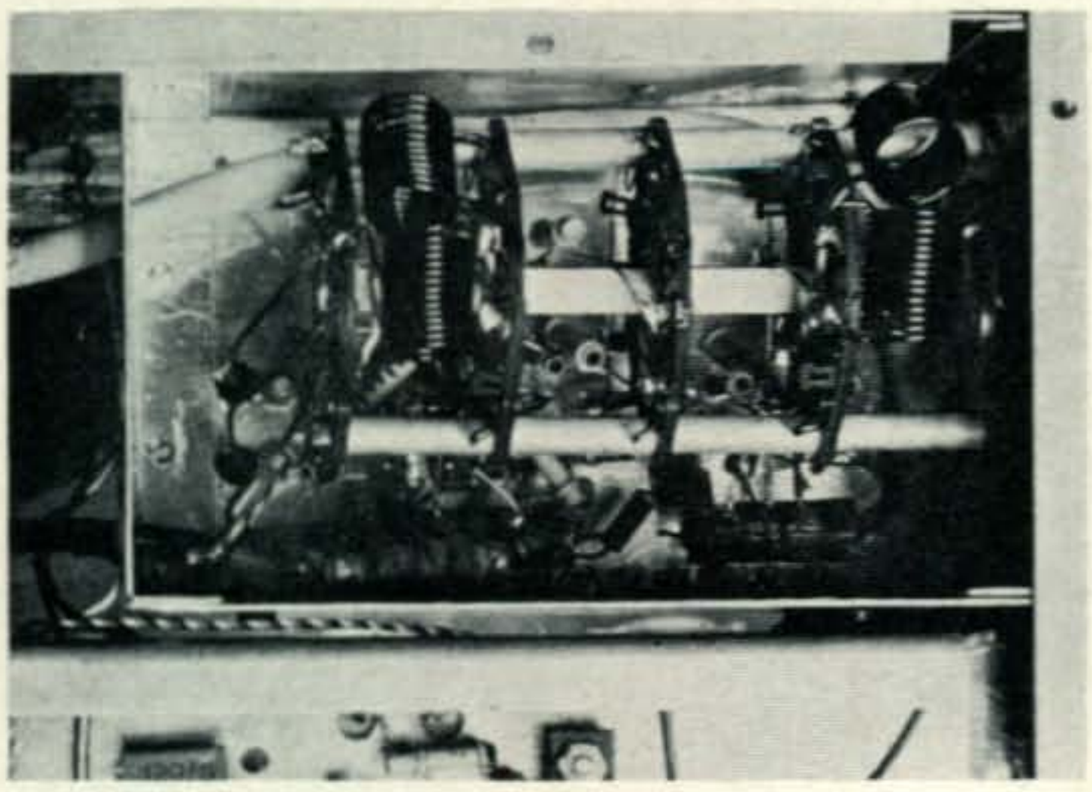
L_3, L_{3A}—0.83 μh., 20t. #24e. close wound, 7/32" dia., air wound.

L_4, L_{4A}—1.15 μh., 20t. #24e. close wound, 7/32" di., slug tuned form (or the modified i.f. described in the text.).

Y_1-Y_6—All are fundamental types, parallel resonant with 32 mmf. (Type B2E, Betron, Leghorn, Italy) Y_1—11 mc, Y_2—18 mc, Y_3—25 mc, Y_4—24.5 mc, Y_5—25.5 mc, Y_6—26 mc.

but only the first one is controlled by the a.g.c. voltage. In this way the second i.f. stage can handle stronger signals without overload.

A diode ring product detector is used for c.w. and s.s.b. signal reception. It is very linear and works as well as any other type of product detector. If there is no b.f.o. input signal there is no output. Also, its balanced configuration prevents the b.f.o. signal from feeding back into the i.f. circuits and disturbing the a.g.c. action. A.m. signals are detected in a normal half wave circuit (CR_6 in fig. 2).



Close up of the preselector chassis.

A.G.C. System

The a.g.c. amplifier circuit consists of two transistors, Q_9 and Q_{10}, a PNP and an NPN, direct coupled. Transistor Q_9 goes into conduction when the i.f. signal at its base reaches 0.5 volts. The second transistor, Q_{10}, is an emitter follower because a forward a.g.c. system needs a low impedance source.

The a.g.c. time constant is not too long. A 1 or 2 second release time is unnecessady if the attack time is very fast. With a very fast attack time and a 0.15 second release time no pumping effects are experienced during s.s.b. reception and the receiver does not collapse into silence for a couple of seconds in the presence of a short noise pulse. If you are not sure of this, check out a Collins 51S-1; it has a very smooth a.g.c. and a check of its circuit will show only a 0.15 second time constant.

In addition to controlling the first i.f. in this homebrew receiver, the a.g.c. circuit also controls the gate of the first r.f. in the preselector. Both stages, as noted earlier, are controlled in the forward direction; the a.g.c. causes the stage currents to increase with increased input signal. Under these conditions the junction fet exhibits a drop in gain

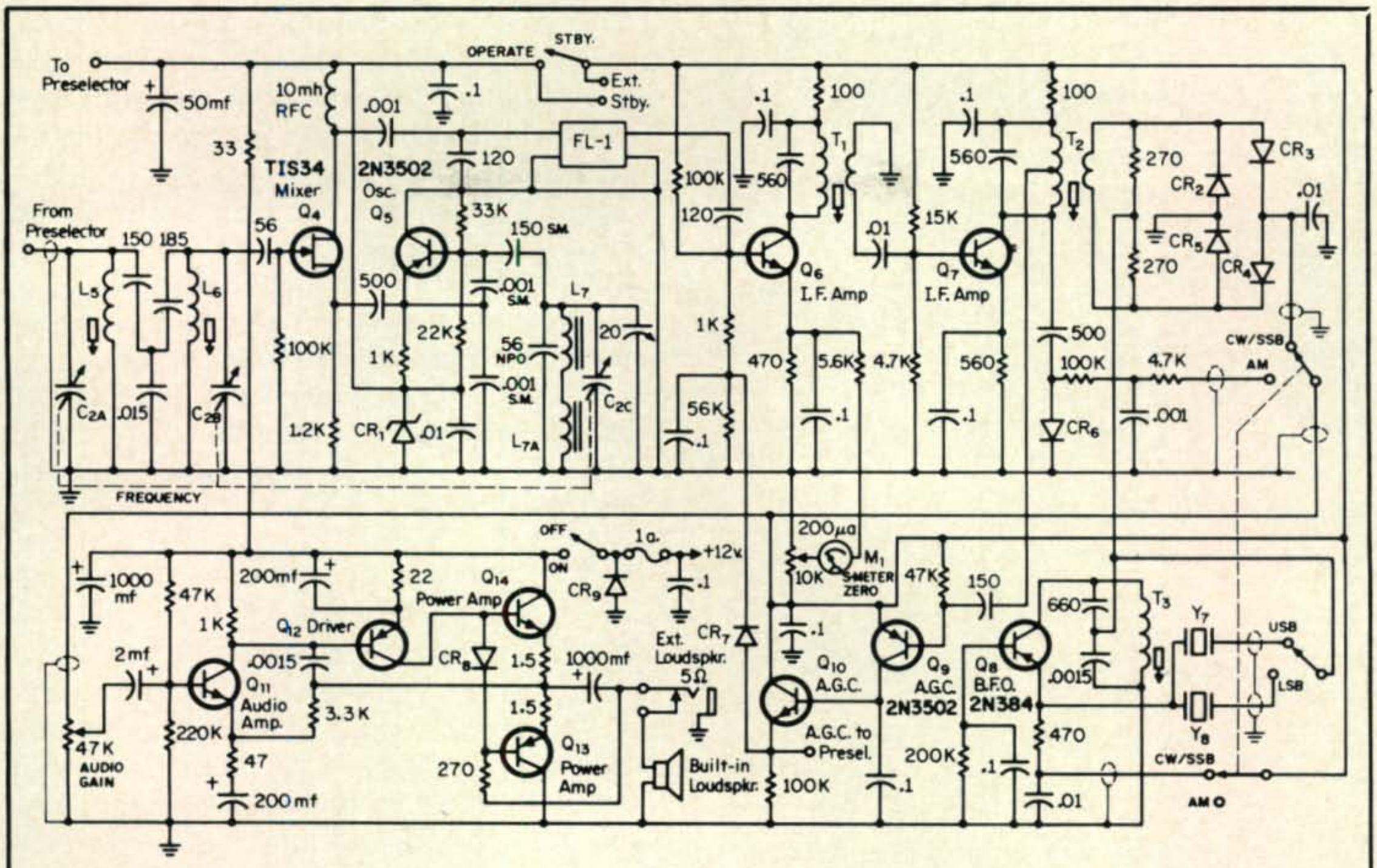


Fig. 2—First and second i.f., detector and audio amplifier circuits of the all band double conversion communications.

C_2—3 gang variable, 30-100 mmf. BC-455 tuning capacitor with gear drive.

CR_1—9 bolt, 450 mw zener diode.

CR_2-CR_6 — 1N34 or equivalent 50 p.i.v. diodes.

CR_7, CR_8—50 p.i.v. silicon diodes.

CR_9—1 ampere, 200 p.i.v. silicon diode.

FL_1—250 kc mechanical filter, Collins F250-A20.

L_5, L_6—7 µh., 37t. #30e. closewound, 0.4" dia. slug tuned forms. (Modified TV sound i.f.'s See text.)

L_7—6.5 µh., 38t. #26e. on a Micrometals 50-6 core.

L_{7A}—0.45 to 0.52 µh., 11t., #20e. on a Micrometals 50-10 core.

Q_6, Q_7—See text.

Q_{10}, Q_{11}—2N930 or Fairchild 2N2484.

Q_{12}—Fairchild BFY56 SGS or any other suitable PNP driver.

Q_{12}, Q_{14}—Phillips AC128 or any 1 amp PNP output transistor.

T_1, T_2, T_3—455 kc transistor radio i.f. transformers modified as described in text.

Y_7—248.8 kc series resonant crystal.

Y_8—251.3 kc series resonant crystal.

of up to 60 db due to the drain-source voltage decrease. The i.f. stage gain drops because its transductance, beyond an emitter current of 4 ma, decreases with an increase in current and the gain is about zero at 12 ma.

The i.f. transistors are of the forward a.g.c. type, BF175, made in Italy by S.G.S., a licensee of Fairchild. As far as I know, this type of transistor is manufactured by Fairchild in the USA as type SE5051, or SE5022. If you prefer, the military types are 2N4134 and 2N4235.

B.F.O.

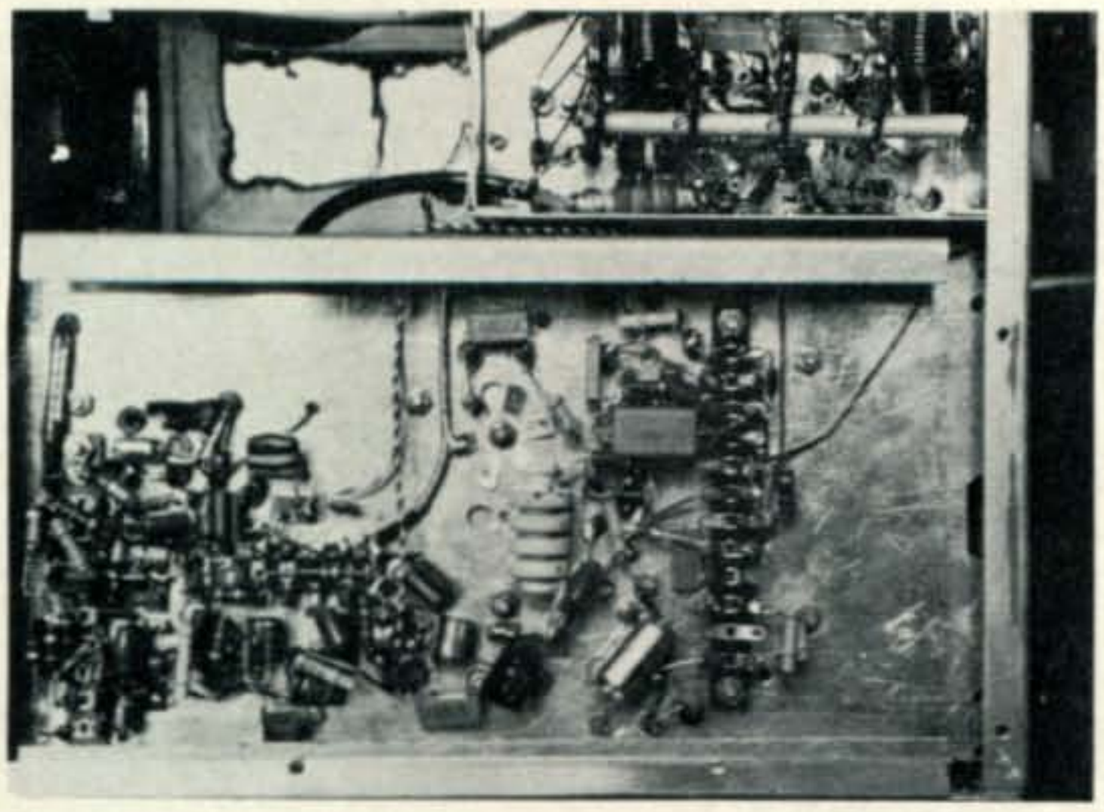
The b.f.o. circuit uses two crystals, selected by a front panel switch, for upper or lower sideband. At these frequencies, however, an *L-C* oscillator would be stable enough.

AF Amplifier

The audio frequency amplifier is the popular "single ended push-pull." (also called a half bridge which delivers 1 watt of a.f. from 50 cycles to 20 kc (very nearly a hi-fi amp). A small loudspeaker is built in and it is switched off, automatically, when an external loudspeaker or headphone (8 ohm) is plugged in to the output jack.

Construction

The layouts of the various portions of the receiver are apparent from the photographs



Bottom view of the receiver. The i.f., detector chassis is in the center. The preselector is in the upper right corner.

and the sketch at fig. 3. A 3" × 2¼" × 4¾" aluminum chassis contains the r.f. amplifier and first converter circuit. The preselector coils L_1, L_4, L_{1A}, where obtained from 10.7 mc f.m. i.f. transformers (Phillips AP1108). This transformer was used because of its size and the faraday shield between the two windings. Coils L_1 and L_{1A} were made by removing 20 turns and adding a four turn link.

Inductors L_4 and L_{4A} are wound on the coil forms salvaged from each of the other transformers as directed in the parts list.

Inductors L_2, L_3 and L_{3A} are small air wound coils soldered directly to the bandswitch.

The component layout in the preselector, while not critical, should follow good construction practice. The inputs and outputs of the r.f. stage must be separated and shielded. Signal carrying lines must be as short and direct as possible. The first and third wafers are used for the r.f. stage and the second and fourth wafers are used for the crystal oscillator. This puts adequate separation between the r.f. coils.

The two gang variable used for the preselector is driven by a 6 to 1 planetary drive mechanism to provide easier peaking particularly on the high frequency bands.

Second Converter and I.F.

The second converter, i.f. and detector sections are all mounted on a second chassis, 4¾" × 13/16" × 9", U shaped, made of aluminum. Much of the available space is taken up by the BC-455 tuning capacitor, but it is worth it because it is a first class unit that provides a good dial and a smooth tuning gear.

The 3.5 to 4 mc bandpass coils are housed in standard i.f. transformer cans. These are single winding TV sound i.f. transformers (4.5 mc) with the windings reduced to the required inductance values.

The v.f.o. coil is wound on a toroid and housed in an i.f. can enclosure, also.

The 250 kc mechanical filter is long enough to provide good shielding between input and output. Signal leakage would reduce the otherwise excellent selectivity.

All the steps usually taken to assure stability in an i.f. stage should be taken here because most of the receiver's gain is produced here.

AF System

The a.f. section is built on a 2" × 3" × 7/32" piece of Vectorboard #85G24 phenolic sheet and can be located anywhere in the receiver cabinet. The audio leads that must be shielded are those to the front panel audio gain control and those leads that connect the mode selector (AM-SSB) switch to the product detector chassis.

While it is also desirable to shield the sideband selector switch leads to the b.f.o., it would be advisable to use a small diameter coaxial cable.

Testing and Adjustment

Before applying power check your wiring carefully. Transistors are not forgiving; an error in wiring can easily burn out one (or more) of them. Diode CR_9 protects against reverse polarity by conducting heavily and blowing out the 1 amp. fuse.

The test equipment needed to adjust the receiver are, a grid dip oscillator, a v.t.v.m. with an r.f. probe and, if available, an r.f. signal generator.

The first step is to check the audio section. A voltage check can be made using the data given in Table I. The voltage at the junction of the two 1.5 ohm resistors in the power amplifier (Q_{13}, Q_{14}) should be half of the supply value.

If all the voltages check out, feed an audio signal into the gain control and listen to the output from the speaker. An input of 50 mv r.m.s. will produce one watt of output or roughly 2.25 volts across the 5 ohm speaker.

Checking the preselector can be next. If you have already adjusted the coils to the inductance values indicated in the parts list you'll find the frequency coverage almost on the nose. If the inductance values are not

	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9	Q_{01}	Q_{11}	Q_{12}	Q_{13}	Q_{14}
Emitter (or source)	2.5	3.5	3.8*	1†	5.8	1.8	1.4	7.6	11.2	0	9	11.5	5.8	5.8
Base (or Gate)	0	0	3.6	0	5.7	2.5	2.2	7.2	11.2	0	9.5	11.3	5.6	6.4
Collector (or drain)	11.2	11.8	11.8	11.2	0	10.8	11	0	0	11.2	11.3	6.4	0	11.8

*0.7-1.0 v.r.f.
†0.45 v.r.f.

Table I—Transistor voltage readings to ground measured with a b.t.v.m. (Supply voltage 11.7 v.)

accurate check out as follows; remove Q_1 and Q_2 from their sockets and switch to the 3.5 mc band. With the variable capacitor at nearly full capacitance adjust the slugs in L_1 and L_{1A} to resonate at 3.5 mc using a g.d.o.

Switch to the 29.5 mc band and open the tuning capacitor almost all the way for close to minimum capacity. Using the g.d.o., tune L_4 and L_{4A} to 29.5 mc. Since L_1, L_{1A} and L_4 and L_{4A} are an enclosure they must be capacitively coupled to the g.d.o. through a 1 to 3 mmf capacitor or loosely link coupled.

Normally, inductors L_2, L_{2A}, L_3 and L_{3A} do not need adjustment but if it is found necessary it can be done later.

Replace the transistors, ground the a.g.c. line temporarily and connect the supply voltage. Check the d.c. voltages at the transistors to see that they conform with the values listed in Table I. The oscillator level at the mixer source resistor (6.8K) should be from 0.7 to 1 volt r.m.s. as measured with a v.t.v.m. and r.f. probe.

If the i.f. strip of the receiver is not finished, connect the output of the preselector to the input of a receiver. With the antenna connected to the preselector you will be able to hear the ham band signals. Using a signal generator, a g.d.o. or a 100 kc marker it will be possible to adjust L_1 through L_{4A} to the proper inductance. L_1 and L_{1A} should be tuned for maximum S meter reading (on the test receiver) at 3.5 mc.

Switch to 29.5 mc, tune L_4 and L_{4A} to maximum with the variable capacitor nearly at minimum capacity.

To tune L_3 and L_{3A} for maximum at 21 mc by peaking the preselector variable (C_1) and adjust the coil spacing for maximum signal.

Follow the same procedure to adjust L_2 and L_{2A} at 14 mc.

The i.f. must now be tuned to 250 kc (or 455 kc if you have a filter at this frequency and it is necessary to have a signal source available. Connect the signal generator output to the mechanical filter input side through a 100 mmf capacitor. If the signal is modulated, switch to AM. If the unmodulated, switch to SSB/CW.

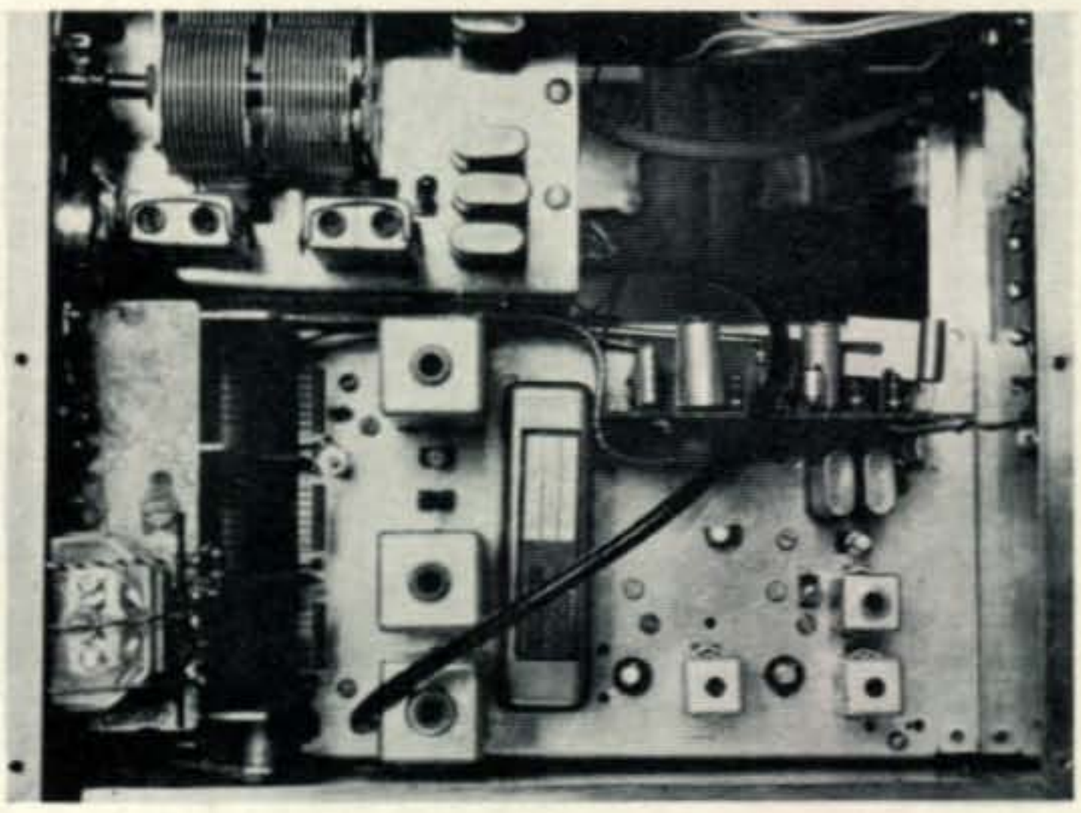
If the SSB/CW position is used, adjust T_3 so that both crystals oscillate as the sideband selector switch is moved back and forth so that the signal can be heard.

Swing the signal generator above and below the r.f. center and you will either hear the audio tone on a.m. or the beat note on c.w. Center on the filter peak, 250 kc, (or 455 kc for another filter) and tune T_1 and T_2 for maximum output as indicated by the S meter. Keep the signal generator output level as low as possible.

Disconnect the signal generator and tune L_{7A} and the 20 mmf trimmer across it to cover a range from 3.5 to 4 mc.

Connect the preselector to the input of the second mixer, L_5, using the exact length of

[*Continued on page 85*]

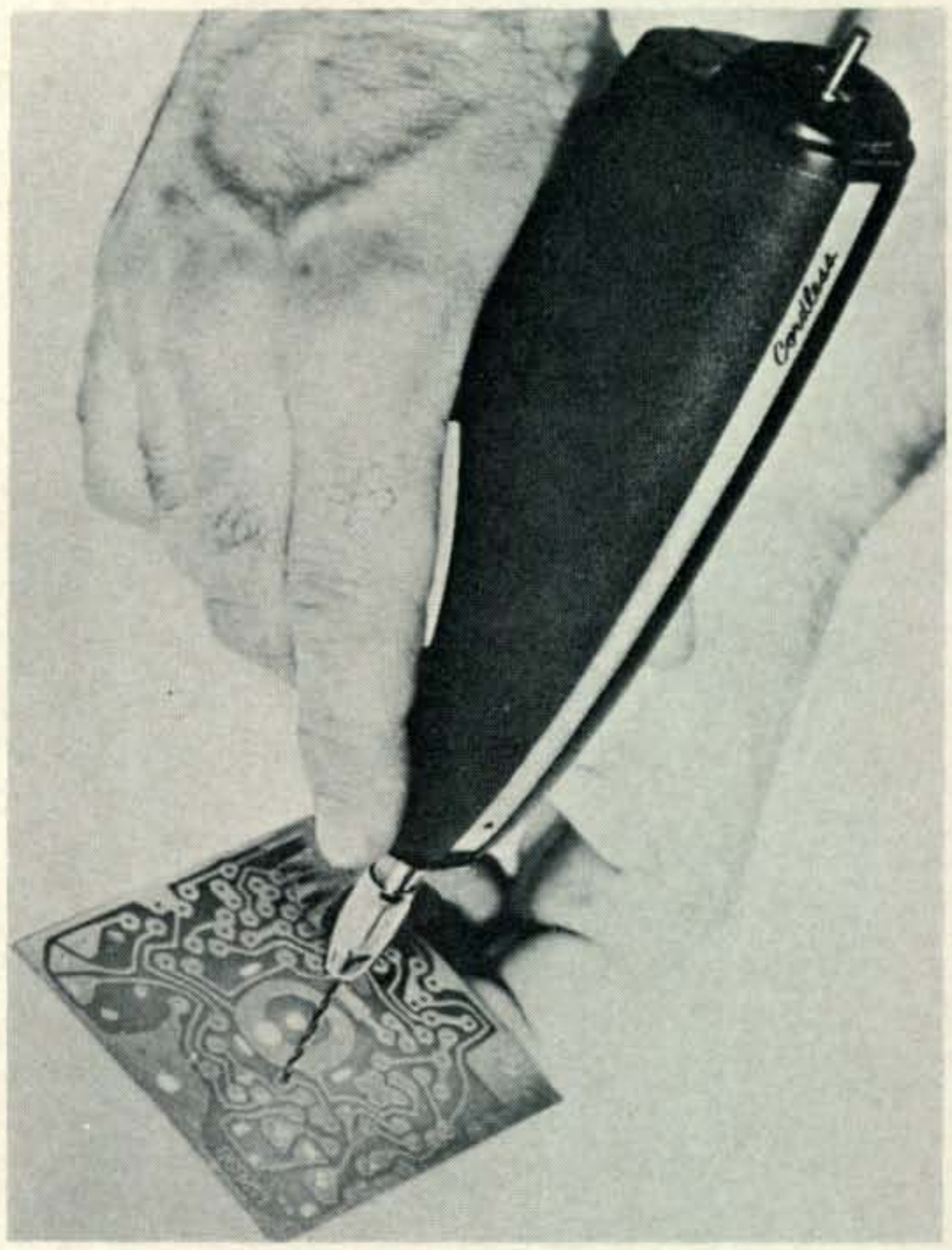


Top view of the receiver. The preselector is in the upper left corner. The a.f. amp is built on the printed board alongside the two b.f.o. crystals.

New Amateur Products

RCA Linear Integrated Circuits Manual

The latest RCA Linear Integrated Circuits Manual has been published, and with its $2.50 price, is undoubtedly one of the biggest bargains in electronics today. The 416 page volume covers in detail: fabrication, packaging and mounting, effects of IC's on circuit design, basic circuit elements, and applications of op-amps, multipurpose amplifiers, differential amplifiers, etc. Available from RCA distributors, the manual is designated IC-42.



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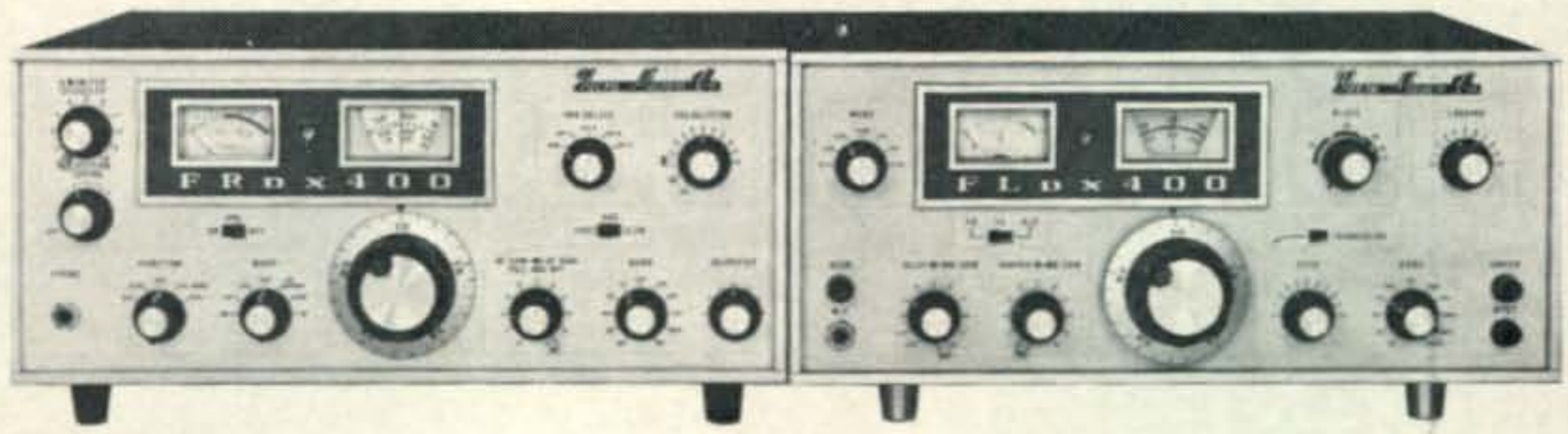

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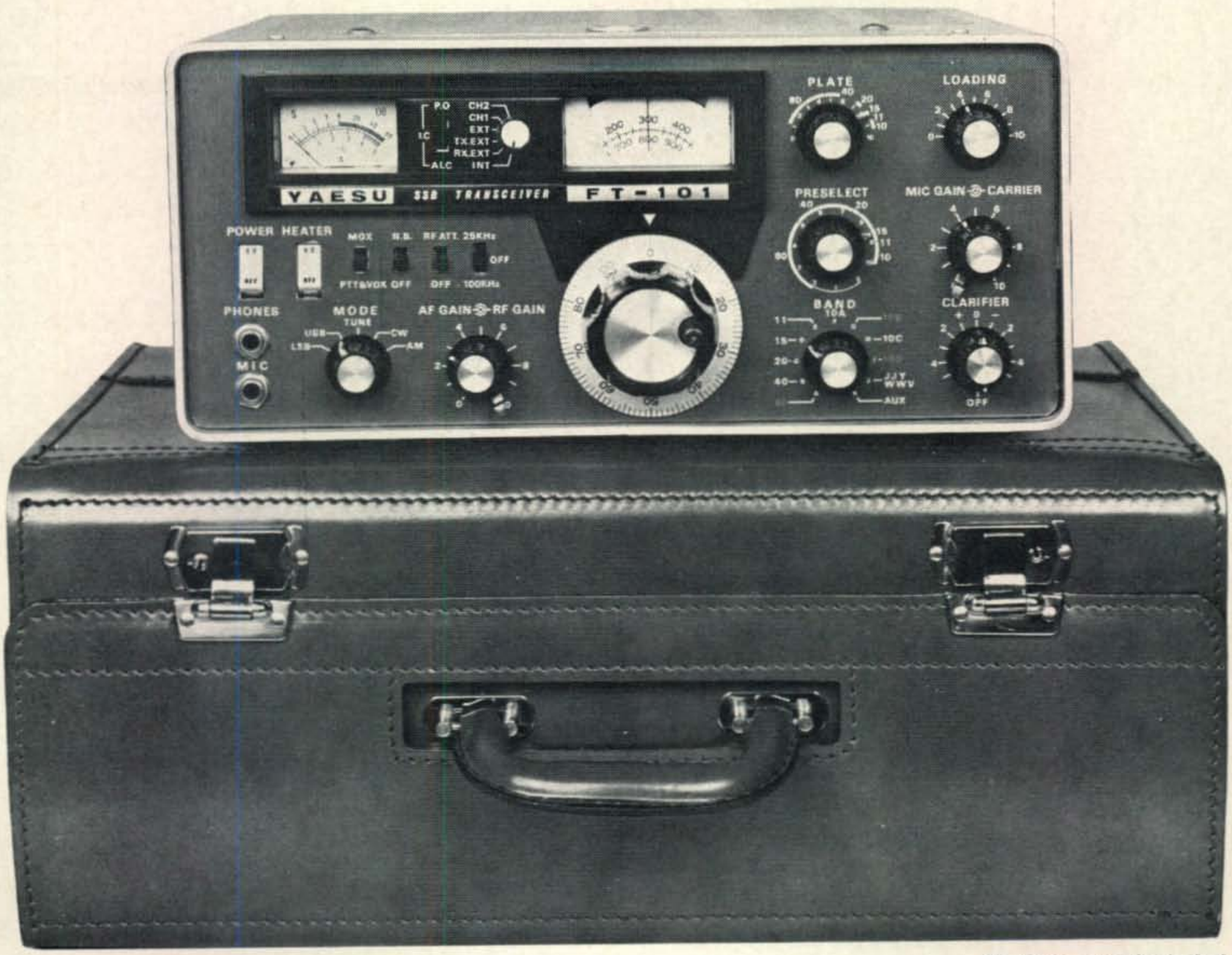

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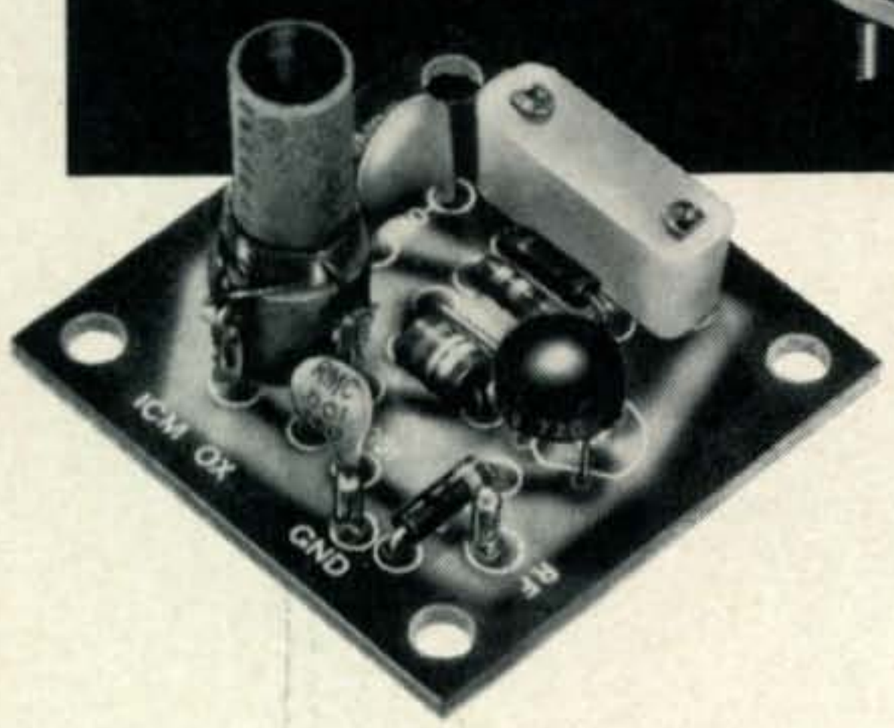

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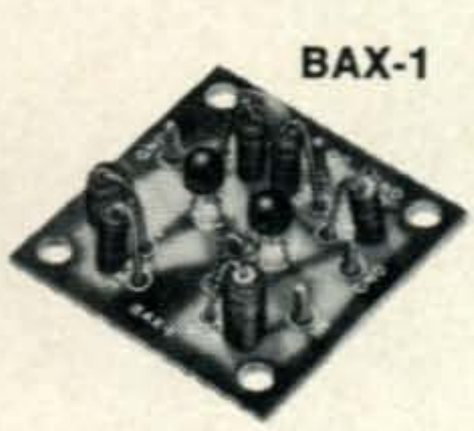

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AN INEXPENSIVE UTILITY ANTENNA FOR 80 METERS

BY WILLIAM I. ORR,* W6SAI

THE perfect, all-purpose 80 meter antenna would combine low angle radiation for DX work, high angle radiation for local contacts, good bandwidth for low s.w.r. across the band and small size for easy erection on a city lot. When you, kind reader, find such an antenna, please let me know, as I have been looking for such an object for over 15 years.

The requirements remind me of the plaintive request of the small-town band leader, looking for a fill-in musician: "I'm looking for a man who plays clarinet and trombone, doubles on the violin and saxophone, and wears a size forty seven suit!"

W6SAI's need for an all-purpose 80 meter antenna came about because of a series of schedules on s.s.b. and c.w. that ranged up and down the Pacific Coast, inland to Nevada, and across the continent to the Mississippi River. This, combined with a love of chasing DX on 3.5 mc, resulted in the desire for a simple antenna system that would fill the bill under all circumstances. Needless to say, the search is still going on for such an ideal antenna system.

In order to survey the problem, let's look at some of the simple antennas used, and the results achieved. The summary should be of interest to Novices, traffic men and DX'ers alike.

The 80 Meter Dipole

One of the first antennas used for various schedules was the simple 80 meter dipole. Figure 1 shows the s.w.r. plot for a dipole cut to the phone band and illustrates typical results obtained when the antenna was erected about 50 feet in the clear. The dipole was slung between a 70 foot tower and a short mast erected on the building housing the station. According to various plots of antenna height versus impedance available in the Handbooks, the feedpoint of such an antenna should be approximately 50 ohms at resonance. Alas, measurements run on the antenna with an accurate impedance bridge proved that, in this particular instance, the assumption was unfounded. As shown in the graph, the minimum value of s.w.r. at resonance indicated the impedance was about 88 ohms and the operational bandwidth of the dipole (assuming a maximum s.w.r. limit of 2.5:1) was about 330 kc.

This proved to be about par for the course. Moving the dipole about the area and fiddling with the feed system changed the results a bit, but the upshot was that the dipole had an

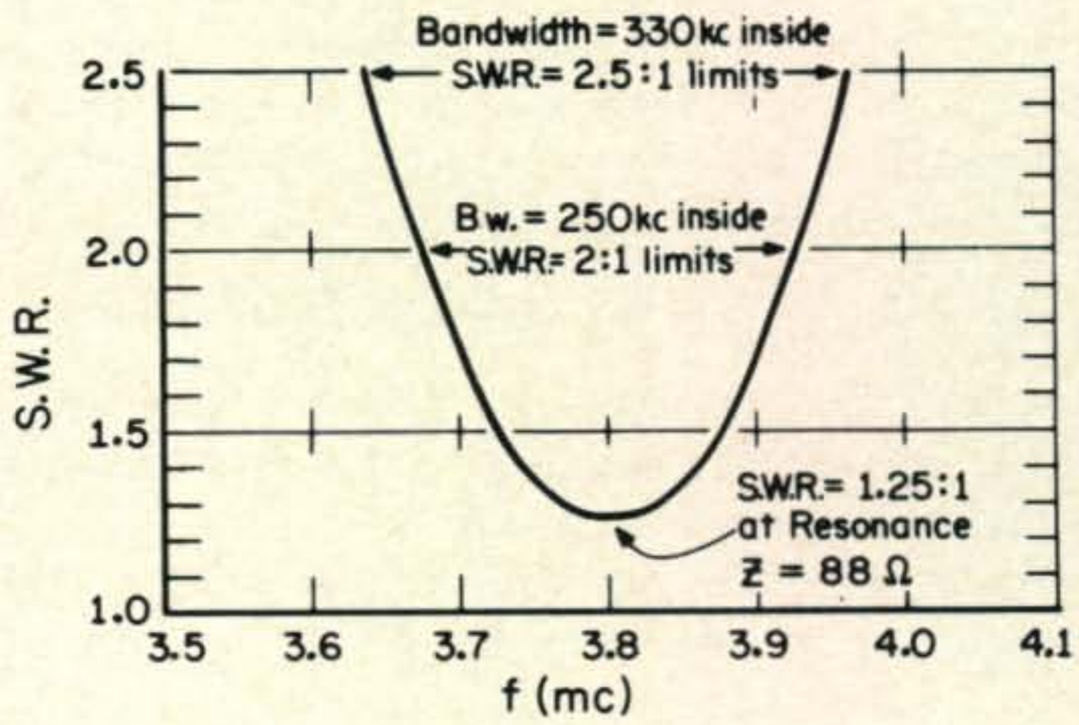

Fig. 1—Typical s.w.r. plot of 80 meter dipole antenna. Because of the low height above ground compared to a half-wavelength, the impedance of an 80 m. dipole varies over a wide range at the feedpoint. In this case, the dipole height was about 50 feet, and the center impedance at resonance measured about 88 ohms. A 72 ohm transmission line (RG-11/U) was used and the operational bandwidth of the antenna is as pictured above. As most pi-network circuits in amateur gear can accept a s.w.r. of about 2:1, or 2.5:1, the useable bandwidth of the antenna is between 250 kc and 330 kc.

*Manager, Amateur Service Department, Eimac Division of Varian, San Carlos, Calif. 94070.

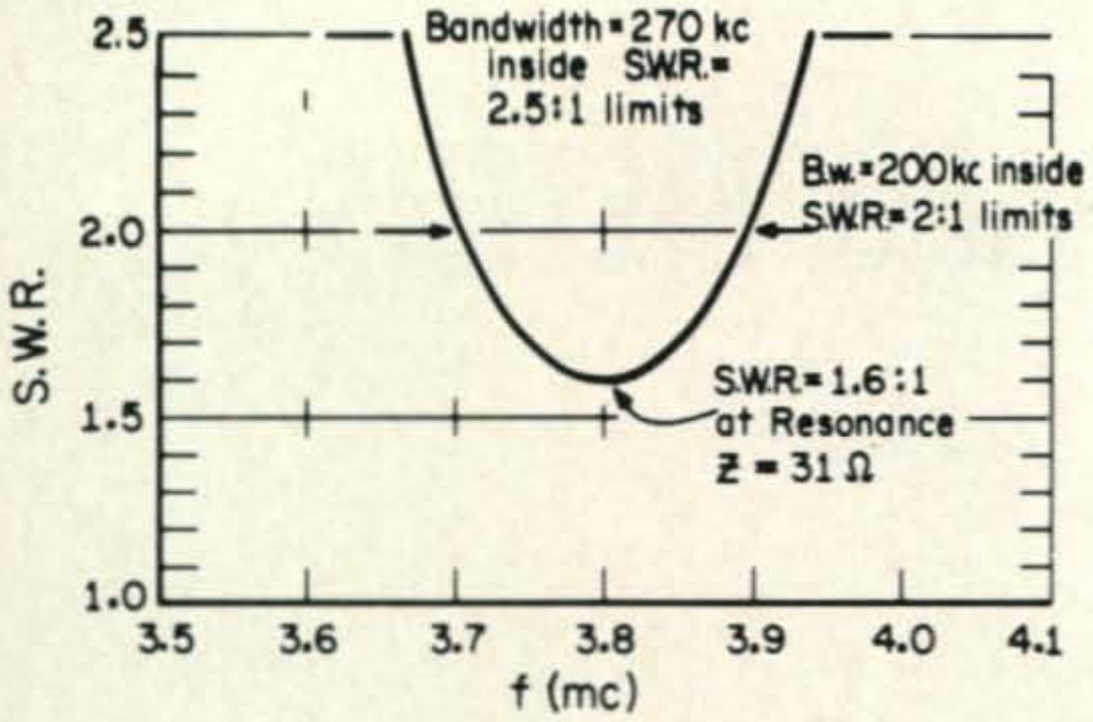

Fig. 2—Typical s.w.r. plot of 80 meter vertical ground plane antenna. This quarter-wave plane was made of light aluminum tubing and had four 66 foot radials at the base, which was about 10 feet above the ground. The feedpoint impedance of the antenna was about 31 ohms at resonance. Operational bandwidth was not as good as that of the dipole shown in fig. 1. Use of an impedance transformation network at the base of the antenna undoubtedly would help matters. Additional radials, of staggered length, might also improve the operational bandwidth.

operational bandwidth at best of about 250 kc to 325 kc, regardless of the positioning or height above ground. The RG-8/U (52 ohm) feedline was removed and the antenna fed with RG-11/U (70 ohm) coaxial line, and the results of fig. 1 were accepted as representative. Adjustment of the height above ground permitted the resonance figure of s.w.r. to be dropped to a value very close to 1:1 but the overall bandwidth of the antenna remained about the same.

Operationally, the dipole worked as expected. Results were poor off the ends and good broadside to the wire. Close-in results were mediocre, with plenty of fading noticeable in the afternoon hours. At night, the dipole performed well at distances 400 to 1200 miles from the station. For short distance (100 to 200 miles) the dipole was *not* outstanding at all.

The 80 Meter Ground Plane

All in all, eight or ten dipoles were used at various times and locations over the past ten years. In 1956, experiments were started with a series of 80 meter ground plane antennas; some full height; some compact, loaded whip arrangements. The representative groundplane was a 66 foot whip with four 66 foot radials run randomly about the yard. The base of the whip was 10 feet above the ground, and the radials were about the same height, or slightly less. The junction point of radials and feedline was grounded with an eight foot copper strap running to a convenient water pipe. Measured results are shown in fig. 2. At resonance, the antenna impedance ran very close to 31 ohms and the overall bandwidth at the s.w.r. limits of 2.5:1 was about 270 kc. The groundplane was fed with 50 ohm RG-8/U coaxial line.

Operationally, the ground plane was inferior to the dipole out to distances of perhaps 600 miles or so. Greater fading was observed on close-in contacts and reports were several S-points weaker on the ground plane than on the dipole. At distances greater than 600 miles or so, the ground plane appeared better than the dipole, and seemed very effective on DX contacts. Working Europeans on 80 meters separates the men from the boys, as far as antennas go, and the ground plane seemed to do a great job. Interestingly enough, a check of the W6SAI log shows that during the period of 1957-1959 when the ground plane was used extensively, over 99% of the replies to CQ calls on 80 meter c.w. (outside of California) were from stations *east* of Ohio! That speaks well for the DX-ability of the ground plane.

On the other side of the coin, the ground plane was a star performer in picking up random noise and static. QRN that was unnoticed on the dipole was exceedingly annoying on the ground plane and many a good DX contact was obliterated by an electric motor or electric razor, somewhere in the vicinity, that blotted out the weak 80 meter DX signal.

The Utility 80 Meter Antenna

After observing the characteristics of the two antennas over a period of years, it was decided to experiment with a modified antenna system that, hopefully, would combine the better features of both antennas and eliminate some of the worse features. After many rolls of wire were expended, the resulting antenna had the operational characterisics shown in fig. 3. The physical configuration of the antenna is shown in fig. 4.

Basically, the Utility 80 meter antenna is an extended ground plane, with the top portion run in a horizontal position to provide a degree of high angle radiation. Experience has shown that such a bent radiator will tend to "fill in" the radiation nulls observed with both the vertical and the horizontal

antennas. To boost the antenna impedance at the feedpoint, it was deliberately made longer than the resonant length, and resonance was established by the inclusion of a series capacitor, much as in the manner used for the popular pre-war "Marconi" antennas, so popular on the dear, defunct [?] 160 meter band.

Operationally, the Utility antenna has done a good job for over two years since it was first erected. The radiation pattern is substantially omnidirectional, and signal reports compare favorably with both the horizontal dipole and the ground plane at various distances. The Utility antenna, for example, is better that the simple ground plane at distances up to 600 miles or so, exhibiting a much stronger signal and less fading. At greater distances, it seems equally as effective as the ground plane. Best of all, the boost in input impedance allows the antenna to cover a substantially greater portion of the 80 meter band than either the dipole or the ground plane. As measured, the 2.5:1 s.w.r. bandwidth of the Utility antenna is about 375 kc and exhibits a s.w.r. of better than 1.1:1 at the chosen resonant frequency.

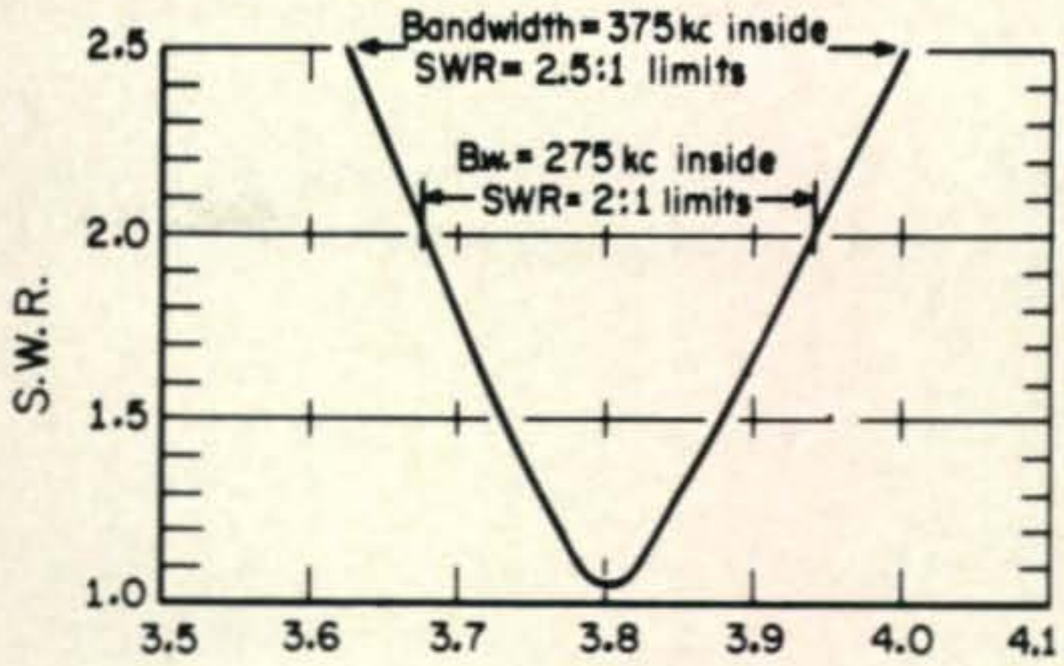

Fig. 3—Typical s.w.r. plot of 80 meter Utility Antenna. The quasi-vertical antenna system of fig. 4 provided this plot of operational bandwidth. The overlength, series-tuned antenna provided a good impedance match at resonance to a 52 ohm (RG-8/U) transmission line, and improved bandwidth as compared to the antennas of figs. 1 and 2.

Constructing the 80 Meter Utility Antenna

The Utility antenna is inexpensive to build and easily erected in a few hours time. In its simplest form, it is a 68 foot wire, 24 feet of which is run vertically, and 44 feet horizontally. The antenna provides both vertical and horizontal radiation in approximately equal amounts and the vertical pattern is a broad "blob". Three 66 foot radials are used, in conjunction with a ground connection. The base of the antenna is placed close to ground level and the radials are run in random directions about 6 inches above the ground. To prevent the radials from becoming a hazard to life and limb, they are run along the base of a fence, along the bottom of a hedge, and along the lower wood siding of the house, at approximately 120° angles to each other.

It must be emphasized that the radials are not counterpoise wires, or substitutes for the actual ground. They form half the antenna and, although they theoretically are not supposed to radiate, no doubt they do and, in addition are "hot" with r.f. at the ends. For safety's sake, therefore, the radials should be made of insulated wire, carefully taped at the ends to prevent inquisitive children from getting r.f. burns when the transmitter is in operation. It is a matter of mild conjecture as to the degree that the radials contribute to the antenna pattern. Not much, probably, as they are very close to the ground, but the reader should not assume that they are not a portion of the antenna radiating system, as they are.

The antenna ground connection is important as it established reference ground for the whole radiating system. It need not be perfect, but it must be there. In this case, the ground connection consisted of two four-foot pipes driven vertically into the soil at the junction of the radials. The pipes are jumpered together and connected to the radials and the outer braid of the coaxial transmission line.

The horizontal section of the antenna should be reasonably in the clear and should not run parallel to electric or utility wires, if possible. The first time this antenna was erected, it caused much distress to the XYL, who found that the dining room lights flickered every time the OM came on the air! Moving the flat-top portion of the antenna at an acute angle to the house wiring cured this annoying problem.

Adjusting the Utility Antenna

The dimension of the antenna are proportioned so that the antenna exhibits a typical 50 ohm load to the feed system at the resonant frequency of the antenna, as illustrated in fig. 3. To resonate the antenna, a variable capacitor is placed in series with the antenna and a two turn link coil that is slipped over a grid dip oscillator (point X). The oscil-

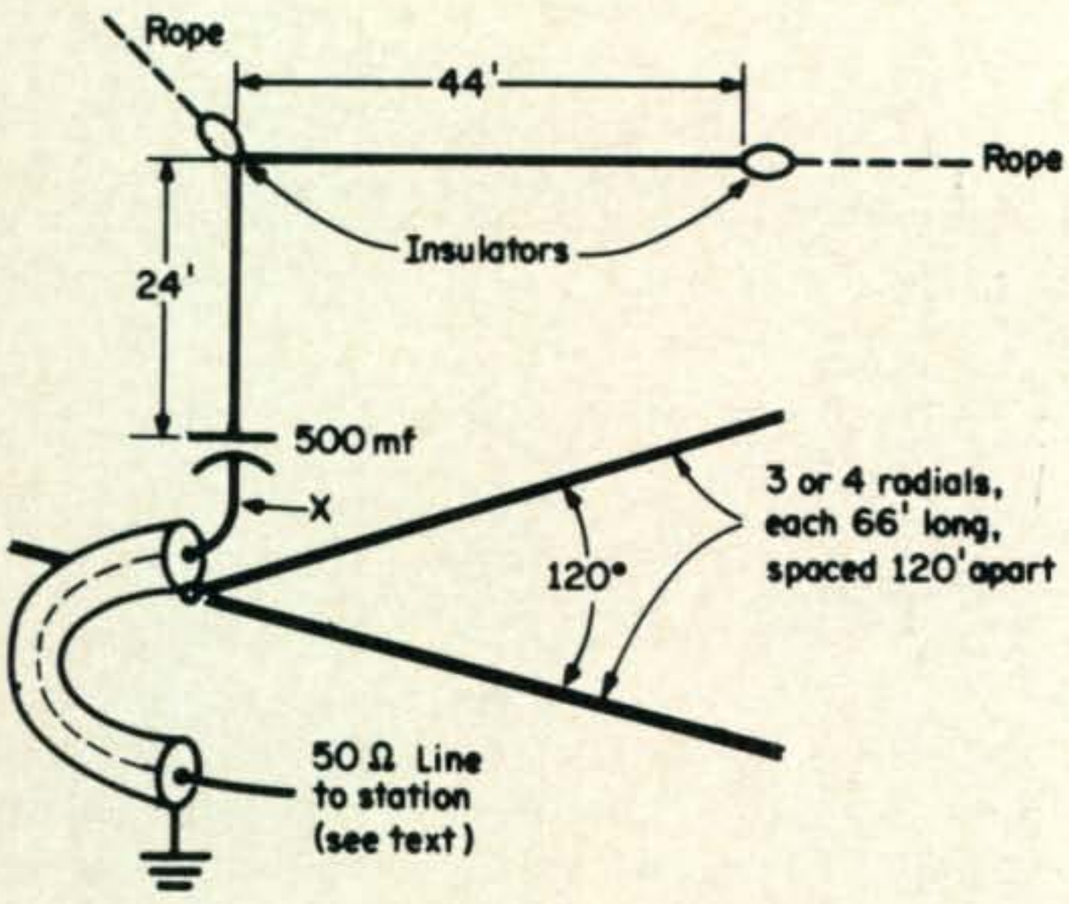

Fig. 4—The simple Utility Antenna for 80 meters. This up-to-date version of the old Marconi antenna provides both horizontal and vertical radiation, plus a 50 ohm feedpoint termination. For adjustment, the antenna is broken at point X and a two turn coil inserted between the series capacitor and ground. (The feedline is unused in this test). The series capacitor is adjusted for grid dip resonance indication at the chosen operating frequency. Three or four 66 foot radials are used, strung a few feet above the ground. A ground connection is also required at the base of the antenna system. The 24 foot leg is vertical, and the 44 foot section is horizontal, forming an inverted L-section, as shown. Radials should be made of insulated wire, and should not touch the ground.

lator is set to the desired center frequency of operation, in this case, 3.8 mc. The series capacitor (made up of paralleled sections of a broadcast tuning capacitor) is adjusted until an indication of resonance is found on the oscillator. The variable capacitor may be temporarily clipped in the circuit, with the stator sections attached to the antenna and the rotor (frame) attached to the pickup loop and ground. When resonance is found, coupling between the loop and the grid dip oscillator is loosened until a very sharp resonance dip is noted. The capacitor may then be removed from the circuit and measured on a bridge or capacitance meter. For the antenna shown, a capacitance of 500 mmf was required to establish resonance at 3.8 mc. More capacitance will be required for a lower resonant frequency, and less for a higher one. Once the value has been determined, a fixed transmitting-type mica capacitor may be substituted for the variable test unit.

The base impedance of the antenna at resonance is established by antenna length. If the s.w.r. value at resonance is judged to be unusually high, the antenna length may be varied a few inches at a time, one way or the other to bring the impedance close to 50 ohms. Conversely, the resonant frequency of the system may be varied back and forth by adjustment of the test capacitor, and a plot of frequency vs. s.w.r. run for the antenna length in use. Observation of the plot will then disclose whether the antenna should be shortened or lengthened to hit the "target" center frequency.

Operational Results

But the antenna is not that critical in adjustment! A bit of juggling of the series capacitor value can move the resonant frequency several hundred kc, an ample amount to swing the antenna plot from one end of the band to the other. In fact, the antenna shown has been operated at 3.5 mc with a measured s.w.r. of 5.5:1 (wow) with no ill results to the transmitter. True, it refused to load at first, but the length of the coaxial transmission line running from the antenna to the transmitter was changed a bit, in small increments, until satisfactory loading was established. This expediency did not alter the s.w.r. on the line in the least, it merely presented a more acceptable value of reactance at the transmitter—a value that fell within the operational limits of the pi-network coupler in the equipment. This length of line was retained, since it did not affect operation of the antenna at the other end of the band in the region of 3.65-4.0 mc.

Thus, by prudently trimming the transmission line, the antenna provided a satisfactory match to the transmitter over the entire 80 meter band, regardless of the fact that a rather high degree of s.w.r. existed on the line below 3.65 mc. The art of juggling transmission line length is not universally known, but it is a good stunt, and effective. The user should not, however, think he is improving the s.w.r. on his antenna system by this stunt. To the contrary, the s.w.r. remains as before; the impedance presented to the transmitter under high values of s.w.r. is merely more acceptable. In each case, the experimenter will have to determine the proper line length for his particular antenna system that will permit adequate transmitter loading at high values of transmission line

[*Continued on page 84*]

A MUST FOR EVERY DXER

DX AWARDS LOG

This fabulous book sells for $3.95 anywhere in the U.S. and is available for immediate delivery from the CQ Technical Library. However, with any subscription to CQ you can obtain a copy of the *DX Awards Log* for just $1.50 (a $2.45 savings). To obtain your DX Log at the discount price it must accompany a subscription order to CQ, but that order can be for renewals or extensions as well as for new subscriptions.

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A Digitally Divided Frequency Standard for Lab or Receiver

BY ALAN NUSBAUM,* W7FZU

THERE have been many articles published on the subject of digital frequency division by means of integrated circuits. There are several commercially available kits for those who wish to assemble their own circuit boards with crystals and I/C's. All these systems function sufficiently well but with one severe shortcoming. The dynamic stability of the crystal is inadequate for precise frequency measurements of receiver calibrations and, more importantly, as the state of digital art in amateur radio application grows by an order of magnitude each year, the need for a high resolution time-base system is an inescapable necessity.

The very concept of any digital design has its roots based in time. A microsecond in todays circuitry is relatively a very long time for error generation. A megacycle is equal to a microsecond times 1 million. Suppose for example, you were to build a digital frequency counter with an error of just 500 cycles in a 1 mc time base generator. It will have an error of 5 kc in 10 mc–25 kc at 50 mc–which should become clear to the builder he has a totally unacceptable margin of error and of course a piece of useless equipment.

*3627 E. Highland Ave., Phoenix, Ariz. 85018.

Front view of the digitally divided frequency standard. This model has switch positions for 1 mc, 100 kc and 25 kc only. 50 kc and 5 kc outputs are inherent in the design and need only be switch selected. The two miniature toggle switches at left are ON-OFF and STANDBY. Output is through the BNC connector at top front.

Frequency Source

Sparetime builders of electronic measuring and test equipment are prone to apply least cost philosophy to some projects thereby solacing their conscience and budgets; but what does it prove? This project does not set out to save you money. It's a precision digital frequency divider. You cannot buy a "cheap" frequency source with any stability or accuracy. You can, however, find some reasonable parameters and stick to them. With some patience, research and some letter writing, you can generally upgrade the quality of your project. As .a case in point, this instrument has a minimal required stability of 2 parts in 10^6 from $-40°C$ to $+55°C$ (as most of these systems run in the home).

Where can these be found? For one, you can build a proportional oven system to stabilize the $f/\triangle f$. This oven cannot use a thermostat but must work with a thermistor bridge network together with temperature compensating passive devices. You must also use a glass enclosed crystal for best thermal performance.

This writer secured a Motorola proportional oven at 1 mc from a surplus junked range receiver. A point to be emphasized is that the frequency of the element is secondary to its mechanical condition. Crystals can be changed or frequencies can be shifted by

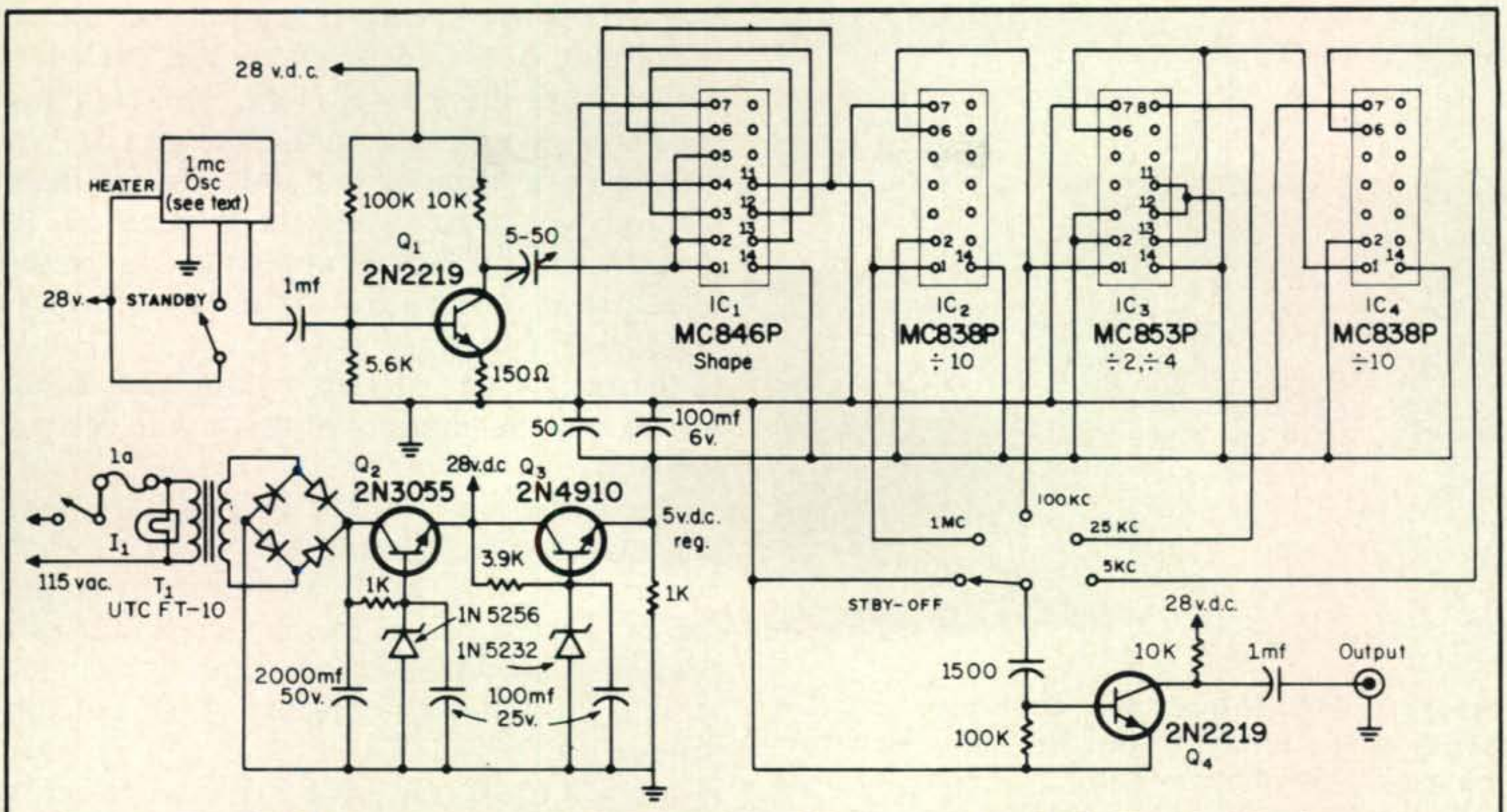


Fig. 1—Circuit of the digitally divided precision frequency standard. The circuit shown provides for 1 mc, 100 kc, 25 kc and 5 kc outputs, although 50 kc output may easily be attained by simply connecting pin 1 of IC_4 to an additional switch position. Useful outputs up to 100 mc are available. Capacitor values are in mmf unless otherwise specified. All solid state devices are by Motorola.

multiplication or division if the fundamental is acceptable.

Divider Chain

The divider chain described here has as a source oscillator a Motorola proportional oven described earlier with an accuracy of 1 part 10^{10} per degree C, with greater than 1 part 10^{10} r.m.s./sec operating at 28 v.d.c. As this unit has 1 mc output, it lent itself to straightforward digital division.

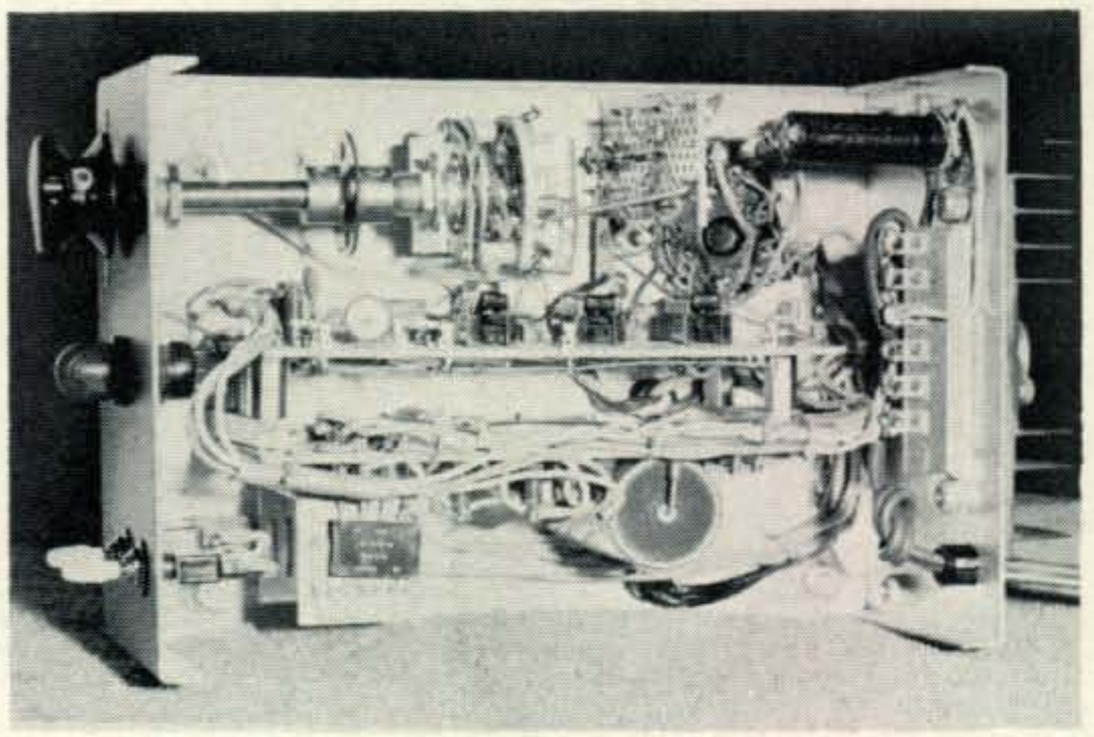
At this point a discussion of odd numbered frequencies is in order. First, 1 mc for our purposes is perfect. We can use a 10 mc oscillator with no degradation in performance. It requires the additional "divide by 10 stage."

If you secure a 5 mc oscillator, using two Motorola MC853P Dual JK Flip-Flops will produce two usable outputs—divide by 5 and divide by 10 as shown at fig. 2. An alternate method, though not encountered, would be to use a FET frequency doubler from 5 to 10 mc then divide by 10 to get one mc. However, it's simpler and better to confine frequency changing to logic circuitry as much as possible as it eliminates the need for tuned tanks and circulating r.f. fields that could play havoc with logic.

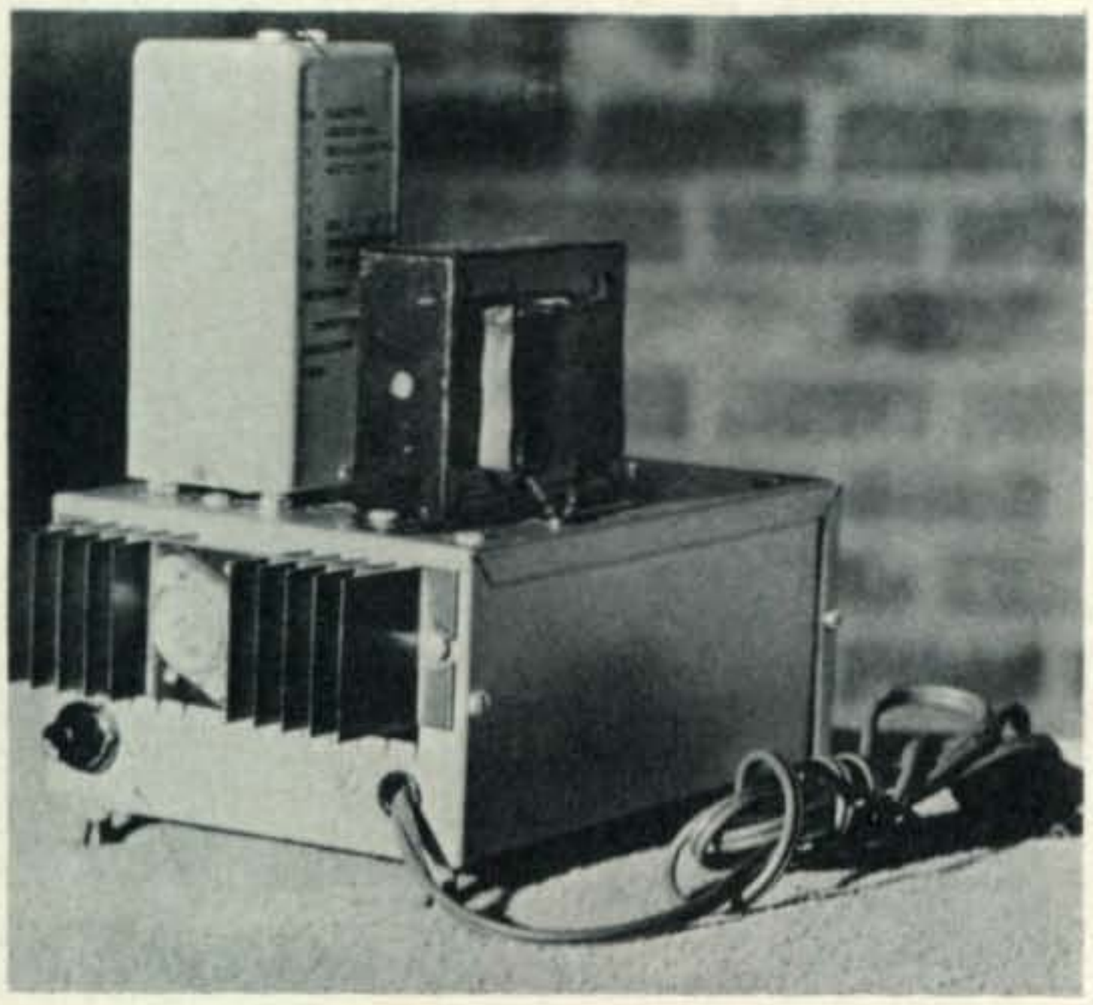
Examining the schematic at fig. 1, the oscillator has a heater line and a power line. The heater line should be connected at all times when using a thermally regulated system.

The logic family is Motorola's DTL, chosen because of good immunity to noise, simple to drive and gate, and low cost. 5 volt regulation is secured through a dual series pass transistor regulator. The voltage must be extremely stable and ripple free.

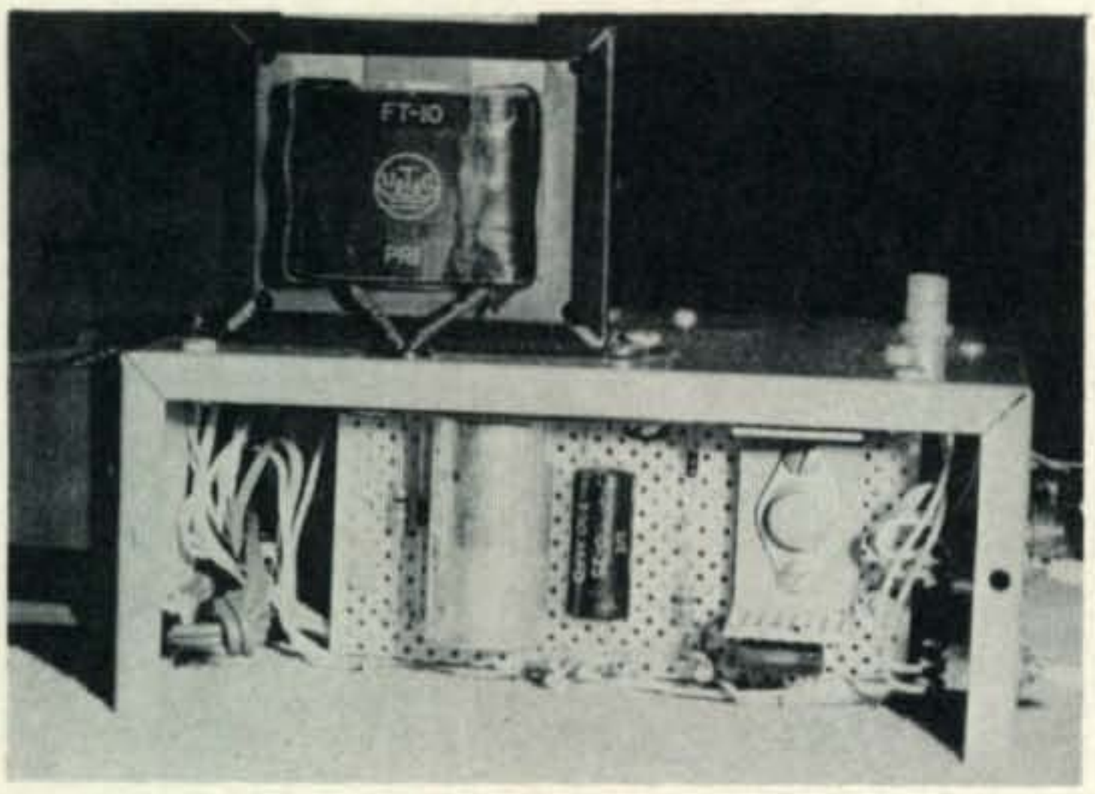
The oscillator's output in this system is 2 volts, too low to drive the shaper circuit. A



Underside view of the precision calibrator. Power supply is at the bottom, with the divider chain circuit board edge mounted at the center. At the top of the photo is the output selector switch, and circuit board containing amplifier Q_1 and harmonic generator Q_4. Also visible is the octal socket accomodating the standard oscillator.



Above: rear view of the calibrator showing series regulator Q_2. Below: left side view shows power supply board wiring. Q_3 is near the front with the Motorola bridge rectifier MDA 942A-2 below.



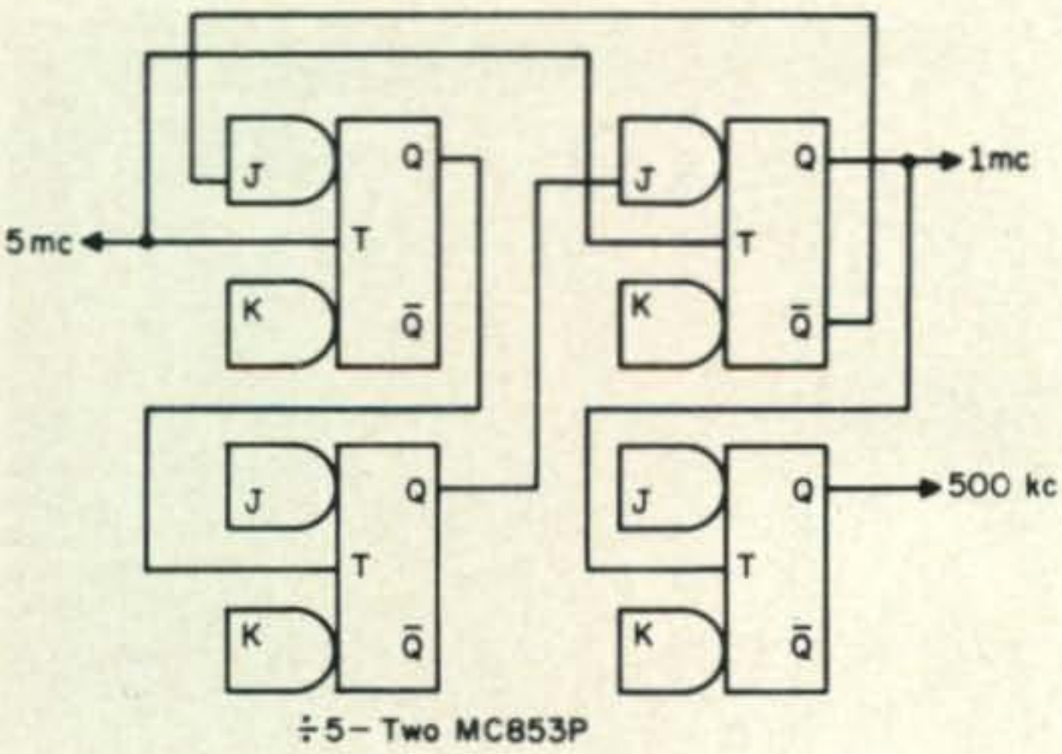


Fig. 2—Divider circuitry for use with a 5 mc standard oscillator. From the 1 mc output, all outputs available in fig. 1 are also attainable, and in addition, 500 kc output can be selected if desired. Tie all unused gate inputs to 5.0 v.d.c. Do not ground any other outputs.

single transistor linear gain circuit was added. Its output is *R-C* coupled to the MC846P whose input drive level is 4v. The coupling capacitor is adjusted until the 4v. P/P is viewed on a scope at pin #1. An alternate method would be to set the trimmer at its lowest capacity before applying d.c. power to IC_1 then observe the output waveform at pin 11 while increasing the coupling. Couple to the pont where a clean square wave is observed and no more; overdrive will destroy the *IC*!

The purpose of the MC846P is to reshape the oscillator's sine wave into a square wave compatible with DTL waveform requirements. The output of the shaper is 4.2 volts peak at 1 mc which is then directly coupled to IC_2, an MC838P "divide by 10" counter producing 100 kc. The output of this stage is coupled to IC_3, an MC853P dual JK Flip-Flop. This device contains two independent (other than power and ground) divide-by-2 flip-flops. The output of the "upper" stage is connected to the "lower" stage so that when the clock goes from high to low on the "upper" the voltage at pin 6 goes high. It toggles the lower," repeating the process, thereby producing a divide-by-4 function.

Examining the output frequencies at this stage we find we have 50 kc from the upper stage and 25 kc from the lower.

We then connect the output of the "upper" (50 kc) to another MC838P "divide by 10" counter whose output frequency will be 5 kc.

A selector switch taps off the following frequencies: 1 mc, 100 kc, 25 kc and 5 kc. If there are reasons to use the 50 kc output, a tap is available. The switch rotor is connected to a non-linear class C amplifier Q_4 whose output is sufficiently distorted to produce rich harmonics up to 100 mc. The output of this system is fed by RG-58/U to a tee connector in the receiver coaxial line and injected directly into the receiver input.

Performance

Tests of this instrument on a Monsanto frequency counter indicate that after initial warm-up of 1 hour, the frequency deviation was about 7 c.p.s. in 10 mc but this may have been ambiguity of the counter. The original frequency of the divider was zeroed to WWV.

Additonal uses for this instrument are found in generating time base marker pips by means of an external one-shot *IC* trigger than can Z-axis-modulate a scope, establish-

[*Continued on page 81*]

IN DEFENSE OF C.W.

BY WILLIAM RYBURN,* W9EG

In 1937, when I was searching for slow, c.w. with a regenerative receiver and struggling to attain 13 w.p.m., there were some around who were saying "c.w. is obsolete, and code skill should not be a requirement for a ham license." I must admit, I probably never would have mastered the code if it hadn't been for my determination to get that ticket. But c.w. was not obsolete in 1937, and it isn't obsolete now. Granted, the method of communicating from hand to ear as originated by Mr. Morse *et al* has been supplemented by many other methods. I would be the last to deny that these other methods have indisputable advantages with regard to speed and the absence of need for learning a new skill. But hand sent c.w. also also has, and will continue to have through the foreseeable future, certain advantages that make it a worthwhile tool in the pool available to the amateur and professional communicator.

To review a few of the advantages that come to mind... first and foremost, with ever tighter cramming of signals into the radio spectrum, c.w. still has the smallest appetite for bandwidth. I defy you to cram five or more readable QSO's into a five kc segment with any other mode that is readily available to the radio amateur.

And, c.w. can afford considerable pleasure with the simplest gear. Even the beginner can "homebrew" his c.w. transmitter. I'll never forget the thrill of that first VK contact, using a breadboard c.w. rig coupled to a Romex fed doublet.

C.w. is the mode used by many of our handicapped friends whose only contact with the outside world is via amateur radio. For example, you may have heard of Richard Joy, WB6YUB. Though Richard has been blind and deaf since infancy, he has mastered the skill of c.w., and with amateur radio he literally has the world at his fingertips... he copies the code with his fingertips.

From my own vantage point, a major argument in favor of c.w. concerns the limitation imposed by international language differences. c.w. allows accurate record copy in spite of language barriers, as compared with voice modes. In my present job as radio officer on the Steamship *Green Forest*, I was awakened abruptly one morning at 5 a.m. by the auto alarm bell... triggered off by the 500 kc signal from the sinking freighter, *Antonios DeMades*. I had the dubious privilege of relaying the last formal message sent out from that ship... and the message was entirely in the Greek language. I don't know how long it would have taken to copy accurately those forty or so Greek words using radiotelephone, but by c.w. it took a couple of minutes. If there are any that say we should have been able to relay by RTTY... well, for one thing, besides practical economics, consider that emergency batteries may be the only source of power still functioning in such circumstances.

To cite another example, at random from my recent experience as a shipboard "sparks," there was an interesting trip through the islands of Indonesia on a freighter making the "rubber run." One of the shore stations I exchanged traffic with was PKC, Palembang, Sumatra. The Palembang shore station equipment at the time consisted of surplus BC-348 receiver, surplus TCS 8 mc transmitter, and a surplus BC-191 for transmitting on 500 kc. The sun was passing almost directly overhead at the time we were exchanging messages by old fashioned c.w. and the QRN level was S9 plus (I built myself an audio noise limiter shortly after that!). But, though the static did give me a little trouble, language difference was no problem in passing English language messages to and from the company's agent in that port. The parallel is there in many of our amateur radio contacts with DX stations via c.w. With even a limited knowledge of the English language and through the use of commonly known "Q" signals and abbreviations, the amateur in a foreign land communicates with us quite acceptably. There's a parallel too in that equipment that I observed when I visited

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PKC, the amateur off the beaten track often doesn't have, or can't afford, the latest most sophisticated equipment.

So, if those of you who haven't really tried c.w. would jump in there and pound a little brass, even though it might take a while to work the rust out, you may just find that it's actually fun. And the c.w. aspect of our great hobby can really get interesting if you stay with it long enough to be able to sit back and listen, relaxing while copying in your head, with just a note now and then... like on phone but more leisurely. Somewhere along the line you also graduate from brass pounder to transistor tickler with an electronic keyer for effortless sending. You get so you recognize the different "fists" on the air because each sender has his own (and sometimes, unusual) way of putting those dits and dahs together. I even suspect that some take on a new personality when they move to c.w. So it is always interesting to meet a guy on phone who you have previously worked only on c.w., and vice versa.

On c.w., one or two short CQ's will often reward you with a QSO, without your having to search and break, or wait to "tail end" a QSO in progress. Furthermore you don't have to be concerned that you'll get involved in a round table type of operation... where you may have to wait so long to say your piece that the subject has changed away from whatever it was you thought it might be nice to discuss. One fellow I worked awhile back said he had given up on phone almost entirely... he was fed up with having so many of the phone QSO's he engaged in turn into interminable round tables.

You meet some very capable and interesting YL ops on c.w.... and your imagination can really run wild. You can imagine a soft sweet voice along with all the other features of your choice. And I've heard fellows say things to the girls on c.w., things they'd never dare say on phone!

On c.w., you can enjoy full QSK with the simple installation of a vacuum tube TR device ...no clacking relays and no concern about blowing the final bottles should a changeover relay fail to function. With full break you can immediately note QRM coming on frequency. And you can hear the fellow on the other end come through with a question or request for repeat... no lost transmission with needless resulting interference.

In time, your ear will develop selectivity to the extent that you'll be able to copy one of two or three audible signals, as long as they aren't exactly zero beat. In fact, it shouldn't take too long to develop this particular talent if you participate in the pile ups around the rare ones.

If you aren't sufficiently impressed by the arguments thus far, there is one more. Operating on c.w. part of the time is an excellent way to keep your code speed up to the 13 w.p.m. that is required in order to renew your conditional, general or advanced class license. That 13 w.p.m. requirement isn't in there just to make things difficult for us, there are practical reasons, having to do with national defense, emergencies, and allotment of limited frequencies to allow occupancy by the greatest number of stations (if we'd just make full use of the c.w. ends). Our amateur privileges are not as firm as the Bill of Rights. The least we can do is maintain that originally required 13 w.p.m. proficiency.

From 13 w.p.m., upgrading to 20 w.p.m. is not the completely "impossible" obstacle that some seem to imply. I've worked youngsters not yet graduated from high school who communicated very smoothly at 20 w.p.m. or more. I suspect that more would be doing that upgrading to the requirement for extra class if it were not for demotivating influence. Many "old timers" are spending a great deal of time complaining about the unreasonable code requirement for extra class. So, maybe we should have a new "Granddaddy" clause, to allow anyone licensd before the time extra class first was initiated to test for it with a code speed requirement of 13 w.p.m., but without the allowance for having passed that speed previously. I suspect that the loudest of the complainers still would not go running to the examiner's office. But at least there wouldn't be much rug left under their cries of woe.

At least a part of the justification for allowing amateur radio to exist is to provide a pool of qualified operators and technicians for times of emergency. If that justification is valid, then by itself it is sufficient to support some type of motivating influence toward the upgrading of operating as well as technical proficiency in the amateur ranks. Passing 20 w.p.m. at the examiner's office requires only one minute of solid copy and concentration, under "ideal" conditions (except for nervous tension for those lacking in confidence). The code sent is perfect tape with no interference, no static. Actual practical traffic handling is something else. An

operator barely able to make one minute of solid copy at 20 w.p.m. from tape would probably do well to maintain a sustained 15 w.p.m. under "on the air" conditions with hand sending. That is not an unreasonable speed to ask of any traffic handler.

I will concede that the staccato machine-gun sound of code at higher speeds can be unnerving to the beginner. It is not nearly so fast as it sounds to the uneducated ear. So a good share of the problem is in overcoming that impression that it might be impossible ever to comprehend speeds above 13 w.p.m. Let me suggest the following procedure that might help in building code recognition without the development of mental blocks. Use a tape recorder set at 1⅞ i.p.s. to record practice material at a speed you can copy with comparative ease. Record it with receiver tuning set for a pitch around 500 cycles. Then, play the material back at 3¾ i.p.s., while reading and following along on your copy made at the lower speed. This will familiarize you with the sound of the letters and, more important, the sound of complete words at the higher speeds.

Some have a problem distinguishing the number of dots at the higher speeds. In my own case, I have found that the brain computer can be conditioned readily by following the dots in "pairs" rather than one at a time. Even the eight dots for the error sign can be easily counted out if you think of it as "dittie dittie dittie dittie" rather than "dit dit dit dit dit dit dit dit." For the odd one, number five, it works out okay as "dittie dittie dit"... two pairs plus a single.

Learning the code was no snap for me. I got hung up on those same plateaus that others have experienced. I flunked 13 w.p.m. once and had to go back the second time. And I still look with envy on the op who can sit there copying 40 w.p.m. with the greatest nonchalance while carrying on a conversation at the same time. So far, the only non aligned function my one track brain will permit while copying on the mill, is smoking a pipe or cigar.

Those for whom code skill comes "naturally" have a gift comparable to that possessed by some athletes with born coordination that allows them to reach the pro ranks with comparative ease. So there may be some effort required to make it rewarding. But it can be rewarding.

[*Continued on page 81*]

KEYED SOLID STATE OSCILLATORS

BY DI MING LEE*

In high-frequency solid-state oscillators not employing crystals as the frequency determining element, it seems that chirp-free keying is somewhat difficult to obtain. While the frequency drift in transistorized oscillators is more or less greater than in vacuum tube oscillators, transistorized oscillators undergo a marked transient frequency change when going from a non-conducting state to a conducting state. This transient frequency change is much more pronounced in solid-state circuits than in vacuum tube circuits. To investigate this phenomenon, several test circuits, which will be discussed in detail later, were set up.

The input circuit of a transistor can be represented by an equivalent circuit consisting of a capacitance and a resistance in parallel. Since chirp is a change in frequency over a short period of time, it can be seen that if the equivalent capacitance changes in value, the frequency will also change.

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Preliminary Experiments

In experiment #1, a test circuit using 3N128 MOSFETs was set up. This oscillator employing source-keying was operated at a frequency of about 24 mc. The power supply used was two 6-volt car batteries connected in series. The capacitive divider C_2 and C_3, used as the positive feedback network and the main tuning capacitance, were mica capacitors with capacitances of 100 mmf and 220 mmf respectively. Twenty-four 3N128s were tested. All twenty-four transistors had chirp. In each experiment, the number of the keying corresponding to the value of the non-oscillating or quiescent current recorded. The quiescent current, ranging in value from about 2 ma to about 10 ma, varied widely for each individual transistor. It was found that no pattern existed between the

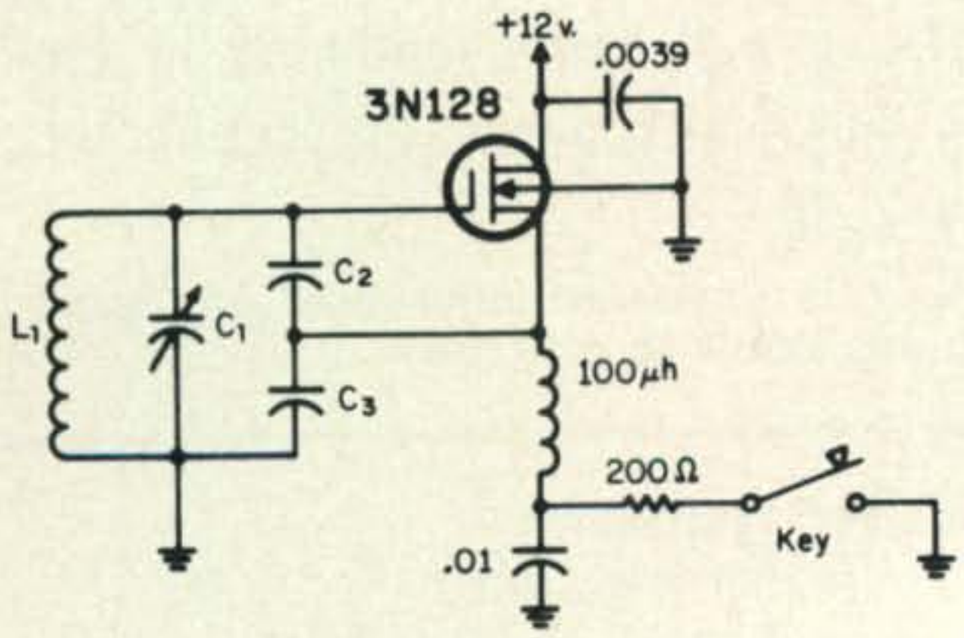


Fig. 1—Keyed FET oscillator used for experiments 1 and 2.
C_1—3-30 mmf air variable capacitor.
C_2—Exp. #1: 100 mmf mica capacitor.
Exp. #2: 270 mmf mica capacitor.
C_3—Exp. #1: 200 mmf mica capacitor.
Exp. #2: 560 mmf mica capacitor.
L_1—Exp. #1: 10½ t. #16 wire, 1" long on 1/2" dia. ceramic form. 4½ t. used
Exp. #2: Same as above except 2¼ t. used.

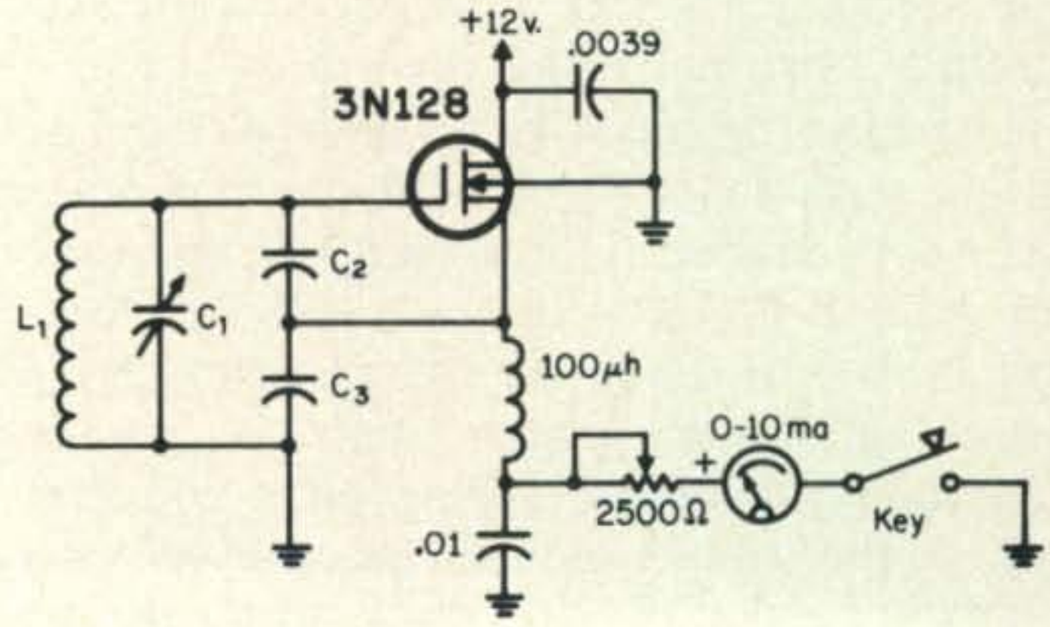


Fig. 2—Keyed FET oscillator with adjustable bias current for experiments 3, 4, and 5.
C_1—3-30 mmf air variable capacitor.
C_2—Exp. #3: 270 mmf mica capacitor.
Exp. #4: 100 mmf mica capacitor.
Exp. #5: 560 mmf mica capacitor.
C_3—Exp. #3: 560 mmf mica capacitor.
Exp. #4: 220 mmf mica capacitor.
Exp. #5: 1200 mmf mica capacitor.
L_1—Exp. #3: Same as in Exp. #2.
Exp. #4: Same as in Exp. #1.

quiescent current and the quality of keying.

In experiment #2, the capacitive divider C_2, C_3 was replaced by a 270/560 mmf combination. This time, two 3N128s gave chirp-free keying. The keying quality of the others ranged from bad to marginal.

In experiment #3, the 270/560 mmf combination was retained. The 200 ohms source resistor was replaced by a 2500 ohms potentiomtter. The potentiometer was adjusted for a minimum drain current to still sustain oscillation. In practically every case, the drain current was adjusted to 2 milliamperes. When this adjustment was made, the quality of keying improved considerably. Now there were only two bad ones and two marginal ones.

In experiment #4, the 100/220 mmf capacitive divider was tried again. This time, the drain current was adjusted accordingly as in experiment #3. It was found that keying was good but not as good as when the 270/560 mmf combination was used.

In experiment #5, the capacitive divider was replaced by a 560/1200 mmf combination. This combination together with the potentiometer adjustment produced chirp-free keying in every transistor. However, the increased tuning capacitance lowered the operating frequency considerably. Decreasing the number of turns of the coil after a certain point to raise the frequency to near 24 mc stopped the oscillations. This is because as the coil turns is decreased, the inductance of the coil decreases much more rapidly than the effective series resistance of the coil, thereby lowering the Q.

It seems that solid-state oscillators are more susceptible to a transient frequency change than are vacuum tube oscillators assuming that in both cases, the supply voltage is regulated. Therefore, solid-state oscillators must be designed with certain other necessary precautions in mind.

Conclusions

From the results of the five previous experiments it can be concluded that both a high tuning capacitance and a low quiescent drain current at the same time are needed to give satisfactory keying. Fulfilling either one of the requirements is not enough. The capacitance of the capacitive divider should be large enough to shunt the effects of any capacitance change within the semiconductor device. At the same time, the capacitance should be small enough to permit operation at

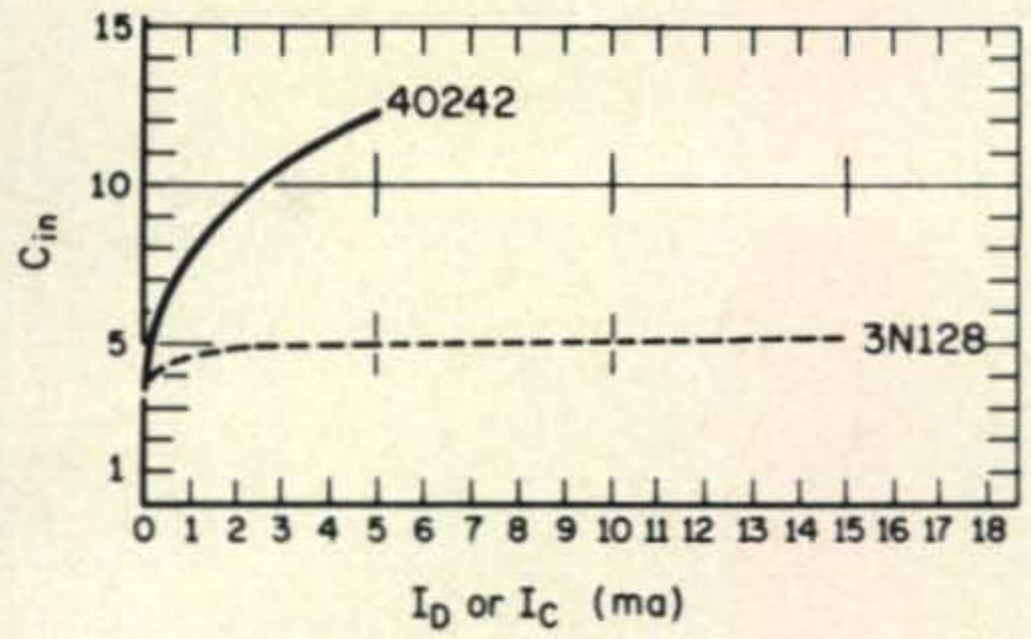


Fig. 3—Input capacitance versus Drain or Collector current for the two transistors used in the author's experiments.

the highest frequency desired without the need to decrease the inductance of the coil to such a degree that it will cut down the Q of the coil considerably.

Another way to minimize the internal capacitance changes within the transistor is to keep the quiescent drain current at a minimum. The input capacitance of transistors changes with the amount of current flowing as illustrated in fig. 3. Therefore, by keeping the quiescent drain current at a minimum, the rise in current when the transistor is keyed from zero current to the operating point is also at a minimum. The less the change in current, the less the change in input capacitance which in turn means less change in the frequency.

There is also another important factor to consider when designing chirp-free solid-state oscillators. It is always desirable to keep the oscillators within the linear portion of the

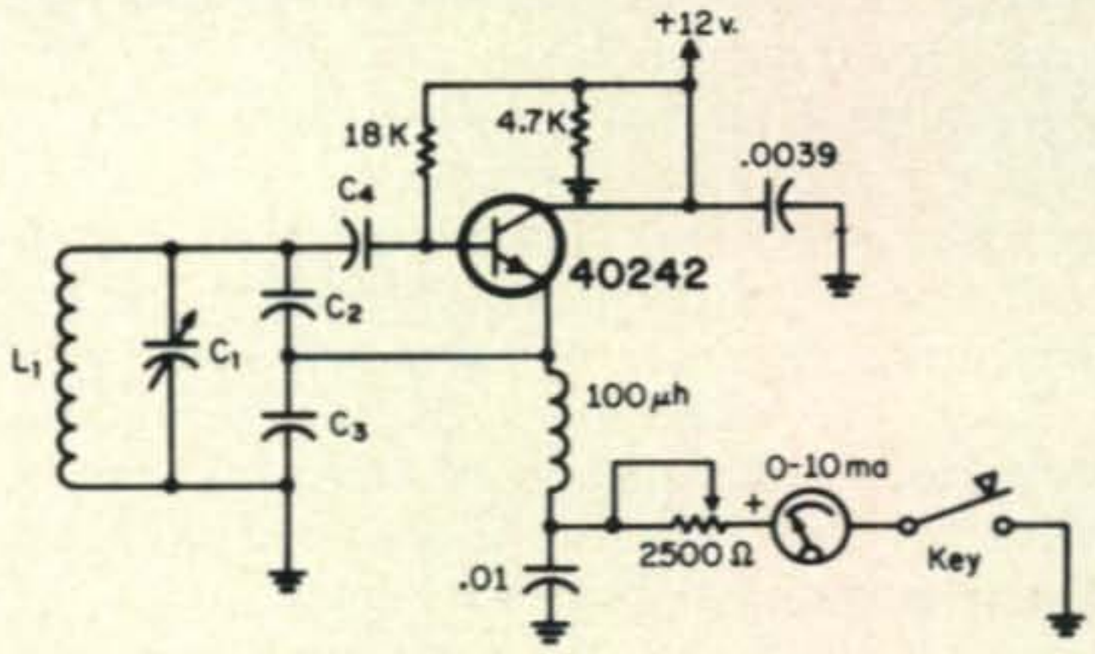


Fig. 4—Keyed bipolar transistor oscillator for experiments 6 and 7.
C_1—3-30 mmf air variable capacitor.
C_2—270 mmf mica capacitor.
C_3—560 mmf mica capacitor.
C_4—1000 mmf mica capacitor.
L_1—Exp. #6: Same as in previous experiments. 2¼ t. used.
Exp. #7: Same as in previous experiments. All 10½ t. used.

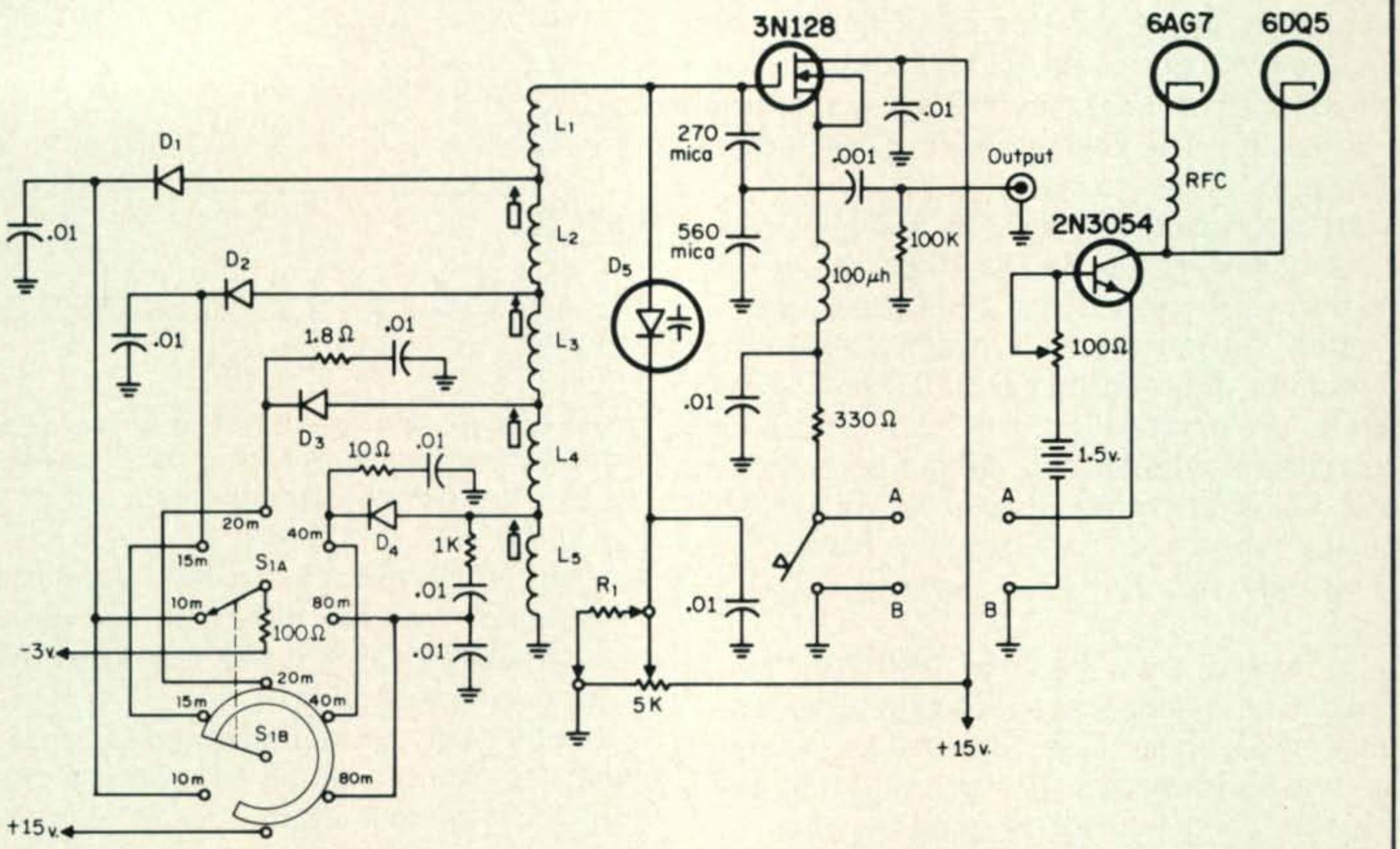


Fig. 5—Keyed 80—10 m. oscillator using the results of the author's experiments. An isolation circuit for keying in conjunction with cathode-keyed tube-type transmitter is also shown. All capacitor values greater than one are in mmf; decimal values are in mf.

D_5—Siemens BB109 varactor diode.
D_1—D_4—Siemens BA136 switching diodes.
L_1—4 t. #16, 5/16" l. on Miller 4200 form with slug removed.
L_2—Miller 20A107RB1 slug tuner coil.
L_3—Miller 4202 slug tuned coil with 7 turns removed.
L_4—Miller 4203 slug tuned coil with 2 turns removed.
L_5—Miller 4204 slug tuned coil.
R_1—For frequency shifting of oscillator as described in text. Value determines amount of shift. R_1 switched in by antenna changeover relay.

transistor transfer characteristics curve, for if the transistor is driven into saturation or cutoff, the value of average drain current as read by a d.c. current will change. The average current decreases when saturation is reached early and increases when cutoff is reached early. This kind of change in current will also affect the input capacitance of the transistor. In order to cut down the amplitude of the oscillation to prevent saturation or cutoff, either the Q of the tank circuit should be decreased or the designed quiescent drain current should be lowered. Both the tank circuit Q and the quiescent drain current are related to the gain of the oscillator, the latter being indirectly related. When the quiescent drain current is lowered, the transconductance of the transistor is lowered. A lower transconductance means a smaller gain and thus, the amplitude of the oscillation will decrease.

In experiment #6 again using the 270/560 mmf capacitive divider which was found to be the most suitable for the 3N128 MOSFETs, RCA 40242 bipolar transistors were tested in a similar circuit. A voltage divider to provide bias for the bipolar transistor and a capacitor to isolate d.c. from the tank circuit were added. The operating frequency was at about 24 mc. Under these conditions, every 40242 transistor keyed was chirpy, even when the collector current was reduced as low as possible. When the frequency was decreased to about 12.5 mc by using the entire length of the coil, the keying was still chirpy.

The poor results obtained from bipolar transistors can be attributed to the wide variation in input capacitance as the collector current is varied. The input capacitanct curve for the 40242 bipolar transistors is plotted on the graph shown in fig. 3.

In another setup, the 3N128 oscillator was connected to a 3N128 buffer. When keying only the buffer, it was found that regardless

of the value of the drain current of the buffer, chirp-free keying was obtained provided the oscillator transistor had the correct value of bias current and a high tuning capacitance to start with. A well designed buffer does contribute frequency stability and aid in giving chirp-free keying. However, when only the buffer is keyed, the oscillator should be well shielded in order to avoid interference during reception. Sometimes, keying both the oscillator and the buffer can be found to be successful due to the cancellation of unpredictable changing parameters in the two stages.

Frequency Shifting

If oscillator keying is not provided or cannot be obtained with good results, it means that the oscillator must be kept running all the time. This necessitates the need for slightly shifting the operating frequency or stopping the oscillation altogether during reception to avoid picking up the oscillator signal on the same frequency as the transmitting frequency. Both of the above alternatives to oscillator keying can be easily accomplished if the variable tuning capacitor is replaced by a varactor diode. In these cases, the d.c. conditions of the devices do not change. The problem of a transient frequency change then does not exist. Stringent circuit design is not crucial.

To shift the operating frequency, a resistor can be switched in across the varactor bias potentiometer by means of the antenna changeover relay when going from the transmitting mode to the receiving mode. When resistor R_1 is switched in as shown in fig. 5, it reduces the varactor bias. The reduced bias voltage increases the capacitance of the varactor diode. Hence, the operating frequency will be shifted to a lower frequency.

Instead of changing the magnitude of varactor bias to shift the operating frequency, the polarity of the bias can be reversed to stop the oscillation. In the transmitting mode the is reverse biased. When biased in this manner, the varacter behaves like a variable capacitor. In the receiving mode when the polarity of the varactor bias is changed to a forward bias, the varactor, acting as a rather large capacitance, provides a very low impedance path or essentially a short circuit for a.c. currents.

[*Continued on page 81*]

An Az-El Antenna Mount for Satellite Tracking

RCA Antenna Rotators Provide Strong, Compact Construction

BY WILFRED M. SCHERER,* W2AEF

Using two of the new RCA TV antenna rotators and a handful of common hardware, a strong and inexpensive az-el mount for satellite tracking can be constructed which will easily handle yagi antennas of large enough size for most satellite applications.

EACH month it has been our custom to present a review limited to a specific piece of gear of interest to the radio amateur. This time we'll depart somewhat from the usual type of report by combining a description of an accessory item with a special application for its use.

The item is the new RCA Antenna Rotator and the application is building an az-el (azimuth-elevation) mount for satellite tracking and communications for which the rotator is well suited.

This should be of particular interest for those planning to participate in the AMSAT-sponsored OSCAR 6 satellite scheduled to be launched some time in 1971, inasmuch as best results for satellite work are obtained when the antenna can be tilted between a horizontal and a vertical position for directivity at various elevation angles as well as being rotated for azimuthal directivity, such as may be accomplished with an az-el setup.

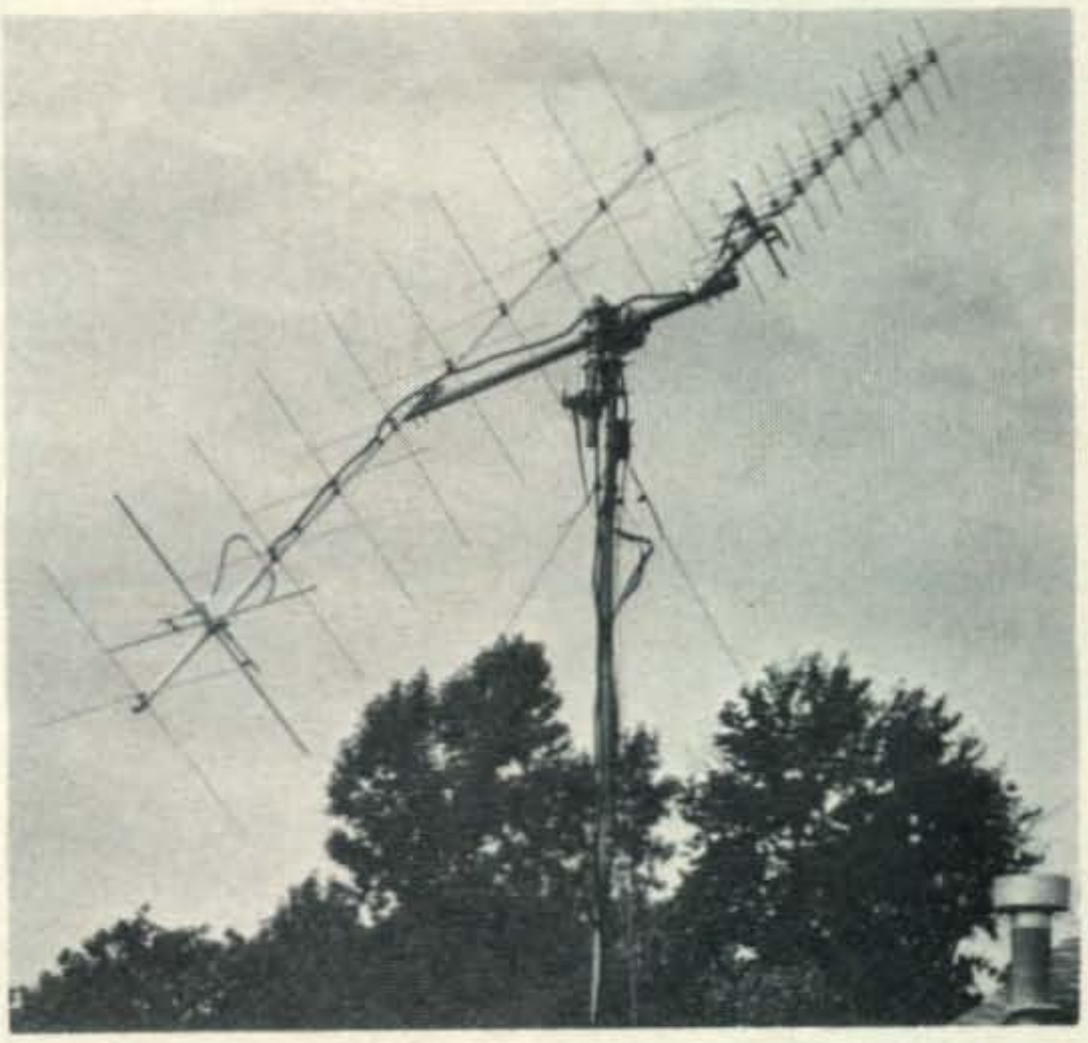
This, of course, does not rule out the use of an az-el mount for other u.h.f. operations, nor does it preclude the desirability of these rotators for other applications for which they are suitable, such as for normal use as a conventional antenna-rotator.

Rotators

There are two different models of the RCA rotators. Both incorporate the same rotating mechanism and type of assembly, the only difference being in the method of operation and the control system used, as will be discussed shortly.

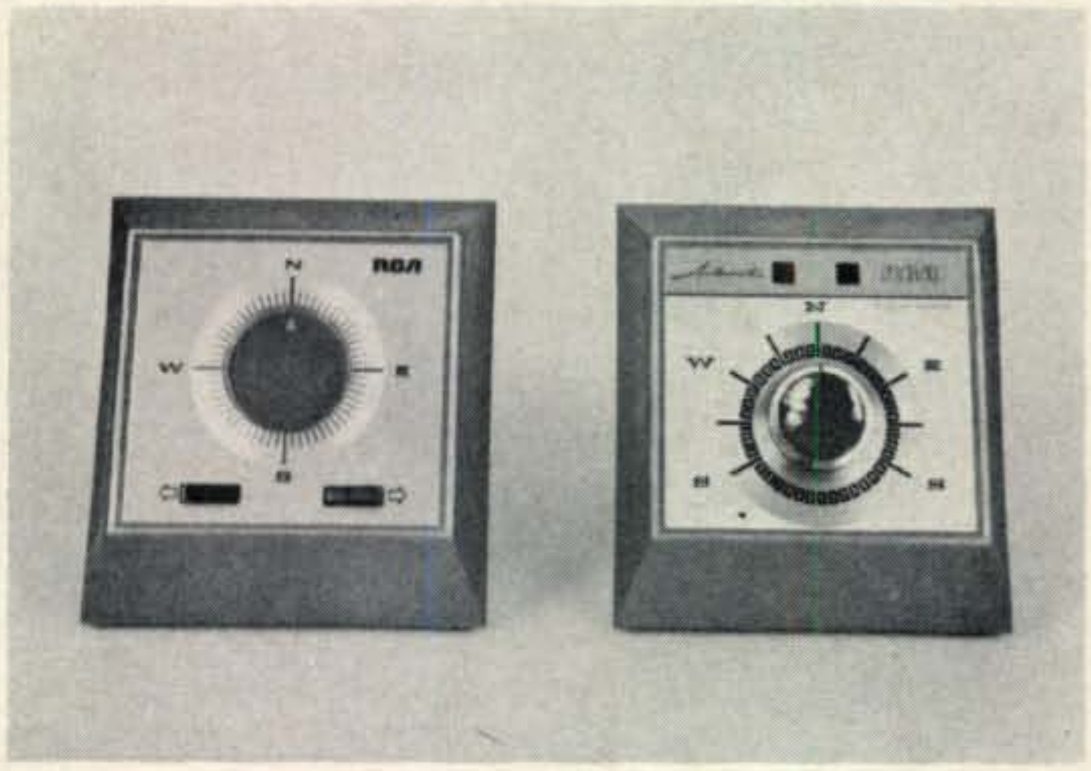
Although designed primarily for use with large TV antennas, the RCA rotators are rugged enough to handle the weight and wind-load requirements for amateur antennas of a size up to that of a normal 3-element 20-meter beam.

They are built into a high-tensile aluminum-alloy housing that is light in weight, yet strong and durable. The mechanism is driven by a high-efficiency low-voltage motor which



Satellite-tracking antennas all set for OSCAR 6. 144 and 432 mc Cushcraft Multi-Polarized Antennas are mounted on a single boom with horizontal and vertical directivity provided by a simple az-el setup and drive system made up with two RCA Antenna Rotators.

*Technical Director, *CQ*.



Control boxes for RCA rotators. That for the type 10W505 is at the left. The rotator is operated by holding down the c.w.- or c.c.w.-rotation push button at the lower left or right. The limit of travel in either direction, is at the SOUTH point of the scale which covers a complete circle and has calibrations in 6° steps (15 per 90° arc). The indicator advances as the rotator turns, permitting the position to be noted at all times. An audible click emanates from the box each time a 6° advance occurs.

The control for the 10W707 is at the right. Automatic operation is obtained simply by setting the selector for the desired direction shown on the scale which covers a 270° arc. The small calibration points are not evenly divisible into 360 degrees. The limit of travel is at the left-hand SOUTH point for c.c.w. rotation, at the right SOUTH for c.w. One of two lights at the top indicate that the rotator is turning and in which direction. The c.c.w. light is at the left, the c.w. one at the right. While the rotator is turning, its position at any instant may be found at the point where the related light goes out and the opposite light goes on as the selector knob is backed up. Operation of this unit is silent. The type 10W707 system is more costly. Prices may be obtained from RCA dealers.

draws a low current that minimizes voltage drop on long control cables. High-temperature insulation on the motor windings permits continuous operation without the need for a thermal cutout. A full-power stall may be withstood without damage. A positive disc brake on the motor prevents overshoot.

A worm, milled directly on its drive shaft, is operated by the motor through a pinion and a set of spur gears where an overtravel clutch allows the motor to start before the load is engaged, thus providing pre-turning momentum. The worm in turn engages a worm wheel that is cast and machined as an integral part of the main drive shaft which is supported at both ends by stainless-steel permanently-lubricated thrust bearings. Besides providing the necessary gear reduction and turning torque, the worm-drive system prevents windmilling.

The main shaft is hollow to accept an antenna support (or upper mast) of up to 1½" diameter. Serrated V-block clamps with a U-bolt, nested in a grooved reinforcement at the top and bottom of the shaft, securely hold the upper mast to the shaft and prevent slippage in high winds. Serrated clamps also secure the rotator housing to the main-support mast. A tab at the upper end of the housing-support rests on the top end of the mast, eliminating the possibility of the rotator slipping down the mast. A mast diameter of up to 2⅛" may be accommodated.

Alignment arrows on the drive shaft and the housing indicate when the rotator is at its mid-position which coincides with the NORTH point on the control-box indicator. The terminal board for the control- and power-cable connections is equipped with a cable clamp and a quick-access cover using a captive nylon thumbscrew which cannot be accidentally dropped and lost.

Control System

The RCA type 10W707 rotator is a fully-automatic unit that turns to and stops at the compass point to which the control-box indictator knob is preset. Two lights on the box indicate in which direction (clock-wise or counter-clockwise) the rotator is turning. When the desired point has been reached, the

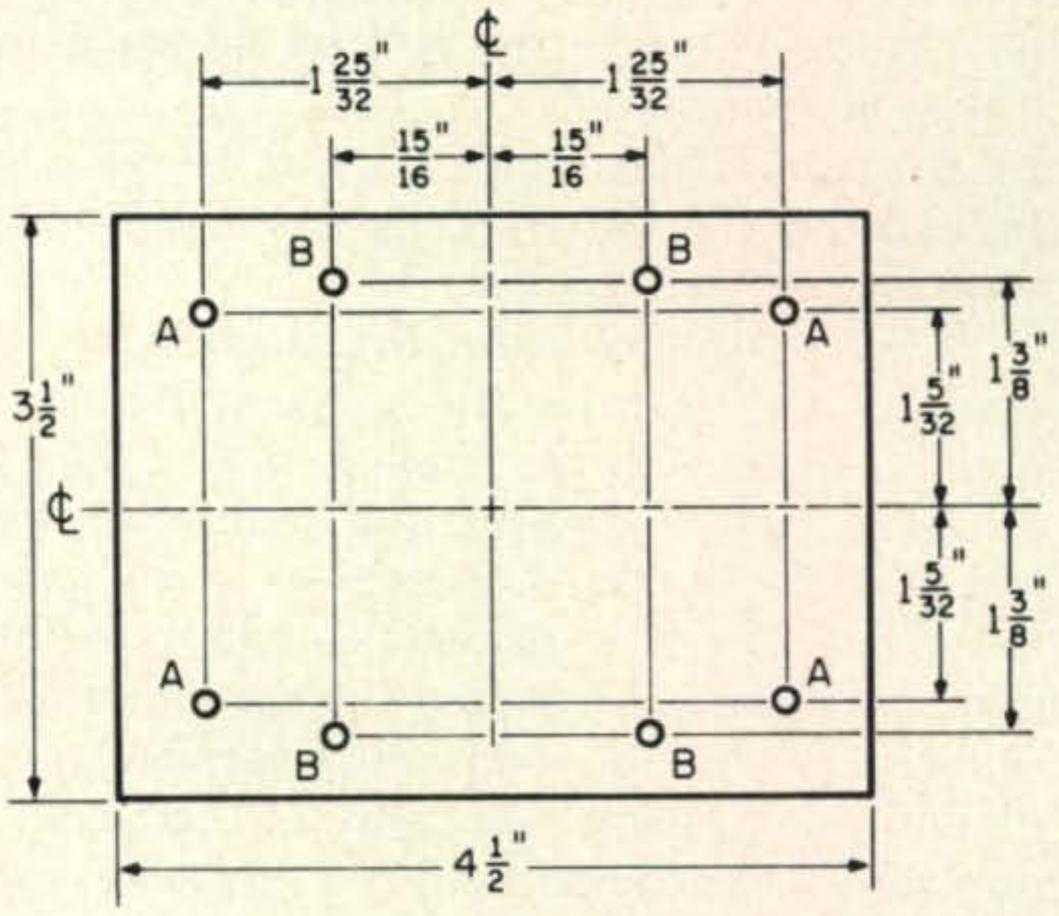
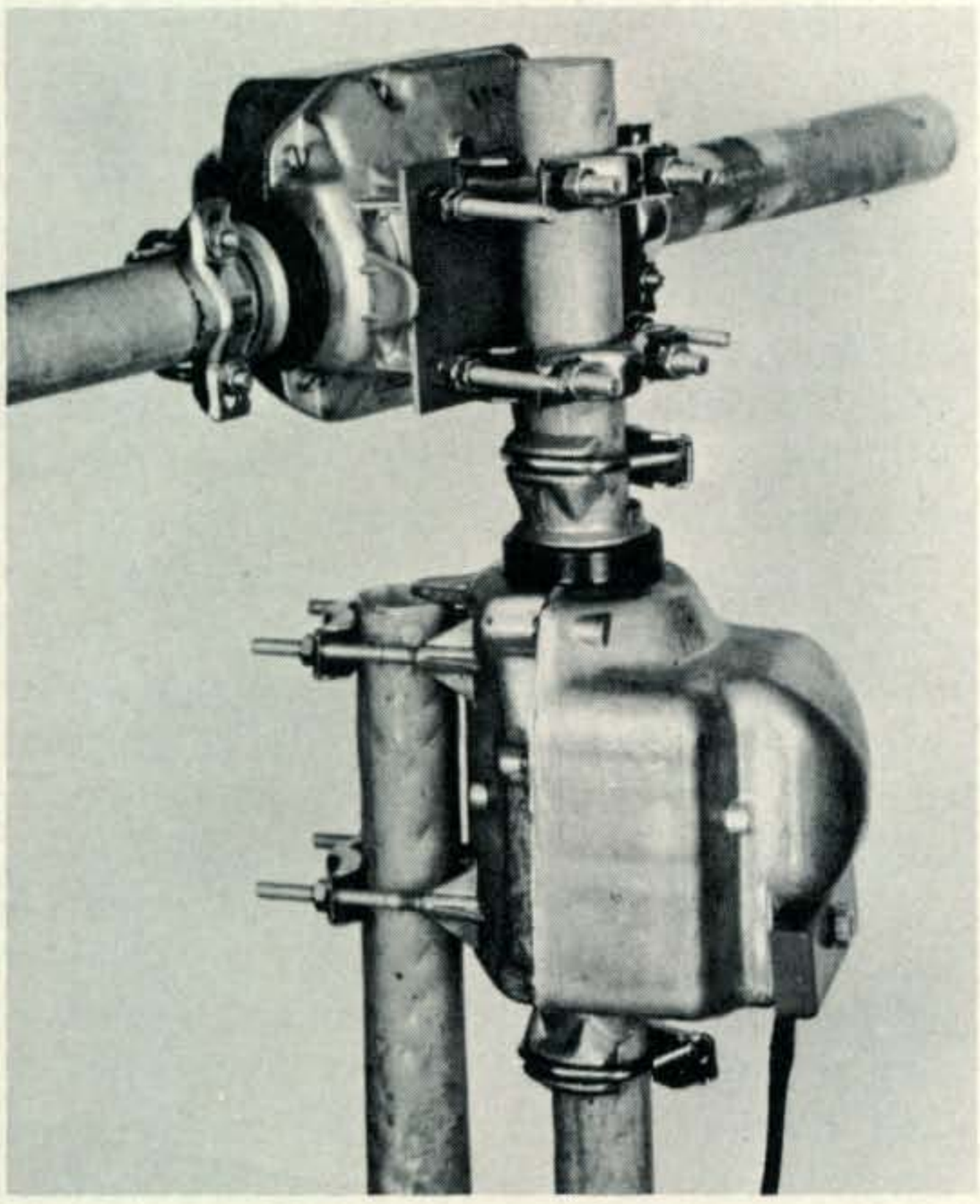


Fig. 1—Drilling dimensions for metal plate used for the az-el mounting. Holes at A are 9/32" diameter to easily fit over rotator stud bolts. Holes at B should be 1/4"-5/16" diameter depending on size of new-hardware bolts used for clamping horizontal rotator to the 18" upper mast.



AZ-EL mount with RCA antenna rotators showing method of assembly.

rotator automatically stops and the related light extinguishes.

The other model is the type 10W505 that is operated by two push buttons. Holding one button depressed moves the rotator in a clockwise direction, and holding the other button down provides counter clockwise rotation. As the rotator is turning, the control-box indicator follows the direction of rotation and shows the rotator position to within 1/60 of a turn. The position is thus shown at all times. Releasing the operating button stops the rotator at the indicated spot. Power for both models is obtained from a 117 v.a.c. source.

The control circuit for the model 10W707 operates on the balanced-bridge principle. A potentiometer in the motor drive unit is operated by the rotator and comprises two legs of the bridge. Another potentiometer in the control box is ganged to the position-selector knob and makes up the other two bridge legs. A d.c. potential is applied to the potentiometer arms which are at their center position when the rotator is at its mid-point of travel and the selector dial is at the NORTH position. The bridge is then balanced.

When the selector is moved to any other position, it applies power to the rotator and also moves the control-box potentiometer off center which thus unbalances the bridge. The bridge balance is detected by two transistors that function as switches so arranged that when an unbalance occurs, relay contacts are opened or closed as needed to cause the rotator to turn in the direction that moves the arm of the rotator-potentiometer to a new point at which balance is again restored. Power is then automatically cut off and all rotation ceases at the spot called for by the selector. A five-conductor cable is used with this model.[1]

With the Model 10W505 power is applied to the rotator by means of one of the two push buttons on the control box according to whether a c.w. or a c.c.w. rotation is desired. A cam-operated arm on the rotator makes a momentary contact at every 6° of arc-travel, producing an impulse which advances the selector indicator by means of a solenoid-driven ratchet coupled to the indicator. The indicator thus follows the travel of rotation according to the number of pulses received. When the button is released, the rotator stops and the dial indicator remains at the point at which the ratchet last placed it, thereby showing the rotator position.

When rotation is to be reversed, operation of the corresponding push button shifts gears that provide reverse-action of the ratchet. A four-conductor cable is required for this model. Rotation of both models is limited to one turn.

The Az-El Setup

Two rotators are required to make the az-el setup. One is used in the conventional vertical position and rotates a short mast to which the second rotator is clamped in a horizontal position. A horizontal boom is passed through the drive shaft of this rotator and supports the antenna system. Operation of the vertically-mounted rotator turns the second rotator with boom and antenna in a horizontal plane for azimuthal directivity; while the horizontal unit provides rotation in the vertical plane which tilts the antenna up or down.

Adaptation of the rotators for this application requires the normal mounting hardware supplied with the units, plus only a few additional easily-obtainable parts. These are:

4—5/16-18 or 1/4-20 bolts 2½"-3" long, each with a nut, flatwasher and lockwasher.

4—3/4"-long sleeves or 12 oversize nuts that fit loosely over the stud bolts on the rotator housing.

[1]Control cables are not supplied with the rotators.

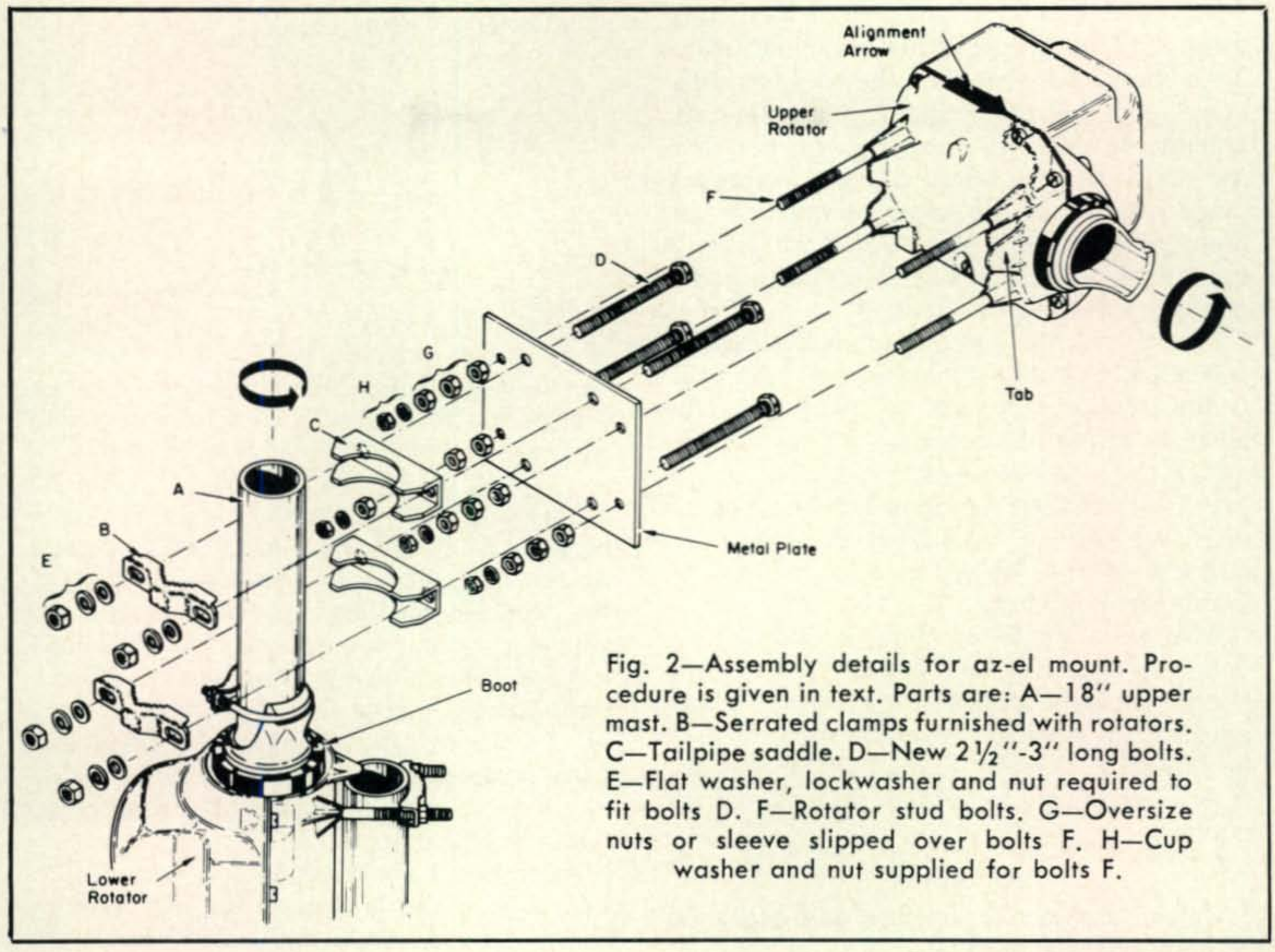


Fig. 2—Assembly details for az-el mount. Procedure is given in text. Parts are: A—18" upper mast. B—Serrated clamps furnished with rotators. C—Tailpipe saddle. D—New 2½"-3" long bolts. E—Flat washer, lockwasher and nut required to fit bolts D. F—Rotator stud bolts. G—Oversize nuts or sleeve slipped over bolts F. H—Cup washer and nut supplied for bolts F.

2—1½" auto-muffler tailpipe clamps.
1—Metal plate (steel or half-hard aluminum) size 4½" × 3½ × 1/8".
1—18" × 1½" o.d. metal masting.

Construction is as follows:

1. Drill holes in the metal plate as indicated at fig. 1.

Refer to fig. 2 for the following steps:

2. Install the 18" mast through the drive shaft of the vertically positioned rotator with one end of the masting 7" above the rotator boot. Use the serrated clamps and U-bolts furnished with the unit, following the instructions also supplied therewith.

3. Discard the U-bolts and nuts from the tailpipe clamps and using only the saddles, plus the indicated new hardware, install the metal plate finger-tight to the 18" mast (permanent tightening of the clamps should be left to the final installation of the setup and positioning of the antenna at the antenna site). The holes in the serrated clamps will have to be enlarged if the larger diameter bolts are used.

4. Mount the horizontal rotator to the metal plate by means of the stud bolts attached to the rotator housing and using the nuts and washers supplied. These bolts are not threaded over their full length, so a 3/4" long sleeve, or three oversize nuts used as spacers, will provide a buildup to the limit of the threaded portion.

Note that the rotator must be axially oriented so that the alignment arrow on the side of the housing is positioned at the top and that the tab is located as shown. It will be best to drill a small hole at the bottom of the housing to vent any condensation. This is not needed with the other rotator.

To prevent rusting, any *new* hardware that is unplated or bare steel, such as the tailpipe saddles, should be given a protective coating such as Rustoleum.

The setup is now prepared for installation of a 1½" o.d. horizontal boom and the control cables and for mounting to the main-support mast using the hardware supplied with the rotators.[2] Note that the tab at the upper end of the mounting emplacement on the housing for the lower rotator should rest on the top end of the mast.

[2]It would be wise to check the operation of the setup, before final installation.

Antennas should be installed on the boom[3] using the normal type of mounting hardware. They should be located on the boom at a distance from the rotator that will not allow the antenna elements to interfere with the rotator, mast or guy wires when the vertical-plane rotation of the boom elevates the antenna-pointing through a 180° arc from a horizontal position at one side to that at the opposite side as shown at fig. 3.

This allows the antenna to always be kept pointed at a satellite during an overhead pass. It thus avoids the need for reorienting the antenna azimuthal position 180° (which requires about 25 sec.) as the satellite passes overhead between the approach and departure, as otherwise would be required if the antenna elevation angles were limited to within one 90° quadrant.

Where a single antenna is installed, a counterweight on the opposite side of the boom would be desirable to provide a balanced load. Similarly, a counterweight may be advisable where antennas of largely different weights are located on each side of the boom.

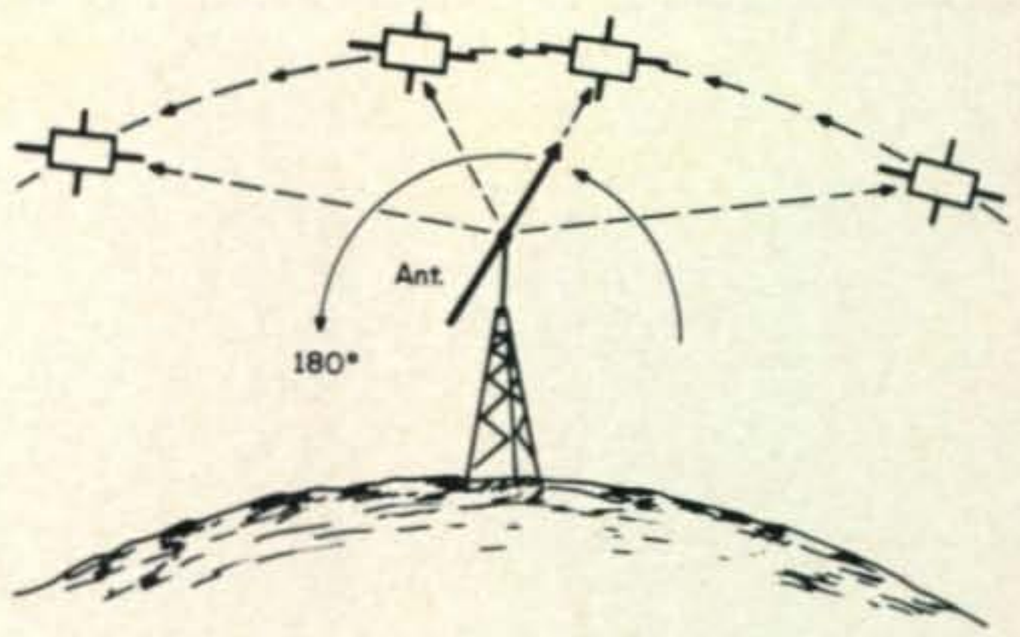


Fig. 3—Vertical-plane rotation of the antenna through a 180-degree arc permits continual tracking of an overhead satellite pass.

Antennas

Signals between a satellite and a ground station may be vertically, horizontally, or left- or right-hand-circular polarized, depending on propagation conditions, satellite antenna attitudes and other factors which may vary during a given pass. Differences in polarization of antennas at ground stations may therefore result in poorer-than-desired signal levels accompanied by adverse fading.

The antennas we have selected for our installation are the multi-polarized "Twist" arrays produced by Cushcraft.[4] These jobs are used by many Weather-Satellite APT re. ceiving stations and at NASA installations. We too have found them advantageous for APT, OSCAR and other v.h.f. operations.

Each antenna consists of two Yagi's on a single boom, one with 10 vertical elements, the other with 10 horizontal elements. Phasing harnesses connected between each Yagi and a coax transmission line provide vertical, horizontal, left- or right-hand-circular polarization, depending on how the harnesses are arranged. The rated forward gain for each mode is 12.5-13.5 db. Polarization modes may be selected at the operating position if two separate feedlines of equal length are employed with appropriate harness connections. This allows the operator to always optimize signal paths as called for by changing conditions. Provisions for altering antenna polarization and elevation angles also are often helpful for ground-to-ground communications channels.

There is a 3 db power loss when both the vertical- and the horizontal- or just the circular-polarized modes are used; however, this loss usually is more than offset by the advantage gained by the minimization of fading signals obtained by optimized combinations of antenna polarization.

Since present plans for OSCAR 6 include a down link on 144 mc and an up link on 432 mc, or vice-versa, a Twist antenna for each band has been mounted on the boom of our az-el setup as shown in the photo. Tracking with the satellite may thus be had simultaneously on both bands.

Consideration had been given to rear-mounting both antennas to the az-el boom, but this would have required a counter-balance, at least for the 144 mc job. This was not deemed worth the effort to obtain a marginal improvement in performance over that which dubiously might be obtained over center-mounting on a metal non-resonant boom between the directors. The 432 mc job, however, is rear mounted, since its size and light weight do not dictate a counterbalance.

Satellite-tracking antennas need not be installed at great heights, as long as there are no significant obstructions within the "line-of-sight" in the immediate vicinity, particularly at low elevation angles toward the horizon. ■

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[3]Boom length will depend on antennas to be installed as discussed in the subsequent text.

[4]For complete technical data and prices, write to Cushcraft, Manchester, N.H. 03103. Stacked Twist arrays also are available for additional gain and may be improvised for use with the az-el mount.

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BY ED GRIBI,* WB6IZF

ON THE BEACH—Just like a sailor without a ship, here's a ham without a license. I submitted my application for a Singapore license a couple of weeks ago and they tell me it will take a couple of more weeks to complete. Licensing of foreign amateurs by Indonesia has been temporarily suspended for good reasons. We all hope that this latter situation will be only temporary. Meanwhile I'm listening a lot and enjoying absorbing all the accumulated correspondence, newsletters, and magazines that I could only glance at in those hectic days before we left California on 16 June.

I enjoyed seeing a lot of old friends and meeting many new ones, including a number of you blessed readers, at the Fresno Hamfest in May. From then on we were totally immersed in preparations for THE MOVE, both personally and in relation to the Company's intended operations. Personally it consisted largely of reducing the worldly goods accumulated in 20 years by a family of 6 from a mountain of junk to a manageable basic household capable of being shipped relatively easily. I got rid of all the radio odds and ends at the swap tables at the Fresno Hamfest. Sold the HW-100, have the SB-33 in cold storage in the event No. 1 son gets his General, and bought a new Swan 270 in the last days before leaving.

The little Swan was fun operating portable from the Hilton Hawaiian Village Hotel in Honolulu during our three-day layover. Enjoyed working a little 15 meter DX, enjoyed even more working WCARS on 7255 over that 2600 mile path, and particularly got a kick out of giving the Honolulu weather to one of my old standbys, the California Weather Net on 3956. That fine Net Control, Cliff, W6ERE, was flabbergasted to have me holler in at 0630 California time. On the eyeball side I got together with the WCARS Hawaiian outpost KH6UL at the Naval Communications Station, Wahiawa, Chief Op. Gary Cox, WBØAFQ, assisted by Larry Quinn, WB4HED. Gary showed us parts of the island that tourists don't normally see. Also met Bud, Net Control for the Confusion Net, 21.400, 0130 Z.

So now we're ensconced in our flat in Singapore with an amah named Ah Foo—honest! I've got a wire out and will have more in the air when that ticket arrives. I'll be hanging around 21.360 and 14.310-20. Also I'll probably be on the Southeast Asia Net, 14.310, 1200 Z. My brief listening so far indicates that 20 seems to be the best band for consistent daytime communications.

*c/o Gulf & Western Indonesia, Box 42 Singapore 11.

Dave Flinn, W2CFP, tells WCARS members at the show about ECARS happenings. (photo courtesy of Les Lester, W6LHQ)

WCARS News (from The Sentinel)

Many West Coast Amateur Radio Service participants were involved in a search for a young student pilot blown off course into Baja California. The unfortunate result, after 11 days, was fiinding the body. The plane

was found in perfect shape in 3 days but the pilot had wandered on foot for 40 miles for a period of a week. The moral, of course, in a case like this is STAY WITH THE PLANE. W6DLN, W6HCD, W6HIT, and W6YSP were prime movers through the JPL Amateur Radio Club acting as communications auxiliary to the Sierra Madre Search and Rescue Team. Coordinating the entire search was Arnold Senterfit, W6ESV, for the Search and Rescue Group of the Californias.

Speaking of Mexican operations, W6HCD met with many of the officials of the Liga Mexican Radio Experimentadores (the Mexican amateur radio national organization) in Mexico City in late April. Closer cooperation in emergency operations between the Liga's "Red Nacional de Emergencia," their emergency group, and WCARS was a prime topic. Nash also tells me that a program is starting to try to get amateur radio into areas of Mexico that have clinics but no communications. This is a joint effort between the Flying Samaritans, doctors who fly into remote areas by light plane, and the Collegas y Amigos, that fine informal group of Mexican and American amateurs who work quietly behind the scenes on many similar projects in Mexico. The sparkplug of the latter group is friend Duke, W6OZD. The things these several groups do continually (utilizing WCARS frequency and people very often, incidentally) are in the highest traditions of amateur radio for public service and international cooperation.

Just received my WC6ARS QSL card for working the WCARS station at the Fresno Hamfest. It's a beauty!

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

EASTCARS News (from *The Monitor*)

W9PWI/mobile 3 called in on 7255, Eastcars monitored frequency, requesting assistance for a car cut in half with people still inside on the Pennsylvania Turnpike. W3AES called the Penn. State Police and an ambulance arrived within 10 minutes. K3LJP/mobile 4 called in a 3 car accident in Virginia with W3AES and W3HQG relaying the information to authorities. W1ILV/mobile 1 calltd in regarding a disabled bus and W1CTB called authorities.

From Bill, W1ILV: "In a recent moment of reflection, after I found myself checking into ECARS for the fourth time in a day, I

A distinguished collection of WCARS members at SAROC, Las Vegas, Feb., 1970. From left to rght: Net Control Howard Lakey, WB6RJG; Big Signal Harold Boring, W6DZJ; Director Bill Cchwartz, K6KZI; Net Coordinator John Stockdale, WB6ABW; Director Fred Deeg, K6AEH. (photo courtesy of Les Lester, W6LHQ)

wondered what the attraction was that made me such a regular habitue of 7255 k.c. Certainly some thirty years of every conceivable variety of Ham should place me above the compulsion to bleat "Check in" at the drop of a hat! And this, especially, into a net which has no regular net control, no proven and formal traffic handling, and, above all, which advocates dropping the ponderous call letter exchanges and all the other heavy sounding ritual which is so dear to the other types of nets. The answer to my self-query is, of course, based on just this informality of approach. No other Ham endeavor offers the opportunity to take part in a fast-moving network which satisfies the urge of every communicator to put his ability and equipment to constructive and often times critical usage—and this at almost anytime of the day or night.

"On ECARS as distinguished from other nets, the results of the communication quickly follows the need. The 'formal' nets go on day after day without anyone really knowing if the traffic handling works out, or if the effort really paid off. This 'instant action' aspect is the real key to the ECARS appeal, I believe."

For information on joining Eastcars, send an SASE to WA1KRN, James R. Lightfoot, Station WB2, Boston, Massachussets 02134.

MWARS News (from The Radio Watch)

Midcars, on 7258, was in the middle of activity connected with tornadoes in Texas in mid-April and mid-May with WCARS, ECARS, and the Kansas Post Office Net acting as anchor men when required. Literally

CQ ADVERTISING RATES

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hundreds of stations were involved, but I've heard glowing reports about W5PIP and W5TJK from SEC W5SSM and have a fine report of activities from WAØNKS. Well done, everyone of you!

WAØNKS/Ø came across an accident with serious injuries and called in on 7258. Between WAØTFV, WØLFF, and WAØSHC an ambulance was on the scene in 22 minutes.

A real hairy one—WA7JHS/7 near Pocatello, Idaho, on the scene of a serious auto accident, was relayed in by WØMBP/Ø, eastern Colorado. WA9RAX/9 placed a long distance call to the Idaho Highway Patrol to get help with K7JLH helping to relay. I'm a strong believer in not hesitating to use the land line when lives are at stake. We're not in this "Instant Service" operation simply to prove that we can do everything with one medium of communication.

For information on joining MIDCARS, send an SASE to K9GPM, Ray Wilson, 25W013 Lacey Avenue, Naperville, Illinois 60540.

DON'T FORGET—If you're still not acquainted, listen for West Coast Amateur Radio Service and East Coast Amateur Radio Service on 7255 and Midwest Amateur Radio Service on 7258 providing all manner of services to the public and other amateurs. They're monitoring so long as the band is open, but it's a good idea to know proper operating procedure:

BREAK-BREAK-BREAK — EMERGENCY ONLY — used for messages having a life and death urgency — such as highway accidents — all stations stand by while control determines method of handling.

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

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

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

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

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

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

73 Ed, WB6IZF, 9V1??, ?YB9

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SWAN		**Reg.**	**NOW**
410C Remote VFO for 500C	FS	$115	$100
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- Transmitter: 5 watts (10w with AC-210 power booster)
- Microphone: High Z
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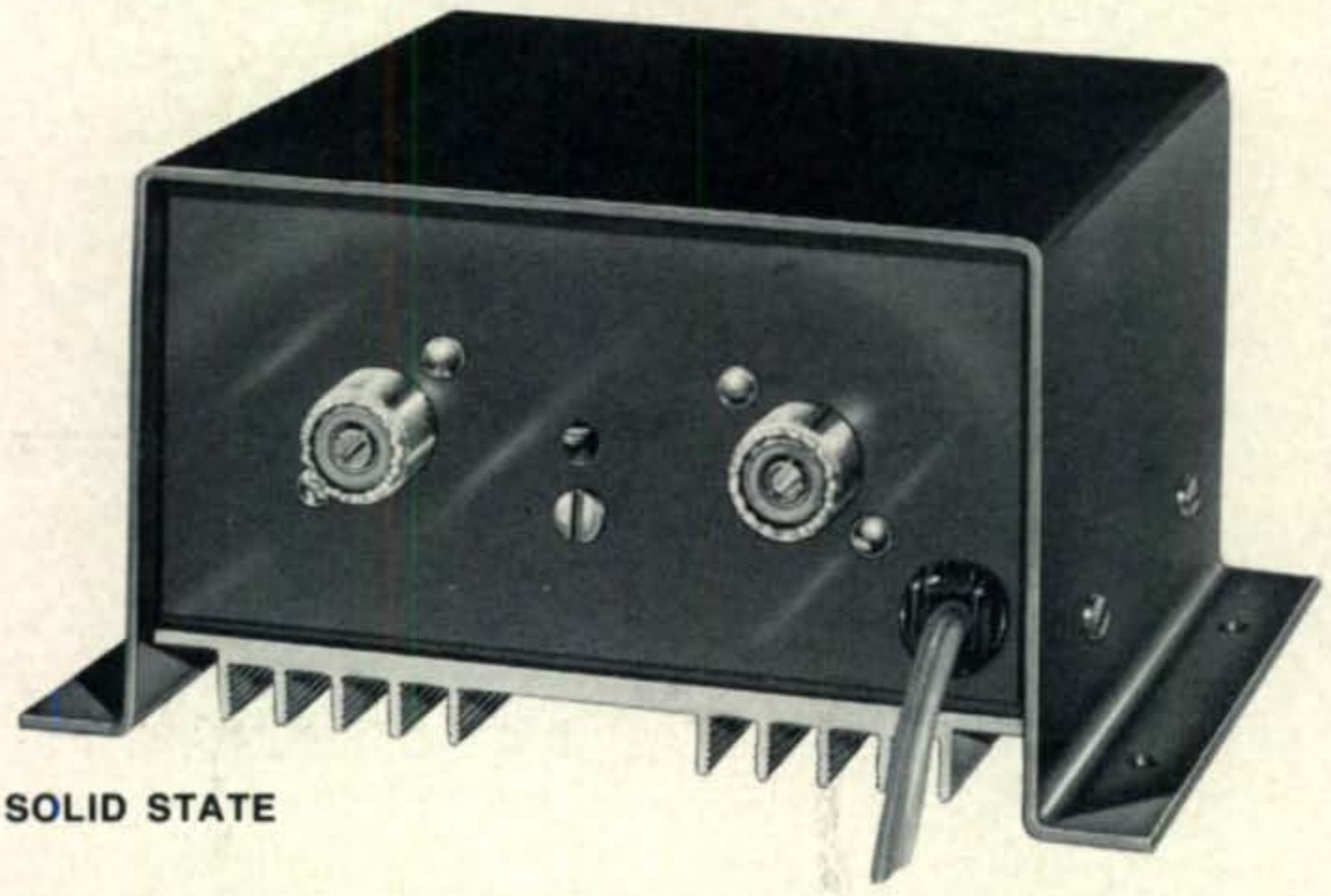

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SPECIFICATIONS:

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- Power Input: 60 watts
- Power Output: 35 watts
- Frequency Range: 143 MHz to 149 MHz
- Operation: Class C
- Drive Requirements: 5½ watts required for 35 watts output (the PA-210 provides operating voltages to the FM-210 for high power operation)
- Antenna Requirements: 50 ohms unbalanced

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THE ORDEAL OF MAIL ORDER

BY D. J. HOLFORD*

HOME brew is a wonderful idea, for the ham near a large electronics store. But how about the man out in the sticks? He must rely on mail order for his parts, and that can be an adventure akin to tracking tigers. You never know what will happen next.

My introduction to the perils of mail order came several years ago when I moved away from the stores. I needed parts for a construction project, and blissfully ordered them from a large mail order house which promises shipment within twenty four hours.

Some six weeks later a few items arrived, including a number of substitutions, (I am surprised they didn't send one six meg resistor instead of the dozen half ones I ordered). The rest of the order was "back ordered", a new term to me then but one I have since become intimately acquainted with.

The rest of the order arrived within the next few weeks and consisted of a large collection of small components tossed into a chassis, and wrapped in brown paper. Needless to say confusion reigned supreme. The small parts were mangled and bent and some were missing having escaped through the gaping holes in the packing. The interior of the chassis was a sight to see. Among the shipment were a few tools which had made some beautiful dents (if you like dents) in the chassis.

In addition to all this, there was no invoice and since the shipment had come from New York it had to pass Canadian Customs. If you have a free day sometime, try to convince a skeptical customs officer that you are telling the truth about the values of unmarked parts. Eventually all the parts were obtained and the project completed.

Not having learned my lesson I decided to try again. This time I ordered in addition to some components, a set of pliers and a wireless intercom. The intercom and some parts arrived over a three month period. The pliers were back ordered (I now knew what it meant). When the pliers arrived some time later they were accompanied by a customs declaration form, unfortunately it listed the value of the full order. If you think I had fun the first time, you should have seen me trying to convince the customs officer that the pliers were not really worth fifty dollars. I think he was beginning to wonder about me.

I stayed away from mail order for over a year. But then the intercom needed a special part. There was no other choice, so I ordered it. After numerous back orders and queries a part finally arrived, it was the wrong part! I returned it and received a back order and a photocopy of my order. Eventually the right part arrived, over a year after my original order. Incidentally this particular house is big on photocopies. They answer queries by photocopying everything you sent them and stapling it to your letter. We ended up shipping a half inch of paper back and forth to each other. I don't think they own a typewriter, they must have spent their entire budget on photocopying machines. After pleading with them to write to me I came to the conclusion that they own a computer, the copying machines and a monkey to work them.

Being a glutton for punishment I entered the arena again a couple of years later when I needed a special item I could not find anywhere else. Off went my order accompanied by a prayer or two. Back came another back order slip advising shipment in a few weeks. A few months later I received a form letter apologising for not sending me the bill earlier. I replied that I was still awaiting delivery of the item. Silence for almost a year, when I received a bill for one cabinet. I wrote a letter

[*Continued on page 84*]

*RR 1, Enfield, Hants County, Nova Scotia, Canada.

AN FET RF ATTENUATOR

BY JOHN J. SCHULTZ,* W2EEY

R.f. attenuators are often very useful at receiver inputs to avoid overload effects due to strong signals. The fet attenuator described allows a wide range of attenuation and other local or remote operation.

SOME time ago the author described a diode attenuator network which was meant to replace the usual resistor network normally used as an r.f. attenuator at receiver inputs when problems are encountered with very strong signals overloading the receiver input stage.[1] The diode network exhibited a fairly wide attenuation range and eliminated the scratchiness and noise usually associated with variable or switchable resistor networks used directly in an antenna lead. From the inquiries received, quite a few amateurs used the network in some form. However, one problem that occurred frequently was finding the diodes specified, if the full attenuation range of the network were to be realized. Although not expensive, diodes with the correct characteristics were not obtainable in many local radio parts outlets.

Recently the author has tried another type of attenuator using a single field-effect transistor. The fet attenuator has all the advantages of the diode network, including attenuation range, but its circuitry is simpler and it will work with almost any simple N or P channel junction-type fet, including hobbyist types such as the GE-FET-1, HEP 801, HEP 802, etc. It will also work up through 2 meters, providing that the gate source capacitance of the fet used does not exceed a few mmf. For 80-10 meter usage, almost any simple junction fet will suffice.

Basic Operation

To understand the operation of the atenuator, one should have clearly in mind how a junction fet can act as a variable element. Figure 1(A) shows a representation of an N channel junction type fet. Without any gate voltage applied, the drain and source terminals are simply joined by the N type semiconductor material (the channel) with its fixed resistance value. With the placing of a negative voltage (with respect to the drain or source) on the gate P type materials, "field effect" restricts the current flow in the N channel (between the P type gate materials) and the effective drain-source resistance increases.

Figure 1(B) shows the basic fet atteuator circuit. The signal input is placed on either the drain or source terminal and the output taken from the other terminal. If the negative potential between the gate and source is increased, the drain-source resistance increases providing some signal attenuation. Also, in an r.f. application, the source to gate capacitance would bypass some of the r.f. The resistor *R* prevents the input signal from being shunted to ground. However, the gate is actually placed mid-way between the drain and source terminals and one can form a more effective attenuator network by also providing a drain-gate bias circuit, as shown by the dotted lines in fig. 1(B). In effect, a more complicated equivalent resistance network is formed involving all three terminals of the fet, in a manner similar to a discrete resistor attenuator network.

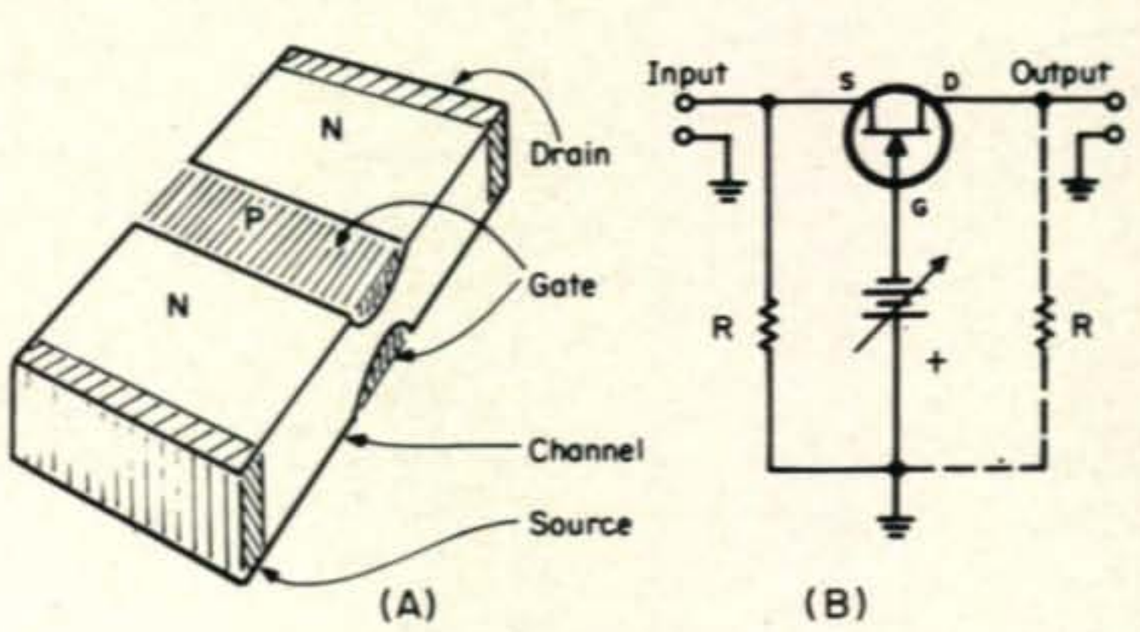
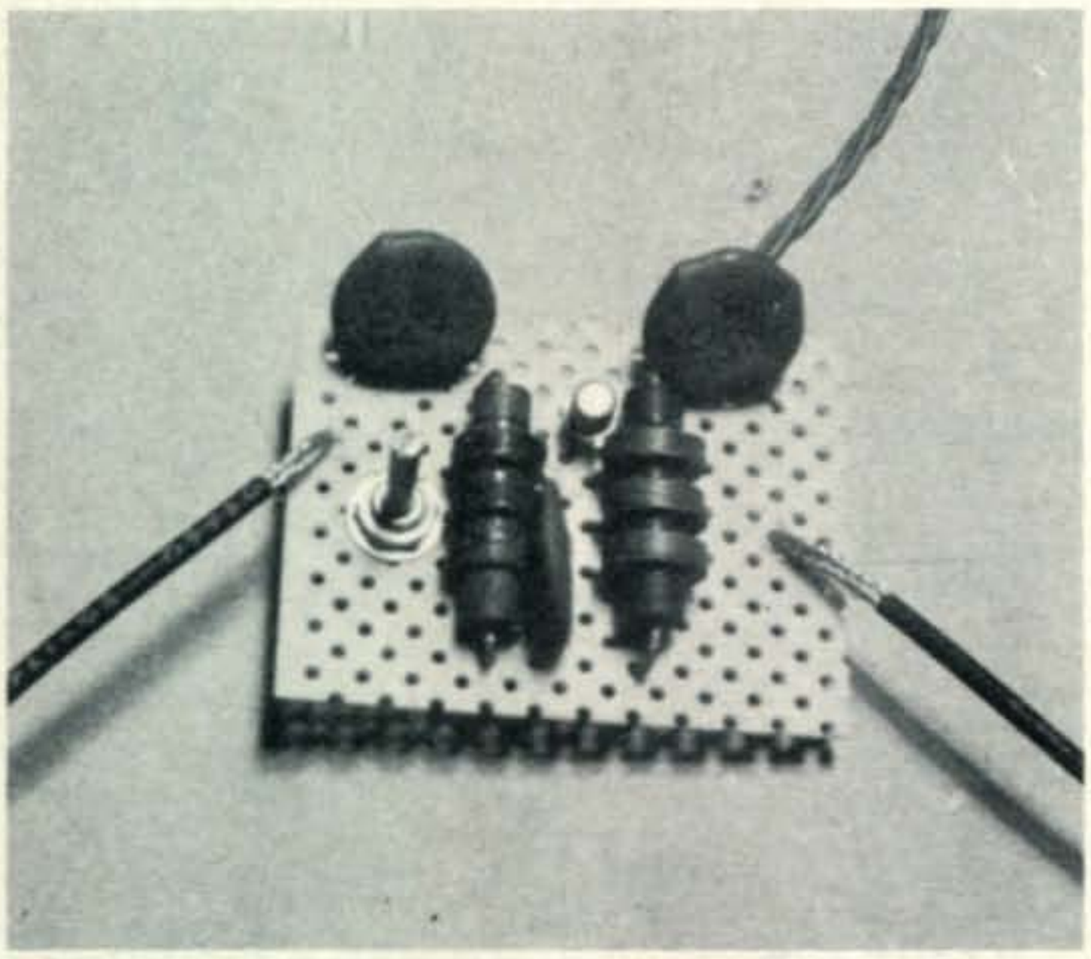


Fig. 1—(A) Basic fet (junction type) structure. (B) Use of fet as a variable attenuator.

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

[1]Schultz, J.J., "The Diode R.F. Attenuator," *CQ*, Aug. '67, p. 59.



Fet attenuator circuit of fig. 2(A) can be completely assembled on a small piece of Vector board stock. The fet shown between the two r.f. chokes is a Motorola HEP-802.

The negative potential can be increased to the maximum gate-drain or gate-source voltage specified for a particular fet. However the maximum attenuation will usually be reached with no more than half of the maximum voltage. Maximum attenuations of 40-50 db are readily achieved. Minimum attenuation is not achieved by reducing the gate voltage to zero. By biasing the gate-source junction slightly forward (positive gate voltage, a significant reduction in attenuation can take place so that the minimum attenuation is no more than a few db. The value of forward current which the gate can handle is usually limited to a few milliamperes, however, and this current must not be exceeded or the fet will be destroyed. One should provide a current limiting resistor in the power supply lead to the fet gate to safely limit the forward current value, as is illustrated later. For absolute zero attenuation, the fet can be by-passed and then when switched in, provide in a 50 ohm system a variable attenuation range from several db to about 50 db.

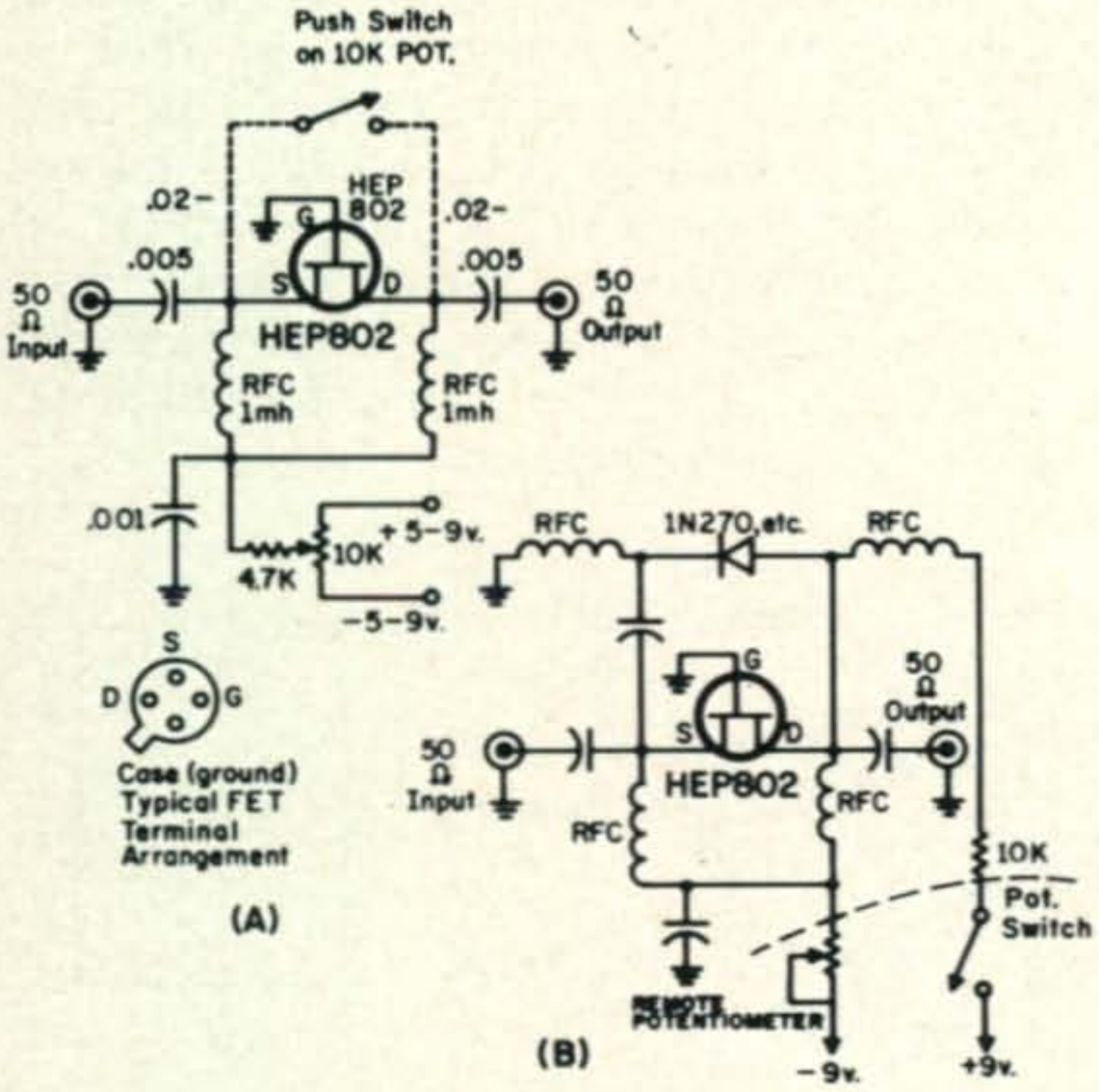


Fig. 2—(A) Fet attenuator circuit with potentiometer switch used to completely bypass attenuator. (B) Remotely controlled attenuator circuit with diode switch.

The foregoing discussion has used an N channel fet to explain fet attenuator operation. A P channel fet will work exactly as well; only the polarity of the gate voltages must be interchanged when considering the maximum and minimum attenuation conditions.

Practical Circuits

Figure 2(A) shows the circuit of a typical attenuator which can be constructed for 80-10 meter use (on higher frequency bands, appropriate RFC's must be used). The RFC's isolate the r.f. signal from the bias circuit while the coupling capacitors prevent the d.c. bias voltage from appearing on the transmission line. The 10K pot serves as the attenuation control with the 4.7K ohm resistor used to limit the gate current when the latter is forward biased. Either a push-switch or s.p.d.t. switch on the potentiometer can be used to short the r.f. path between the drain and source, if desired.

The potentiometer of fig. 2(A) cannot be located far away from the fet, if the shorting feature is to be provided. This limitation can be overcome by the circuit of fig. 2(B) which allows the potentiometer to be as far distant as desired. The potentiometer switch is used in this case to control the 1N270 diode switch, forward biasing it when desired to switch out the attenuator.

Construction

If used in a receiver or preamplifier, the attenuator circuit should be placed directly at the 50 ohm antenna input terminals. The remote control feature of the attenuator also makes it possible to place the unit by a mast mounted preamplifier, if a separate receiving antenna is being used.

The r.f. leads connected to the attenuator circuit should be kept as short as possible. The photograph shows one simple method

[*Continued on page 85*]

Improving the Ham-M Rotor Indicator

GENE A. NURKKA,* VK9GN

THE Ham-M direction indicator is very sensitive to line voltagt changes. In fact, the reading is directly proportional to the line voltage. If the voltage changes by 10% the full scale reading will change by 36 degrees! The center reading will change 18 degrees.

Many U.S. amateurs live in areas where line voltage fluctuations of 10% are common and amateurs in DX countries frequently run into much greater variations. Here in New Guinea I have encountered fluctuations as great as 15%. The result was a 54 degree change (near full scale) on my Ham-M indicator, so somethng had to be done!

The Ham-M manual gives directions for an "Instant Meter Calibration" modification. If this modification is made, the operator still must manually recalibrate whenever the line voltage changes, and this happens from minute to minute. This article describes a better modification which allows the operator to "set and forget" the calibration control once and for all.

HAM-M Indicator Operation

The direction indicator of the Ham-M control unit is a 1 ma d.c. meter powered by a simple half-wave power supply. The meter multiplier consists of an 18K ohm resistor (R_1) plus a 5K compensating control and 5K calibrating control. R_2 balances the circuit to reduce the maximum error. The meter responds to the position of the center arm of the 500 ohm potentiometer in the rotor. See fig. 1.

With the rotor in the extreme right position, the compensating and the calibration controls are set to give a full scale deflection. With a normal line voltage of 115 volts, the power supply provides 21 v.d.c. Under these conditions the compensating and calibration controls plus R_1 total 21K for the 21 v.d.c. to give the 1 ma full scale deflection. The current through the meter is directly proportional to the d.c. voltage. This d.c. voltage is directly proportional to the line voltage, hence the changes in meter readings with changes in line voltage.

Zener Regulator

By adding a simple voltage regulator, the d.c. voltage driving the indicator is made independent of line voltage changes. The meter reading then remains constant regardless of line voltage fluctuations.

The zener diode action of reverse biased silicon transistor junctions has been noted in a recent article.[1] I decided to try 2N2924 transistors since I had several on hand and at 27 cents each in Allied's catalog they are cheaper than most zener diodes.

The first circuit I tried (fig. 2) improved matters a great deal. The zener voltage of the base-emitter junction of the 2N2924 turned out to be about 8.4 volts. A 500 load (in place of the rotor) was made by paralleling two 1K resistors. This was connected to terminals 3 and 7 of the control unit and terminal 3 was connected to ground (chassis). R_2 was

*Box 73, Ukarumpa, E.H.D., Territory of New Guinea.

[1]Charles, J., "Using Silicon Transistors As Zeners," *Electronics World*, January 1970, p. 86.

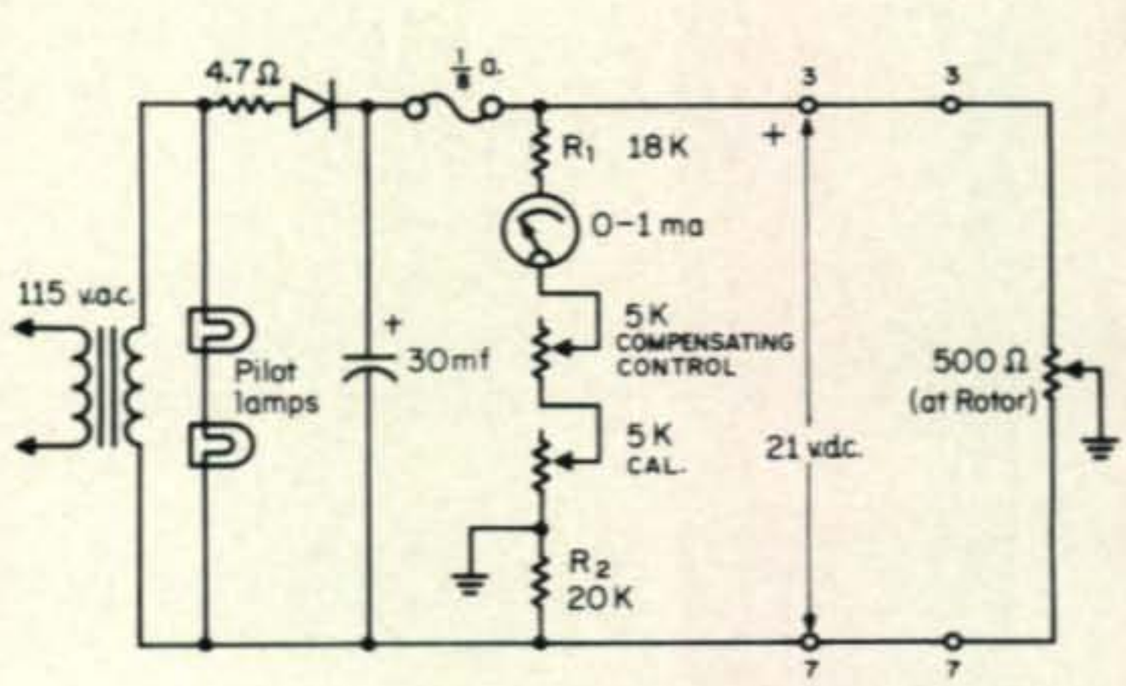


Fig. 1—Unmodified indicator section of CDR Ham-M antenna rotator.

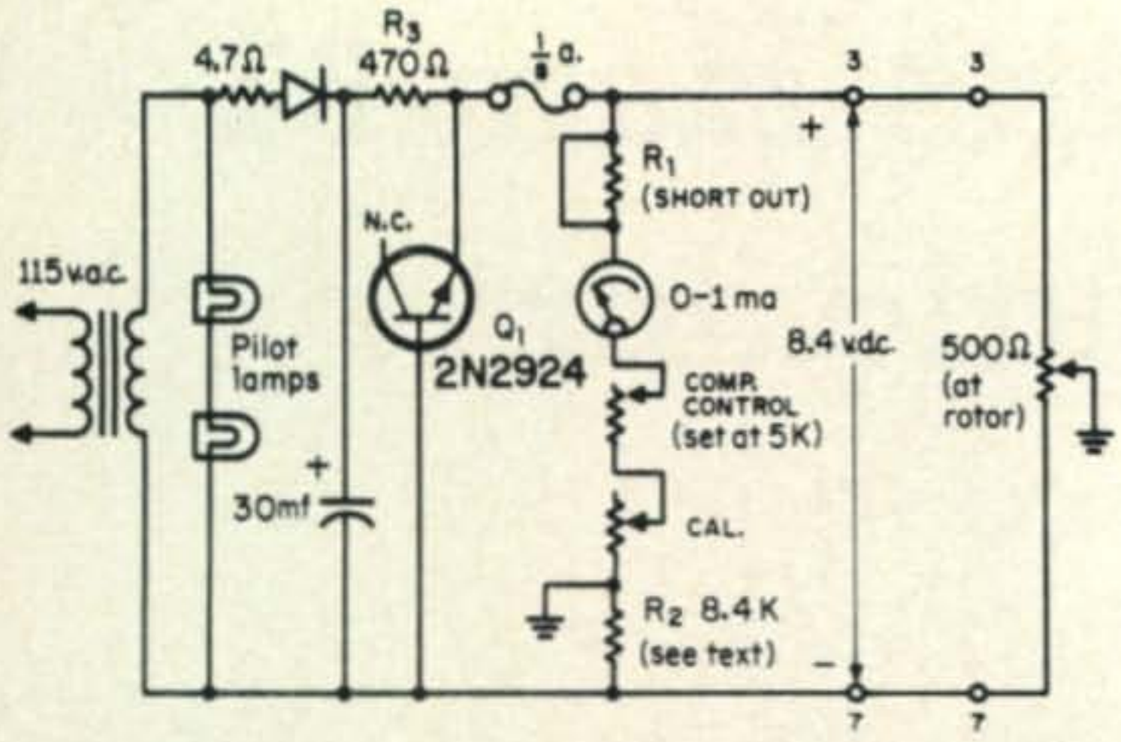


Fig. 2—Simple zener regulator added to Ham-M indicator. R_3 and Q_1 have been added; R_2 has been changed to 8.4K.

changed to 8.4K ohms (a 12K and a 27K resistor in parallel) and R_1 was shorted out.

The compensating control was turned fully counter-clockwise to give 5K ohms and the calibration control then was adjusted for a full scale deflection. The value of the multiplier now totalled 8.4K ohms (for the 8.4 volts) for the 1 ma full scale reading.

Now as I varied the input (line) voltage from 120 to 100 v.a.c. the full scale meter reading changed by only one division which is 5 degrees.

Series Regulator

To try to obtain an even better result I added another 2N2924 as a series regulator. After a little experimenting I arrived at the values shown in fig. 3 and this is the circuit I used for the modification. The change in the full scale meter reading is now much less than one division, only an estimated 2 degrees, for a 20% change in line voltage.

The voltage output now is 7.8 volts as the forward biased base-emitter junction voltage of Q_2 (0.6 of a volt) subtracts from the zener voltage of Q_1. The calibration control needed only a slight re-adjustment to give a full scale reading with this new voltage. R_2 was changed to 7.8K (a 12K and a 22K resistor in parallel). R_3 should be no lower than 470 ohms to keep the dissipation of Q_2 under its rated 200 mw.

Comments

Two other transistor types were found that worked just as well. They gave identical results, even the zener and output voltages were the same. These were the 2N3393 and the 2N2925. The 2N3393 is only 25 cents in the Allied catalog. Other small silicon transistors will have different zener voltages.

Once this modification is made to the Ham-M control unit, you can set the calibration control and forget it! You will know exactly where your beam is heading regardless of line voltage changes. The results obtained are well worth the investment of a little time, and about one dollar for parts. ■

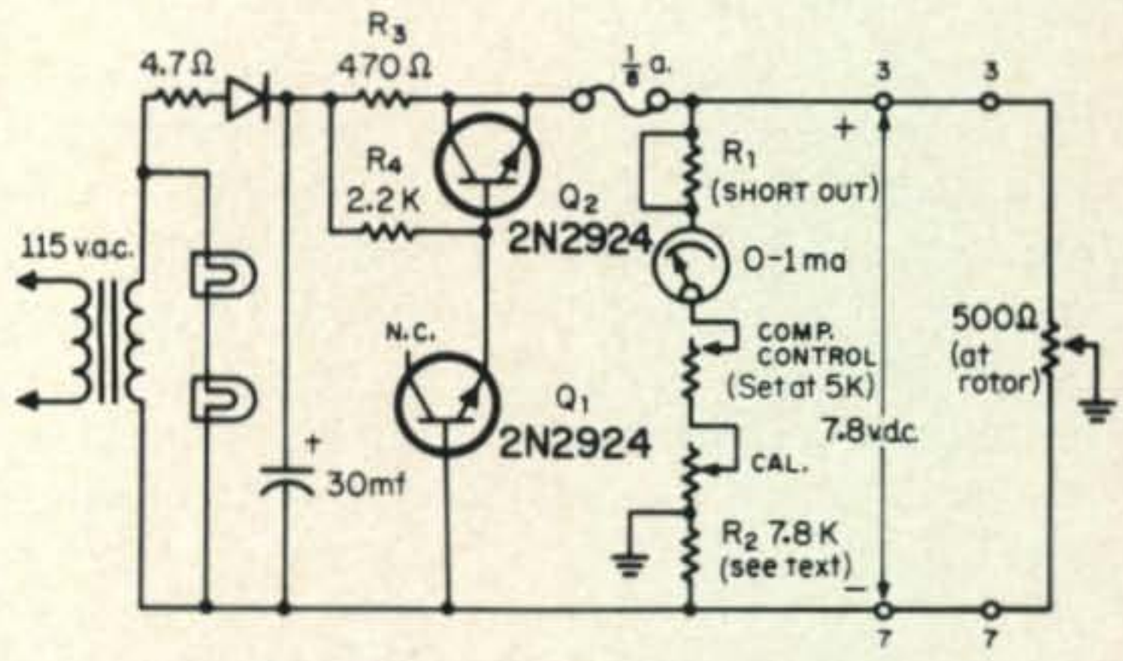


Fig. 3—Final version of the zener regulator circuit added to the Ham-M rotator indicator. R_4 and Q_2 have now added, while R_2 has been changed to 7.8K.

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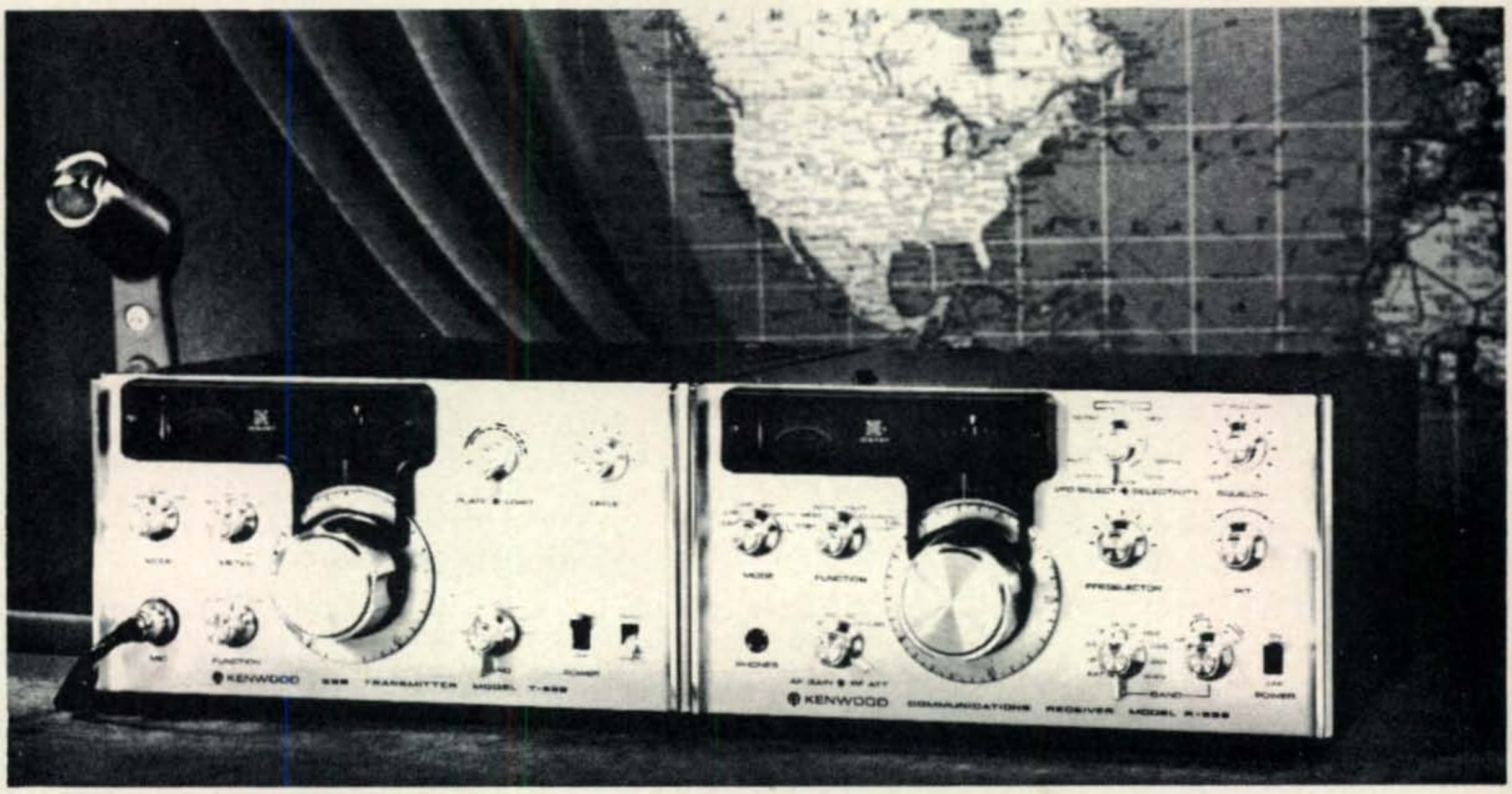

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BY JOHN A. ATTAWAY,* K4IIF

ELSEWHERE in this issue we are announcing the new *CQ* C.W. DX Award and a completely reorganized *CQ* S.S.B. DX Award. These are for the usual 100 or more countries on c.w. or 2-way s.s.b.

Please be assured that the addition of these new certificates to the line does not imply any loss of interest in WAZ and WPX by the *CQ* DX department. As a matter of fact, both WAZ and WPX are receiving recond-breaking interest from the world's DXers. During the fiscal year July 1, 1969–June 30, 1970, we awarded 398 new WAZ certificates for an average of 33 per month. The normal monthly average over the years has been only 15, so we are going at a pace more than double our projections. In the same period we averaged 22 new WPX certificates per month in comparison with a normal figure of 12.

De Extra

Recalling the abusive letters we received after our editorial 2 years ago pointing out that "incentive" licensing was an experience in futility, were almost afraid to write this one at it tackles another "sacred cow," high power. However, its worth saying even though we will get a few letters from those who think super power should be permitted.

Wouldn't it be nice if everyone went QRP. Think how much easier it would be to find a clear spot between two QSO's at the 100 watt or 50 watt level than it is trying to find space between two kilowatt stations. You could probably do it with only 100 watts or less yourself, instead of having to wedge out a spot with your own kilowatt, and leave room for another QSO as well.

Many have said, and continue to say, that sometimes you need that power to get through when conditions are bad. True, *sometimes* you do, but how many people use their linears *only* when conditions are really bad? Darn few, we venture to say, present company not excepted. Last saturday W1WY and 1 were keeping our regular sked on 20 meters and I must confess that I was blasting away with over 600 watts. I was 599 in Connecticut, probably all over Europe too, and getting through the QRM with no trouble. However, when for the fun of it I switched to my little PM3A with 5 watts input I was a respectable 569 and Frank copied my transmission 100%. Since that time I've answered many CQ's with the PM3A, and all stations but one have come right back to me, including several in Europe. While I wouldn't advocate that everybody go to 5 watts, I do think there is plenty to be said for running those exciters barefoot unless they're really needed. You can work plenty of DX with 100 watts and its a lot more fun to use skill and good antennas instead of that plug-in appliance, even though you do have a few hundred bucks tied up in it.

The OH2BH/FA Story

On July 10, 1970 a group of Finnish amateurs headed by Martin Laine, OH2BH, succeeded in bringing off the first legal amateur operation from Albania in many, many years. They made 868 QSO's with 52 different countries in 8½ hours of operation. The West Coast DX Bulletin has provided us with the following information on the trip.

"The OH-group drove by car to Copenhagen from where they flew directly to Albania. No answers had been received to their

Mike Czuhajewski, WA8MCQ, formerly of Paw Paw, Michigan, but now of the US Air Force. Mike is one of the guiding lights of the QRP movement, and has never run over a maximum of 4 watts. He has 48 states confirmed including Alaska.

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

letters of inquiry so they took the trip just on the hope that something might work out. They were passed through customs without any examination and went directly to their hotel with the rig, an HW-32 transceiver. At the hotel they learned that they would not be permitted to go on into Tirana, the capitol city, but with their Albanian guides showing a proper positive attitude they raised their antenna and started the action.

"The next morning the Albanian authorities appeared at the door, apologized for not having noted the declaration of the radio gear on their entry, and advised that the bringing of a radio into the country was prohibited by law and they would have to hold the gear until they left the country. Thus the operation was over by 0700 on July 11.

"During the balance of their stay the OH-group tried to get a special visa to visit the capital and discuss the situation. At first they were not successful, but after developing a good understanding with the Albanian guides some special arrangements were finally made which allowed them to visit Tirana on the last day of their visit. They had a one hour meeting with the Vice-Director of the Ministry of Communications where they were advised that their letters had gone unanswered because there was no provision for amateur radio in Albanian law,it being neither allowed nor prohibited.

"The Vice-Director exhibited a good attitude towards amateur radio, and promised to do whatever possible to advance it in Albania. He asked that complete information be sent 2 months in advance of any future trip so that arrangements could be made.

"Apparently the Albanians had expected the visit as a monitoring station manned by multi-lingual Albanians was set up only 200 yards from the hotel. Their transmissions were recorded and checked. The group kept all transmissions in English, commenting favorably on the Albanians at frequent intervals.

"On why the rig was impounded, there is a feeling that the authorities wished to examine it, or possibly did not wish to have to monitor the activity for the full week. It was returned in good condition. A decisive factor in the Albanian attitude toward future operations will be what benefit the country might derive from the amateur service.

"The group wish to thank the International DX Association for making the HW-32 available."

Here is the OH2BH/ZA gang during their recent DXpedition to Albania. See short story elsewhere in this column. Left to right are Eric, OH2BW, Ville, OH5SE, and Martin, OH2BH. This bold trio put Albania onto the ham bands for the first time in 11 years. *(Photo via West Coast DX Bulletin)*

Reports from the Rare Zones

Several DXers wrote in to suggest that Zone 18 be added to this list, and from the scarcity of stations logged we can see why. As a help to those needing this zone, most UA9 (or UW9 or UV9) stations having the leters H, O, P, U, V, and Y immediately after the number, or UA∅ (or UW∅ or UV∅) stations having the letters A, B, O, S, T, U, or V immediately after the number, are in Zone 18. The following stations in Zone 18 were recently reported at the frequencies and times shown:

UA∅AO—7007 kc—2314 GMT
UA∅TD—14010 kc—0012 GMT
UW9OP—14052 kc—0120 GMT
UV9OM—14025 kc—0221 GMT

Zone 19 stations may usually be identified by the UA∅ (or UW∅ or UV∅) prefix immediately followed by the letters C, E, G, F, I, J, K, L, M, Q, R, or Z. A number were logged this month:

UW∅FB—3504 kc—1216 GMT
(by WA6GLD)
UA∅MT—14001 kc—2247 GMT
UA∅MQ—14210 kc—1240 GMT
UV∅IE—7030 kc—1225 GMT

Others reported at unspecified times included UK∅IAB on 14085 kc, UA∅JO on 21027 kc, UA∅MX on 14020 and 21023 kc, UV∅IP on 14013 kc, UA∅KLE on 14007 kc, UA∅ED on 14024 kc, UA∅KHI on 14007 kc, and UK∅FAA on 14035 kc.

The following were logged from Zone 23:

JT1KAA—14082 kc—1135 GMT
JT1KAF—14072 kc—1330 GMT
UA∅YT—14068 kc—1350 GMT

and the following from Zone 34:

SU1IM–14000 kc–0050 GMT
14076 kc–0100 GMT
14010 kc–0228 GMT
ST2SA–14300 kc–0300 to 0430 GMT
21035 kc–1700 GMT

QSLs for ST2SA may be sent to WA5-REU, direct correspondence to Box 253, Medani, Sudan.

Rare and Special Prefixes Reported

EL3–EL3YW, 14262 kc.

HG1–HG100UA/G/D/K was the Lenin Centenary Exhibition station operated from various regions in Hungary. QSL to HA-bureau.

HI7–HI7JM was worked on 7008 kc at 2215 GMT in W4-land.

JE1–JE1NHM logged on 21040 kc at 0400 GMT in California. This is a Japanese assignment.

JY1–Simply JY1 is the personal call of King Hussein of Jordan, QSL to P.O. Box 1055, Amman. JY2 is reported to be Princess Muna, QSL to P.O. Box 2101, Amman.

KF4–KF4GSC was a special station operated by the Georgia Southern College Amateur Radio Club, Statesboro, Ga., during the Ogeechee State Fair, Oct. 10-20, 1970. QSL to Larry, W4DQD.

KFØ–KFØNEB was a special station at the Nebraska State Fair, Sept. 3-9, 1970. QSL to WØYOY.

LJ2 – LJ2L was reported on 14202 kc at 0640 GMT in W6-land. LJ is a Norwegian prefix block.

OI3–OI3NS, 21002 kc.

OI9–OI9SUF was a Boy Scout Jamboree station in Finland.

OK5–OK5TOL, 14012 kc.

RF6–RF6FB is a v.h.f. (10 meters and above station in UF6-land. Try 28090 kc.

U4–U4L was active on 14 mc c.w. at 0000-0200 GMT. QSL to UA4LM.

WF3–WF3IEC was a special events station during the 35th General Meeting of the International Electrochemical Commission, Washington, D.C., May 18-30, 1970. QSL to W3ZA.

WP4–WP4DHD, 21115 kc, novice in Puerto Rico.

YB3–YB3AAI was active from the Surabaja Fair during September. QSL to P.O. Box 327, Surabaja, Java, Indonesia.

YTØ–YTØM, 21053 kc.

4JØ–4JØU on 21250 was a special prefix in the Soviet Republic of Georgia. A report says that QSLs may be sent to W7MSJ.

The WPX Program

S.S.B. WPX

537.....PAØPMC
538.....WA2HSX
539.....PY1DFF
540.....WA8ASV
541.....W3EAD
542.....W6JYT
543.....G4JW
544.....KØWWX
545.....ZL4BO

C.W. WPX

1048.....W9EVD
1049.....UA6LC
1050.....DL9TJ
1051.....W6CNA
1052.....LU9WA
1053.....HA5AF
1054.....SP9UH
1055.....3Z6BFK

Mixed WPX

248.....W6KHS
249.....DK1YK

Phone WPX

199.....DL8PC

VPX

25 (SSB).....WPE4JAX
26 (Mixed).....DL-11595

WPNX

We are very pleased to have 3 applications for this award in the same month. This is the first time we have presented 3 WPNX certificates in a 30 day period.

20.....WN4GJX
21.....WN7OLT
22.....WN7LTA

WPX Endorsements

S.S.B.: W4NJF–850, W9DWQ–700, K2POA–700, W6YMV–550, ZL4BO–450, WA2-HSX–400, VK2KM–400, K6SSN–300, W6-JYT–300, G4JW–250, G3UKH–250, PAØ-PMC–250 and W9GHO–250.

C.W.: OK2QR–750, W9DWQ–700, OK2-DB–600, LU9WA–500, DL9TJ–450, WA6-JVD–400, W6KHS–400, and WA3CSF–350.

Mixed: W9DWQ–900, W8ROC–700, VE3-GCO–650, WA2FQG–600, PY3APH–600, W4DRK–550, and WA6TAX–500.

Phone: YV4QG–550, DL8PC–550, and K2-OLG–400.

20 Meters: UA6LC

Europe: WA9SUJ, W6CNA, and VK2KM.
North America: OK2QR.

Oceania: OK2QR and K6SSN.

South America: OK2QR.

VPX (Mixed): DL-11595–450.

Complete rules for WPX, WPNX, and VPX are listed on pages 66-67 of the June, 1970 issue of CQ. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to WPX Manager, P.O. Box 1271, Covina, Calif. 91722.

The CQ S.S.B. DX Award Program

100 Countries
653.....PY1DEF
654.....WA8NNK
655.....VK7LZ
656.....K3TVE

200 Countries
207.....ZL4BO
208.....DK2BI
209.....K5HYB

The WAZ Program

The following list is based on applications received between August 1 and August 31, 1970:

S.S.B. WAZ

811.....W6OMR
812.....JA7QJ/1
813.....CT1UE
814.....K6PIH
815.....WB2RLK

C.W.—Phone WAZ

2981.....VEAYY
2982.....WA1EUV
2983.....K6MT
2984.....W4PGW
2985.....W9POC
2986.....K2QBW
2987.....DL6XW
2988.....VE5JS
2989.....F9AP
2990.....JA2IOD
2991.....K4PVZ
2992.....WA7ABO /W7FS
2993.....WA9NSR
2994.....K4CFB
2995.....K3AIG
2996.....PE2EVO
2997.....K7ABV
2998.....I1ZKJ
2999.....W1ESN
3000.....WB2AMO
3001.....F8VK
3002.....F9LX
3003.....G2BUL
3004.....W8CNL

Phone WAZ

444.....G2FQP
445.....VK7LZ

Complete WAZ rules are shown on pages 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

CQ DX Awards Advisory Committee

With the advent of the *CQ* C.W. and S.S.B. DX awards it is a good time to remind you that our Committeemen are authorized to verify cards foro the members of their clubs, and others in their immediate areas, who wish to apply for *CQ* DX awards. We endeavor to keep active representatives in major DX clubs across the country. The present membership is as follows:

RON KREGAR, VE3DLC, Canadian DX Association—30 Zenith Drive, Scarborough, Ontario, Canada.

HERB KLINE, K1IHP, New England DXCC, 23 Jacqueline Road, Waltham, Ma. 02154.

FRANK ANZALONE, W1WY, *CQ* Contest Department, 14 Sherwood Rd., Stamford, Ct. 06905.

LEW LEVITT, WB2NDI, Kings County Club, 1250 Ocean Ave., Brooklyn, N.Y. 11230.

BOB WILSON, W3GHD, Frankford Radio Club, 139 Campbell Ave., Havertown, Pa.

JOE HILLER, W4OPM, Virginia Century Club, 2208 Dinwiddie Rd., Bayside, Virginia Beach, Va. 23455.

DON Busick, K5AAD, West Gulf DX Club, 12301 Zavalla St., Houston, Tx. 77045.

ED GOODBOUT, W9DWQ, Northern Illinois DX Association, 134 Forest Ave. River Forest, Il. 60305.

BILL HIGGINS, WØYDB, Twin City DX Association, 3534 West 28th. St., Minneapolis, Minn. 55416.

GARY STILWELL, W6NJU, Southern California DX Club, 7164 Rock Ridge Terrace, Canoga Park, Ca. 91304.

DAVE BAKER, W6WX, Northern California DX Club, 930 Colby Ave., Menlo Park, Ca. 94025.

DICK SPENCELEY, KV4AA, Member-at-Large, P.O. Box 403, St. Thomas, V.I. 00802.

Vacant positions now exist for Committeemen representing the Long Island DX Association, the North Jersey DX Association, and the Ohio Valley Amateur Radio Associa-

Roberto Reyes, YS2RAR, of Santa Ana, El Salvador, is shown at the rig of Syl, W1MD in Hingham, Mass.

On the far right is Lele, HB9AMY, entering Liechtenstein for his 1970 all band DXpedition as HBØAMY. QSL to P.O. Box 768, Lugano 1, Switzerland.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed *current* prefixes submitted in accordance with the master prefix list. The total shown is the current net regardless of an operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1000
W9WHM	John R. Leary	811
W8LY	Michael A. Bakos	785
KØBLT	Frank Cahoy	733
W8ROC	Frederick Riecks	729
G3DO	D.A.G. Edwards	714
K1SHN	Chuck Banta	714
I1SF	Serafino Franchi	690
W3PVZ	Joseph M. Olnick	680
WA5LOB	James Edwards	680
VE3GCO	Garry V. Hammond	678
W4IC	George A. Mack	676
DL1MD	Heribert Rechl	646
W4BQY	G.B. Fisher	639
WA6EPQ	Larry Brockman	617
YU1AG	Djura Borosic	614
W8KSR	Jon Hodgin	609
W8GMK	John Marhefka	592
WAØCPX	Edward C. Gray	550

SSB

W4OPM	Joe Hiller	899
W4NJF	Gay E. Milius	835
DL9OH	Karl Muller	690
K2POA	Arthur Johnson	674
WA5LOB	James Edwards	673
HP1JC	Juan G. Chen	644
G3DO	D.A.G. Edwards	622
W3DJZ	Arden Hopple	620
I1AMU	Alfonso Porretta	619
K1SHN	Chuck Banta	604
F2MO	Michel Dort	581
W4IC	George Mack	562
W6YMV	Paul Friebertshauser	553

CW

W4OPM	Joe Hiller	850
W8LY	Michael A. Bakos	786
W2AIW	Charles Rogers	776
VK3AHQ	Henry Denver	753
W8KPL	William W. Simpson	750
DL1QT	Helmut Baumert	744
W2HO	W. Vollkomer	720
ON4QX	Bob Berge	682
W9FD	W:W. Johler	680
G2GM	F.D. Cawley	598
K1SHN	Chuck Banta	588
VE4OX	D.E. McVittie	579
I1SF	Serafino Franchi	571
YU1AG	Djura Borosic	569
W8GMK	John Marhefka	562
K1LWI	Wendell Boyden	550

PHONE

W9WHM	John R. Leary	813
G3DO	D.A.G. Edwards	708
W3DJZ	Arden Hopple	654
CX2CN	Samuel Barreiro	574
I1SF	Serafino Franchi	568

tion. The presidents of these groups may appoint properly qualified DXers to fill these positions.

QSL Manager of the Month

The 2nd winner of the Scott's QSL Service Manager of the Month Award is Bert Isemann, VE3EUU.

Bert first became an amateur in 1961 and started handling cards the following year. His first station was ZS6BDU. Some of the more recent stations he can confirm for you include VP2EUU, VP2KM, VP2LM, VP2LL, VP2AL, FG7TI/FS7 and PJ7JC.

In addition to QSLing chores Bert has also made two DXpeditions to the Caribbean and has earned several merit awards for public service. He is a member of the Canadian DX Association.

QSL Information

Cards for all U.S. s.w.l.'s may be sent to Golden Gate QSL Bureau, 71 Surrey St., San Francisco, Calif. 94131.

AX9KS–Via W1YRC.
AXØKW–To VK7KJ.
BY1PK–Cards sent to Box 427, Peking are returned marked "Nom du pays destinataire. Errone. Retour." Has anyone receiver a QSL from this station?
C21JW–To 22 Berry St., Cronulla, N.S.W., Australia.
C31BI–Via F9IE.
C31DE–c/o EI6AU.
CR9AK–To CT1BH.
CT2AA–c/o WA3HUP.
DL4US/LX–Via WA3BZA.
EA9CC–To WB4QNP.
ET3USA–c/o VE3IG, 287 Kathleen Ave., Sarnia, Ontario, Canada.
FB8XX–Via F2MO.
FB8YY–To F9MS.
FM7WE–c/o K4CFB.
FMØXF–Via DL5RI.
FO8BO–To WA6TQK.
FS7NN–K9GCE/4, 6636 11th. Ave. No., St. Petersburg, Fl. 33710.

[*Continued on page 82*]

Ted Laker, G6LK, of Surrey, who has turned in a very fine performance on 160. *(Photo via W1BB)*

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE December, "Story of The Month", about Roy Needham, ZL1KG (courtesy of Paul, W4YWX) after these commercials.

The Special Honor Roll again lists two more who have qualified for All Counties. Rumor has it that at least one more County Hunter has qualified for All Counties but a couple of QSLs are slow in arriving, and several others need very very few to make All Counties.

Don McCarthy, WAØZZT/WA9PRE acquired a Mixed USA-CA-2500.

All A3A 2500 awards were issued to Bob Holt, GW3NWV and Joe Ripp, WA9SKB.

Gary Medford, W2EQK found time to fill in his *Record Book* and applied for awards 500 through 2500, endorsed All 14 mc A3A.

The South Jersey Radio Association, Inc., K2AA, with their special call WS2JRA acquired a USA-CA-500.

Other USA-CA-500 awards were issued as follows: Mixed to Bob MacIntire, VE4ZX; All 21 mc A-1 to Ingemar Jacobsson, SM6-CAW; All 14 mc A3A to Dave Mackey, W2-TND; and Larry Beilin, K6VDP. Dick Foster WA9OUE acquired a 500 award All A3A.

Special Honor Roll
All 3079 Counties!

#37—Willie A. Carr, WA4RDV 8-22-70.
#38—Robert Smolenski, W2OST 8-23-70.

USA-CA HONOR ROLL

2500		2000		500	
WAØZZT/WA9PRE	86	W2EQK	116	WS2JRA	806
GW3NWV	87			VE4ZX	807
W2EQK	88	1500		SM6CAW	808
WA9SKB	89	W2EQK	146	W2TND	809
				WA9OUE	810
		1000		K6VDP	811
		W2EQK	214	W2EQK	812

Roy C. Needham, ZL1KG

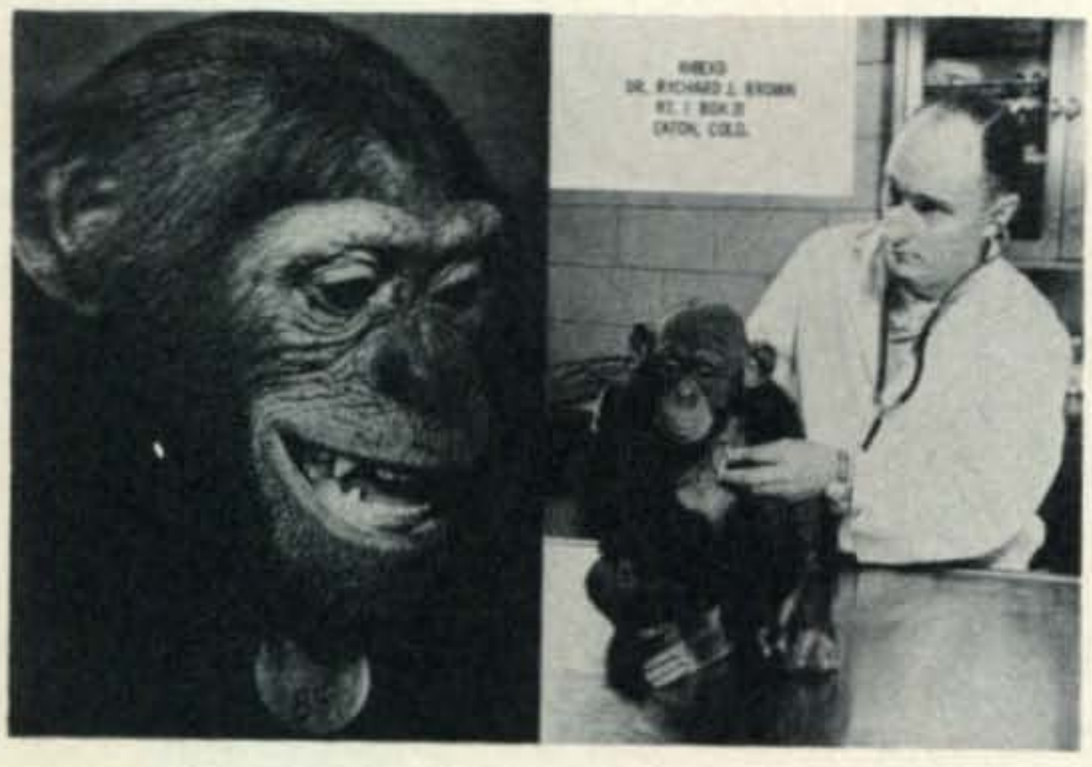
First seeing the light of day on April 3, 1912, Roy produced his first radio some 13 years later, a broadcast crystal set (cats whisker type). The broadcast station was 500 watts and about 30 miles away, but was not received, however the next effort which followed at once, did the job ok. Progress was made up through the hobby building tube sets, the early ones being regenerative jobs. In those days, many US broadcast stations were heard down under, the loudest and having the greatest following was KFI.

The urge to become a transmitting amateur came at about 17 years of age, but nothing much was done about it as information was scarce and there was no one available with the "know-how". However, around 1932 a non-active amateur moved into the area and he provided the necessary source of information and the urge returned.

The equipment was all homemade, of course. The receiver which was made in 1933 to get code practice from commercials (mostly LSI in South America), was followed by

Roy C. Needham, ZL1KG

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



Dick, W0EXD, checking W2GT's heart (?).

others of conventional design of the times—TRF, Det and 2 audio. The power transformer was even home wound—what a monster compared to present day standards. The transmitter built was PP45 osc. to PP45 PA. And so on May 22, 1934, ZL1KG came on 80 meter c.w.

80 meters (mostly fone) was used until around late 1946 when an excursion was made onto 10 meter fone. The DX bug bit and Roy has been on 10, 15 and 20 practically ever since. WAZ fone certificate #29 was received and a DXCC score of about 240 was made using 95 watts a.m. fone and still all homemade equipment.

An opportunity came in early 1960 to acquire some used commercial equipment and s.s.b. has been in use since then. This was the end of homemade equipment except for beams which are still being home built.

An interest in County Hunting was acquired in late 1967, a check of all QSLs showed only 398 county confirmations, this due to the practice of many years standing of QSLing only upon receipt of a QSL (actually a common and accepted practice of many many DX stations). Through 1968, hunting was done in earnest and the worked total got to about 1000. In January 1969 Roy started checking into the Independent County Hunter Net on 14336 and by the end of August the total had reached 2000.

Roy is married and they have 3 sons and 2 daughters plus 7 grandchildren (at the time this was written, Hi.). Roy had a radio sales and service business for some 23 years, which he sold 6 years ago, but retained the Public Address System portion of it which he still runs and incidentally still designs and builds his own equipment for it.

It is his firm intention to work *all counties* —whether this will be possible or not from so far off—only time will tell, but with the grand cooperation from all coupled with the fantastic comradeship found with the County Hunters—it appears there is a reasonable chance for Roy to make it.

Roy will be visiting the U.S. next year and the Independent County Hunter Mobileers are going all-out to help Roy have his dream come true. Yes, Roy will be at the Independent County Hunter Convention in Kansas City in 1971 and hopes to visit much of the U.S.

Roy puts in a fine signal on the Independent County Hunter Net around 1900 GMT via long path and bores a big hole in the ether around 0600 GMT.

Our records show that Roy on December 20, 1969 received 500 award #761; 1000 award #187; and 1500 #125. On March 3, 1970 2000 award #98 was issued; and on May 21, 1970 2500 award #75 was issued. All awards have been endorsed ALL FONE and his 1000 and 1500 awards were the 2nd such awards issued to any station outside US/Canada and his 2500 was the 1st outside US/Canada. The first 1000 and 1500 went to Bob, GW3NWV and he received #2 2500. USA-CA AWARDS have gone to only 4 other New Zealand stations, ZL1AH, ZL1HW, ZL1TB and ZL4CK—all have been 500 awards, except for Gordon, ZL1HW who also has a 1000 award.

Awards

"5 × 5": This Premier Award has been instituted by the New Zealand Association of Radio Transmitters Inc. (NZART) to recognize the increasing interest in 5 Band Operation. The initial award can be obtained after contacting the *same* station on 5 different bands, repeated with other stations in 4 different DXCC countries. Endorsements are available for 10 DXCC countries and then each further 10 to 100 when the 10 available endorsements will have been won.

Application requires a certified list of stations worked (with essential QSO/Log data) and a fee of $1.00 which includes the issue of all endorsements. Send to NZART Awards Manager, ZL2GX, 152 Lytton Road, Gisborne, New Zealand. Note—Initial award requires 5 Band operation with 5 different DXCC countries. First endorsement after a further 5 has been contacted (making a total of 10), the 20 endorsement requires a further 10 and so on.

Cook Bi-Centenary Award: Available to all amateurs who contact 50 ZM stations

operating in New Zealand provided at least one is from each of the four districts. QSLs not required, send full log data with 3 IRCs or stamps to value of 25 cents (any country) to Awards Manager, ZM2GX (ZL2GX), 152 Lytton Road, Gisborne, New Zealand. Note –NZART issue some 10 other fine awards, send s.a.s.e. or s.a.e. and an IRC to ZL2GX for full details.

Centenary Award: A special award celebrating Rome Capital 1st Centenary 1870-1970. Issued by the ARI Rome club to any amateur or s.w.l. for working or hearing amateurs living in Rome between January 1st and December 31, 1970. During this period Rome amateurs will use the call IRØ.

Italians need 25 points.
Europeans need 12 points.
All others need 8 points.

Each QSO will count 1 point but contacts on September 20th, Centenary Day, will count 3 points. Send log data and 8 IRCs before March 31, 1971 to ARI, Sezione di Roma, Centenary of Roma Award, P.O. Box 361, Rome, Italy.

Yugoslav Dalmatian Award: A DXpedition to ten islands in the Adriatic Sea between July 15 and August 25 using calls 4N2CI, 4N2SO, 4N2BR, 4N2HV, 4N2KR, 4N2KO, 4N2LO and 4N2ML on A-1 & s.s.b. will help you with Geoff Watts IOTA Award, WPX as well as the Yugoslav Award. For the Yugoslav Award stations outside Europe need work only 2 different islands, others need 4? Send your QSLs via YU2NEG. But for the Award send QSLs and 7 IRCs to YU1SJ.

Notes

Some complaints received regarding APOLLO 13 certificates. Investigation reveals they *are* being mailed slowly but surely because of the cut-back in work at Kennedy Space Center, plus transfers cutting down the Club membership. At the moment only one club member is working on the certificates, so with all his other work, they are getting out slowly, but for sure! Sorry for the delay!

Am anxious to give you some promised data on the "Mobile Amateur Radio Awards Club, Inc." (MARAC). Organized on March 14, 1970 as a non-profit Kansas Corporation. *Among* the objectives are to promote efficiency in mobile and portable operation; to recognize and award outstanding achievement in mobile radio operation. At present their newly adopted constitution and by-laws list three types of membership—regular members, associate members and honorary members. Actually there are still some openings for Charter Membership at $10.00 with regular dues after the first year. Regular membership is $3.00 and this includes their fine *Newsletter*. Get membership forms and apply for membership to Cleo Mahoney, WAØSHE, 6001 Blue Ridge Cut-Off, Raytown, Missouri 84133. MARAC already has a very fine Awards Program, but more about that later.

Speaking about Awards, I would like to mention that the Far East Auxiliary Radio Operators (FEARL) have reactivated their fine *Awards Program* and are issuing 7 fine Awards, some of which were mentioned on page 112 of June 1968 CQ. For full data send s.a.s.e. to FEARL(M), Attn: Awards Manager, CMR Box 1414, APO San Francisco 96525. Remember it was a member of FEARL who acquired the first USA-CA Award to an Asian station, KA9MF in April 1968.

Some time ago *CQ* mentioned that an amateur from the 5th district was involved in our space program and I believe he was receiving Astronaut training. Well, for those of you who have had the pleasure of a QSO with Dick Brown (D.V.M.), WØEXD, you might like to know that he is an Air Force Veterinarian and involved in the selection, training and utilization of all animal space travelers. Yes, he does check into the Independent County Hunter Net.

Regarding active County Hunting frequencies: for s.s.b. (although most will answer c.w. stations) 14336 daily, until the band folds, from about 1400 GMT; when 14 mc folds look on 7290 (used to be 7265) and 3930. For c.w.: look on 7055 Sundays at 1600 GMT and Wednesdays at 2400 GMT and on 14070 at 1400 and 2000 GMT on Saturdays.

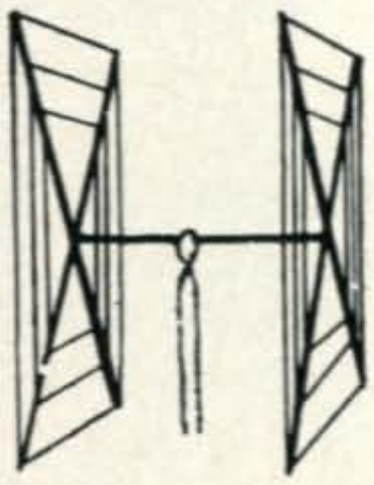
The other night I had a dream that I had 30 beautiful (and efficient) secretaries and I was able to write each of you a nice "thank-you" letter and also send each and everyone of you an appropriate Christmas card. Unfortunately this was a dream, but will you all please realize that the thought was there. Kindly permit me (this way) to wish each and every one of you and your loved ones a very Merry Christmas and a Happy and Prosperous New Year. How was your month?

73, Ed., W2GT.

AHA! YOU THOUGHT GOTHAM

made run-of-the-mill ordinary antennas. No, no, no. Our materials are the best, and our design superior. WA1JFG won the New England Round-Up championship with our 3-element 15meter beam by a margin of 5,982 points!

QUADS Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...



W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.: 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

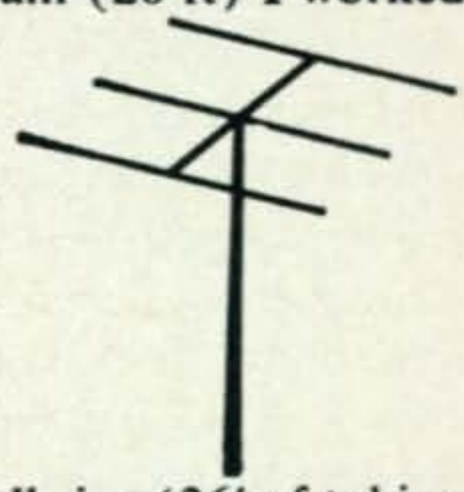
Feedline (not furnished); 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
TEN METER CUBICAL QUAD	25.00

(all use single coax feedline)

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$21	4 EL 10	20
3 EL 20	27	7 EL 10	34*
4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*		
5 EL 15	30*		

*20' Boom

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

GOTHAM
1805 Purdy, Dept. CQ, Miami Beach, Fla. 33139

"HOW TO ORDER: Send money order (bank, store, or United States) in full. We ship immediately by REA Express, charges collect. DEALERS WRITE."

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Nov.	**28-29**	**CQ WW DX C.W. Contest**
Dec.	5-6	Indiana QSO Party
Dec.	5-6	Tel. Pioneers QSO Party
Jan.	**30-31**	**CQ WW DX 160 Contest**
Jan.	30-31	French C.W. Contest
Feb.	12-14	QCWA QSO Party
Feb.	27-28	French Phone Contest
Feb.	27-28	YL-OM Phone Contest
Mar.	13-14	YL-OM C.W. Contest

Indiana QSO Party

Two Periods: (GMT)
1900 Sat. Dec. 5 to 0600 Sun. Dec. 6
1600 to 2400 Sunday, December 6

The same station may be worked on each band and mode for QSO points.

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

Scoring: One point per QSO; Ind. multiply by the number of states, VE provinces and countries worked. Out-of-state stations use Ind. counties for their multiplier. (max. of 92) Indiana stations may work each other for QSO points.

Frequencies: C.W.–3535, 7035, 14035, 210-35, 28035. Phone–3955, 7265, 14295, 21395, 28600, 50400.

Awards: Certificates to top station in each state, province, country and each Ind. county. Special award to the in and out of state highest scorers.

Mailing deadline Dec. 31st to: Thomas J. Thamann, WA9MXG, 5013 Nowland Ave., Indianapolis, Ind. 46201. Include s.a.s.e. for results.

Telephone Pioneers QSO Party

Starts: 1900 GMT Saturday, December 5
Ends: 0500 GMT Monday, December 7

The object of the Party is for telephone pioneers to contact other members in the US and Canada. The same station may be worked on different bands and modes.

Exchange: Signal report, contact number, chapter name and number.

Scoring: One point for each exchange and one point for each chapter worked.

Frequencies: phone–3965, 7260, 14295, 21365, 28675. v.h.f.–50.1, 50.25, 144.275, 145.-500. c.w.–3565, 7065, 14065, 21065.

Indicate your Chapter on your log and mail before January 5th to: Frank J. Wojcik, W2-SNJ, Stanley S. Holmes Chapter No. 55, Telephone Pioneers of America, 100 Central Avenue, Kearney, N.J. 07032.

CQ WW DX 160 Contest

Starts: 0000 GMT Saturday, January 30
Ends: 1500 GMT Sunday, January 31

Rules remain the same as they have been the past few years.

This is a c.w. *only* contest. No c.w. to phone or cross band contacts allowed.

Exchange: RST report plus a progressive contact number starting with 001 for the first contact, followed by your state or province. (It is not necessary for DX stations to send their country, the call will identify them.)

Scoring: For W/VE/VO, 2 points per QSO with other W/VE/VO stations. Contacts with all DX 10 points per QSO.

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

Multiplier: For all stations, a multiplier of

There were quite a few Contest Expeditions scheduled for this year's Phone Contest, possibly with the Stu Meyer, W2GHK Trophy in mind. Here is John Attaway, K4IIF presenting the 1968 award to Lou Persons, W4PJG for the ZF1EP operation. The occasion was the Orlando Ham-fest last summer.

*14 Sherwood Road, Stamford, Conn. 06905.

United States & Possessions 160-Meter Operating Regulations

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

A reduced view of the United States Operating Regulations for 160 meters. Much larger copies are available from CQ. An s.a.s.e must accompany your request.

one (1) for each US state, Canadian province or foreign country worked.

Final score: The sum of QSO points multiplied by the total multiplier.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of this contest, or unsportmanship conduct, or taking credit for duplicate contacts in excess of 3 percent of the total made, will be deemed sufficient cause for disqualification.

Awards: Certificates to the top scoring station in each state, province and foreign country. Additional awards will be made if the score or participation warrants.

This year, for the first time, a Plaque will be awarded by *CQ*, to the station having the highest over-all score.

Hawaii and Alaska will be considered "foreign countries" for QSO and multiplier credit. The District of Columbia counts as Maryland. And keep in mind that VE1 is divided into three provinces, Nova Scotia, New Brunswick and Prince Edward Island.

Log sheets and United States Regulations for 160 may be obtained from *CQ* upon request and a large s.a.s.e. with your request.

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

French DX Contest

C.W.–Jan. 30-31 **Phone**–Feb. 27-28

Starts: 1400 GMT Saturday

Ends: 2200 GMT Sunday

You may work French stations as well as stations in French territorial areas in this one.

Exchange: The RS/RST report plus a progressive QSO number starting with 001.

Scoring: Each QSO counts 3 points. And a multiplier of 1 for each REF department or DUF country worked on each band. (F stations will indicate their dept. by 2 figures after their call)

Final score, total QSO points times the sum total of the multiplier from each band.

It also mentioned that HB, LX, and ON stations will be on with their own activity during this period and contacts with these stations may be credited for QSO and multiplier points in the French contest.

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

Logs go to: R.E.F. Contest Committee, Boulevard de Bercy 60, 75 Paris 12, France.

Editor's Notes

This is the last month for you to work 25 different Central and/or South Americans for the "Beam the Americas" award. The activity comes to a close the 31st of December. Contacts must be of 10 minutes or more duration and reported before April 1st 1971 to: Ernest L. Bracy, W1BFA, P.O. Box 88, Readfield, Maine 04355. Details in May '70 CALENDAR.

The ARRL has organized a 160 Contest that will take place this month (Dec.) I don't know what type of a contest it will be but understand the object is to promote c.w. activity on the Top band. A very good idea, but haven't we been doing that for the past ten years or more? Who said, "imitation is the highest form of flattery."

About the only reference I can make about our WW DX Contest at this late date is to make sure to send us your log. Remember, all calls will be published regardless of your score.

It doesn't seem possible that another year has gone by the boards. All the best to you and yours for the Christmas Season, and may the New Year bring you many Blessings.

73 for now, Frank, W1WY

Propagation

BY GEORGE JACOBS,* W3ASK

DURING December good-to-excellent openings are forecast to most areas of the world on 10 meters. The band is expected to open shortly after sunrise, peaking on signals from an easterly direction before noon; from a southerly direction during the afternoon hours; from a westerly direction during the late afternoon and early evening hours. Excellent openings are also predicted for the 15 meter band, with signals peaking from various directions about an hour or two after they peak on 10 meters. During most of the daylight hours it should be a toss-up between 10 and 15 meters for DX propagation honors.

Good-to-excellent DX propagation conditions are forecast for 20 meters during December. The band is expected to open at sunrise, and remain open to one area of the world or another through the daylight hours and into the early evening. To some areas of the world, 20 meters may remain open during the hours of darkness as well. Optimum DX propagation are predicted for this band during the sunrise period and again during the late afternoon and early evening hours.

DX propagation on the lower frequency amateur bands is usually optimum to most of the world during the winter months. Static levels should be at seasonally low values during December, and signal levels are expected to be stronger than at any other time of the year. DX openings on 40 meters should begin during the late afternoon hours, with the band opening first to Europe and to other areas in a northeasterly direction. Forty meters should remain open to one area of the world or another through the hours of darkness and until shortly after sunrise, when conditions are expected to peak to Oceania and to areas in a generally southerly and westerly direction.

Some fairly good 80 meter DX openings are forecast for December to many areas of the world during the hours of darkness and the sunrise period. Signals are expected to peak at about the same time that they do on 40 meters.

Even the 160 meter band should have its share of DX during December. Some fairly good openings are likely to take place when the transmission path is entirely in darkness,

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

LAST MINUTE FORECAST

December, 1970

	Days	Forecast Rating & Quality (4)	(3)	(2)	(1)
Above Normal:	2, 9, 12, 17, 23, 28, 30.			B-C	C
Normal:	1, 3, 10-11, 13, 15-16, 18-19, 22, 24-25, 27, 29, 31.	A-B	B-C	C-D	D-E
Below Normal:	4, 6-7, 14, 20-21, 26.	C	D	D	E
Disturbed:	5.	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 Dec. 15, 1970 through Feb. 15, 1971 and are prepared from basic propaga-propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

or when part of the path is in darkness and the other in either twilight or dawn.

VHF Ionospheric Openings

There is a slight possibility that an occasional transcontinental F-layer opening may be possible on 6 meters during December. Some openings may also be possible between the continental USA and Hawaii and between the USA and South America. The probable times for such openings is about an hour or so before noon, and during the early afternoon hours.

Trans-equatorial scatter, or TE openings on 6 meters are expected to fall off a bit in the northern hemisphere during December, but some openings should still be possible between the southern half of the USA and South America. TE openings take place during the evening hours, peaking between approximately 8 and 11 P.M. at the path midpoint.

A secondary seasonal peak in sporadic-E propagation should occur during December (the major peak occurs during the summer months).

This is expected to result in a number of good short-skip type openings on the 6 meter band, between distancts of approximately 800 and 1400 miles. Sporadic-E conditions usually peak during the early evening hours, but some openings may occur at other times as well.

Two significant meteor showers are expected during December, which may make possible some meteor-scatter type openings on 6 meters, and possibly also on 2 meters, *Geminids,* a major shower, is expected during the second week of the month, peaking the late evening hours of December 13. *Ursids,* a less intense and shorter duration shower, is expected December 21-22, peaking during the afternoon hours of the second day.

Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially during periods when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during the month.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly mean sunspot number of 93 for August, 1970. This results in a smoothed sunspot number of 106 centered on February, 1970. The plateau in solar activity continues, with the present cycle remaining practically constant throughout the entire period between April 1969 and February 1970 (The 1970 and 1971 dates given in last month's column were in error).

This month's column contains DX Propagation Charts valid from December 15, 1970 through February 15, 1971. Short-Skip Propagation Charts valid for December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year.

73, George, W3ASK

December 15, 1970—February 15, 1971

TIME ZONE: EST (24-Hour Time)

EASTERN USA TO:

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

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

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

CENTRAL USA TO:

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

New Years Resolutions:

1. Subscribe to CQ.
2. Send in early for CQ log forms.
3. Enter CQ contests—starting with the CQ WW DX 160 Contest, Jan. 30 and 31st.

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

TIME ZONE: PST (24-Hour Time)

WESTERN USA TO:

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

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

P.T.T. and Squelch for Heath Twoer

QUESTION: Have you any data on modifying the Heath Twoer for push-to-talk operation and a squelch?

ANSWER: Complete data on a p.t.t. setup for the Heath Twoer may be found under "Heath Two'er Modifications," *CQ*, October 1963, page 34.

Information on a squelch system will be found in HAM CLINIC, *CQ*, August 1960, p. 78. Although the circuitry is specified for the Heath CB-1 Citizen's Band Transceiver, it should be adaptable to the Two'er inasmuch as the receiver circuitry for both sets is similar.

Another modification which may be of interest is "Souping Up the Heath Two'er," *CQ*, March 1965, p. 35.

Heath SB-200 A.L.C. With Collins 32S-3

QUESTION: Is the a.l.c. voltage derived from my Heath SB-200 Linear Amplifier compatible with the a.l.c. input circuitry of the Collins 32S-3 or are there any changes required to get the desired level of control of the exciter by the linear?

ANSWER: When the Heath SB-200 Linear is properly tuned up, it cannot be overdriven by the Collins 32S-3; however, if it should be desired to use a.l.c. from the amplifier, the a.l.c. threshold in the SB-200 is set too high for operation with the 32S-3, in which case it must be reduced. How this may be accomplished is described in the following item. Proper tuneup without amplifier flattopping is described in the review of the SB-200, page 62 of the June 1969 issue of *CQ*.

*Technical Director, *CQ*.

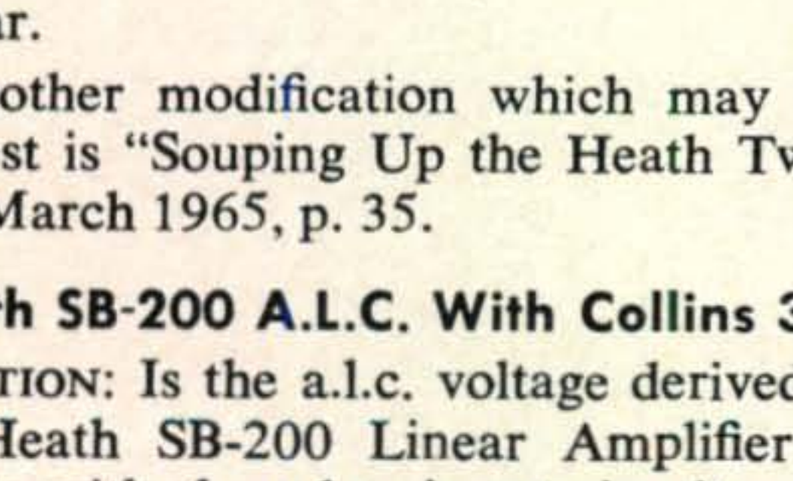


Fig. 1—Circuit revision to provide an a.l.c. threshold control for the SB-200 by means of *Rx*.

Adjustable A.L.C. Threshold for the Heath SB-200 Linear Amplifier

As noted from the previous item, the threshold for the a.l.c. in the SB-200 linear amplifier may have to be altered for use with some exciters where a.l.c. control from the amplifier is desired. An adjustable a.l.c. threshold for the SB-200 may be obtained by revising the a.l.c. detector circuitry as shown at fig. 1. *Rx* should be a small size potentiometer (1" dia.).

Referring to fig. 2, installation details are as follows:

1. Remove the amplifier from the cabinet.
2. Disconnect the gray lead from lug 1 of terminal strip AB located above the rear of the tube sockets.
3. Cut off all but about 1" of the control shaft for *Rx*.
4. Install *Rx* using stiff wire (at least #14) between lug 1 of terminal strip AB and lug 2 of *Rx* and between lug 1 of *Rx* and a solder lug to be installed at the cover screw above terminal strip AB, in a manner, that will support *Rx* in an upright position to allow its operation when the cabinet is raised (If desired, a metal bracket could be rigged up for mounting the pot in lieu of the stiff-wire supports). Make sure *Rx* is placed so that it will allow proper clearance when the amplifier is replaced in the cabinet. An additional lead may have to be spliced to the gray lead to reach lug 3 of *Rx*.
5. Reinstall the amplifier in the cabinet.

Adjustment should be made as follows: With the a.l.c. lead disconnected between the amplifier and the exciter, modulate the exciter and adjust the mic gain until the exciter a.l.c. meter indicates 3-4 db of a.l.c. Then, leave the mic gain set, connect the a.l.c. line between the two units, apply modulation and adjust *Rx* (SB-200 a.l.c. threshold control) for an a.l.c. level slightly higher than that initially indicated by the exciter meter. Advancing *Rx* beyond this point to where there is no threshold potential (*Rx* arm at ground

end) with most exciters will significantly reduce the exciter drive and the output of the amplifier.

A smilar circuit revision should be possible to incorporate in the SB-220 amplifier.

C.W.-Band Reception with the Heath HW-32A 20-meter Transceiver

QUESTION: Is there any simple modification that might allow reception with the Heath HW-32A in the c.w. portion of the 20-meter band using a simple switching arrangement?

ANSWER: Receiving in the c.w. portion of the 20-meter band with the HW-32A may be accomplished in two ways. One is to switch in a different crystal at Y_6. The crystal frequency should be 200 kc lower for 14.0-14.150 mc coverage, 150 kc lower for 14.05-14.2 mc coverage. This might be difficult to set up, since the crystal is soldered on the circuit board.

An easier solution is to alter the v.f.o. range by switching out padder C_{130} which is easily accessible near the v.f.o.-tuning capacitor. This can be done with a diode switch as shown at fig. 3. The v.f.o. frequency will be raised by about 200 kc, which is what is needed to *lower* the operating frequency to 14.0 mc.

In either of the above cases, L_5 may have to be retuned a bit lower in frequency for maximum signal, but this would affect phone-band transmissions. Leaving L_5 tuned as is may thus be advisable as long as there is enough heterodyning signal to allow c.w. reception.

A *very* small percentage of those we attempt to aid through this department of *CQ* are kind enough to let us know how they make out with our suggested solutions to their problems. One such response is from WA2-HGJ who posed the above inquiry. A portion of his letter is quoted herewith in the interest of those who may wish to make a similar modification to this or other equipment.

"I thought you might like to know how I made out with getting the receiver portion of my HW-32A to cover the 20-meter c.w. band. I did as you suggested and switched out C_{130} (this capacitor is labeled C_{205} in my manual). I used a s.p.s.t. switch between the capacitor and ground. With the capacitor switched out, the frequency range within the dial markings was about 14.07-14.26 mc and went down to about 14.05 mc below the dial markings. This is just fine for my purpose, since I have only

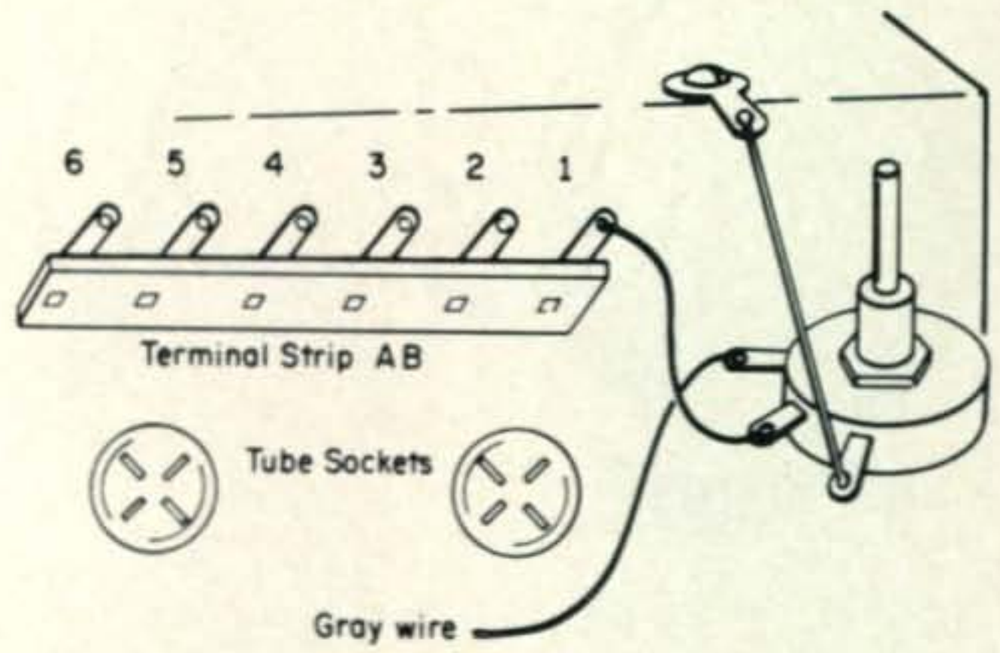


Fig. 2—Wiring diagram for installation of a.l.c. threshold control in the SB-200. Procedure is given in text.

a General ticket and can't go further down. I didn't find it necessary to retune anything, except for a minor adjustment of L_6 after installing the switch which is a miniature type mounted on the rear apron between two of the four phono jacks. Although the dial markings are not valid for the c.w. band, c.w. reception is satisfactory and at least now I don't have to throw my 50-watt c.w. transmitter into storage!"

WA2HGJ goes on to say, "I also built a version of the "Vacationeer Antenna" you described in the May Q & A Column. It really works fine and is the answer to an apartment dweller's dilema. The one I put together for 20 meters cost about $10.00 for everything (63" whip, loading coil and other parts)."

To which we reply "Many thanks for your thoughtfulness, Paul."

75S-3B A.G.C. Release Time

QUESTION: I find that the release time for the

[*Continued on page 88*]

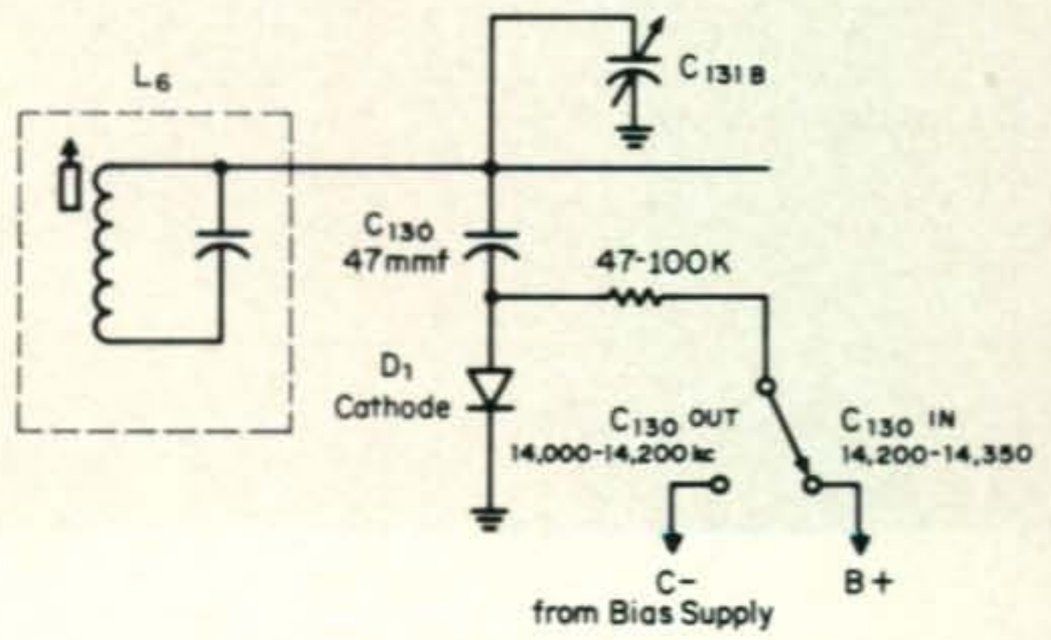


Fig. 3—Revised circuitry at the v.f.o. for the HW-32A to allow reception in the c.w. portion of the 20-meter band. D_1 may be any type diode such as 1N34A, 1N456, etc. See text for other details.

SURPLUS sidelights

BY GORDON ELIOT WHITE*

I HAD a letter from WA2IMC last fall, asking how to align a low-frequency Command Receiver. After reviewing the steps in the process, it seemed likely that others might find it useful to know how to bring these little receivers into proper adjustment. They can give excellent sensitivity and stability if properly tuned, and the process is not hard, but it does need to be done in a logical way.

As nearly everyone knows, Command Receivers were built in several series, covering a dozen frequency bands from 190 kilocycles to 156 megacycles. Only units in five of the bands were built in large numbers, though there are probably a few of the Western-Electric built R-28/ARC-5 crystal-controlled auto-tune v.h.f. sets still in existence that were made to completely different specifications.

The 3.5-7 mc set was only a prototype, and the 100-125 and 125-156 mc tuneable receivers were made in small quantities. There were more of the 20-27 mc 13.5-20 mc units turned out, and a few 9-13.5 mc receivers, but few of these have been seen in surplus.

The majority of the sets still to be found, 35 years after they left the Aircraft Radio Corporation drawing boards, are the 190-550 kc, 550-1,500 kc, 1.3-3 mc, 3-6 mc, and 6-9.1 mc receivers.

All should be tuned identically: bring the intermediate frequency transformers into line first, then set the main tuning near the high end of the dial and adjust the r.f. oscillator with an accurate signal generator, following up by aligning the oscillator padder at the low end alignment point.

Table I is a table of the i.f. frequencies of the Command receivers, and the high and low alignment points.

In the 190-550 and 550-1,500 kc receivers the intermediate frequency amplifier transformers have variable coupling. When you remove the knurled covers you will see small bakelite rods. Pull these gently to the upper position during alignment. For sharpest selectivity, leave them up. For general use, push down the first and third rods, leaving the #2 rod up. Especially in the 85 kc units, loose coupling (rods up) will be so selective as to cut into audio sidebands. Fine for Q-5er work and c.w., but less desirable for audio reception.

Assuming we are aligning a 1.3-3 mc "marine band" set, which is already set up and operating, though it seems to be misaligned, we will set our signal generator quite accurately to the receiver's 705 kc i.f. Attach the generator output lead to the cap of the 12K8 mixer tube, through a capacitor of about 100 mmf. *Do not* remove the tube clip. The generator should be nominally set to 30 percent modulation at 400 c.p.s. but if you can't get that, use a low audio tone with the input reduced well below the a.v.c. threshold of the receiver, *i.e.* audible in the 'phones, but not loud. A 10 milliwatt output or 1 volt on an a.c. voltmeter is about right into a 300 ohm load. If you don't have a v.t.v.m. that you can measure across a 300 ohm resistor, your ear will do tolerably well.

Using an insulated screwdriver, tune the trimmer capicators (under the knurled cap) of the rearmost i.f. can, starting with the hole marked "1" (which is the input plate circuit) Follow by tuning "2" (grid or diode output), go on to the middle can, and finish with can number 1. Turn down the input or the r.f. gain as necessary to keep the output roughly constant as the alignment progresses. If you are really fussy, repeat the process. Using a v.t.v.m., or even a v.o.m., you can tune to a very sharp peak, especially with the lower frequency units. To be sure of getting correct

Band	i.f.	high point	low point
190-550 kc	85 kc	520 kc	210 kc
520-1,500 kc	239 kc	1,400 kc	570 kc
1.5-3 mc	705 kc	2,900 kc	1,550 kc
3-6 mc	1,415 kc	5.8 mc	3.1 mc
6-9.1 mc	2,830 kc	8.9 mc	6.1 mc
9-13.5 mc	4,200 kc	13.3 mc	9.2 mc
13.5-20 mc	4,200 kc	20 mc	13.8 mc
20-27 mc	4,200 kc	27 mc	20 mc
108-135 mc	15 mc	131 mc	111 mc
118-148 mc	15 mc	144 mc	122 mc

Table I—Command receiver i.f. frequencies and alignment points.

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

Band	C-4F	C-4G
190-550 kc	minimum	half
520-1,500 kc	min.	half
1.5-3 mc	half	half
3-6 mc	half	maximum
6-9.1 mc	half	max.
9-13.5 mc	half	max.
13.5-20 mc	half	max.
20-27 mc	half	half

positions of trimmers

minimum capacitance ⊕

maximum capacitance ⊕

half capacitance ⊖

Table II—Auxiliary trimmer positions for Command Receivers. The position of the cross with respect to the fiducial mark determines the capacitance.

front end tracking, you have to get the i.f. tuned to the right frequency, so be certain that your signal generator is correctly calibrated. If the dial seems to be accurate, you could hope for the best and tune with a received a.m. signal through the set, or whatever you could tune in near the upper end of the dial, but while you might get a good i.f. alignment, you would not get a really accurate alignment of the front end.

After tuning the i.f. transformers, turn off the signal generator modulation and adjust the b.f.o. to zero beat. Its trimmer, C_{28}, is located near the rear of the chassis on the right side, accessible through a small hole in the case.

After completing the above alignments, remove the outer receiver cover. (take out the four bright screws along the strip at the bottom of the cover along each side of the receiver. Do not remove the dull headed screws at the front—the cover is slotted and is not held by those screws.

Under the cover will be an unpainted shield over the tuning capacitor. It should have three holes in it, marked with short fiducial lines. Looking from the front, label these, left to right, C_{4D}, C_{4E}, and C_9. The first is the r.f. amplifier trimmer, the middle one the r.f. oscillator and the third the oscillator padder capacitor.

On our receiver we will tune to the upper alignment frequency given in Table I which is 2.9 mc. With the signal generator still connected to the 12K8 cap, tune C_{4E} tentatively for maximum output. If there are two points which give maximum output tune to the one that represents the *higher* capacitance.

Now attach the signal generator lead to the antenna post directly, without a coupling capacitor. Adjust the output as suggested for the i.f. alignment. Trim the ALIGN INPUT control for maximum gain.

Adjust r.f. trimmer C_{4D} for best gain, and with the receiver b.f.o. on, carefully align the oscillator trimmer C_{4E} (with the signal generator modulation off) to get zero beat in the output. Re-trim the input and r.f. sections.

For the beginner in receiver alignment, zero beat is the point at which two oscillators are at precisely the same frequency. In this case we have a warbling audio tone which we reduce in the tuning process to a lower frequency until a hissing or rushing tone is heard, indicating a difference of one or two cycles per second, which is about as accurate as manual alignment can be done.

Now we will tune the receiver dial to the low end alignment point of 1,550 kc.

With modulation "on" and the b.f.o. "off," set the signal generator to 1.55 mc. While "rocking" the main tuning of the receiver slowly back and forth over a short area, tune C_9 for maximum output.

Return to 2.9 mc and again align C_{4E} to zero beat. Re-check the r.f. trimmer and the ALIGN INPUT trim. If the set was more than a hair off 2.9 mc on the dial after making the low end check, repeat that step and finally touch up C_{4E} and C_{4D}. Replace the cover.

If, however, the process does not seem to bring the dial into agreement with an accurately calibrated signal generator, there is one last resort: check the position of two other trimmers which should be hidden under the tuning capacitor shield. The shield can be removed by taking out the dull-finish screws, and two bright screws at the lower rear of the cover. You will have to remove the tubes, and the i.f. cans, which un-plug easily after their hold down screws are taken out. They are keyed to prevent replacing them in the wrong order.

Under the shield are two additional trimmers, C_{4F} and C_{4G}. Table II gives the correct placement of these for each frequency band. Maximum capacitance is obtained when the short end of the "cross" is aligned with the fiducial mark. On the main tuning capacitor this is toward the rear of the set and on the i.f. cans it is toward the center of the unit.

The two auxiliary trimmers should not be

used to adjust the front-end tuning if there is sufficient range on $C_{4D, E}$, lest the tracking of the r.f. amplifier and antenna tuning stages with the r.f. oscillator be upset, or the tuning be altered with respect to the dial markings. oscillator tuning over a higher band of frequencies than the r.f. stages (the difference being the i.f. frequency) is a complex receiver design problem which has been carefully worked out with the indicated padding and trimming capacitances.

Best practice is to tune the trimmers counter-clockwise from the maximum capacitance point.

In the i.f. transformers of the 190-550 and 550-1,500 kc and 1.5-3 and 3-6 mc sets there are two trimmers each. In the earlier RAT, RAV, ARA and SCR-274-N series the 6-9.1 mc receiver had single-tuned i.f.s, but these were changed to double-tuned in the ARC-5 Navy receivers made at the end of World War II. Most of the later AN/ARC-5 receivers were marked with a yellow "S" stamped over the tuning cable fixture indicating that the tuning capacitor of the receivers had been redesigned for better stability.

This redesign was an outgrowth of a survey of combat areas by Jimmy Doolittle and designer Fred Drake. Faced with too much dial twiddling by pilots who got their sets off frequency at crucial moments, the military decided to remove the in-flight tuning and set the receivers on the ground, then lock them by removing the tuning cable. A short splined tool was included with these later units, threaded to fit over the tuning cable socket when not in use.

The same procedures described for aligning the AN/ARC-5 sets will work with the R-10 and R-11 post war receivers (520-1, 500

and 190-550 kc) but if the shield over the tuning capacitor must be removed it's a big job, since the i.f. cans must be unsoldered to remove them. The later sets did not have b.f.o.s, either.

For the v.h.f. sets R-13, R-15 and R-19 which were made after 1947 covering 108-135 and 118-148 mc, tuneable, similar procedures are applicable, but the intermediate frequency is 15 mc, and there is no oscillator padder to adjust.

The later sets have loctal tubes with no mixer grid cap, but a test point is provided just to the left of the 14S7 mixer on the chassis of the R-10 and R-11 receivers and just to the left of the second r.f. amplifier 9003 tube on the front end chassis of the v.h.f. sets.

For these later sets use a 5 ohm signal generator source and a .006 mf coupling capacitor to the test point to set the i.f. amplifiers. These units use an advanced type of automatic gain control, and you should, if possible, use a milliammeter in the cathode circuit (pin E of the front panel jack to ground) and as a final step increase the signal generator output until it reduces the cathode current to 5 ma and adjust the #2 trimmer of the third i.f. can for maximum output.

For the later v.h.f. sets, the i.f. should be set the same way, but after initial alignment, detune the #1 trimmer in the fourth i.f. transformer to give minimum output. Readjust the #2 trimmer for maximum output, then finally trim #1 to maximum without touching #2. Repeat this process on the third, second and first i.f. cans.

Adjusting the r.f. stages of the v.h.f. sets requires a special tool, A.R.C. #10307, available from Aircraft Radio Corp., Boonton, N.J. or you can juggle the trimmers with an ice pick . . . Set the oscillator, then the second r.f., first r.f., and antenna stages in that sequence.

All of the Command receivers will require oscillator realignment whenever the oscillator tubes are changed, and they will give best performance by realigning whenever any r.f. or i.f. tubes are replaced. If you put high-gain 12SG7 or other high-performance tubes in these sets, realignment is necessary to correct for differences in internal tube capacitance.

Old hands will recall that the AN/ARC-5 sets used a 12SR7 tube in the second i.f. position, in place of the 12SK7 used in the earlier units. The purpose was provision of a diode for the a.v.c. circuit. ■

Freq. Standard [*from page 19*]

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In Defense of C.W. [*from page 22*]

There are quite a few who agree with my views on c.w. The manufacturers are getting some return by offering us a choice variety of electronic keyers and other accessories, as well as transceivers with provision for c.w. mode plus sidetone, sharp selectivity option, key control of vox for semi break, receiver offset tuning, and so on. But we could use a lot more good operators down in the c.w. areas. If nothing else, it would reduce the QRM level for you died in the wool phone only types, so you should plug for it too. ■

Keyed Solid State Oscillators

[*from page 41*]

Practical Applications

Utilizing all of the formerly discussed lator, a keyed oscilator to cover the amateur bands from 80 meters to 10 meters was bulit. The complete circuit of the oscillator which employs source-keying and electronic band-switching is shown in fig. 5. If the oscillator is to be used in conjunction with a transmitter, a buffer and an amplifier will most likely be needed. To key the solid-state oscillator along with a transmitter employing cathode-keying, the cathodes of the tubes should not be connected in parallel with the keying terminals of the oscillator. An isolation circuit should be used instead. A MOSFET oscillator has been keyed successfully with a 75-watt transmitter[1] by using a transistor switching circuit to provide isolation. This circuit is shown in fig. 5. ■

[1]ARRL *Radio Amateur's Handbook*. 1960 37th Edition, pp. 178-181, "A 75-Watt 6DQ5 Transmitter."

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DX [*from page* 64]

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Two Northern California DX Club Big Guns join in a mutual admiration society at the 1970 Fresno DX Meeting. John Steventon, W6CLS, and Don Schliesser, W6MAV. Don't forget the 1971 Fresno bash on Jan. 30-31. *(Photo via West Coast DX Bulletin)*

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9F3USA–To VE3IG.
9X3WJ–c/o W1MIJ.
9Y4US–Via K8NSA.
9Y4VE–To VE3GCO.

73, John, K4IIF.

80 M Antenna [*from page 30*]

s.w.r. At W6SAI, various lengths of RG-8/U are always at hand, complete with fittings, that can be spliced into a transmission line in a few seconds, when operation is contemplated near regions of high s.w.r. indication.

As for operational results, the little Utility antenna has been in use for nearly two years and has proven its worth. The radiation pattern seems nearly omnidirectional, and good signal strength reports are consistently received out to 1200 miles or so. In short, the antenna compares favorably with the best characteristics of both the ground plane and the center fed dipole.

Old Timers will scoff that this antenna is little more than a jazzed up version of the old Marconi antenna. Perhaps so, but it is more subtle than it looks. Not only does it provide a good impedance match to a 50 ohm transmission line, but it also affords good bandwidth and a practical radiation pattern usable for both short-haul and long distance contacts. In short, it "plays clarinet and trombone, doubles on the violin and saxophone, and wears a size forty-seven suit". ■

Mail Order [*from page 54*]

requesting that I be allowed to communicate with anyone! Guess what came in the mail today. Two lovely clear photostats!

Now, some sixteen months after I placed

the order I still have no cabinet. Mind you I get photostats once in a while. I am still talking to the photocopier with no hope of finding humanity. All this despite repeated pleas for a letter, or some other indication that there are still people in New York.

I should make it clear that I am not tarring all mail order houses with the same brush. Some of the smaller ones provide excellent service. But if you want unusual items the big ones are the only place to go, even if it does take a year or two. ■

Comm. Receiver [*from page 21*]

coaxial cable to be used in the final set-up. This is important because the coax capacity is in parallel with L_5 and affects the tuning. About one foot of RG-58/U is enough (30 mmf). Tune L_5 and L_6 for maximum signal level at 3.75 mc.

The S meter is zeroed with the 10K pot and the sensitivity is controlled by the series 5.6K resistor. If a calibrated r.f. source is available, the S meter may be calibrated in S units or microvolts. ■

R.F. Attenuator [*from page 56*]

used for assembling the components. The fet is in the upper center of the two r.f. chokes and the coupling capacitors above each r.f. choke. In this case, the potentiometer used to control the attenuator was mounted directly on the Vector board stock.

Summary

The fet attenuator is designed strictly for receiving purposes only, since a typical fet in the circuits shown probably can handle no more than 50 mw or so. The unit can be used in various impedance transmission lines. It does not maintain a constant impedance match between its input and output terminals, but this is of no importance in the usual receiving situation where only a wide range input signal attenuation is desired and where the usual transmission modes—a.m., s.s.b., c.w., etc. are employed. The unit can be used in a balanced transmission line also simply by using a separate fet in each side of the line controlled by a single potentiometer.

Incidentally, this article was concerned only with the use of junction fet's as uniquely interesting r.f. attenuators. The same principles discussed can be applied for any application of a fet as a noiseless, remotely controlled attenuator for d.c. to r.f. circuits. ■

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Q & A [*from page 76*]

a.g.c. on the Collins 75S-3B is too fast to optimize the signal-to-noise ratio. How may this be improved?

ANSWER: We have found no such difficulty with the release time for the slow-a.g.c. on the 75S-3B. Barring a defective component in the a.g.c. line, this should not ordinarily be a problem; however, if you should desire to increase the release time of the SLOW a.g.c. position, we suggest you raise the value of C_{50} to 0.25 or 0.33 mf or so. Also, if you're bothered with man-made back-ground noise, bringing the notch filter into play near the midpoint often will help minimize back-ground noise and yet will not seriously impair voice intelligibility due to a loss of some of the passband. You might, as a matter of fact, find it more pleasant listening in this manner.

Some suggestions received from Irvin G. Kanode, WA9CKP are as follows:

Inexpensive Cable

There are many times when one needs a cable to connect various pieces of gear to-gether, but find that one is not handy at the time. A TV rotor cable has either four or eight color-coded wires and will serve very nicely where there are no heavy current or shielding problems. Such cable may be picked up at most local TV repair shops at a reason-able price.

Plastic Pill Bottles for Parts Storage

Plastic Pill bottles can be bought at a local drug store for a few pennies a piece. They come in various sizes from 1″-3″ in diameter and 2″-3″ long. They make an excellent place in which to store small parts, nuts, screws, washers, lugs, diodes, transistors, etc. Also, a shock-proof wavemeter can be built into one of these bottles by using a variable capacitor that fits inside. Do not drill holes, but use a small soldering iron to melt in the holes where needed.

The End of Another Year

Boy, how the time flies! Here we are at the end of another year for the Q & A Column and the time to again thank all for helping make the Column a success with their interest shown by queries, patient waiting for replies, helpful suggestions for others and encouragement to us. May the blessings and spirit of the Christmas Season be with everyone at this time and throughout the coming year.

73, Bill, W2AEF

A Thoughtful Gift

YOU probably have several very near and dear friends who are Hams, for whom expensive and elaborate Christmas gifts this year are out of the question.

IF SO, you're not alone! Thousands of Christmas shoppers face the problem of what to get these friends...while holding expenses within their budgets.

A SUBSCRIPTION to CQ and any of the fine books listed will be appreciated by those who receive it and will be a reminder of your thoughtfulness throughout the year.

SAVE MONEY on your subscription as well as your gifts.

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

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

SELL: Hallicrafters HT-37, $175. Drake 2B Receiver with spkr and Q-mult., $175. Both for $300. From estate of W2JB. Contact: Frank Anzalone, W1WY, 14 Sherwood Rd., Stamford, Conn. 06905.

CODE QUICK — Complete course to 15 WPM on convenient cassette tapes. Guaranteed results. $10.00 complete. Audiofonics, Box 5044, Raleigh, North Carolina. 27607.

FOR SALE: Marauder HX10, $200. TT4 Page Printer, $95. Model 14, $75. Model 14 TD $50. SX42 $95. HA14 KW Kompact, No PS $95. WA2DVU. Will ship REA. Bill Riches, 76 Dennisville Rd., Cape May Ct Hse, N. J. 18210.

HEATH SB-101 Transceiver with CW filter, HP-23a power supply, SB-600 speaker and D-104 mike. A beautiful rig in perfect condition. $450. Chuck Schmidt, WA9ZEH, RR2, Anna, Illinois.. 62906.

BUY, TRADE, SELL USED RECEIVERS. Available HQ-180C, R-4A, HQ-200, HQ-215, NC-109, NC-190, SX-110, SX-122, and 51S-1. Steven Kullmer, Evergreen Hatchery, Dysart, Iowa. 52224.

KWM2 Number 1057, perfect, $525.00; AC $75; 30LI $350.00. TR4, $400 AC $75. NCL2000 Trade for G. G. 2KW Linear. W0BNF, Box 105, Kearney, Nebraska.

NOVICES: need help for general ticket? Complete recorded audio-visual theory instruction. Easy, no electronic background necessary. Write for free information. AMATEUR LICENSE, Box 6015, Norfolk, Va. 23508.

SELL: Transceiver SSB/CW/AM with AC supply and spkr. EICO 753 and 751. $150 FOB W6RAB, 5454 Milligan Drive, San Jose, Calif. 95124.

LISTING SERVICE: Gear to sell? Need rig? Sellers- $1.00 Lists information Year. Buyers- Free. SASE brings details. W8TXX, Listing Service, Box 1111, Benton Harbor, Mi. 49022.

NOVICE STATION: Hammarlund HQ 110-C, Hallicrafters HT-40. Speaker, key, coax relay. Like new, all for $135. Bill Boring, W7YQI, 2103 NE 142, Portland, Ore. 97230.

CHARTER JET FLIGHT to SAROC. Roundtrip New York City Las Vegas, $229.00, depart JFK 10:00 am January 7th. Roundtrip Chicago Las Vegas $199.00 depart O'Hare 12:00 noon January 7th. Return January 10th. Includes meals and meals aloft, Flamingo Hotel Room three nights double occupancy, Transportation and baggage in and out of Flamingo Hotel, Dinner Show, Midnight Show, Saturday Buffet Luncheon, Sunday Buffet Breakfast, SAROC tickets, Tax and gratuity, $60.00 will confirm reservation, includes one dollar service fee. Final payment due before November 25th. Flight cancellation or written request for deposit refund will be accepted until December 1st. SAROC, Box 73, Boulder City, Nevada. 89005.

WANTED TO BORROW: June 1968 'Ham Radio'. Will Xerox and return. J. Wegner, Jr. POB 262, Glendale, California. 91209.

FOR SALE: Johnson Viking kilowatt desk model, $350.00. Hallicrafter HT 32, $175. Both perfect condition with instruction manuals. Cash and carry. O'Brien, 190 Knickerbocker Rd., Apt. 9, Englewood, N. J. 07631. Phone: (201) 871-3420.

TUBE TESTER, Mutual Cond., 1-177-B with MX-949A/U adapter. New. $75.00. W4JGO, 643 Diamond Rd., Salem, Va. 24153.

TRADE: Collins 62S1 2-6 meter converter for Collins 32S1 Xmttr - Mint condition. Serious trader, phone collect, J. P. Ashcraft, WN5BFZ, Dallas, Texas. AC 214-361-6611 or write: 3008 Southwestern Blvd., Dallas, Texas. 75208.

SALE: Hallicrafters SX-100 receiver, Hammarlund HX-50 transmitter, both for $300; Ameco TX-86 transmitter, Regency ATC - 1 converter-- Mosley TA-33 Jr. beam; W9AMN, 4809 Marathon, Madison, Wisconsin. 53705.

HEATH: 2 meter lunch box. Brand new. Needs calibration and alignment. Mike, AC power cord & tubes included. Best offer. Will ship at end of 2 weeks after publication. Ray Gregoire, 96 W. Sixth Street, Lowell, Mass. 01850.

FOR SALE: Hammarlund HQ-170 AC receiver. 160-6 meters. With 24 hour clock. Complete with manuals and S-200 speaker. Perfect condition, without a scratch. $219.00. Art Penrose, WN2MXI, 635 North Manetta Dr., Pt. Pleasant, New Jersey. 08742.

QSL's. Second to none. Same day service. Samples 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah. 84015.

TRADE GOOD USED HAM GEAR for Marine Radiophone or other Marine or CB gear. Write: Box 8352, Savannah, Georgia. 31402.

WANTED: General Radio Model 1606-A RF Bridge or equivalent. State price and condition. Howard Enstrom, 323 Cottage Ave., Glen Ellyn, Illinois. 60137.

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 23648-H, San Francisco, California. 94126.

KLEINSCHMIST TELETYPEWRITER, page printer TT100B/FG60 or 100 WPM. Send rec., sprocket or friction feed, as desired. Synchronous motor; operating condition like new. $65.00 each. ATLANTIC SURPLUS SALES, 580 3rd St., Brooklyn, New York. 11215.

TELETYPE PICTURES FOR SALE. Vol 2, 16 pages containing 50 pictures, $2.00. Volume 3 coming, $1.50. Also audio and perforated tapes. W9-DGV-3, 2210-30th Street, Rock Island, Il. 61201.

HEATHKITS Wired, 15% of cost. Price, reference on Request. SASE. P. O. Box 6144, Linglestown, Pa. 17112.

NOVICES: Have complete novice station. DX-60B, xtals, key, Electronic TR, antenna, balun, coax; HR-10B, Xtal Calibrator spkr, earphones. All you need is license. Used less than one year. Best offer over $200.00. Dave Kliss, 1106 Lakeside St., La Porte, Indiana. 46350.

HQ-170, $130.00. Ranger w/dowkey relay. $80.00. Courier Linear, $115.00; Johnson matchbox 250, $40.00; T.O. keyer w/key, $55.00. F.W. dipper, $18.00. Or trade complete station for garden tractor. WANTED: HW 32 w/d.c. pwr. supply. WA8TND 4986 Leavitt Rd., Lorain, O. 44053.

EICO 753 Transceiver, Transistor No-Drift VFO, 751 A.C., Built-in speaker, mint, $140.00; Millen Monitor Oscilloscope, mint, $50.00; Heath Calibrator, $9; Heath Keyer, mint, $25.00. WANTED: HT32B. F. Martin, 202 Kenny St., Fayetteville, N. Y. 13066.

SBE-33, $170.00; Gotham 3 band quad, $20.00; converted prop pitch, $25.00; Eico FM tuner, $20.00. Roy Neste, Park River, N. D. 58270.

12 VOLT DC TO 117 VOLT AC 450 WATT INVERTER UNUSED TRIPPE MODEL 450. Original Cost, $118.00. Will sacrifice for $75.00. Idea for Mobile or Maritime work. Ed Siegel, 777 Third Ave., New York, N. Y. 10017.

SELL: HQ170C with Manual. Excellent condition. $150.00. Cliff Phillips, WA0TST, 1000 North Oak, Creston, Iowa. 50801.

SELL: Drake T4XB with AC-4 Pwr Supply, R4B, and Heathkit SB-200. All manuals and cables included. All yours for only $800.00. R. L. Case K9SIY, RR3, Box 61, Lot 54, Altus, Okla. 73521. Telephone: (405) 482-0296.

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

NEW STANDARD SR-C806MA plus SR-CL25 Linear 25W. Output 2-Meter solid state FM, all xtals for 12 channels, $320.00. K2BQO, Paul W. Haczela, 8 Yale Pl., Armonk, N. Y. 10504. 914-273-9067.

ELECTRONIC VOLTMETER, Ballantine Model 305, Like new, $125.00. W4JGO, 643 Diamond Rd., Salem, Va. 24153.

WANTED: Back issues of all 'Treasure' type magazines, reasonable. Joe Wegner, Jr., P. O. B. 262, Glendale, Calif. 91209.

MILITARY SURPLUS Power Supply PP14420/FST-1 30v 1 amp. New in original packing, $14.95. Trans. 7v 1.3 amp. 96 cents new original pkg. Eico Transceiver with DC supply, new orig. pkg. & Factory wired, factory warranteed. $278.00. Hla Oung, XZ2AD, 115 Sudden St., Watsonville, Calif. 95076. Tel. (408) 724-6201.

160 METER MATCHBOX resonates any 40 or 80 meter inverted vee/dipole on 160 meters. Handles 250 watts. $29.95 postpaid. TOP BAND SYSTEMS, Dept. 1, 5349 Abbeyfield, Long Beach, California. 90815.

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

SELL: QST Jan. '61 thru Aug. '68, $18. Also 2 - 810s, $15 each or both for $25; 4 - 872s, $5 each or all 4 for $15; 1 - 866 $2. O'Brien, 190 Knickerbocker Rd., Apt. 9, Englewood, New Jersey. 07631. Phone: (201) 871-3420.

NOVICE CRYSTALS: 40-15M, $1.38; 80M, $1.83. Free flyer. NAT STINNETTE ELECTRONICS, P. O. Drawer Q, Umatilla, Fla. 32784.

RTTY GEAR FOR SALE. List issued monthly. 88 or 33 Mhy torroids, uncased, five for $2.50 postpaid. Elliott Buchanan and Associates, Inc., 1067 Mandana Blvd., Oakland, California. 94610.

QSL's: FREE SAMPLES: 200 designs catalog. 25 cents to ACE PRINTING SERVICE, 7809 Lorain Ave., Cleveland, Ohio. 44102.

SUCCESSFUL HAMS invest in W6SAI Handbooks for top-man results! Cubical Quad Handbook, $3.95; Beam Antenna Handbook, $4.95; VHF Handbook, $3.95; Better Shortwave Reception, $3.95; Electronic Contruction Practices, $3.95. Sold by leading ham dealers. On orders to publisher, please add 20 cents per book for handling/postage. RADIO PUBLICATIONS, INC., Box 149-A, Wilton, Conn. 06897.

FOR SALE: Antenna farm, 150 acres, private airport and KWM-2. Two turf runways, 2300 ft. and 2600 ft., J. Brink, POB 3734, Fayetteville, N. C. 28305.

FOR SALE: Hallicrafters SX-111. Prefer pick-up will demonstrate. $59.00. W2EEJ, Herb Greenberg, 821 Rutgers Rd., Franklin Square, New York. 11010. Or phone: (516) IV6-0809.

FOR TRADE: Will trade Hammarlund SP-600 for 2 KW PEP Linear Amplifier factory built or good HB. J. Brink, POB 3734, Fayetteville, N. C. 28305.

CONTACT US for the best deal on new or reconditioned Tempo-One, Collins, Drake, Swan, Galaxy, Hallicrafters, Hammarlund, Hy-Gain, Mosley, Henry Linear, towers, antennas, rotators, other equipment. We try to beat any deal and to give you the best service, best price, best credit plan, top trade-in. Write for price lists. Try us. Henry Radio, Butler, Missouri. 64730.

FOR SALE: Hammarlund SP-400 with Collins Mechanical Filter and NICE HB SSB Transmitter ideal for experimenter. $100.00 each. J. Brink, POB 3734 Fayetteville, N. C. 28305.

SELL SWAN 500C w/117XC, Brand new, never out of factory carton, $495.00; Ham-M rotator, $90.00; Mosley TA33, $95.00; 30' Rohn Tower. All new, never used, WA5WKR, L. D. Niblack, 2708 N.W. 120th Street, Oklahoma City, Oklahoma. 73120. (405) 751-4515.

SX-100: In mint condition, $135.00; HT-46, as new condition (2 mos. old), $220.00. Lt. Bob Faraone, 7727B Nelson Loop, Ft. Meade, Maryland. 20755.

SELL: HW-6, like new, xtals 3707, 7035, 7050, 7153, 7158, $85.00. R. Keimling, WN8GCR, Route 3, Galion, Ohio. 44833.

CLEANING SHACK: Tubes, equipment and components. Send SASE for list. Jim Hurt, W9CUU/6, 6853 Lindbergh, Edwards, Calif. 93523.

EE CONVERTED ART 13 WID PWR — 350W AM - Extra Final. Excellent condx - everything works. $80. Pickup only. W7PRF, 3104 West 17, Spokane, Wn. MA-4-7269.

SELL: Mint HT-32 XMTR with manual and plug-in silicon rectifiers for more output. $189 FOB my QTH. W2GT.

SWAP OR SELL: Heath OM1 scope, Crosley showbox radio, antique tubes for ATV equipment. Send SASE for more info. K. Horvath, WA2AYP, Meadow Lane, Huntington, N. Y. 11743.

HEATH HT-32A, DC/PS., Knight T-60, Halli-SX130. WB4JIB, John Bridges, 806 Scruggs St., Waycross, Ga. 31501.

SELL: BC-454, Command receiver, converted with power supply built on rear. 3 to 6 mc. $15. WA-3BGN, 6117 Smithfield St., Harrisburg, Pa. 17112.

SELL: Mosley TA-40KR, converts Mosley beams to 40 mtr. New, best offer. Consider swap. Mal Kinney, WA2CDE, 2 Howard Blvd., Hyde Park, N. Y. 12538.

AEROTRON 500-D 2 meter transceivers, 10 w, Squelch, PTT, 6/12 VDC & 115 VAC, $80 each, 3/$200. L. Amundson, Rte 2, East Grand Forks, Mn. 56721.

AMECO 80-6M PREAMP & PS $20.00, WATERS COMPREAMP, $13.50; COMMAIRE 6 & 2 M Ant Match and SWR, $35.00. FOB T. SCHROPP, RR 6, Clarksville, Tenn. 37040.

HAM RADIO needs good publicity. Send me news items, clippings, all returned. WA1GFJ, 160 Elm Street, North Haven, Connecticut. 06473.

RANGER II 160M-6M AM Transmitter 65W, mint condition. Best offer over $125.00, plus shipping. Richard Fricton, 4 Carteret Rd., Allendale, New Jersey. 07401. WA2YPD.

Sola, Sorensen, Gulow, Tygon, power supplies. Various voltages. Variacs, 115V 10 or 15A, 220V 2A or 4A. 1" tape punch 1" magnetic tape deck, memories, circuit boards, sinks, computer caps, Tektronics 514AD. SASE: Doug Craton, 5625 Balfrey Drive, W. Palm Beach, Fla. 33406.

MICROWAVE EQUIPMENT, Sperry Parabolic Antenna. All control motors and mount, schematics. Spectrum Analyzer, 6000 — 9000 MHZ. Bill Goble, 330 Wood St., Clarion, Pa. 16214.

WANT: Pre-1920 WIRELESS equipment and catalogs. Description, price. Dick Sepic, 1945 E. Orangegrove Blvd., Pasadena, California. 91104.

SAROC, January 7-10, 1971. Flamingo Hotel Convention Center, Las Vegas, Nevada. Sponsored by Southern Nevada ARC, Inc., Box 73, Boulder City, Nevada. Advance registration $14.50 per person accepted until January 4, regular registration at door, includes Flamingo Hotel Late Show and drinks, Sunday Breakfast, Cocktail Parties, technical seminars and meetings, ARRL, DX, FM, MARS, QCWA, WCARS-7255, WPSS-3952 and WSSBA. Ladies Program. Flamingo Hotel SAROC room rate $12.00 plus room tax, per night, single or double occupancy January 3 thru 12, 1971. Mail accommodations request to: Flamingo Hotel. Mail advance registration to SAROC, W7PRM, Club President. W7PBV, SAROC Convention Chairman.

QSL MANAGER. Will volunteer my services. W7HKI, D. G. Larry Larison, Traveler's Lodge, Edmonds, Washington. 98020.

POSTAL CHESS: American Postal Chess League Box 1022, Greeley, Colorado. 80631.

FOR SALE OR SWAP: Laboratory Test Equipment, garage full: Hewlett Packard U.H.F. Signal generators, $25.00 ea.; Oscilloscope, storage type, 5" screen, similar to Tecktronix, $250. 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.

WANTED: QST before 1920 and amateur radio teletype publications. Orville Magoon, 1941 Oakdell Drive, Menlo Park, California. 94025.

WILL BUY OR TRADE good used Ham Gear for Frequency meters such as Lampkin, Gertsch, Bird, Systron Counters, Wattmeters. Write: Box 8352, Savannah, Georgia. 31402.

SELL: Vibroplex "Champion" bug, new, $15.00; 115 vac spdt coax relay, new, $15.00; Star Roamer Shortwave rcvr with manual, $20.00; You pay shipping; WA6OQZ, Don Griffith, Box 14380, UCSB, Santa Barbara, California. 93107.

YAESU FT200 240 PEP SSB Transceiver fixed or mobile. VOX-ANL-Clarifier-Xtal Calib. 5 band w/spkr AC & 12V DC supplies. New, w/manuals, $400. Also New YAESU Mike w/PTT Stand, $20. W4PC, P.O. Box 10371, St. Petersburg, Fla. 33733.

WANTED: Galaxy RV-1 Remote VFO. Sale: Camera and Darkroom equipment. F. Strickhausen, WA0NLR, 715 Tyler Apt. 36, Topeka, Ks. 66603.

WANTED: SP-600 receiver that is clean and in good operating condition. Only a reasonable price will be paid. WA4FCC, John E. Carr, Rte. 2, Rockmart, Ga. 30153.

FOR SALE: KW amplifier parts. 3-400Z and socket and fil. xfmr. pr. 813's and sockets. Vacuum variables, variac (30A), 6 ft. rack, pwr supply parts. Rack mounted blower. Cash preferred, but will swap rack for SB-610. Larry W. Irwin, Box 55, Weston, Georgia. 31832.

HEATH KW COMPACT LINEAR HA14 with HP-24 AC supply in good condition, $100. Firm and no trades. You pay shipping. Keith O'Brien, 8401 North Atlantic Avenue, Number L15, Cape Canaveral, Florida. 32920.

SELLING OUT: Collins KWM-2 w/waters Q-Multiplier, 516F-2 power, MP1 Mobile power, 351D-2 mount, 30L-1. DX100— NC109 Receiver, Best, reasonable offer. WA3HMQ, 717-761-1107.

WANTED: Old battery radios and crystal radios of the early 1920's. Need not be working. State make, model, and price. D. McKenzie, 1200 W. Euclid, Indianola, Iowa. 50125....

BC-348, built-in power supply — excellent condx-RTTY Model 19 complete — spare typewriter deck, spares, test meter — best offer cash or trade; you ship. W4FOV, Geo Olson, Rt. 3, Clemmons, N.C.

CANADIANS: Expert amateur equipment service by fully equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta.

CQ — Rex W. Aust if you were stationed in Alconbury, England in 1958, please contact WA4-TOJ, M. C. Fortune, 2957 Gaffney Rd., Richmond, Virginia. 23234.

BARGAINS: Have tremendous list of equipment. Parts, crystals, rare electronic books. Send SASE for free list. Am clearing out! Frank Gilmore, K0JPJ, 1258 E. Cherokee, Springfield, Mo. 65804.

MOTOROLA: TU540W 455-kc filter, $3.50. Want certain Bell RECORDS, $1.00. W3AFM, P. Rockwell, 5800 Hillbirne Way, Chevy Chase, Md. 20015.

WHAT OFFERS. Westinghouse 1922-ser. 4329 Tunes 180-700 mtrs. Tuner and det. amp. VE7HP, 376 Campbell St., Duncan, B. C.

HEATH DX-60B, HR-10B with calibrator, HG-10 VFO, CW monitor and Vibroplex bug. All for $200. Chan Shippy, WA0YAK, Rt. 2, Colome, So. Dak. 57528.

WANTED: Melehan Valiant Mechanical full automatic key. Ronald M. Nagata, W6RQZ, 1330 Curtis Street, Berkeley, Calif. 94702.

FOR SALE: Pair of new 4-400A's, H.V. Power Transformer, CRV-46151 Aircraft Recvr, FMT 30D Chassis Less tubes, R-28/ARC-5, RCA Model AVA126 power Unit, Best Offer: Sam, WA9-VBG, 6675 E. 19th, Indianapolis, Ind. 46219.

WANTED: Hustler 4-BTV and 80 meter resonator; Millen Trans-match Junior or Drake MN-4; Low pass filter Drake TV-1000LP; HA-1 electronic keyer. Carsner, 283 N. Colorado St., Chandler Arizona. 85224.

BC-610 Xmtr w/speech amp, junction box, coils, tuners, cables, rect. Perfect Condx. $200.00. Silbert, Box 77, Wh. Sulphur Spgs, N. Y. 12787.

LIKE NEW SSB: HT-46 $239; SX-146 AM, CW Filters and cal. $199, excellent transceive PAIR, K3FOD, 925 Coleridge Rd., Balto., Md. 21229.

HAMMARLUND MC-35-S CAPS 1.00 BOURNS TRIMPOT 20 OHMS 1.00. List other parts SASE. K. Maas, 256 Robert St., Burlington, Wis. 53105.

FOR SALE: Clegg 66'er, $125. 30L1, $350; Swan 500C, VX2, 117XC, $450. HW32A, HP23A, $135, HW22A, HP13, $150. Galaxy 300, PSA300, $185. NCL2000, $325. Bandit 2000C, $325. 75S3, 32S3, 516F2, 312B4, $1000. 75S1, 32S1, 516F2, 312B4, $700. Varitronics, FDFM-2S, PS-1500, $225. J. W. Craig, W1FBG, 29 Sherburne Ave., Portsmouth, New Hampshire. 03801. (603) 436-9062.

ESTATE OF W3OGP, Package Deal: Johnson Valiant, Johnson Match Box, Johnson TR Switch, Collins 75A2, Ref. Power Meter. LM-15 Freq. Meter. B. & W. 51SSB Converter Speaker and Vibroplex Gold Bug, Complete 10 to 160 meter station $475.00. Leonard Jezorek, W2BH, 1701 Oakwood Terrace, Scotch Plains, N. J. 07076.

NEW YORK CITY & CHICAGO area AMATEURS fly to SAROC. Charter Jet Flight; see our display advertisement for details. A flight and convention you will long remember.

WANTED: Buy, rent or borrow to copy, manuals/schematics for Globe Hi-Bander (VHF 6 plus 2) Globe Chief 90, Gonset 2 mtr Communicators II and IV. WA1IUR, C. Heuberger, 51 Maynard Av., Seekonk, Ma. 02771.

SELLING OUT: Ranger, $40.00 (needs work), British KW-2000 transceiver, 160-10 meters SSB/CW with VOX, calibrator, A.C. supply and all manuals, excellent, $300.00, QST's and CQ's back to 1956, $2.00 per year. Much more, Stamp for list. James Shank, 21 Terrace Lane, Elizabethtown, Pennsylvania. 17022.

SWAP SUPER-PRO BC-779 with improvement kit MC-531 for HW-32 or 22 w/PS, etc. WA6GZZ, 4133 Stonecutter Wy., No. Highlands, Ca. 95660.

OLD QST MAGAZINES: January 1929 thru Dec. 1963. Johnson, 92 Lawson, Hempstead, New York. 11550.

HQ-140-x with RME DB23 Preselector, mint condition, first certified $100, plus shipping. W3TRC, 401 Goodley Rd., Wilmington, Del. 19803.

SELLING: Drake 2B Receiver with Model 2-AC Calibrator and instruction book. Looks and performs like new. B. Nastoff, 320 West 56th Pl., Gary, Indiana. 46410.

WANTED TO BUY: Heathkit SB-200 Linear and HD-10 Keyer in A-1 condition. Dick Scott, 371 Claymore Blvd., Cleveland, Ohio. 44143.

SELL: Mint 75S-3C No. 10095, manual, all 10M Xtals, 500 CPS Filter, $500; mint SB-400, manual, $200. R. Crupi, 12831 Owen, Garden Grove, California. 92641.

WANTED: Unconverted Prop Pitch motor. SELL: Wagner 2600-0-3600 V. 1 amp Xfmr with 110/220 primary, $30.00. W0AIH, Paul Bittner, 814 4th St., South, Virginia, Minn. 55792.

FOR SALE: 12 Volt DC to 115 Volt AC Power pack - 245 Watt - New, with carrying case and cables, $25.00. Also HE50 10-meter Transceiver, $50.00. E. T. Smith, W2JND, 2 Geoffrey Ave., Syosset, New York. 11791.

NEED: Manual for CFT-46154 and TS-175C/U. Purchase or photostat of yours. F. E. Rice, Glasgow, Kentucky. 42141.

FOR SALE: With manuals: TS239UP scope; 522 HF rig; 400 V 600M reg. supply; model 15 printer, W7CRP, 55 East 8th St., Sheridan, Wyo. 82801.

EIMAC: 2 ea. 4CX300A/X578, new, $20.00 ea; one SK-710 socket, new $20 (for 4CX300). T. Hopkins, Box 396, Faison, N. C. 28341.

TRADE: RTTY or RTTY Journal issues for QST. Need first six of 1965. W6DOU, 3154 Stony Pt. Rd., Santa Rosa, California. 95401.

SELL: Simpson 5" Scope, model 466 Handiscope-Like new, $95.00. F.O.B. Al Schnurle, W7DUP, Rte. 1, Box 216, St. Anthony, Idaho. 83445.

GE PROGRESS LINE Pwr Supply for FM Xceiver, $35.00; sound pwr fones, $20; HP13, $50, all A1. B. Meyer, 6505 Yellowstone, Flushing, N. Y. 11375.

WANTED: Crystals will buy 1 or 100. Also wanted: HQ-110 or SX-101. Rob Schmitt, P. O. Box 279, Payson, Az. 85541.

NEW YORK CITY AREA Amateur Charter Jet Flight to SAROC January 7-10, 1971. SEE DISPLAY ADVERTISEMENT or Write for details. SAROC, Box 73, Boulder City, Nev. 89005.

HAVE 120 Crank-up Towers, new, complete with anchor rods, guy wires, and plate. Will trade for transmitter and power supply AC. James T. Lundy, Box 26, Deming, New Mexico. 88030.

SELL: Knight Kit VTVM. Needs tube. $15.00. Paul J. Skinner, W9QXR, Research Hosp., Galesburg, Illinois. 61401.

SELL: Swan 270 new unused many new accessories included, $450.00. Simonson, 1380 Oak Hill Drive, Number 9, Escondido, California. 92025.

SELL OR TRADE CQ's & QST's. Send your want list for Quote. Erv Rasmussen, W6YPM, 164 Lowell, Redwood City, California. 94062.

WANTED: Vehicle presence detector. (Electronic system using loop buried in Driveway to actuate relay). WILL BUY entire unit or schematic. Pay cash or swap Model 28 ASR Teletype units. J. Thomsen, W9YVP, 8280 S. Tennessee Ave., Clarendon Hills, Illinois. 60514.

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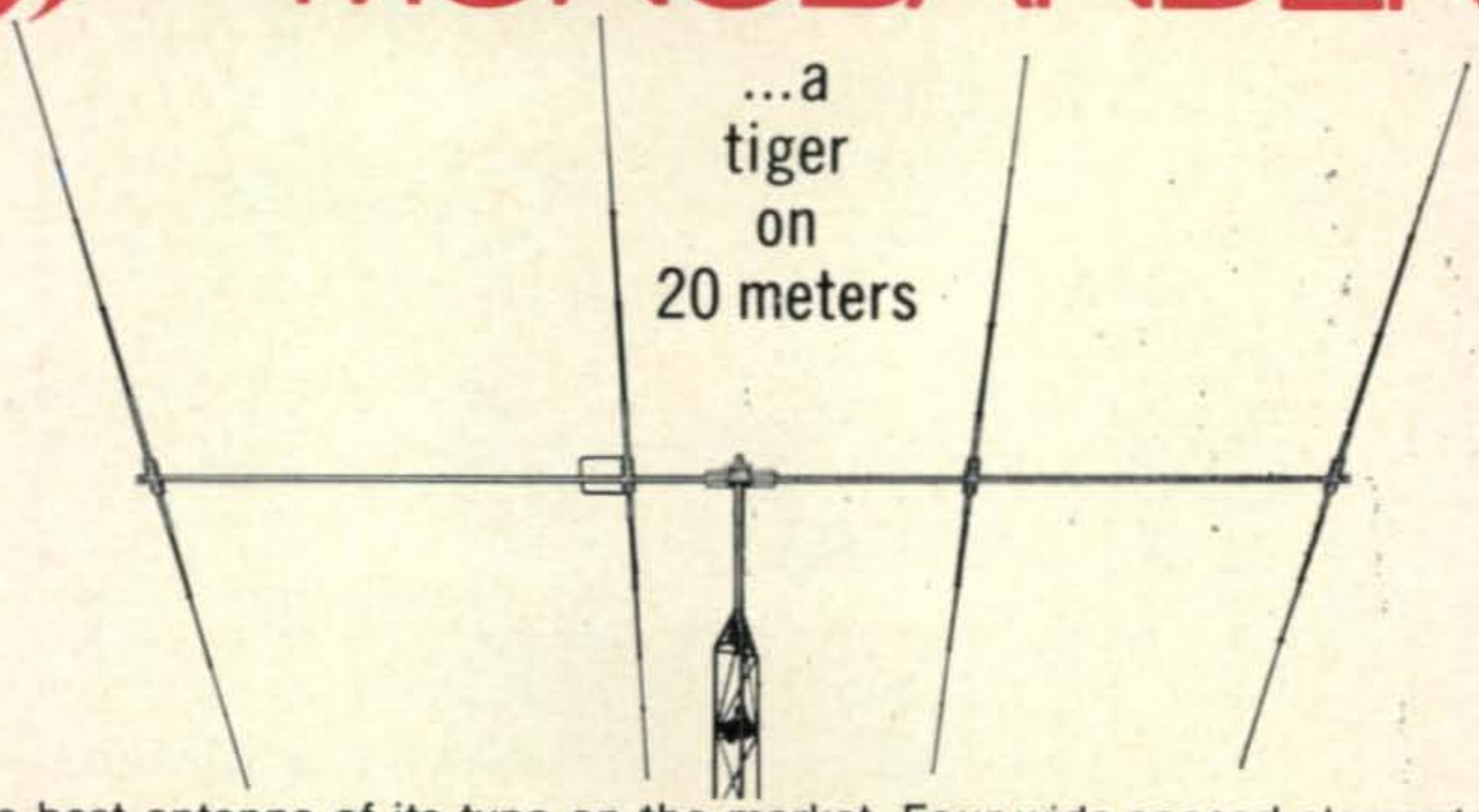

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