CQ

August 1972
$1.00

See page 52

The Radio Amateur's Journal

08240

Digital frequency readout

Heathkit SB-102
Transceiver

Heathkit SB-650
Digital Frequency Display

Make no mistake about it. This is no simple counter. Our SB-650 is an arithmetical computer/display. Hook it up to your transceiver and it computes the true operating frequency by subtracting LMO and BFO frequencies from the HFO frequency. That means you have hyper-accurate digital-readout tuning whether or not you are actually transmitting or receiving a signal. Show us a counter that does that! With a separate transmitter and receiver the SB-650 displays the receiver frequency — or you can gang your rig in a pure transceive mode for T/R readout. Accuracy? The SB-650 displays 80 through 10 meter ham bands down to the nearest tenth of a kHz, plus or minus one count. And the easy-to-assemble kit gives you everything you need to hook-up with your Heathkit SB-series receiver, SB or HW multiband transceiver — right down to the extra jacks and plugs. The manual fully illustrates the procedure for the specific unit you own. The Heathkit Digital Frequency Display — counters just can't compare.

Kit SB-650, 9 lbs., mailable **$179.95***

SB-650 SPECIFICATIONS—Frequency Display Range: 3-30 MHz (80-10 meters.) **Frequency Display:** 6 display tubes (kHz to 5 places, plus tenths of kHz.) **Maximum Viewing Distance:** 30 ft. **Maximum Input Signal:** 5v rms. **Accuracy:** 100 Hz ±1 count. **Compute Time:** 160 msec. **Sensitivity:** Adjustable. **Input Impedance:** 2000 ohms. **Internally Generated Spurious Frequencies:** Less than 0.25 uV equivalent signal level. **Crystal (clock) Frequency:** 1 MHz. **Crystal Aging Rate:** Approx. 10 ppm/year. **Ambient Crystal Stability:** Approx. 10 ppm from +10 to +65°C. **Ambient Operating Temperature:** 0°-+40°C. **Ambient Storage Temperature:** −55° to +80°C. **Power Source:** 120/240 VAC, 50/60 Hz, 10 W. **Dimensions:** 3½" H x 10" W x 10" D.

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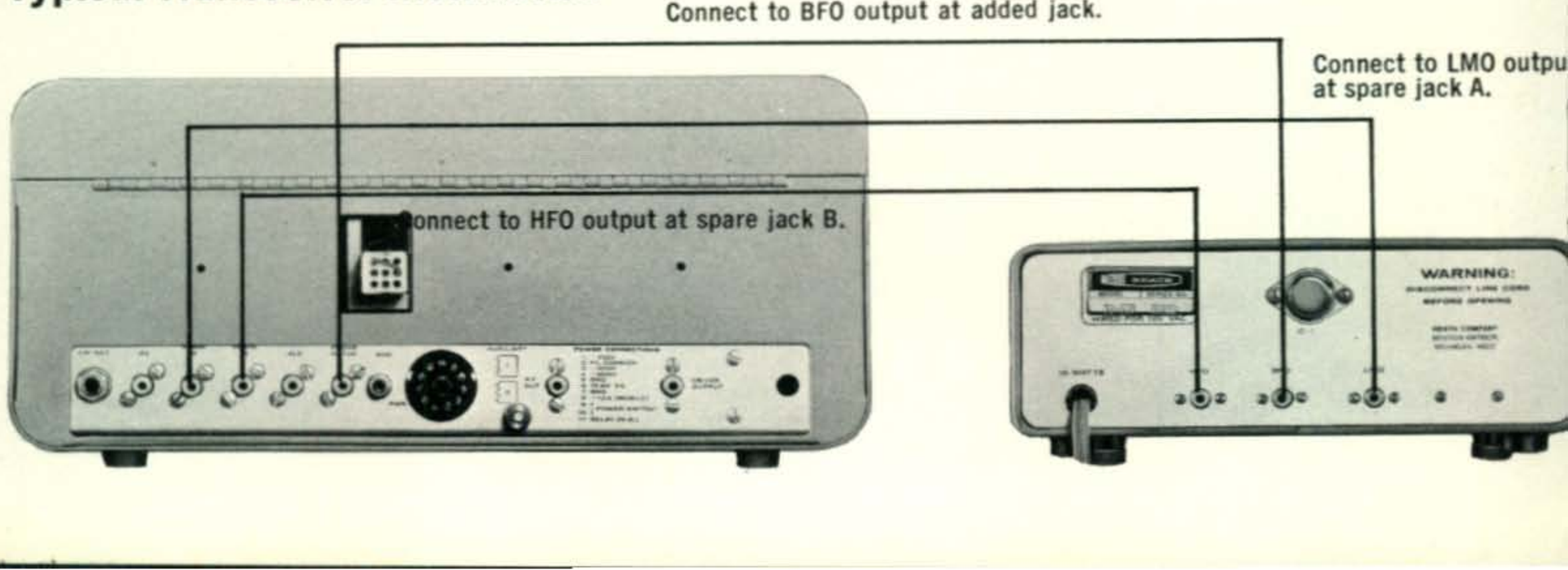
Kit SB-102, 24 lbs. **$385.00***
Kit HP-23A, AC supply **$51.95***
Kit HP-13A, DC supply **$69.95***

Typical Transceiver Installation



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CQ

AUGUST, 1972 VOL. 28, NO. 8

The Radio Amateur's Journal

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DEPARTMENTS

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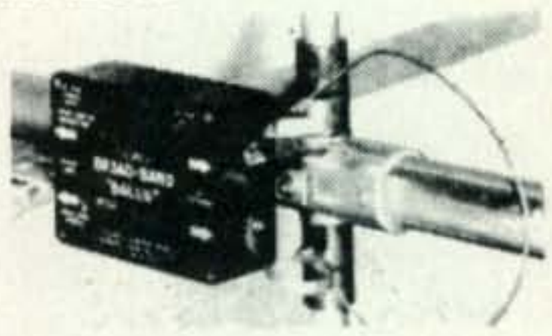

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OUR READERS SAY

Battle of the mu

Editor, *CQ:*

In reference to the history of Byron H. Kretzman, W2JTP "A Converter for 225 mHz F.M.," *CQ*, pages 14-17 in the April 1972 issue.

He said, "Starting from the venerable 6AK5 with its transconductance of 5100 μmhos, we went to the 6EV5 used in late vacuum tube receivers of Motorola. This had a transconductance of 8800. Then at suggestion of W2FI we looked to the 6ER5: transconductance of 10,500 μmhos."

Not good enough! Mr. Kretzman must hit the books again! There are much better types in v.h.f. triodes, for example 6GK5 with 15,000 μmhos and of course the ECC900, 6HA5/6HM5 with transconductance of 18,-000 to 20,000 μmhos. These two types are much better than the nuvister 6CW4 in converters at 144 mHz. I've used both types plus the nuvister. One single r.f. stage at 144 mHz gives about 6 db more using the 6GK5 against the 6CW4. Besides, the nuvister has short life, is affected by electromagnetic radio fields and needs more skill to make connections. In all respects, the 6HA5/6HM5 is the best choice that Mr. Kretzman can make—and it's cheap also!

Dr. L. M. Moreno Quintana LU8BF/TI2MQ
San Jose, Costa Rica

AND vs. NAND

Editor, *CQ:*

I wish to comment on "Math's Notes" in the June 1972 issue of *CQ*.

It is important to distinguish between AND gates, and NAND gates. To this end, the industry has settled upon the symbolic use of a little circle to indicate an inversion (NOT function). This little circle may occur at the input to a device, or at an output. In particular, for the SN7400, the little circle should be included at the output of each gate in the package.

This is not just nit-picking. Other SN-series units (as well, of course, as other series of logic elements) *are* AND gates. The SN-7400 is not.

This point may cause confusion to the person just learning this business. Indeed, it certainly will.

The above comments apply in turn to such pins as clock inputs, and some set and reset inputs on the SN7490-92-74, as well as the monostable/Schmidt trigger SN74121, all of which appear in the article "out of phase" with the rest of the industry.

In the early days, there was much variance in the literature as to symbology. By this time, this early confusion has settled down, and nearly everyone uses a "standard" set of symbols. I urge *CQ* to do the same.

Nevertheless, I applaud *CQ* for running articles such as this one since clearly a knowledge of logic circuitry is becoming more and more part and parcel of the mental toolbox of anyone pretending to be well rounded in the electronics game.

Norman Pos
Imperial Beach CA

Armed Forces Day

Editor, *CQ:*

It was good to see the announcement of the Armed Forces Day Tests in May *CQ* this year. I believe this is the first year *CQ* has done that, and I hope you will announce Armed Forces Day every year from now on.

It's fun to work the military station "cross-band" and to receive the commemorative QSL cards. Also, I *almost* copied the c.w. message correctly. Wait till next year!

John J. Herro, K9YRA
Glenview, IL

More correctly, this was the first time *in a few years* that we've run the Armed Forces Day announcement. We'll make it a regular practice from now on.—*Ed.*

A Look to the Future

Editor, *CQ:*

I am writing you in reference to the letter I read in your magazine last month, in which the writer's name was withheld. I am, by the way, very pleased with your magazine and what it stands for—the welfare of all amateurs and peoples of the world. I am glad that you do not seem to censor any of the letters written to you with genuine concern.

I agree fully with this fellow in his letter of concern and am not making any attempt to modify it. I think that it is highly possible that

[*continued on page 95*]

Announcements

Concordia, Kansas

The Kansas Nebraska Radio Club will hold their annual hamfest on August 6th at the Moose Club at Concordia, Kansas. Registration will start at 9:00 A.M. All amateurs are welcome.

Burlington, Vermont

The Burlington ARC will sponsor the 1972 International Field Day at the Old Lantern, Charlotte, Vermont, on August 13th 1972. There will be a flea market, contests, demonstrations and special events for the ladies plus door prizes. Registration is $3.50 at the gate, $3.00 in advance. For more information write to Bob Hall, W1DQO, General Greene Rd., Shelburne, Vermont 05482.

Huntsville, Alabama

The 1972 North Alabama Hamfest will be held in Huntsville, Alabama on August 19 and 20th. It is an annual event attended by scientific technical personnel from the National Aeronautics and Space Administration, the Army Missile Command, local aerospace contractors and many others. For full details contact Randall G. Byars, North Alabama Hamfest, P.O. Box 423. Huntsville, Alabama 35804.

Yankton, South Dakota

The Prairie Dog Amateur Radio Club of South Dakota will hold its Summer 1972 Picnic August 19 and 20 at the Isaac Walton League Club House on Lewis & Clark Lake west of Yankton, Solth Dakota. The festivities will begin at 1:00 P.M. Saturday with a talk-in on 3955 kHz. and 146.94 mHz. There will be swap tables and a social get-together, transmitter hunt, films, tours of Electronics manufacturing plants and the Gavins Point Dam, special interest sessions, programs for the ladies, bingo, and nearby swimming facilities. A Kenwood TS-511 with a.c. power supply will the the grand prize at this year's picnic. All those registering are eligible to win. Pre-registration by August 15 is $4.00; registration at the gate is $5.00. The winner need not be present to win. In addition, other fine prizes will be offered at drawings and other events. To pre-register send $4.00 to P.D.A.R.C., P.O. Box 321, Yankton, South Dakota, 57078.

Tacoma, Washington

The Radio Club of Tacoma Ham-Fair will be August 19th and 20th at the Sportsmen's Chateau, 164th and Canyon Road, south of Tacoma. Activities will include contests, transmitter hunts, technical talks and displays, manufacturer's displays, auction, country store, beauty contests and door prizes. Grand prize will be a solid-state 2 meter transceiver. Talk-in frequencies—146.76 and 3965. Camping—$1.50 per night with electrical hookup. Advance registration will cost $5.00 and includes Saturday evening dinner, or $3.00 without dinner. Contact Emil Koth, K7GPK, 13616 10th Ave., East, Tacoma, Washington 98445, for registration forms or motel information.

Belvidere, Illinois

The Bel-Rock Hamfest will be August 20 at the

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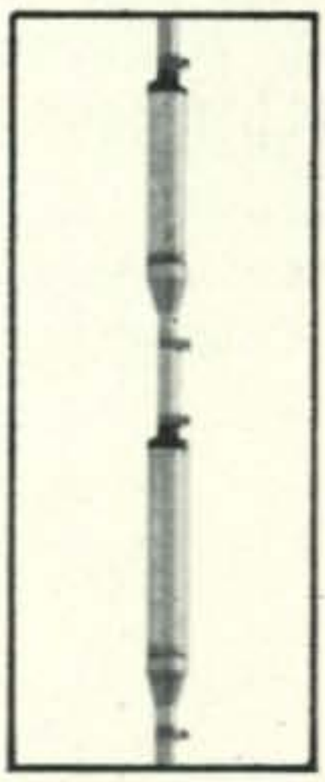

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Boone County Fairgrounds, just north of Belvidere, Illinois on highway 76. Free coffee and donuts from 9:30 to 10:00 A.M. There is no set-up fee and plenty of free parking is available. Talk-in on 146.94 mHz. Advance tickets are $1.00, $1.50 at the gate. For further information, contact: Lee Gehlhausen, WA9-WVY, 4610 Cayuga, Rockford, Ill. 61107.

Warren, Ohio

The Warren Amateur Radio Association will hold their 15th annual hamfest on Aug. 20th from 7:00 A.M. to 6:00 P.M., at Yankee Lake, Ohio (5 miles north of Jct. Interstate 80 & Ohio Rt. 7). there will be plenty of prizes and events for the whole family plus a 5 acre flea market. There is also camping facilities and light planes will be accommodated at Obermyer Airport, one mile from the hamfest with no field fees and free transportation to the hamfest. For further information write to Dick Ellers, K8JLK, W.A.R.A., P.O. Box 809, Warren, Ohio 44482.

Marshalltown, Iowa

The annual Iowa 75 meter phone net picnic will be held on the third Sunday in August-August 20, 1972—at Riverview Park in Marshalltown, Iowa. All amateurs and their families are cordially invited, or anyone interested in amateur radio. Each should bring a covered dish and his own service. Festivities will begin around noon. Prizes will be offered an a swap table will be available. Nearby camping facilities are available.

Puyallup, Washington

The Puget Sound Council of Amateur Radio Clubs will issue an Operating Achievement Award Certificate signed by Governor Daniel J. Evans for contacts made during Washington State Amateur Radio Week, September 9th through 17th. Out-of-state hams must contact 10 Washington hams and in-state hams must contact 20 other Washington hams during this week. Send your list of stations worked, their locations, dates worked, and your name, call, and address, along with a legal size self addressed stamped envelope to: The Puget Sound Council of Amateur Radio Clubs, 12306 80th Ave. East, Puyallup, Washington 98371.

MARCO, Medical Amateur Radio Council Net

The time schedules for the MARCO 80 meter net have resulted in some confusion as the net meets on 3920 at 0400 GMT, Monday, Wednesday and Friday which is 9:00 P.M. PST, Sunday, Tuesday and Thursday evenings. This is also true of the 7264 net at 0330 GMT, Monday, Wednesday and Friday. In the 6th and 7th call areas, the 3920 net actually meets at 9 P.M. PST daily. All those interested are invited to sign in.

ERA Net

The Electronic Representatives Association has organized the amateurs within its membership as a group activity. The activity is open to ERA members and their amateur employees. Over 100 ERA amateurs have already declared their

[*Continued on page 93*]

Swan's 500CX gives you a voice to the world!

The heart of many a DXers success has been the Swan 500CX Transceiver. It reaches out to pull in signals from every continent on earth.

Unsurpassed reliable performance of the 500CX has built a reputation that has made it a standard of comparison among Ham operators the world over. The smooth pleasing fine touch of Swan's Velvet Tuning lets you zero-in with accuracy. Select upper or lower sideband operation and cover the five most popular amateur radio bands with ease. You can get extended frequency coverage for MARS operation with an optional plug-in crystal oscillator, Model 510X.

The 550 watts P.E.P. of the 500CX isn't all there is. To reach the full legal limit, with 2000 watts P.E.P., Swan offers the MARK II Linear Amplifier as a fitting companion to the 500CX. Requires only 100 watts of drive for full input.

If you want the best value, insist on a station built around your own Swan 500CX. Full specifications are listed in Swan's 1972 Spring Catalog, available FREE on request.

MARK II Linear Amplifier

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Q AND A

WILFRED M. SCHERER,* W2AEF

Tube-Checker Tests

This may seem like a strange statement—"testing tubes with a tube-checker does not always indicate whether or not a tube is really good or bad, especially for a particular application." Unless the test shows a tube to be way out of whack, such as open, internal shorts, no or extremely low emission or conductance, etc., it still may be good for certain types of service. On the other hand, a tube that tests *good* may not necessarily be suitable for use in a specific circuit.

For example—we recently had an inquiry about a problem with a T1, raw a.c., note on c.w. signals (also affecting s.s.b.) on a certain receiver. From other symptoms given the cause appeared to be at the h.f.o. Although it was reported that the oscillator tube tested okay in a tube-checker, among other suggestions we made was that the oscillator tube be replaced with another one of the same type. A later acknowledgment reported that this cured the trouble.

In another case from our own experience with a vacuum-tube frequency counter, tubes that tested as being perfect often made the counter malfunction; while one that tested relatively poorer provided proper operation of the unit.

In another case, equipment performed properly with tubes produced under the label of only one specific manufacturer, even though these tubes and others of the same type from other sources all tested the same in a tube checker!

So, if you suspect poor performance in a certain application due to a bad tube, do not rely only on a tube checker to confirm this; but rather, substitute a new tube for the suspected one. On the other hand, if you run across a tube that tests out "not up to snuff" or one that does not give correct performance in a particular position, do not discard it. It

*Technical Director, *CQ*.

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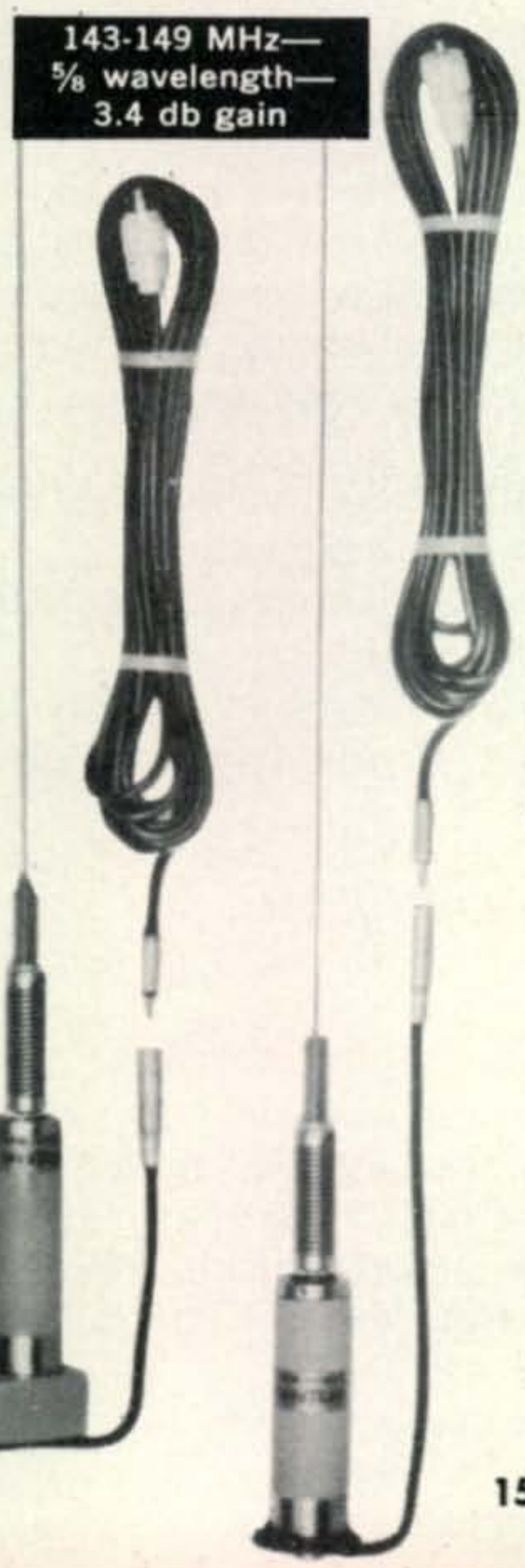

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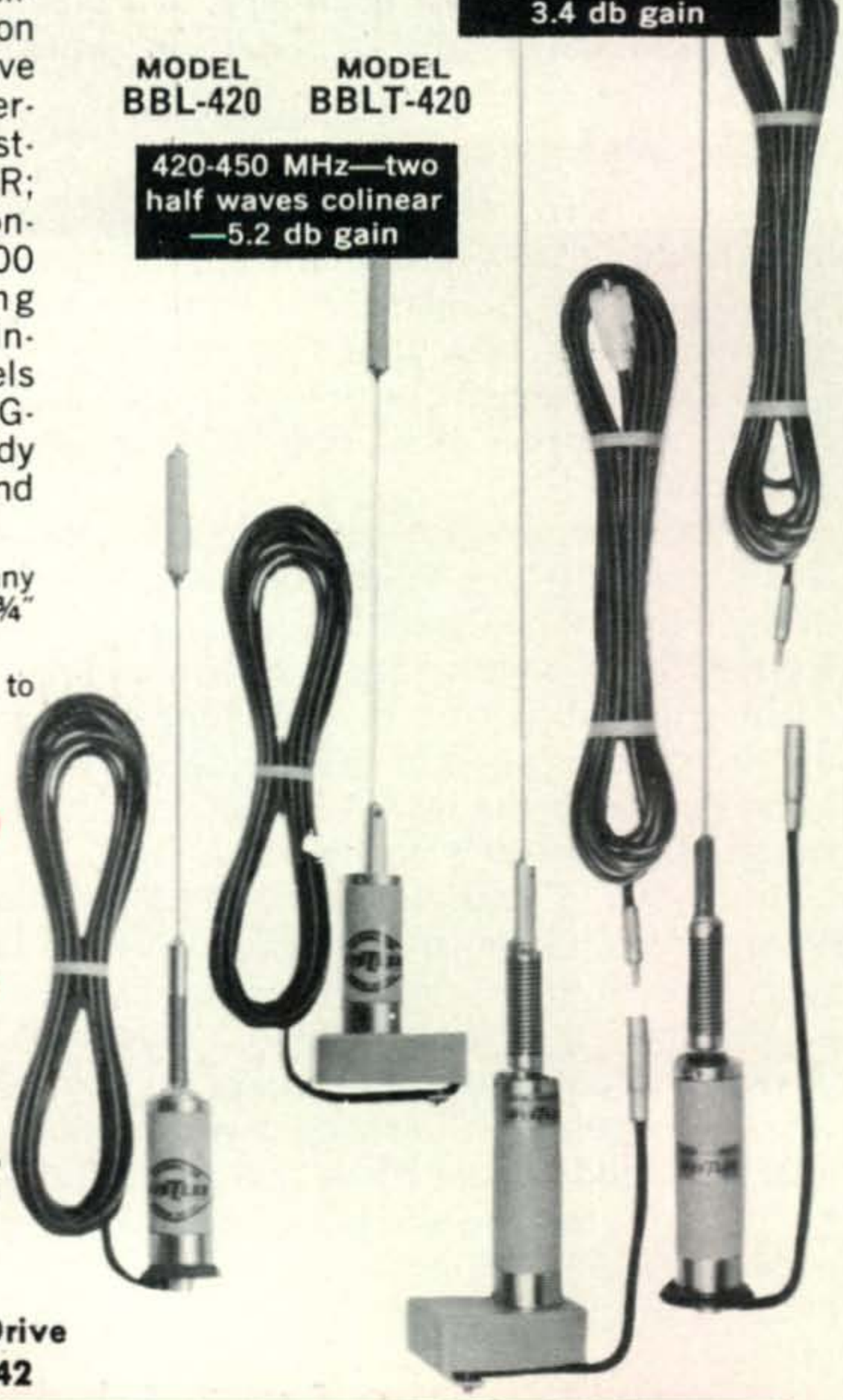

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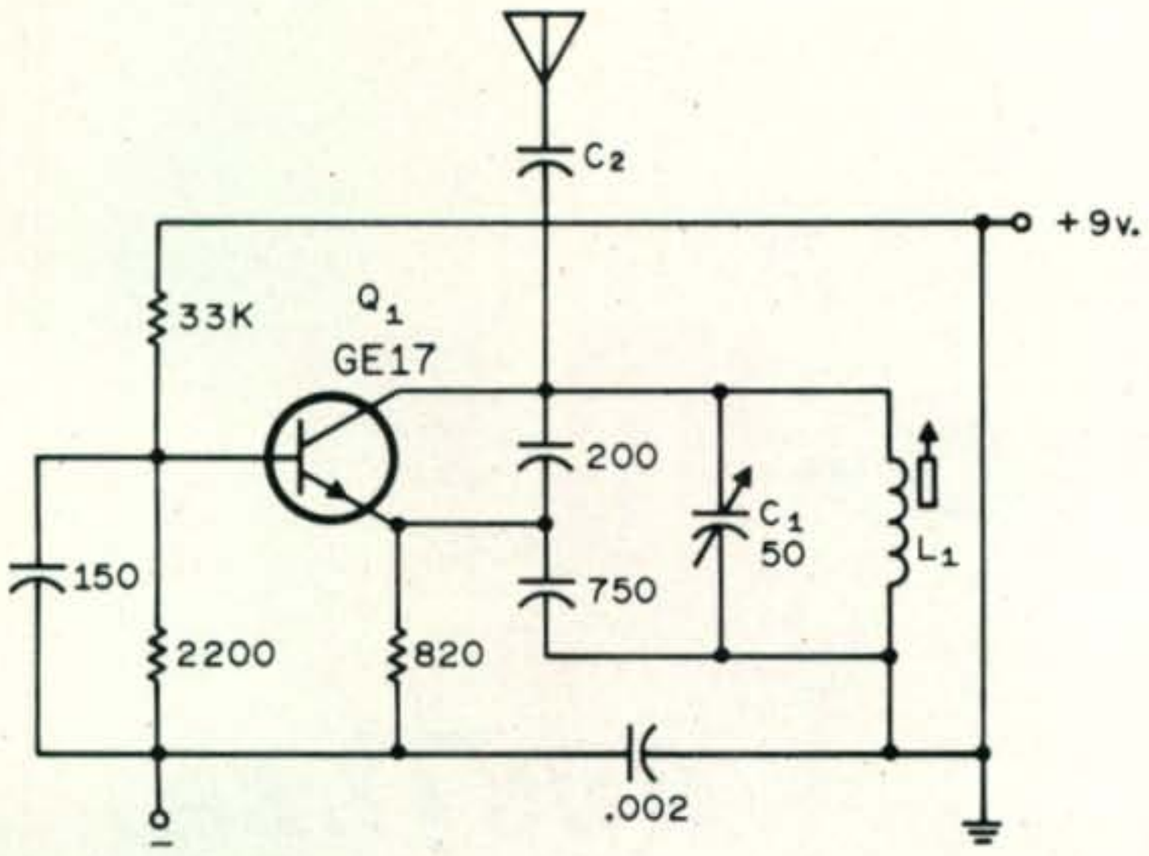

Fig. 1—Circuit diagram for b.f.o. with portable radio C_2 is "gimmick" type capacitor (2 pieces) 2" #18 plastic-covered hookup wire tightly twisted together. Antenna is 12-18" stiff wire mounted on insulator on top of b.f.o. box. L1 is one-half Radio Shack 455 kHz i.f. transformer with 150 mmf capacitor removed.

may work well in another circuit or come in handy during an emergency.

Tube checkers do have their place; however, the "proof of the pudding is in the eating," so make a tube replacement where trouble is suspected.

Downward Modulation

QUESTION: I recently built a linear for two meters using a 5894 tube. I have approximately 500 volts on the plate, 250 on the screen and minus 25 v. bias. It is used in push-pull. It works fine, except for downward modulation. The exciter is okay. Can you give me a hint or two?

ANSWER: The problem with the above situation is evidently due to improper adjustment of the linear. When you use a linear amplifier for a.m., the amplifier has to be driven for a *carrier* output power of only one-quarter the maximum possible peak-output value. For example, if the most you can get out of the amplifier is 100 watts, the drive should be adjusted for a carrier output of 25 watts from the amplifier. If you watch this on a scope, the display (carrier) will be half the height (half the voltage) of the maximum possible output during full drive. Failure to set up operation in this manner will result in improper modulation. Note, that with 100% modulation on a.m., the peak power (at the crest of the positive peak) is four-times that of the carrier. The amplifier also should be *fully* loaded under conditions of maximum peak power. This is best set up when full steady drive is applied during tuneup.

B.F.O. For Portable Radios

T. W. Webb, W4YOK, of Owensboro, Ky. has submitted the following data on a simple b.f.o. for use with portable transistor radios. His letter reads as follows:

"A desire to use my all-band portable radio for outdoor code-practice reception as well as just listening to s.s.b. and c.w. signals lead me to this simple b.f.o.

"It is built into a 2" × 3" × 5" Minibox and consists of a tunable 455 kHz Colpitts oscillator powered by a small 9-volt battery. The circuit is shown at fig. 1. An old radio or a trip to your Radio Shack store provides the inductor. The Colpitts configuration eliminates the need for a tap on the coil. A GE17 NPN transistor was used because it was available, but just about any NPN one should work, but the base divider resistor may have to be juggled a bit.

"Stability is good. S.s.b. signals are easy to tune in. Injection to the receiver is made and varied by simply moving the oscillator toward or away from the radio. Be sure your radio has a 455 kHz i.f. before attempting to duplicate this setup."

Many thanks OM.

SBE-34 Modifications

QUESTION: I have an SBE-34 which I should like to modify to permit c.w. operation. Although SBE markets a "Codaptor" to accomplish this, I prefer to follow the "do-it-yourself" approach. Have you any suggestions to offer along this line?

ANSWER: C.w and other modifications for the SBE34 may be found as follows:

"C.W. and Extended Coverage for SBE-34," *CQ*, July 1966, p. 31.

"Expanded Coverage and Convenience for SB-34," (includes c.w. modifications), *CQ*, September 1968, p. 57.

"How to Improve Your SB-34 Transceiver," *CQ*, April 1967, p. 50.

"An S-Meter for the SBE-34," *CQ*, January 1970, p. 35.

Coax Phase-Angle Detectors

QUESTION: Where can I obtain information regarding a coax phase-angle detector?

ANSWER: Data on coax phase-angle detectors may be found in the following articles:

"Coax Phase Detector," *CQ*, January 1962, p. 24.

"Phase Angle Detector," *QST*, July 1952, p. 17.

"Automatic Antenna Coupler Tuning," *QST*, August 1952, p. 11.

73, Bill, W2AEF

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RF550A contains high accuracy watt meter; calibrated in 400 and 4,000 watt scales; switch for forward or selected power; switch to select 5 antennas or dummy load. Order No. 857 Ham Net $75.00

RV550A is a solid state VFO. Function switch selects the remote unit to control Receive-Transceive-Transmit frequency independently. Order No. 856 Ham Net $95.00

SC550A Speaker Console with headphone jack. AC400 power supply will mount inside. Order No. 858 Ham Net $29.95

AC400 Power Supply is heavy duty solid state to operate GT-550A at full power, on SSB or CW, and with switch selection of 115/230 VAC, 50/60 Hz input voltages. Order No. 801 Ham Net $99.95

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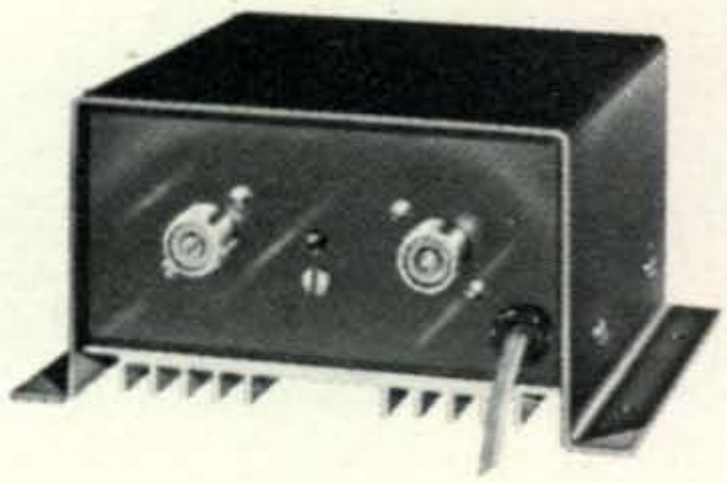

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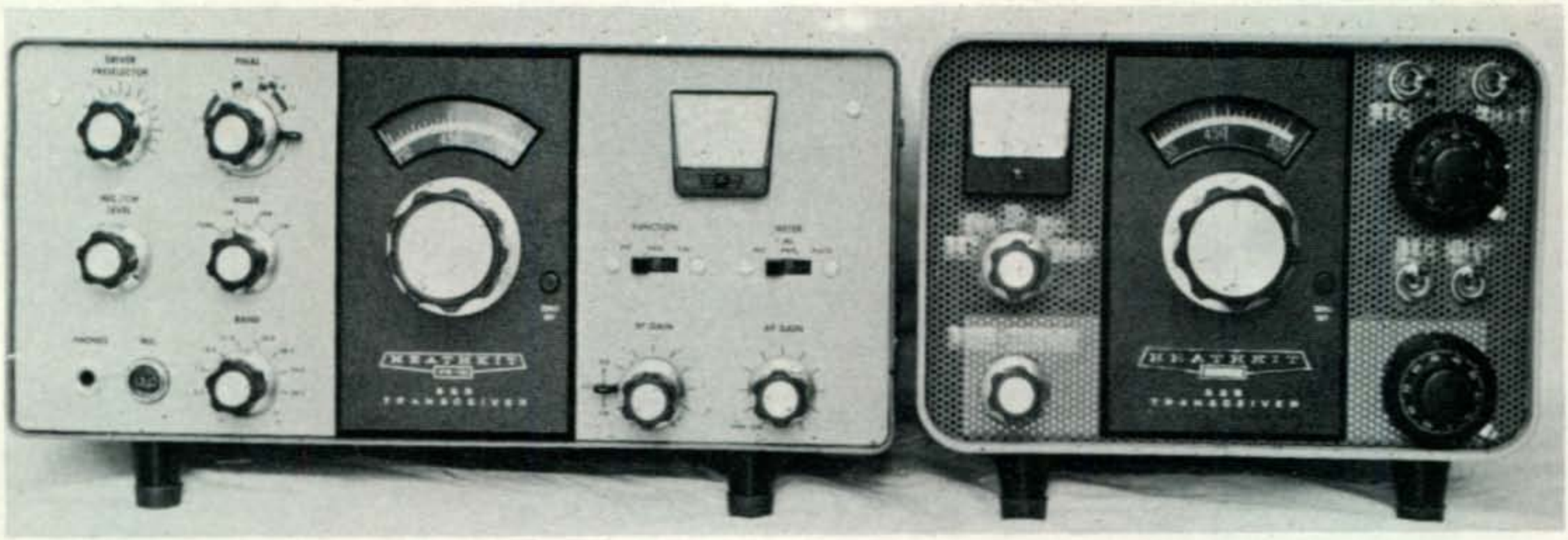


The Heathkit HW-101 s.s.b. transceiver shown with auxiliary v.f.o. mounted in SB-600 speaker enclosure.

Increasing The Operating Capability of the Heathkit SSB Transceivers

BY JERALD R. MALIN,* WB2LEI

THE average s.s.b. transceiver lacks flexibility, and thus prevents full participation in certain forms of amateur activities. Some of these categories are DX hunting, net operation, v.h.f. operation, and contests to name a few. These activities often call for the ability to transmit and receive on frequencies separated by as much as 100 kHz, often more. The ability to switch between single frequency transceive operation and separate frequency operation instantaneously is another desirable feature. Still another is the ability to add converters and transceivers for v.h.f. operation with all switching integrated in the basic rig to eliminate the messy rats nest of external cables, coax relays, etc. The same feature includes the ability to add external receivers or pre-amps with built in switching.

This article describes the methods used to add the above features to a Heathkit HW-101 transceiver. However, these features may be applied with equal ease to any of the HW-series or SB-series 5-band s.s.b. transceivers. In fact the described features can be adapted to many other brands of transceivers also, they are not limited to Heathkit gear. The resultant of the following series of modifications gave me a far more flexible rig as well as a well packaged accessory that compliments the appearance of the station.

The major feature is the packaging of an additional v.f.o., complete with the necessary switching controls and incremental offset tuning, in the Heathkit SB-600 speaker console. Packaged along with the v.f.o. is a frequency independent wattmeter. The accessories are all pluggable, so by removing the plug, the rig operates normally. Except for the addition of a few connectors added to the rear chassis apron, the appearance of the rig is unmodified, and the performance specifications are not compromised by any modification. The BNC connectors added to the rear apron are for an interesting and useful modification in the antenna switching circuitry. Heath uses a portion of the modification in the SB-series rigs, but fails to carry it to the point of maximum utility. This modification is wholly independent from the v.f.o. attachment, as is the incremental tuning. Thus by keeping the modifications in modular form, they may be implemented wholly or in part depending on the individual station requirements.

Circuit Description

The heart of the modification is the v.f.o. itself. I purchased a complete compliment of parts used for the v.f.o. from Heath for less

*2723 Camelot Rd., Endwell, N.Y. 13760

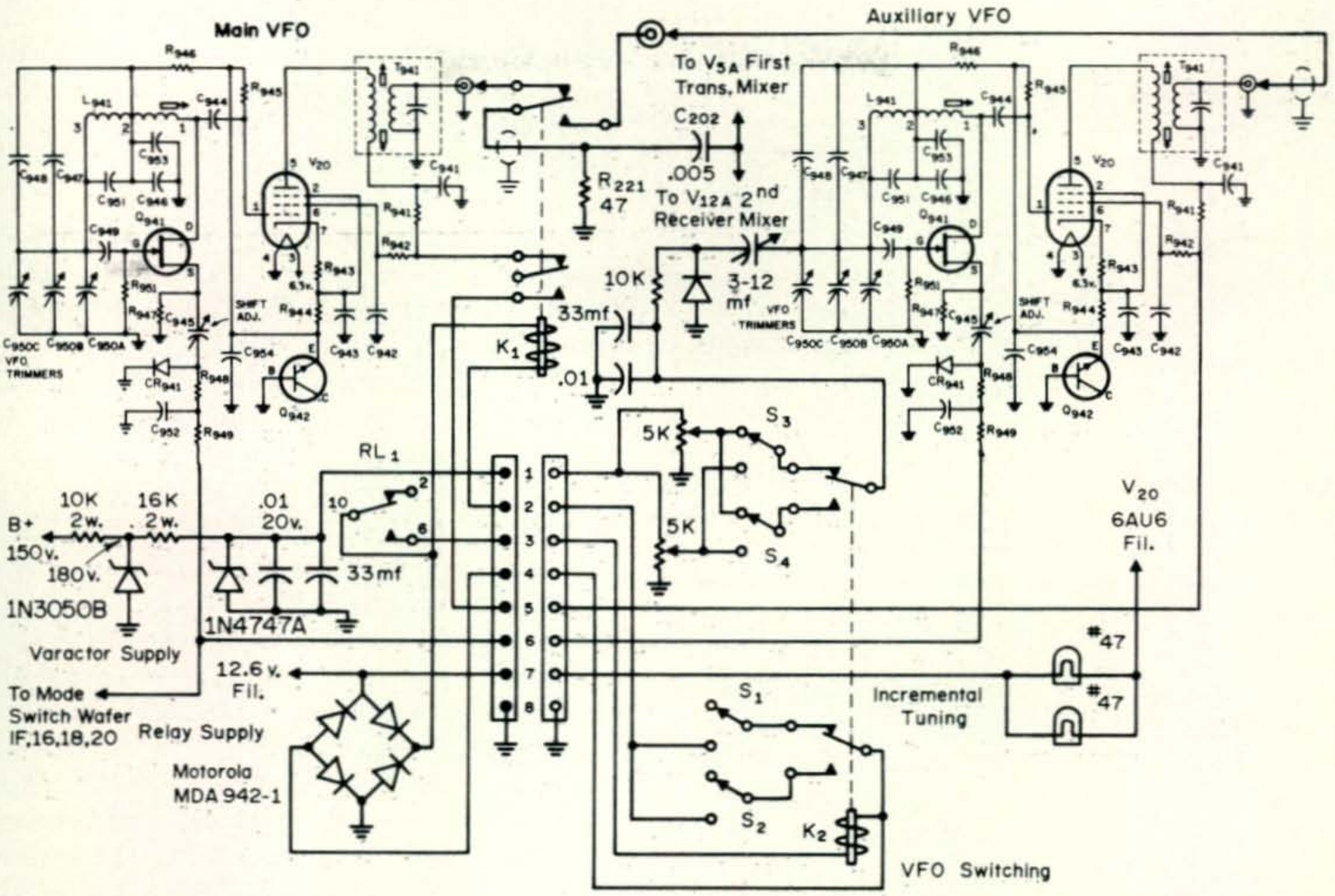
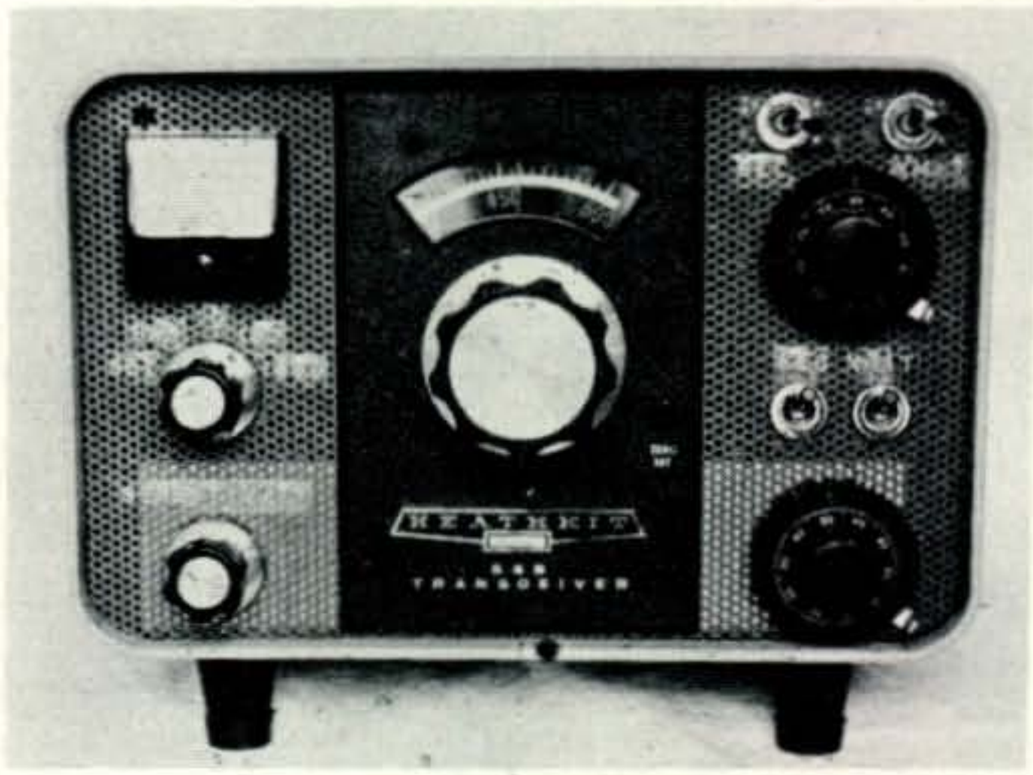


Fig. 1—Schematic diagram showing auxiliary v.f.o. switching, incremental tuning, and associated power supply. Either the main or auxiliary v.f.o. may be used for either transmit or receive or both depending on settings of S_1 and S_2. Switches S_3 and S_4 select either of two incremental tuning pots for either transmit or receive. Relay K_1 and the power supply components are installed in the transceiver; all other components are in the auxiliary v.f.o. cabinet.

than $30. By duplicating the v.f.o. that is in the original rig, all compatibility problems are avoided. Heath will sell any part or group of parts without questioning what you intend to do with them. Due to the similarity of circuitry between the HW-series and the SB-series circuitry, the HW-series v.f.o. will exhibit the proper characteristics for use as an external v.f.o. for the SB-series transceivers. The biggest difference in using the HW-series v.f.o. in the SB-series gear is the lack of ability to read your frequency to 200 Hz as you would be able to if you used the SB-640 external LMO. However, by only paying one third of the cost of the SB-640, you must put up with a dial calibration of 5 kHz per division as opposed to the 1 kHz per division with the SB-640. Much of the circuitry for switching the external v.f.o. in and out already exists in the SB-series transceivers, and may be utilized as one sees fit. Note, however, that the SB-102 lacks the filament and B+ connections as the LMO is solid state. The B+ for the external v.f.o. may be obtained from the switching circuitry that drives V_5, the crystal oscillator. The arrangement offered here using a relay to switch the external v.f.o. in and out of the circuit exhibits slightly more



Panel layout of the auxiliary v.f.o. console. The wattmeter is at the left. Two ten-turn controls for incremental tuning are at the right with toggle switches for selecting the desired v.f.o. and/or incremental tuning combination.

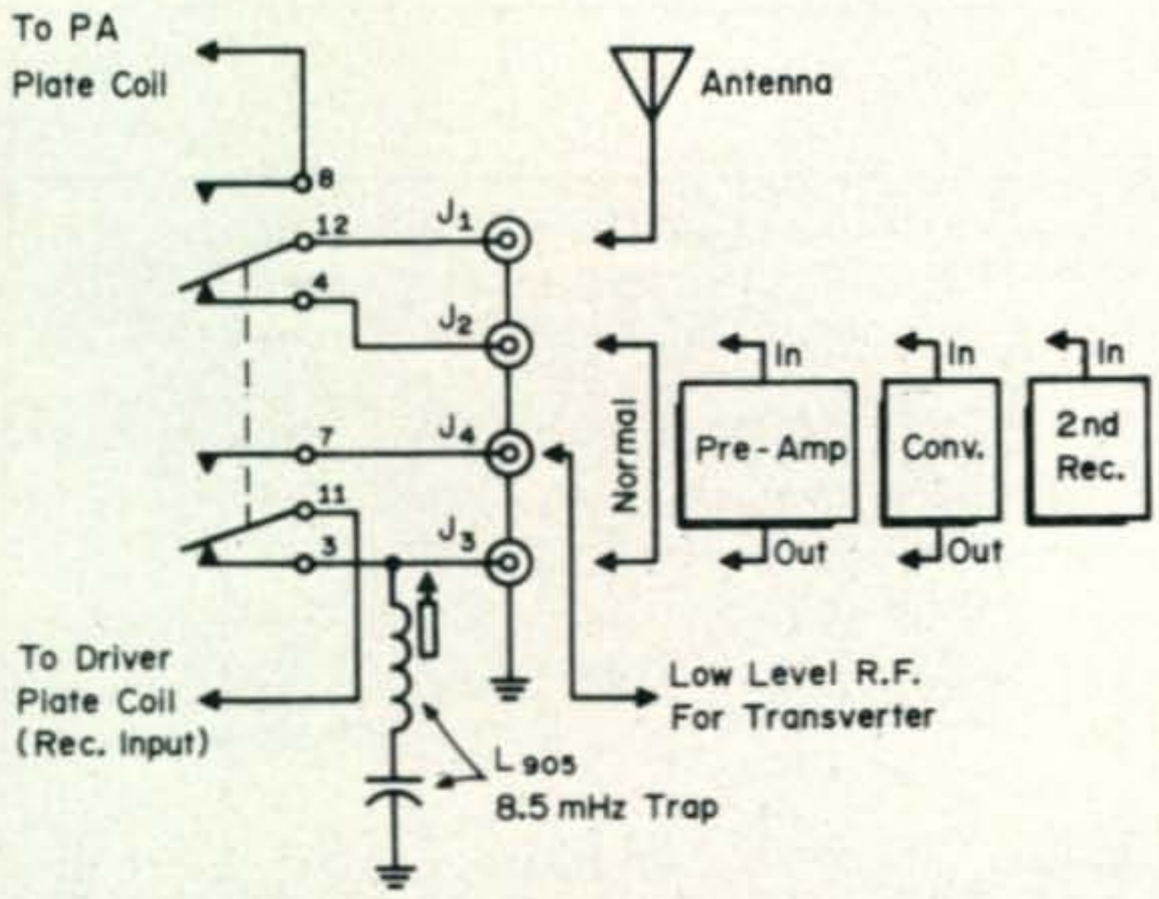
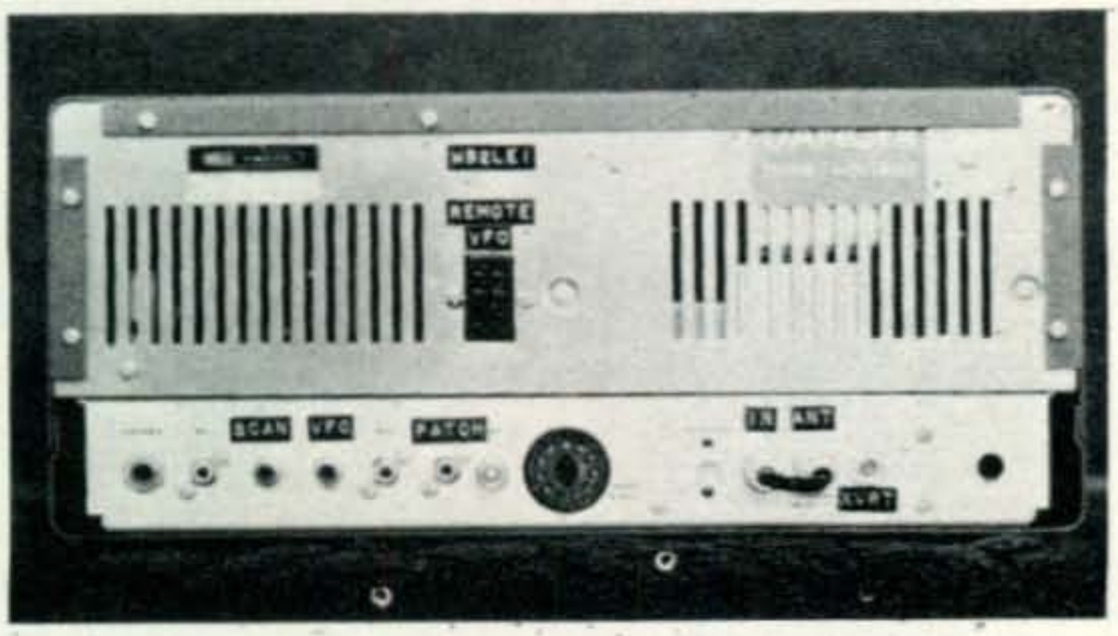


Fig. 2—Antenna switching modifications to the Heathkit HW-100 or HW-101 transceivers to permit easy installation of external converters, preamps or receivers. Relay RL_1 (original in transceiver) is rewired as shown, using previously unused contacts.

flexibility than the switching built into the SB-series transceivers, and may be incorporated as is. This is left up to the individual who is best qualified to judge his own requirements.

Added to the external v.f.o. is another useful feature, incremental offset tuning. A Varactor is loosely coupled by means of a small value trimmer capacitor to the frequency determining elements of the v.f.o. A small d.c. voltage obtained from an adjustable potentiometer is applied to the diode. As the voltage is varied, so the capacitance of the diode varies, thereby causing the v.f.o. to vary slightly in frequency. By using ten-turn pots, and adjusting the trimmer to give me a total frequency variation of 10 kHz, I had a fine tuning rate of 1 kHz per turn, or based on the 100 divisions on the knob I used, I had a tuning rate that approximated 10 Hz per division. Due to the nonlinearities in the diode, I could not relate the dial markings of the ten-turn pot knob to specific frequencies, although a calibration chart is certainly possible. The control does exhibit a fine adjustment with smooth, no-backlash tuning. In my particular arrangement, I used two ten-turn pots in conjunction with a suitable switching arrangement which allows me to select one or the other pot on either transmit or receive, giving me four possible combinations. The various combinations may be switched instantly giving me a large degree of flexibility. Although I chose to add the incremental tuning only to the external v.f.o., it can be added to the main v.f.o. also. This is a useful feature to consider for any transceiver that lacks offset tuning.



Rear view of HW-101 showing extra connectors and remote v.f.o. power socket.

Switching between v.f.o.'s is simply accomplished by relay K_1. Both the B+ line to the v.f.o. and the v.f.o. output line are interrupted by the relay. (See fig. 1.) When the relay is unenergized, the rig operates normally. When the relay is energized, the B+ is shunted to the external v.f.o., and the output signal from the external v.f.o. is shunted into the rig. Control of relay K_1 is accomplished by switches S_1 and S_2 in conjunction with K_2. These controls are located on the external v.f.o. console. S_1 selects which v.f.o. is used for receive, and S_2 selects the v.f.o. for transmit. Relay K_2 is energized on transmit, and shunts the control voltage for relay K_1 to the proper switch. The four possible settings of S_1 and S_2 give the maximum amount of flexibility.

Power for the relays is obtained from the filament supply. I rectified the 12.6 v. a.c. filament supply for two reasons: I had only d.c. relays in my junk box, and if I ever powered the rig from a d.c. supply (Fie'd Day, mobile, emergency, etc.) I would maintain compatibility. If you do not anticipate using this feature under d.c. conditons, a.c. relays may be used, elminating the need for rectifiers. In fact the only requirement is that the relays match the supply voltage used. Plate circuit relays may be used if you desire to power the relays from the B+ supply.

The filament voltage for the 6AU6 in the external v.f.o. is obtained by dropping 1/2 of the 12.6 v. filament voltage across a pair of #47 pilot bulbs connected in parallel. The 6AU6 and the parellel #47 pilot bulbs both draw 300mA, splitting the supply voltage evenly. Other methods are equally acceptable, such as using a 12AU6 tube in place of the 6AU6, and paralleling a 12 v. pilot bulb such as a #53 or suitable substitute. Another method is to obtain the 6.3 v. from the center

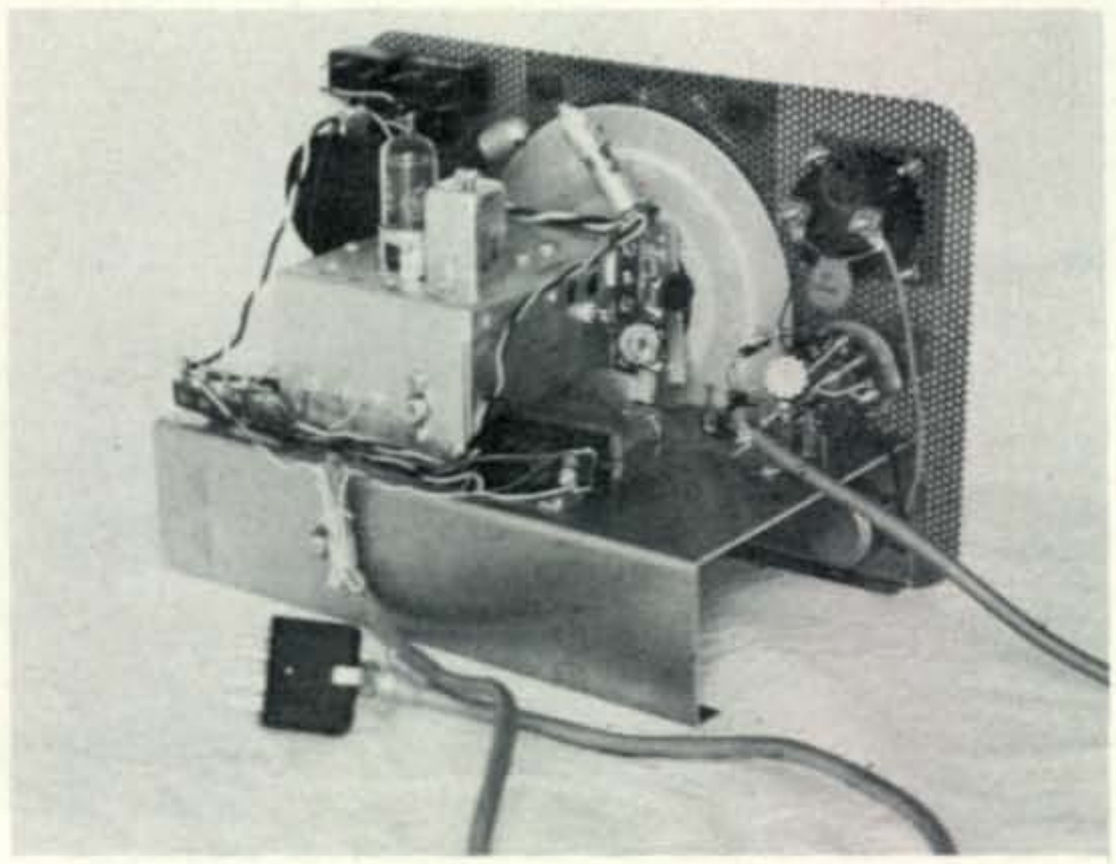
tap of the filament supply.

The B+ supply for the external v.f.o. is switched on by relay K_1. The voltage is obtained by disconnecting the B+ line normally going to the main v.f.o. By only energizing one v.f.o. at a time, the power supply loading remains unmodified. The VR tube regulated 150 v. supply has insufficient capacity to power two v.f.o.'s. As a matter of interest, the Signal One model CX-7 does have a feature whereby they connect two v.f.o.'s to the receiver at the same time, allowing one to hear two portions of the band at once. The external v.f.o. described here can be used for the same purpose if a separate supply is used to supply the 150 v. B+. With the crowded band conditions that exist, I feel such a feature has limited usefullness, and can be a source of unnecessary confusion, and therefore I do not recommend its implementation.

The inside of the v.f.o. console is fairly empty, as is the side of the front panel opposite the offset tuning controls. There is ample room for the addition of another useful station accessory such as a phone patch, a Q multiplier, an audio c.w. filter, or an s.w.r. bridge, etc. I chose to add a frequency independent wattmeter using an external pick-up element. My reason was the inability to monitor plate current and relative power output at the same time. By placing the wattmeter adjacent to the meter on the rig, I can monitor both the plate current and the power without switching. This is especially useful during tune-up. One can tune for maximum power out and by keeping the plate current low, the finals are protected from excess dissipation when you take a little longer than you should.

The circuit used was similar to that described by Doug DeMaw, W1CER.[1] The theory and construction of this type of wattmeter is readily available.[2] The circuitry used is conventional, and so will not be repeated here.

The antenna switching circuit is shown in fig. 2. There are two sets of unused contacts on relays RL_1 in the HW-series transceivers. The SB-series transceivers use three of the four contacts on relay RL_1, but most of this modification is already wired in and requires no additional relay contacts. The original phono connector used as the antenna jack was replaced by a BNC connector. In addition to the antenna connection, three more BNC connectors were added to the rear apron. Only two additional connectors would have to be



Interior of the auxiliary v.f.o. console. Relay K_2 is mounted flat to the chassis next to the v.f.o. At the right is the wattmeter circuitry, while part of one of the 10-turn incremental tuning pots is visible to the left of the v.f.o.

added to the SB-series transceivers, as an additional jack already exists. I recommend that this additional jack be converted to a BNC also.

With the antenna connected to J_1, and a short coax jumper connected between J_2 and J_3, the rig operates normally. If you wish to add a 160 meter or v.h.f. converter to the rig, simply remove the jumper between jacks J_2 and J_3, connect the input of the device to J_2, and the output of the device to J_3. The device will automatically be placed in series with the antenna and the receiver input during receive

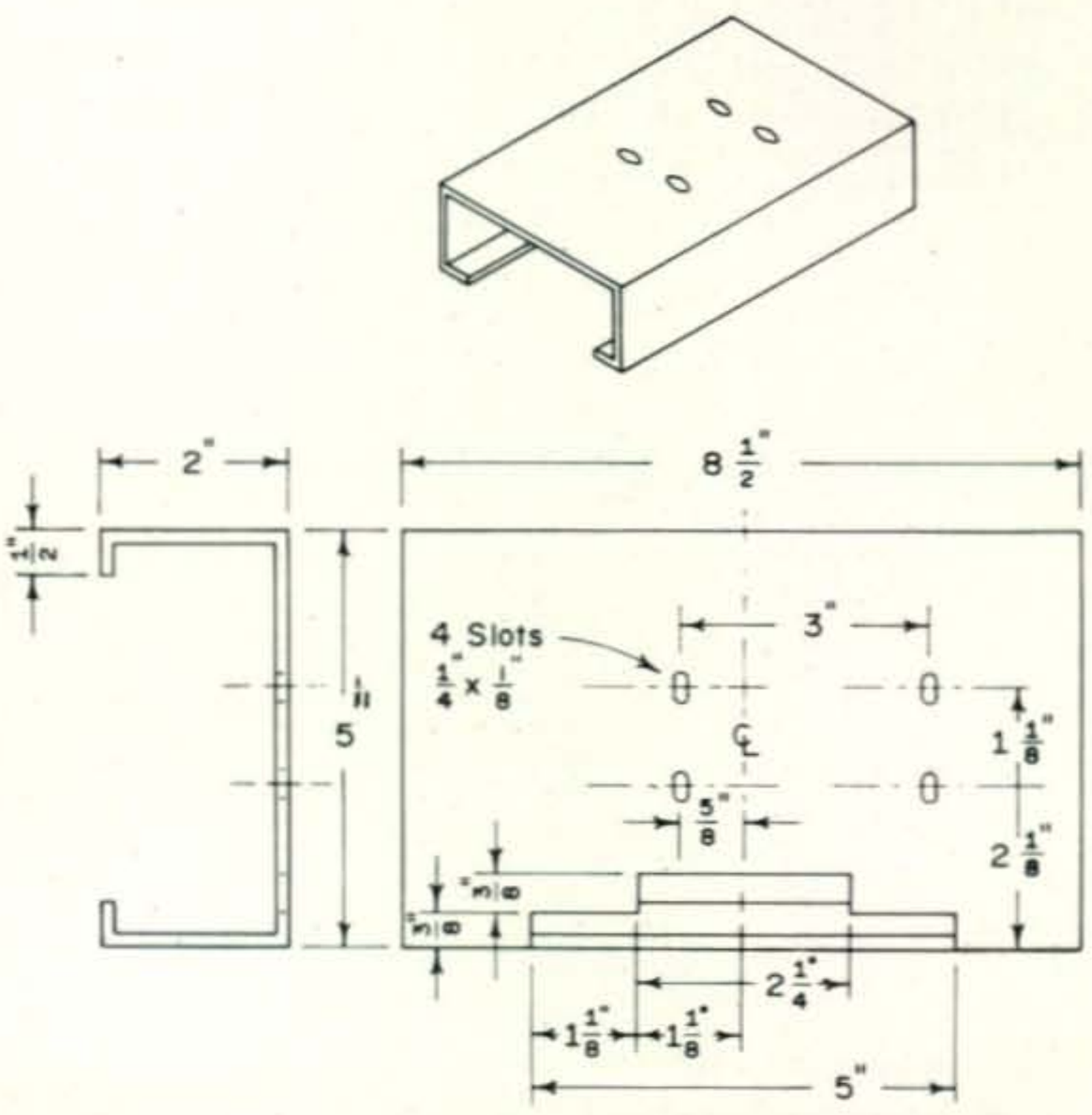
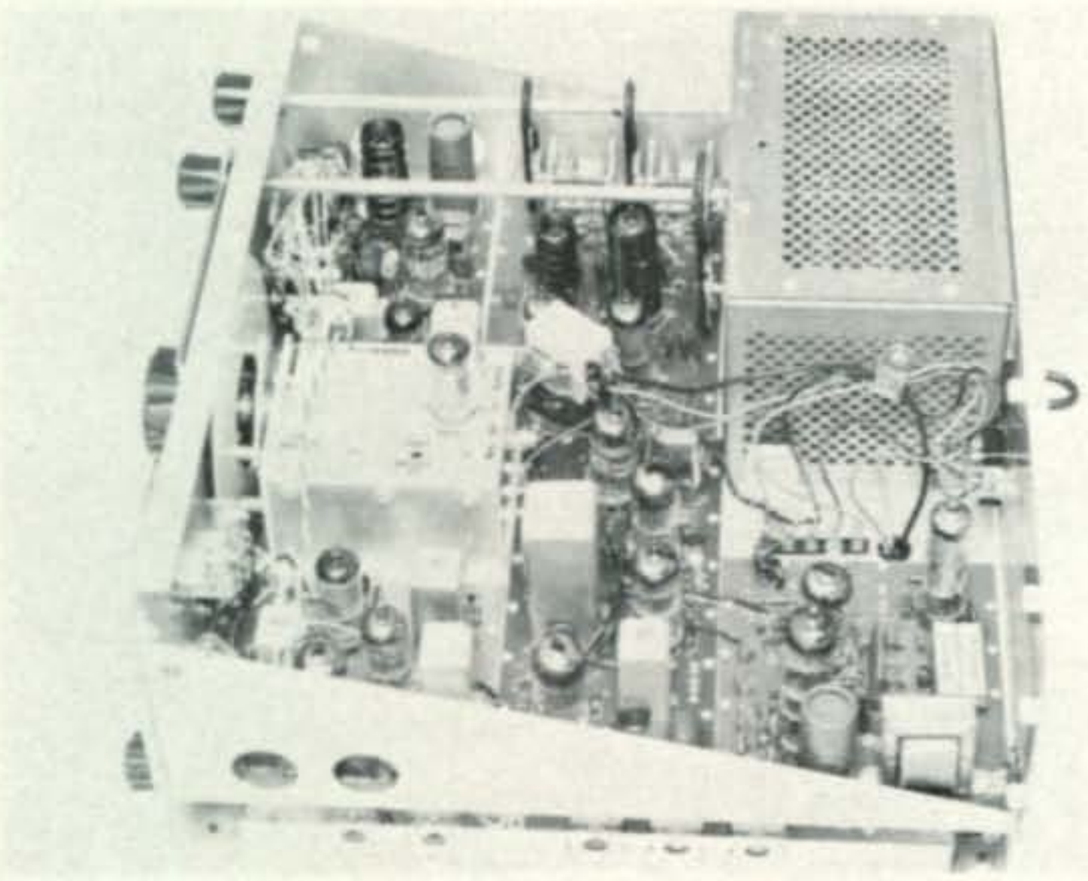


Fig. 3—Chassis dimensions and layout for mounting auxiliary v.f.o. in Heathkit SB-600 speaker cabinet.



Top view of the modified HW-101 shows relay K_1 mounted at an angle from the rear of the v.f.o. The five-lug tie strip and Jones connector adjacent to the PA enclosure carry wiring for the relay power supply and remote v.f.o. power.

mode, and will be switched out of the circuit completely during transmit. Pre-amps or pre-selectors may be used in much the same manner as the converters. If one desires to add an external receiver, simply remove the jumper as before, and connect the antenna input of the receiver to J_2. The antenna will be automatically switched to the external receiver. Perhaps you wish to drive a transverter with a low level r.f. signal; J_4 is coupled to the driver stage during transmit, and provides the same signal as the SB-102 when using the driver output jack to drive the SB-500 2-meter transverter. Provisions must be made to disable the screen or plate voltage to the finals when using this mode, as opposed to taking the high level r.f. out of the antenna jack. To expand the partial implementation of this feature to the SB-102, remove the connection between pins 3 and 4 of relay RL_1. Connect pin 3 to J_3, along with the 8.5 mHz trap. Connect pin 4 to J_2. This completes the modification for the SB-102. For the SB-101 and SB-100, connect pin 7 to J_4. Connect pin 4 to J_2. The RECEIVE ANT jack is now J_3, and the RF OUT is J_1. The DRIVER OUT jack on the SB-102 is J_4. The internal switching saves a lot of cables and external relays which usually result in a mess that you prefer to hide behind the rig.

The voltage supply used for the incremental tuning was derived from the 300 v. B+ supply. The regulated 150 v. B+ lacked sufficient capacity to handle the current requirements of the tuning pots, and still maintain good regulation for the v.f.o. circuitry. Two zener diodes are necessary to provide sufficient regulation for the pot supply. Without good regulation, the tuning will appear to drift around with variations in the line voltage. By allowing one of the zener diodes to regulate at a relatively high voltage, the minor voltage variations that do get by the first zener diode will be reduced by the fraction of the final voltage desired over the first zener voltage. This causes the second zener to have less voltage variations to contend with. The particular zeners used are not critical, any combination of a relatively high voltage zener and one at the desired pot voltage will do. There is a tradeoff on the voltage variation applied to the Varactor diode and the degree of coupling of the Varactor to the frequency determining elements of the v.f.o. I used a Crystalonics CV5022 Varactor, rated at 25 volts breakdown. This led to the selection of a 1N4747A 20 volt zener for the final pot voltage. Coincidently this zener was in my junk box along with a 1N3050B 180 volt zener diode. This was a strong point favoring their selection. The 1N4747 costs a nominal $1.25, and the 1N3050 costs about $2.50. There is not enough complexity in these circuits to warrant the "A" or "B" suffix on the diodes; they only increase the price. Stay with the cheaper diodes. The resistor values were derived for the particular diodes used, and substituting diodes with other zener voltages would require recalculation of the resistors. *The Radio Amateur's Handbook* is an excellent reference for those who are not familiar with calculating suitable resistor values in power supply regulator circuits.

The CV5022 diode was selected because it was available. Just about any back biased silicon diode will exhibit a change of capacitance with a change of voltage across it. Motorola offers some tuning diodes for around 50¢. These are the MV2201-MV2203-MV2205-MV2209 series. Any of those diodes may be used. Use that old ham philospohy, try (everything in your junk box) before you buy.

Construction Details

The external v.f.o. is mounted on a homebrew chassis, which was formed from a 10" by 8½" sheet of 1/16" aluminum. After folding 1/2" lips inward to form a base, 2" sides are formed giving you a sturdy chassis 8½" wide, 5" deep, and 2" high. The 1/2" lips on the bottom of the chassis line up with the various mounting holes of the SB-600

speaker cabinet. The front lip is in line with the holes used for mounting the front feet, and the rear lip is in line with the holes used to mount the HP-23 power supply. The mounting holes were traced onto the chassis which was then drilled and tapped to accept suitable screws. Sheet metal screws are easy enough to use if you lack a set of taps. Figure 3 is the layout of the chassis showing the clearance slots for the dial, and the mounting holes for the v.f.o. The dimensions shown are approximate, and may vary if other methods are used.

Figure 4 shows the approximate size and location of the various front panel mounting holes. The dimensions were obtained by tracing the holes from the HW-101 front panel before it was mounted. Some difficulty was had in keeping the drill aligned when drilling in the perforated front panel of the SB-600, therefore it is advantageous to modify the mounting hole locations if possible to line up with the perforations for easier drilling. If you do not wish to have the speaker mounted behind the v.f.o., a solid front panel could be used.

The sheet metal screws used to fasten the v.f.o. chassis together are excellent for mounting the additional pilot bulb socket and a tie strip used to mount the varactor and associated components. Parts placement can vary greatly depending on individual requirements and personal preference.

For that "Human Engineering" touch, I positioned the front panel switches so they "point" to the function they are performing. This reduces confusion, and eliminated the need for proper labeling, which will be difficult at best on the perforated panel. The two switches on the top of the panel, S_1 and S_2, select the v.f.o. to be used. In my station, the transceiver is to the left of the external v.f.o. With the switches pointed to the left, I use the transceiver v.f.o., and likewise if the switches are to the right I use the external v.f.o. The left most switch, S_1, is for receive, and the right most switch is for transmit. If I have S_1 to the right, and S_2 to the left, I will receive with the external v.f.o. and transmit with the main v.f.o. The same situation was applied to the lower switches. When the switches point up, I fine tune with the upper pot, and when the switches point down, I fine tune on the lower pot. As before, the left most switch, S_3, is for receive and the right most switch is for transmit.

A variation of WB2LEI's approach is this setup by K2ZRO. Dual incremental tuning is used for the main v.f.o. as well as for auxiliary v.f.o. rack mounted above the transceiver. The main v.f.o. tuning pots are mounted on either side of the transceiver's meter. An s.w.r. bridge occupies the right end of the rack panel.

Although I used no labels, the arrangement of the controls was such that after five minutes of use, I was operating the controls with familiarity, and no confusion resulted.

Ten-turn pots are very convenient, they provide smooth and easy tuning. They are also expensive if you must go out and buy them new. The counting type knobs used with multi-turn pots are not exactly given away either. For this reason I would suggest using

[*continued on page 98*]

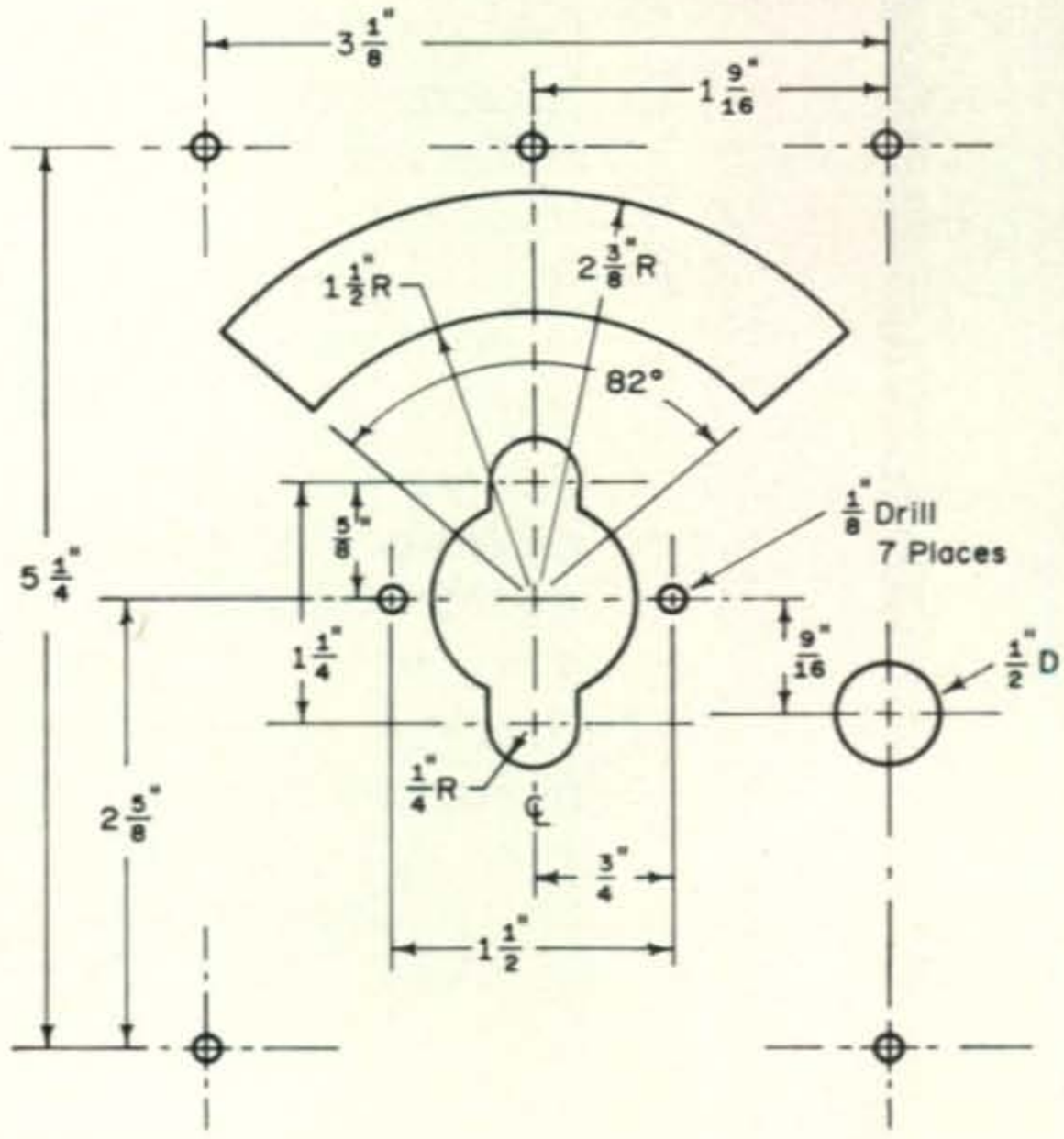


Fig. 4—Layout for drilling and cutting front panel to accommodate Heathkit v.f.o. dial mechanism for auxiliary v.f.o.

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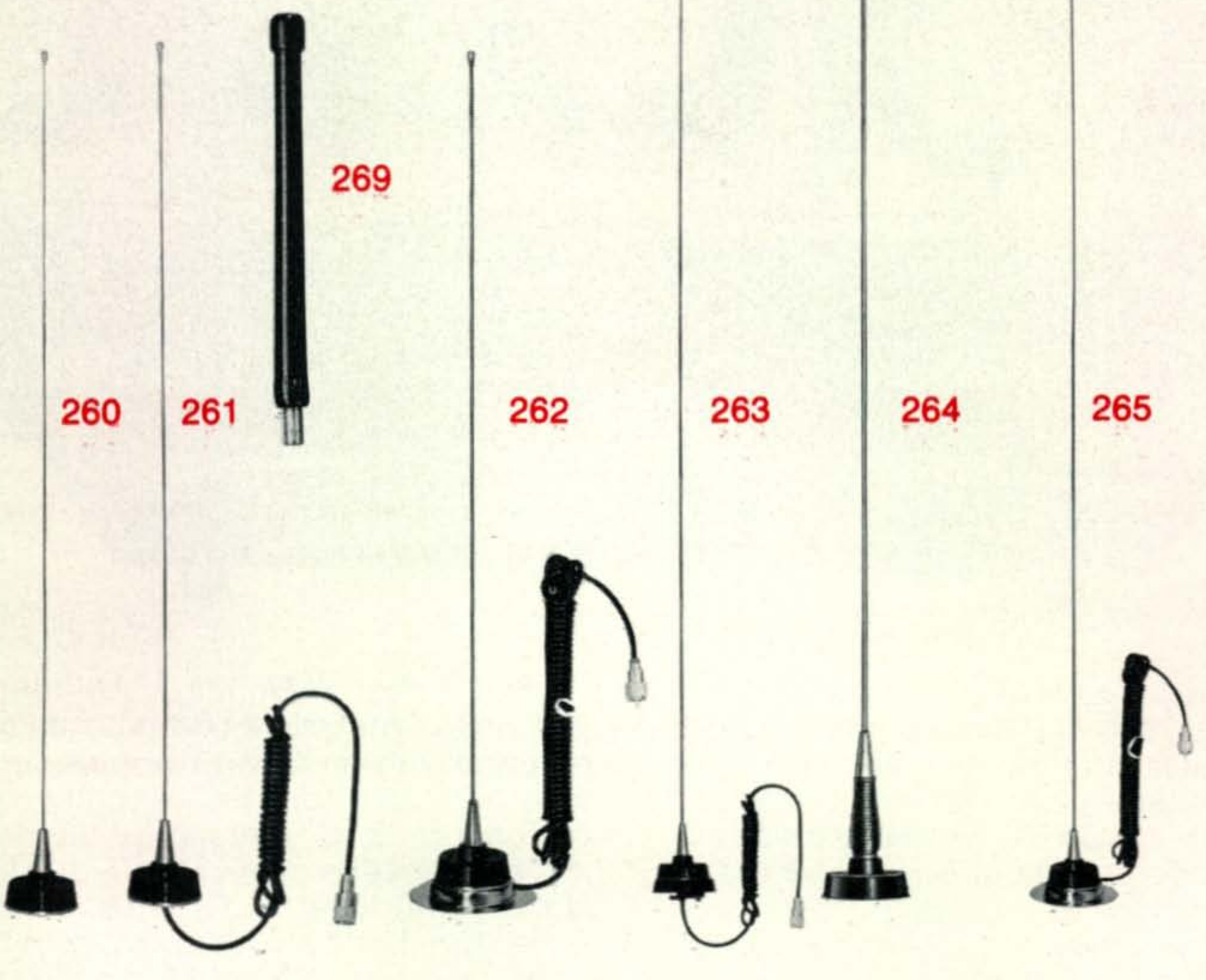

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The System

BY AL D'ONOFRIO,* W2PRO

Many an Old Timer will remember the famous Candler c.w. system of yesteryear and its distinguished honor roll of champions. Though many of their keys are today silent, the techniques of the system that they popularized are just as valid and as solid as ever.

Is there an OM past his seventh birthday cake who doesn't spend just a little part of his time day dreaming about discovering some incredible, sure-fire system for achieving instant mastery and success—for winning it big.

For us dreamers, and I certainly do include myself in that group, that big "it" dream is so very close, so very real. The big "it" dream embraces a wide color-coded spectrum, too: you name it—from sleek, racy thoroughbreds with long odds, to tightly packaged redheads with long lashes; from leaving them slack-jawed as you loft a 350-yard ball to the green on a par four, to the prospect of razzle-dazzling them on forty c.w. with your fantastically beautiful and devastating fist. Yes, indeed; there's plenty of grist for the ol' dream machine.

But, confidentially, as for sure-fire winning systems, my success with the horses is about as bad as it is with redheads; and the long green fairway has been, of late replaced by the bowling alley. But when it comes to good fists and c.w., I've a winning system that you just might like to hear about. It's a system that has helped many a ham get his ticket, and has brought world-wide acclaim to a few of yesteryear's great c.w. champions, and has brought countless others years and years of happiness in the form of pleasurable QSO's.

For those who like statistics, it's the very same system that enabled the late Ted McElroy to copy his record-busting 75.2 w.p.m.; and any system that turns out this type of champion is certainly worth looking at.

Let me start at the beginning . . . always a good place for most stories. Our protagonist —we'll call Charley—an amiable good fellow; what he lacks in technical know-how, he makes up for in honest enthusiasm for ham radio.

Charley thought that he had nailed dowr that 13 w.p.m. solid for his Class B ham examination, but apparently one of the nails must have worked itself loose, and the entire structure came falling down in a thousand pieces, right in the middle of the receiving test. The FCC Inspector, a slow and steady type of person who had witnessed many a receiving "crack-up," approached slowly with Charley's scribbled copy: "Sorry, young fellow," and edged him away from the open window—they were on the sixth floor and he was not about to take any chances.

Charley listened in silence. The FCC man grasped Charley's shoulder, with deep understanding, "Your sending was not so good either, but wanted to see first how you did on the receiving." They shook hands without saying any more, and Charley left the building, sick and alone . . . and ashamed. He didn't know what happened; it all happened so quickly. He felt like Humpty Dumpty after his ignominious pratfall, now searching about, forelornly, for a big pot of glue.

He shuffled through Grand Central Station for that lonesome ride back home, silently thinking black thoughts that should befall the FCC and their idiotic c.w. exams. He considered visiting the Terminal's friendly oasis, where one could become anesthetized with double "whooshkees"—like they do in the cowboy pictures; but, hah—the bartender would be too smart; he'd know Charley was only 13. So instead, Charley took the next express northbound and went home; and there, cracked open a bottle of homemade rootbeer that his mother always put up, and carved out a large slice of apple pie—to soothe his troubled woebegone spirits.

Later that week, from force of habit mostly, Charley dropped in at the monthly radio club meeting, held in the basement of the library; He mumbled his Hi-there's to a few, and quickly moved into the shadows in

*1537 Central Park Ave., Yonkers, N.Y. 10710

the back of the room. But Charley wasn't getting off that easily; and within the space it takes to complete a *CQ* Test QSO, Charley spilled it all out. They'd find out about his failing the code somehow, he figured. At least they'd get the story straight; besides, he felt a little better now, too.

It was a bitter pill for Charley: to be picked clean; to bomb out on that exam. What he neglected to mention, though, was that he also flunked the sending part, too. But a man has to have some secrets.

A senior citizen of that illustrious group held a commercial ticket, had spent several years sailing about, and had now, being finally married with a small brood of his own, become ensconced as No. 1 at the local radio station—all 300 watts of it. "Hay, kid," he said, after the rest of the pack had licked their chops and left him alone, "tough break, flunking that code. Went through that myself once," easing himself in a nearby chair and leaning back.

"Maybe you might be interested," he continued, relighting a short butt cigar, "got this correspondence course thing . . . 'scalled the Candler System . . . teaches you the code . . . good course." Charley was hungry and biting; that Candler system sounded good. But in those days, radio-minded gentlemen never discussed money, at least not until all other avenues had been explored first. He blew an ever-widening black acrid smoke ring over Charley's head: "What'cha got to trade, kid?"

The ensuing conversation picked up speed fast, with imaginative offers and rebuttals and counter-offers. They bargained like two camel riders on the way to the local bazaar, each inquiring and bidding on what the other might have in his goatskin bag. And so it was done; and the two smiled and shook hands: his Candler system correspondence course for Charley's almost like new six-tube Emerson radio—the one Charley had resurrected from the ashes, literally.

A day later Charley was beaming as he spread the ten or so neatly packaged lessons before him upon the kitchen table. He was the happiest kid in town; he itched to get started; here it was: the code systems of the champions, the very same kind that Ted McElroy himself learned from.

With hushed, reverent humility, and pride, Charley opened to the first page of Lesson No. 1, and read the cordial greetings by Mr. Candler himself. The message was spiritually uplifting and told of the almost indescribable hardships that had befallen Mr. Candler as a young, hardworking, and ambitious young man working on the railroad as a telegrapher. It was a pillar to post existence, to be sure, with hirings and firings all over the place; it read like Dickens—the valiant up-hill struggle.

But then, the letter went on, one fine day in June Mr. Candler received his revelation from above. Half dozing at his key, Mr. Candler suddenly understood the secret of good, reliable, high-speed telegraphy. And here, in Charley's two little hands, was Lesson No. 1 of that secret. Mr. Candler wanted only one thing from Charley: unswerving obedience to all instructions, diligence, hard work, and temperate living: Charley wasn't too sure of what temperate living meant, but he was all for that, too. He read on.

Candler spoke in great detail about his mandatory limbering-up exercises for every good telegrapher, such as Charley was training to be. The principal limbering-up exercise was the 15-minute lustral soaking of the hands prior to handling the straight key. Although only one hand is required for manipulating a key, it's just as easy to soak both hands, if one wishes, as to soak just one. Soaking the hands in tepid water, clear up to the elbows, would ease tensed muscles, soothe away those rheumatic and arthritic pains—even from a 13-year old. Charley dutifully obeyed, clear up to the elbows and beyond. Charley's mother thought the whole thing looked pretty silly, like the ritualistic washing a surgeon goes through before performing brain surgery. But she didn't mind Charley's silly splashings, especially before his coming to the supper table.

Next came the technique of developing a good fist using a straight key. With a simple one-tube audio oscillator, mounted atop an empty Philly cigar box, and with an old brass Signal Corps key before him, Charley clamped a pair of headphones on his head, and squared himself for the task that lay ahead.

Stripped of all verbiage, Candler instructed Charley to send with the precision of a marching cadet on review. At first, Charley would send just well-spaced dots—hundreds of them; he sent each dot like the staccato hammering on a blacksmith's anvil—dot—space—dot—space—dot—space; Faster the staccato went. Candler then switched to dashes—three times the length of a dot. And Charley sent the anvil ringing—dash-two-three—space—dash-two-

Table 1	Table 2	Table 3	Table 4
EEE III	TTT MMM	EEE AAA	CAT DOG
SSS HHH	OOO MMM	TTT NNN	THE MAN
EIE IIS	TMT MMO	TTE NNN	CAN DAY
SSH HSH	OOM OMM	AAT TTN	SAW SEE
EEE III	TTT MMM	EEI EIA	FOR TOP
SSS HHH	OOO MMM	EEE SSS	AND YOU
555 HHH	∅∅∅ OOO	VVV UUU	BIG ARE
H5H 5HS	O∅O ∅OM	AAU UUV	ALL ASK
SII EEI	MMT TTM	NND DDN	ADD HAS
EIS H55	TMO OMT	NND BBB	HIS USE
HSI E5S	∅MT T∅M	NDB BBD	ONE SHE

three. Whatever Charley may have lacked it wasn't dedication.

Then Charley started sending from rows and rows of tabular material, very much like that shown in Tables 1, 2, and 3. Candler went on to point out that good code has a musical quality, a definite rhythm to it. Once a person is made aware of this rhythmic quality and gets in-phase with it, good sending is easy. Each of us has a built-in keeping-the-beat mechanism—like a metronome that a beginning pianist uses to play a piece at the right, steady tempo. Most musicians tap a foot in time with the music, at least in the early stages of their musical training.

Candler urged Charley to think of code as a musical score, and as such, has a certain rhythm to it—so many beats to a measure. Sending good code is easy, once you've set the metronome ticking off the beats—the w.p.m. beat. With continued practice, Charley found himself swaying rhythmically to the beat, like a wide swinging pendulum clicking off the rhythm.

One danger exists: some operators enjoy the lilt of the rhythm so much that they like to improvise on the score; their enraptured sending swings the pendulum too far and spills over into what is called, the Lake Erie Swingers. Rhythm is heady stuff; so take care. Good sending is rhythm under full-time control.

Charley spent the first few weeks of the Candler system just washing and sending—sending and washing. Without a single doubt, he had the cleanest fist in town.

Then one fine day Charley turned a page and discovered what he had been longing for: the technique that leads to receiving high-speed c.w.—Candler's QRO technique.

In a nutshell, Candler's QRO technique rests squarely upon the operator's skill in being able to copy behind. It's a skill that can be learned, as with most skills. It's this kind of ability that separates the real good telegraphers from the rest. It was this ability that made Ted McElroy a world's champion back in '39—a record that still remains intact today.

Boiled down, the technique of copying behind—one or more letters behind the letter being sent—tends to keep you relaxed and more confident; when you are truly relaxed and confident in your ability to copy well, you will, indeed, copy better. The underlying psychology of copying behind is academic, and more suitable for after-five get-togethers and hamfests; the important thing is that the copying behind technique does work, and works well.

As an introduction to the copying behind technique, Charley was instructed to speak aloud one column of words, letter by letter, while writing down on paper, letter for letter, a second column. A representative pair of these columns is shown in Table 4. For example, Charley would say aloud the letters C-A-T given in one column while writing down D-O-G given in the other column. Doing this is weird at first: thinking and saying aloud the word CAT, while simultaneously writing DOG. It was mental gymnastics, to say the least.

In time, Charley was graduated into other, still harder columns, except with these Charley had to send the second column instead of writing the letters down. He would say the word T-H-E aloud, for instance, and send the letters M-A-N. But Charley's dedi-

cation never flagged for an instant.

Some might describe the copying behind technique a little like trying to echo another's exact words, only about two seconds later. Controlling the time-leg takes self-discipline and a good deal of practice. Your worst enemy in all this business is your nagging desire to hurry and "catch up," to echo the letter the second you hear it; that is, to write down the letter the second you hear it. And it's this continuous anxious state of wanting to write down the letter *instantly* that wears you down and prevents you from moving up the w.p.m. scale.

The home-stretch of Candler's lessons concentrated on both sending and receiving, the latter requirement bringing into play Charley's Sky Buddy receiver, dutifully zeroed on W1AW. As an extra bit of insurance, Charley borrowed a crankhandle tape machine with two rolls of tape.

The study material grew increasingly more difficult. Candler's orders were explicit: from now on, when copying, write down at least one letter behind the letter being transmitted, increasing the time-lag to two letters as soon as you can. Charley forced himself to copy behind; first one letter; then two letters.

Occasionally Charley would accidentally slip into copying "on-the-edge," but would quickly check himself. Little by little, day by day, he got better at copying behind. Gradually a warm wave of confidence seemed to engulf him, as he found himself casually crossing his T's and dotting his i's (a mandatory point that Candler often made). By golly, Charley thought, copying like this is easier. He couldn't imagine what all the fuss was about, once a fellow got the hang of it.

In the closing lessons, part of the day's assignment was devoted to just plain listening to good code. Here the object was to copy without a pad and pencil—just listen and copy it in one's head. Charley listened, feet comfortably propped, eyes closed in reflective meditation, letting the dit's and dah's spill over. His goal: try to recognize the word clusters and common endings—words like THE—FOR—WE—YOU; and the endings ED—LY—ING—MENT—ABLE. Charley soon discovered that the English language is bulging with these workaday words and endings. In time, Charley was finding it easier to recognize these clusters; they were there all right, once Charley trained himself to listen for them.

[*Continued on page 94*]

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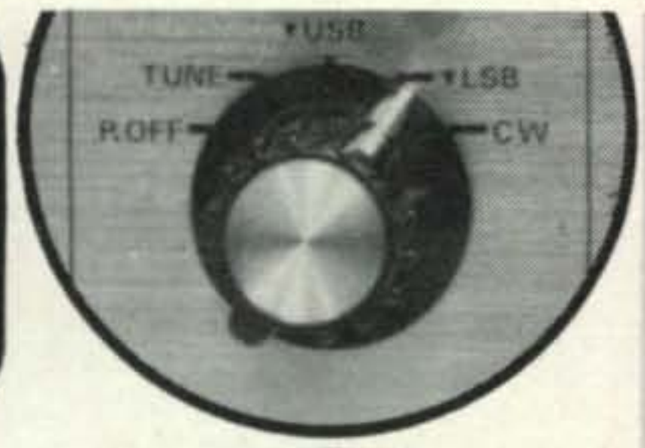

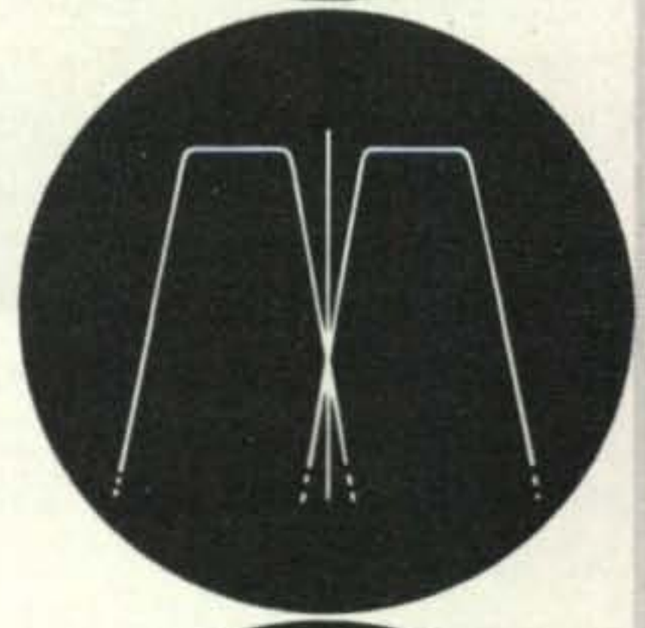

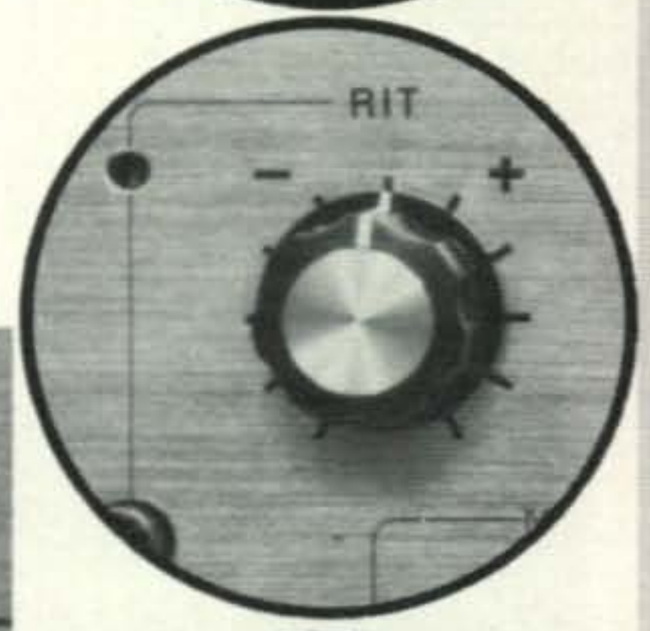

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CQ Reviews:

The Heath Solid-State Triggered-Sweep Oscilloscopes

BY WILFRED M. SCHERER,* W2AEF

Two of the newest oscilloscopes made available by the Heath Company are their Models IO-103 and IO-105. These are solid state triggered-sweep jobs, the Model IO-103 having a single trace with a vertical frequency response of d.c.-10 mHz, while the Model IO-105 is a dual-trace instrument for use at d.c.-15 mHz.

Before taking up the details on these units, let us consider the advantages of a triggered-sweep scope over the lower-priced general-purpose recurrent-sweep types usually used by the radio amateur.

A triggered sweep provides a stable display of waveforms regardless of the vertical-input frequency. You don't have to precisely adjust the sweep frequency to get it locked to the input frequency or to get away from the effects of signal variations or noise in order to have the pattern stand still. Jitter and slipping out of sync are eliminated.

*Technical Director, *CQ*.

The Heathkit Model IO-103 solid-state triggered-sweep 10 mHz oscilloscope.

This is due to the circuitry whereby the signal starts the sweep, after which the sweep setup is automatically dropped from the sync circuits. This prevents anything else on the input channel from affecting that particular sweep. The sync simply triggers the sweep into action in step with each initial impulse of the input signal. The system also allows the signal to be easily expanded without loosing sync.

The sweep oscillator in the triggered scopes is calibrated in various time bases which along with the extremely fine linearity inherent with the particular sweep circuits, makes it possible to obtain frequency and time measurements along the horizontal axis such as may be desired in relation to pulse rates, duration, rise and fall times; capacitor charge and discharge times; a.g.c. time constants; relay-contact timing; etc. Digital- and many TV-circuit displays also are best observed on a triggered-sweep scope.

Although not unique to a triggered scope, the extended frequency range of these Heath scopes also make them more useful to the radio amateur over that provided by the run-of-the-mill general-purpose types limited to a response of a few hundred kHz or at best to 5 mHz as we shall subsequently see.

Model IO-103

The Model IO-103 is d.c.-coupled throughout; however, either a.c. or d.c. coupling is provided at the *input* to the vertical amplifier and is set up by a lever-type switch the center position of which grounds the input to

[1]The excellent inherent linearity is mainly due to the fact that the individual timing capacitors for the sweep oscillator are each used for a limited sweep range where the linearity of their discharge time is maximized.

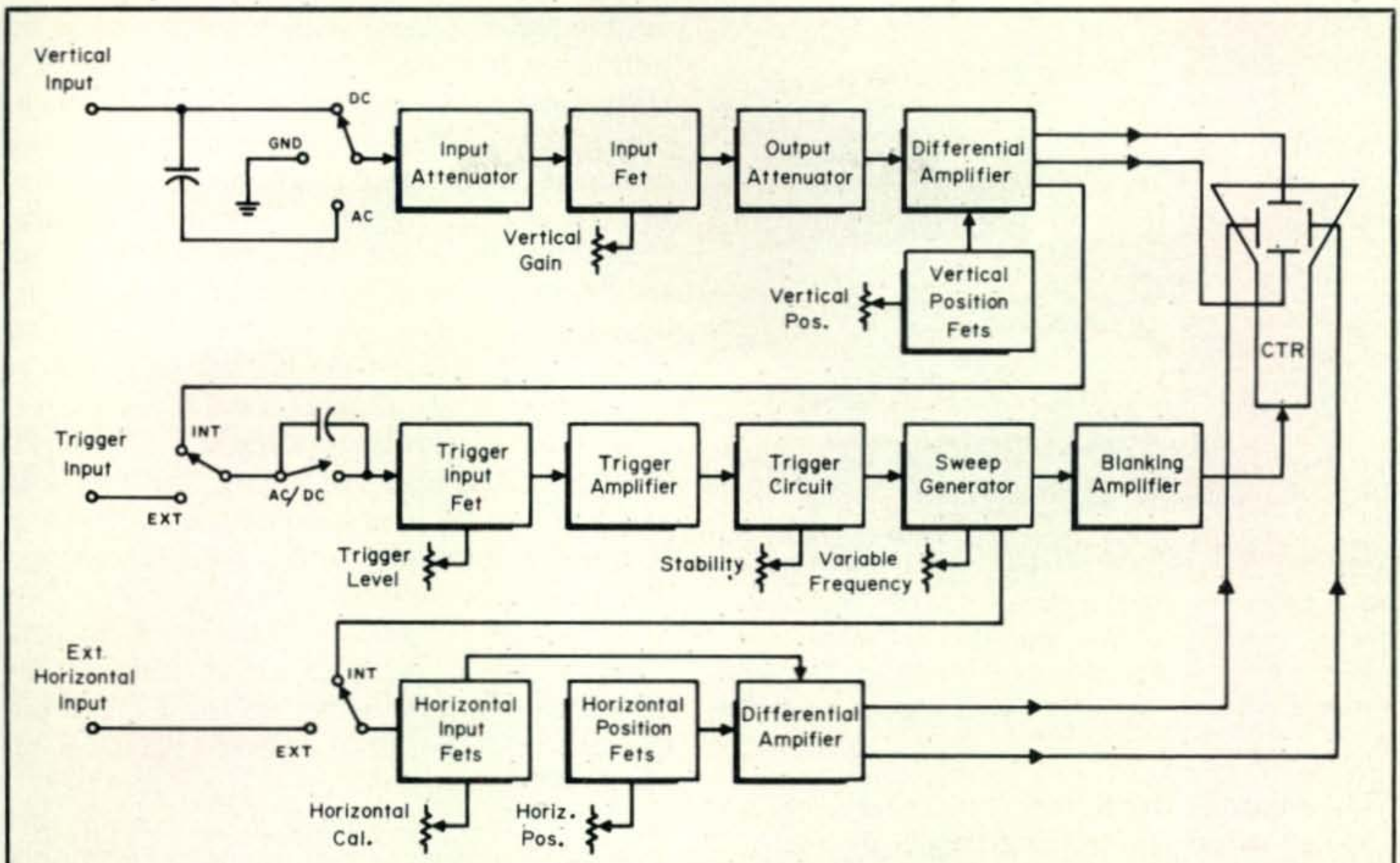


Fig. 1—Block diagram for the IO-103.

handily provide a zero reference without having to otherwise remove the input signal.

The vertical input frequency response is rated at d.c. -10 mHz ± 3 db with a 3 centimeter deflection, d.c. -8 mHz ±3 db with a 6 cm deflection. The sensitivity is .05 v./cm. Input impedance is 1 meg shunted by 30 mmf. Rise-time rating is less than 50 nanoseconds.

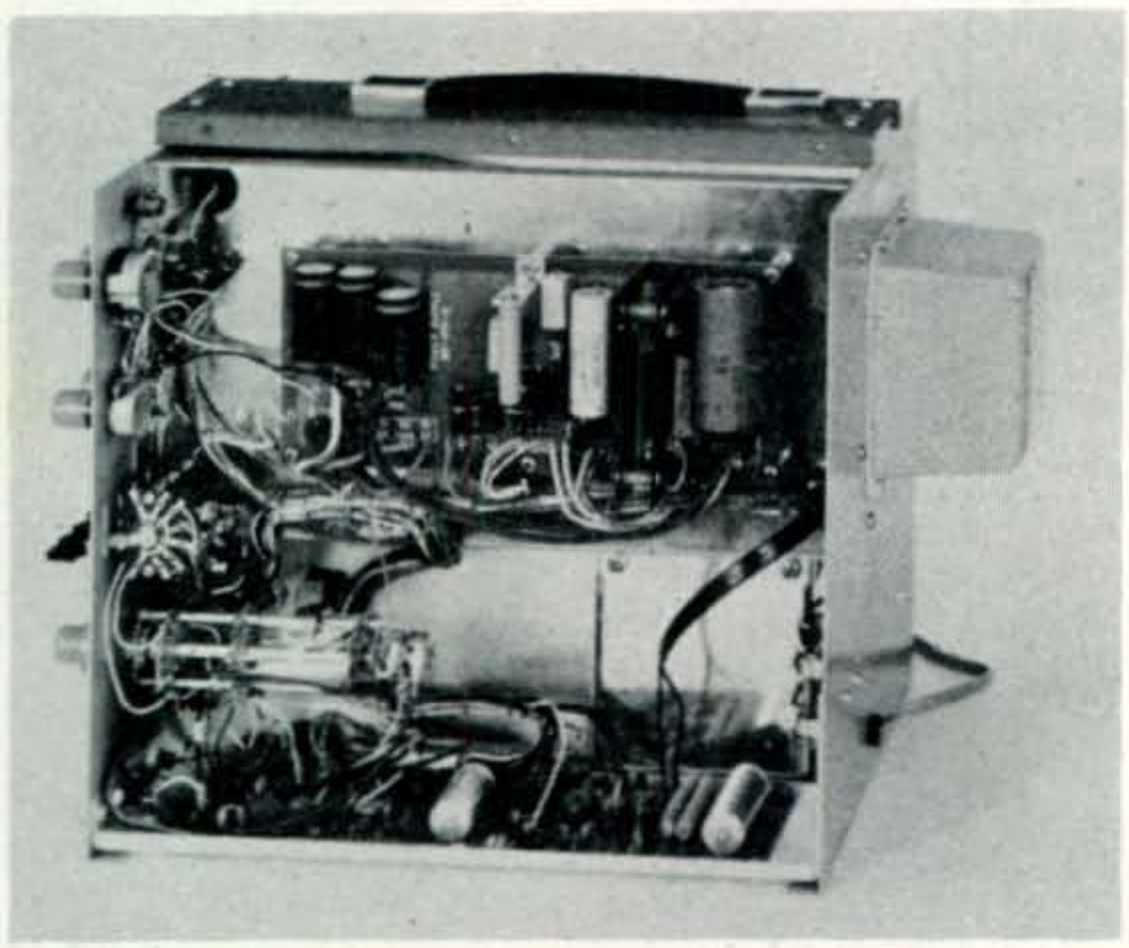
A vertical-input attenuator is employed for determining the absolute voltage values at any point of the signal as displayed on the c.r.t. It is calibrated in nine steps related to .05, .1, .2, .5, 1, 2, 5, 10 and 20 v./cm. The attenuator accuracy is rated at ±3%. The setup is especially helpful where complex waveforms are involved. A variable control provides gain adjustment between steps, but such use does not hold the calibration.

The viewing area is 6 × 10 cm (vertical × horizontal axis) on a rectangular edge-lit graticule with major calibration lines spaced 1 cm apart and minor calibrations at the 2 mm increment along the center axi. Vertical amplitudes of .01 to 120 volts may thus be determined. The graticule dimensions will accept a conventional camera mount.

The horizontal sweep has seven steps: .1, 1, 10, 100 microseconds and 1, 10, 100 milliseconds per centimeter, ±5%. Thus one complete cycle over the 10 cm horizontal axis can be seen of vertical-input frequencies of 1 mHz—1 Hz. On the other hand, operation of a ×2 magnifier switch stretches the sweep to halve the time for a 1 cm sweep. This makes it possible to observe 5 cycles over the 10 cm width for waveforms of signals up to 10 mHz. A concentric knob at the sweep selector permits the frequency to be varied between the calibrated rates, but the calibration holds only when this knob is set maximum clockwise. Internal retrace blanking is provided.

There are four lever-type switches that set up various triggering functions. These pro-

The Heathkit Model IO-105 solid-state/dual-trace triggered-sweep 15 mHz oscilloscope.



An interior view of the Model IO-103. The power-supply board is at the top. The horizontal-amp/sweep-oscillator board is at the bottom. The c.r.t. extends through the rear panel and is protected by a rigid plastic cover.

vide internal triggering (requiring a 1 cm vertical display), external triggering such as by TV sync pulses not related to the input signal (0.5 v. p-p required), automatic triggering at the input-signal zero-crossover point (±1/2 cm), normal triggering (with a.c. or d.c. coupling) adjustable for at a given point on the input-signal slope or at a preselected d.c. level. Positive- or negative-slope triggering also may be had. Since these functions may be foreign to the uninitiated, they are briefly explained in the manual.

The horizontal section of the scope also may be used for external signals. The sensitivity therewith is rated at .25 v./cm (ours measured .125 v./cm). A variable control is provided to reduce higher input levels down to as far as zero-deflection. The frequency response on this channel is d.c. — 500 kHz. Input impedance is 100K ohms.

A 1-volt peak-to-peak potential is available at a panel jack. There also are the usual controls for: vertical and horizontal positioning, intensity, focus and astigmatism.

The IO-103 employs one IC, 56 transistors (some of which are FET's and some used as diodes) and 36 diodes (16 of which are Zeners). A block diagram for the setup is shown at fig. 1.

The circuitry is mainly incorporated on four individual circuit boards. An input attenuator board includes an FET preamp protected against overload at its input through the use of two diode-functioning transistors. A vertical-amplifier board contains a three-stage differential amplifier that provides a double-ended output with a single-ended input. Two transistors thereat are used in a temperature-compensating network to maintain stable operation with changes in temperature. A horizontal-amplifier board also has the sweep, trigger and blanking circuits. Except for the input attenuator and preamp, the horizontal section is like the vertical one. The ×2 magnification is simply obtained by doubling the gain of the horizontal amplifier handled through a panel switch. A power-supply board furnishes a variety of operating potentials, many of which are regulated to ensure stable operation of the instrument. There are three different transistorized regulating setups included for this. 1340 volts accelerating potential for the c.r.t. is held constant by a string of zener diodes. The power supply may be set up for a line-input potential of 110-130 or 220-260 v.a.c. 50/60 Hz @ 35 watts drain.

The c.r.t. is a 5DEP1F with a green medium-persistence phosphor. It is a round-faced type, but the bezel with the graticule provides a rectangular viewing area.

The overall dimensions for the IO-103 are 12¾" × 9¼" × 16¼" (H.W.D.) and it weighs 26½ lbs.

As usual, the extensive use of circuit boards plus a wiring harness simplify assembly which in our case required 18 hours to get the whole job done including adjustments and calibration which require use of the 1 v. p-p source on the instrument plus a high-impedance voltmeter and a source for producihg 10 kHz sine waves and square waves of 1000 Hz and 100 kHz.

Model IO-105

The Model IO-105 incorporates the same basic features as found in the IO-103, in addition to which the dual-trace setup, the wider frequency response and a few other facilities make it a more sophisticated job.

Besides the advantages gained with the triggered sweep, the dual-trace feature makes it possible to simultaneously observe two individual signals with the display of either one positioned anywhere below or above the other or superimposed upon the other. Comparisons between the two signals may then be handily made in relation to phase shift, loss or gain, difference between input and output waveforms (indicating integration, distortion, etc.), flip-flop performance and other phenomena associated with digital circuits.

This is done using two vertical preamps, one for each channel, the outputs of which can be switched for a display of both channels alternately at the same time base with the sweep triggered by each signal or for a chopped mode at a 50 kHz rate using the same time base. Each channel also may be displayed individually without the other.

Channel-2 preamp also may be switched over to the horizontal section of the scope which along with the use of Channel 1 for the vertical deflection provides separate calibrated inputs for both the X and Y axi. Phase shift between channels is less than ±5% to 50 kHz.

The sensitivity and calibrated steps for any of the vertical modes (with a.c. or d.c. coupling) is the same as that given for the IO-103. The frequency response is d.c. -15 mHz ±3 db with 4 cm deflection. Input impedance is 1 meg shunted by 35 mmf and the rise time is rated at 24 nanoseconds.

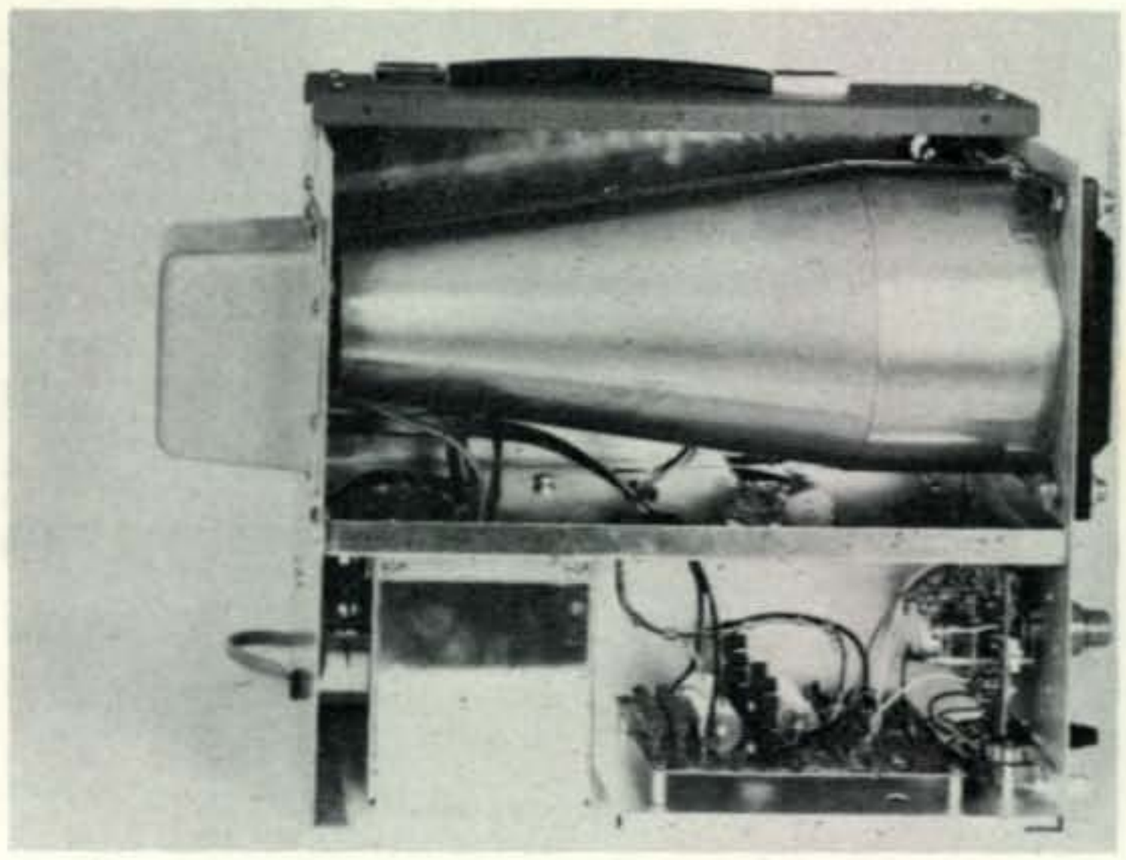
Using the X-Y mode with the Ch. 2 preamp, the horizontal frequency response is d.c. −100 kHz ±3 db. This mode is particularly useful for trapezoid or Lissajous patterns for studying modulation characteristics, frequency and phase with the application of separate signals to the Ch. 1 and 2 inputs.

A separate horizontal-deflection input also is available without the Ch. 2 preamp for which the sensitivity is 0.75 v./cm (uncalibrated and not variable) with a minimum input impedance of 100K ohms.

The horizontal sweep is set up for 18 calibrated rates in a 1, 2, 5 sequence from 100 ms/cm to 0.2 μs/cm ±3% and includes the customary variable control for uncalibrated rates between steps. A ×5 magnifier is available to conveniently stretch the sweep for closer examination of waveforms. This provides up to a maximum sweep rate of .04 μs/cm.

In addition to the various triggering modes, triggering by the power-line frequency also may be had. A panel switch provides triggering by the Ch. 1 signal alone, the CH. 2 signal alone, or by CH. 1 and 2. Internal or external (TTL-compatible) blanking may be set up with a rear-apron switch where a gating output pulse of 3.5 v. also may be obtained from the sweep circuits.

The two preamps are identical d.c.-coupled differential types with overload protection at their input. A control at each amplifier is used for positioning its trace vertically on the



Another view of the Model IO-103. The attenuator and the vertical-amp boards are at the lower part. The c.r.t. and power transformer are magnetically shielded.

c.r.t. The amplifiers are balanced against each other for equal output between them for a given input. The differential signals from each amplifier are coupled to bridge-type diode circuits that function as switches to enable the amplifiers to be used for the modes previously described.

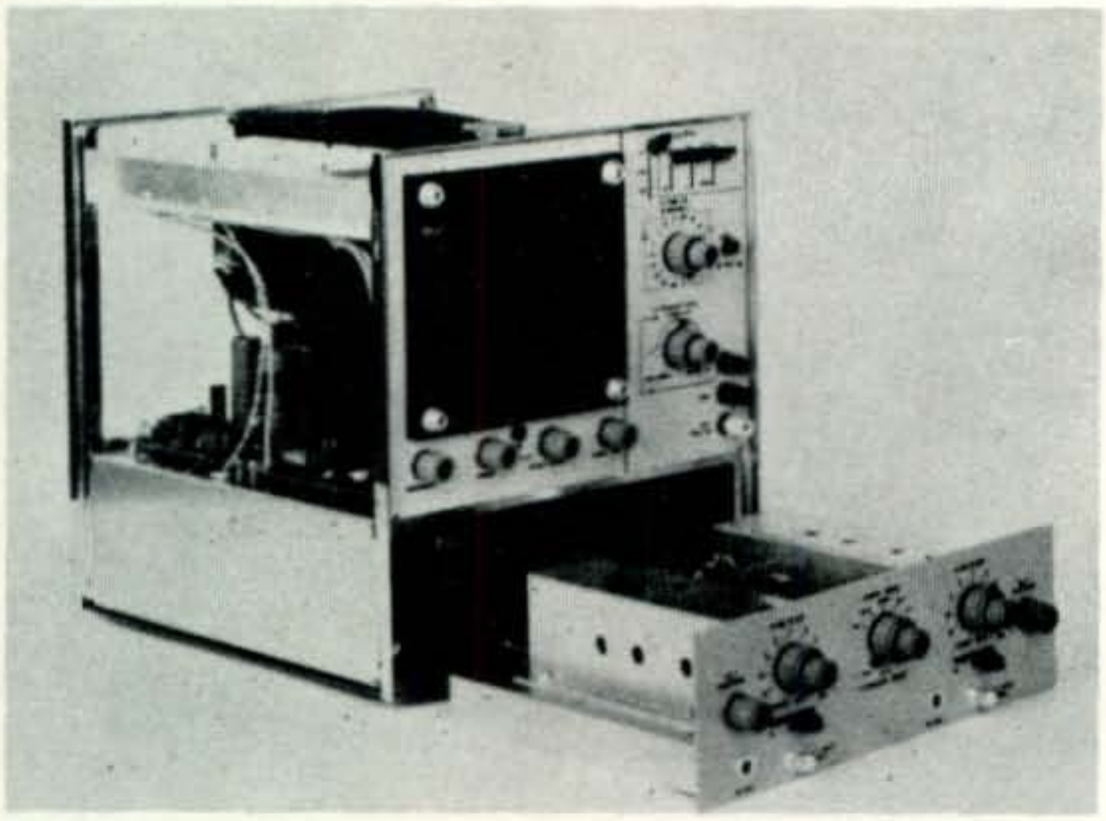
The switches are gated by d.c. potentials controlled by two transistors one of which is cut off while the other conducts and vice versa. These are controlled by an IC used as a J-K flip flop which is placed in one state or the other during use of each channel individually or for the X-Y mode; for functioning at a 50 kHz rate derived from a 100 kHz crystal-controlled multivibrator for the chopped mode or is placed in changing states which switch each related channel during every other horizontal sweep for the alternate mode of operation.

A portion of the output from each amplifier, as the need requires, is engaged to trigger the sweep.

The preamps are assembled on individual circuit boards which along with the switching-control setup for the various modes on a third board, plus an input attenuator for each channel, are installed on a drawer-like chassis that slides into the front of the scope.

The vertical deflection amplifier also is a differential type with its input switched between the outputs of the preamps according to the desired mode of operation. The horizontal-deflection amplifier is similar, except for a ×5 and X-Y gain internal adjustment and a horizontal-positioning control.

These amplifiers as well as the blanking,



View of the IO-105 showing how it is constructed. The preamp chassis in the foreground slides into the opening at the front of the instrument.

trigger, and saw-tooth sweep oscillator are on other circuit boards on the main chassis. The power-supply board has two transistorized voltage regulators and a number of zener-regulated output voltages.

The c.r.t. is a D14-107GA with an 8 × 10 cm rectangular flat face for which the graticule is accordingly calibrated. A rotation control varies the current through a coil around the tube to change the magnetic field about it and thus making it electronically possible to align the trace exactly with the graticule stripes. Bowing at the top and bottom of the c.r.t. screen is corrected by a geometry control that changes the potential applied to a shield within the tube.

Except for the circuit boards, assembly of the IO-105 is quite involved. A number of interconnecting leads and several harnesses are engaged to which many connections must be made in relatively hard-to-reach places or requiring meticulous care in performing the job. Adjustment and calibration require the use of a v.t.v.m. and internal-potential or signal sources from the scope itself. Alignment also may be made in conjunction with a sine/square wave generator. It took us 33 hours to get the IO-105 together and aligned.

The size of this model is 12⅜" × 10⅝" × 15" (H.W.D.) and it weighs 28 lbs. Power requirements are 105-125 or 210-250 v.a.c., 50/60 Hz, 60 watts.

Performance

Both scopes performed according to specifications. Excellent stability, good brilliance and fine waveform definition were experienced. In addition, the IO-103 performed well up to 15 mHz as long as the maximum vertical deflection above the 10 mHz, 3 cm, rated limit was held to within 2 cm, making it useful for observing modulated r.f. envelopes or monitoring on the 160-20 meter amateur bands. This is simply set up by coupling the vertical input to the transmission line through a gimmick-type capacitance of 1 mmf or so. You don't have to go to a scope with special r.f.-input facilities. Similarly, the IO-105 functioned above the 15 mHz 4 cm limit up through 21 mHz with a 2 cm deflection,[2] providing usefulness on an additional amateur band.

The wide frequency response and the sensitivity of these scopes also make them useful for signal tracing in receivers and transmitters for localizing malfunction of the equipment.

These attributes plus the versatility and advantages of the triggered-sweep, calibrated time bases and input-signal levels for other r.f. and a.f. applications in the amateur's shack, the lab or the classroom make these scopes well worth the additional cost and assembly time required over those otherwise employed. One thing is certain—once you've used a triggered-sweep scope, you won't want to go back to a recurrent-sweep type.

The IO-103 is priced at $229.95 (kit). The IO-105 is $399.95 (kit). A wired version of the IO-105, the Model EU-70A is available under the Heath-Schlumberger name for $595.00. These products are available from the Heath Company, Benton Harbor, Michigan 49022. —*W2AEF*

[2]The scopes will respond to higher frequencies with less sensitivity, but at a sacrifice in linearity. Above the frequencies and the deflection limits given above modulated r.f. envelopes will be distorted.

Results of the 1971 CQ World Wide DX (Phone) Contest start on page 52.

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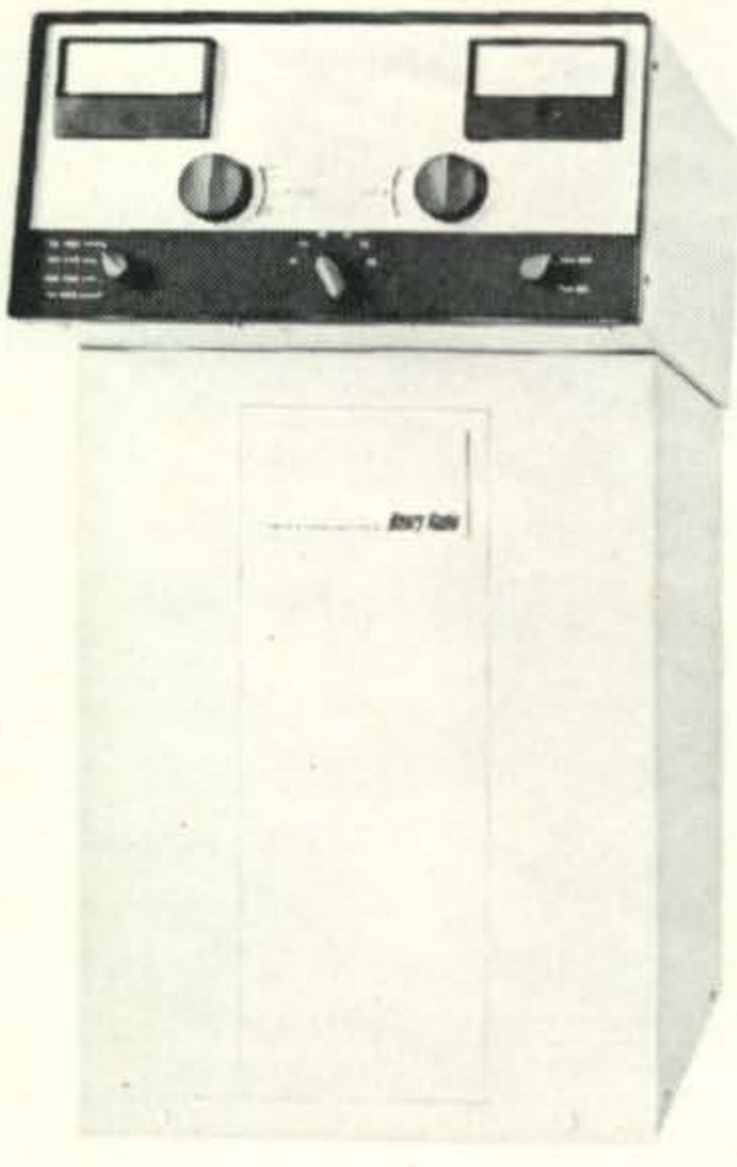

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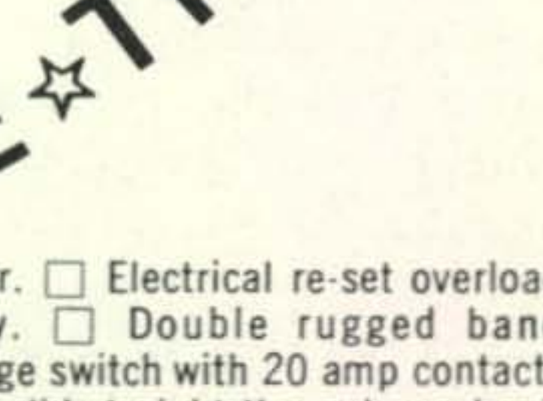

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Adjusting and Cleaning of Speed Keys (Bugs)

BY AL D'ONOFRIO,* W2PRO

You suspect that your speed key (bug) isn't working the way it should—the dots are too light and mushy sounding and the "feel" is too heavy. To find out what's wrong, you've checked for bug adjustments in the popular handbooks and, to your understandable chagrin, you've come up with practically nothing you can use. In truth, little information is readily available on how to adjust a bug—as though every ham must "certainly" know about such things.

To help fill the information void, I've put together a successful procedure that will go a long way toward keeping that bug working properly. In the main, the procedure stems from first-hand experience; the rest, from other seasoned c.w. operators who take pride in keeping their bugs in tip-top shape.

By far the most important item in this whole business is knowing how to adjust your speed key for proper dots; once you have done this properly, all the other adjustments are relatively minor ones.

Now you would at first think that any adjustment of the dots would be a simple once-and-forever procedure, like that of adjusting the i.f.'s in a receiver. Unfortunately, it isn't quite that simple; if it were, the manufacturer would have permanently adjusted the dots for you. There's no one magic adjustment, simply because no two operators are exactly alike. Each operator must discover the key adjustment that is the right "feel" for him alone.

But take heart: certain successful middle-of-the-road guidelines do exist that will put you in the right area. Using these guidelines, you will eventually hit upon the "right" combination of adjustments. But take all this with a pinch of salt: there is no permanent "right" combination for you; it's continually changing, just as your handwriting continually changes as a reflection of your attitude at the time.

For locating the adjustment points, refer to a representative speed key shown in fig. 1. Although nomenclature will vary from one manufacturer to the next, the function of the adjustments are basically the same.

As an important initial adjustment—one that sets the stage for all the rest—adjust both the left and right trunnion screws so that the vibrator arm (pendulum) lies perfectly *straight* and butts *lightly* against the damper wheel. This adjustment establishes your normal "hands off" position of the key.

Depending upon the type of key you have, slide the one or two speed weights on the vibrator arm to the end (slowest) position; tighten the weights, making sure that the screws don't touch the damper wheel.

In the adjustment steps that follow, a certain amount of trial-and-error interplay exists —with one adjustment affecting another. Take your time and get these adjustments right.

Hold the thumb paddle in the steady dot position and adjust the left trunnion screw so that the vibrator dot can move to the left about 1/64 of an inch. Use a small-scale ruler to gauge the distance. Tighten the left trunnion screw.

Hold the paddle for steady dots and allow the vibrator arm to stop vibrating. Now adjust the dot contact screw (on the dot post)

*1537 Cetral Park Ave., Yonkers, New York 10710.

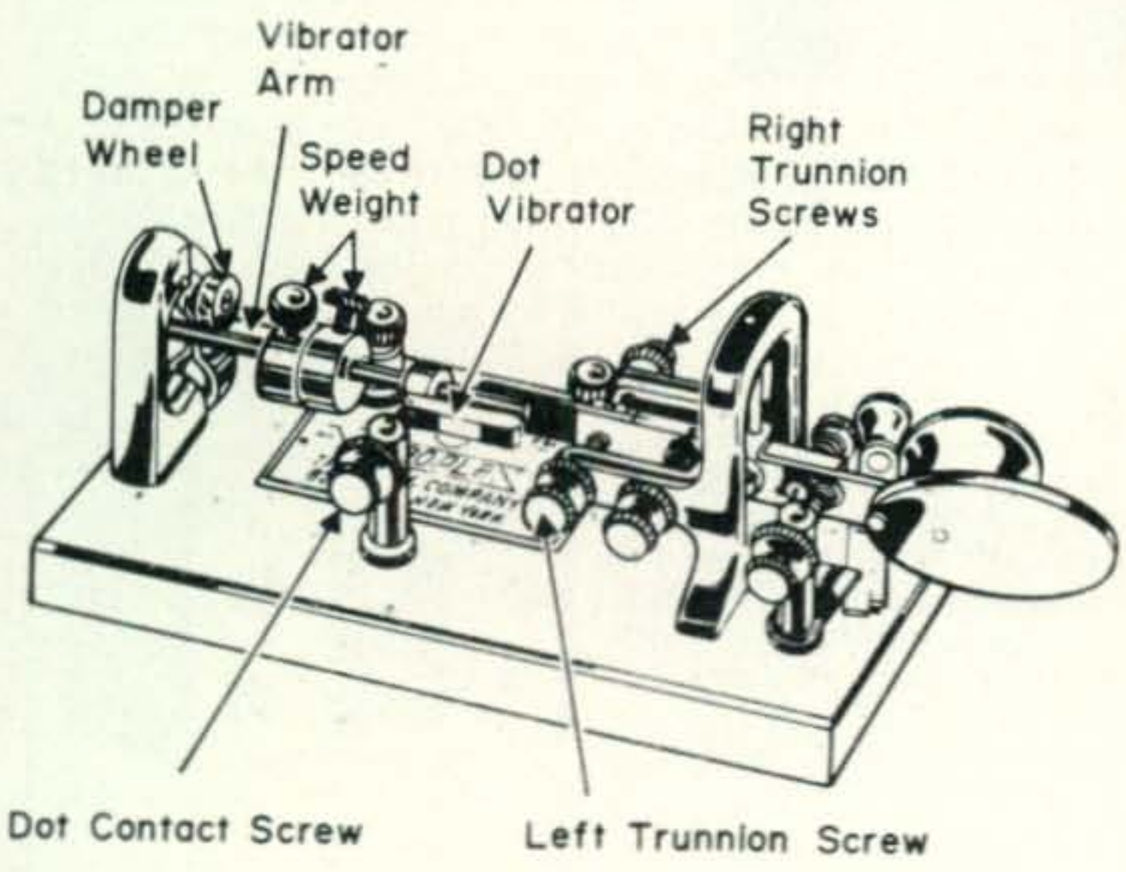

Fig. 1—Speed key adjustment points.

so that the contact just makes firm connection with the vibrator dot. In this position, you'll hear a steady c.w. tone. Tighten the contact screw; release the paddle.

To test the dot adjustment, hold the paddle for a string of dots. Check that you can detect at least 40 dots for each individual hold of the paddle. You can count the 40 easily if you think of them as 10-dot clusters tied together with each tap of your foot.

Reposition the dot contact screw (on the dot post) to get the required 40 dots or more. When the vibrator arm stops vibrating, the vibrator dot should come to rest lightly touching the contact screw.

Let's highlight all that again: a lateral swing of about 1/64 of an inch; a string of about 40 dots for each separate dot movement; a steady tone of "contact" after the vibrator arm has stopped vibrating with the paddle being held in the dot position. Recheck that when the vibrator arm settles in its normal "hands off" position, the vibrator arm is lightly pressing against the damper wheel, and that the vibrator arm does not have any noticeable bend to it.

If you have a two speed weight key and you want to speed up the dot speed, slide the innermost weight toward the paddle end; always keep the outermost weight at the end of the vibrator arm, regulating the dot speed with the innermost weight.

For adjusting the dashes, position the dash contact for a lateral movement of about 1/64 to 1/32 of an inch. Many hams set both their dot and dash distances using the thickness of a hefty business card—about 0.010 of an inch. It's a matter of personal preference. But as a general rule, the smaller the distance, the easier and better the "feel" of the key.

Adjustment of spring tensions is also a matter of personal preference. Many hams use about 20 to 40 percent of the spring tension available. The lighter the spring tension, the easier the "feel."

From time to time, examine the condition of the silver contacts; check that they are reasonably clean and bright. For polishing the contacts, here's a fast and good way: wedge a piece of clean bond paper between the two mating silver contacts, close the contacts firmly, and pull the paper through several

[*Continued on page 92*]

Two Methods of Testing Unknown Zener Diodes

BY BRUCE A. RAHN,* WB9ANQ

OVER the past several years the cost of producing semi-conductor devices has dropped rapidly, flooding the market with manufacturers' overruns and seconds at an ultra low cost to the experimenter. It is a common thing to see ads in magazines offering 100 bargain transistors for a dollar, or a mixed grab of untested diodes and zeners for only two dollars. Most of these components are untested and unmarked and the experimenter must find a way of testing them.

Transistors may be tested as to type by using a v.o.m. or v.t.v.m. or the more expensive transistor testor, diodes too may be tested by these means. But what about those zeners? It's a different story in this case. A v.t.v.m. or v.o.m. will show only if the device is open or shorted and will tell little else. Unless you experiment with them in circuits, it is impossble to identify the zener diode's breakdown voltage at which zener action takes place. Shown in fig. 1 is an accurate method of finding this zener breakdown voltage.

All that is needed for this first simple device is a v.o.m. or a v.t.v.m., two 1/2 watt resistors, and a high voltage, low current supply near 250 volts d.c. If a variable power supply is on hand which can supply a voltage from 0-250 volts, it can be used in place of the fixed supply and the 250K ohm pot. The 250K pot is used as a voltage divider and the 270K resistor serves the function of a current limiter. The diode is placed into the circuit as shown noting the polarity with the cathode to the postive side. The voltage is adjusted upward until the meter shows no further increase in voltage. This voltage is the zener breakdown voltage of the device under test. If the meter reads zero, the zener is shorted and if it reads the supply voltage, the zener is open.

While this method gives an approximate indication of zener breakdown voltage, it is slow and takes a fair amount of time. The circuit in fig. 2 gives more accurate results and is a much faster way of checking zeners. All that is needed is an audio sine wave generator and a good oscilloscope. The generator should be capable of putting out a voltage on the order of 60 volts peak-to-peak and the scope should have a screen calibrated in either volts/cm or volts/inch. The procedure is quite simple. The zener may be hooked into the circuit as shown, and the signal generator set at 100 Hz. The generator output is increased until breakdown occurs as illustrated in figure three. V_z is the zener breakdown voltage and is read from the horizontal calibration graduations. The current flow of the circuit may be read off the vertical axis since the voltage is displayed and may be changed to current by ohm's law since it is the voltage drop across the 1K ohm resistor. The forward biased characteristics of the zener are like a regular diode and are shown on the right side of the vertical axis. Thus it is also possible to determine diode characteristics using this same circuit. If the device is shorted, the trace will coincide with the vertical axis and if it is open, the trace will lie on the horizontal axis.

So here you have two easy, simple methods of testing your junk box zeners and diodes. Good luck and have fun. ■

*1511 East Main St., Little Chute, Wisc. 54140

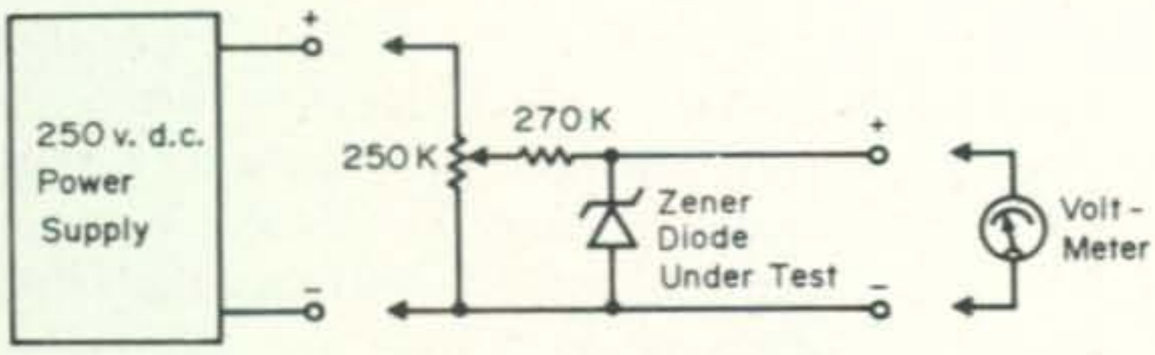

Fig. 1—Simple method for determining the approximate zener point of unknown zener diodes. The meter may be any v.o.m. or v.t.v.m.

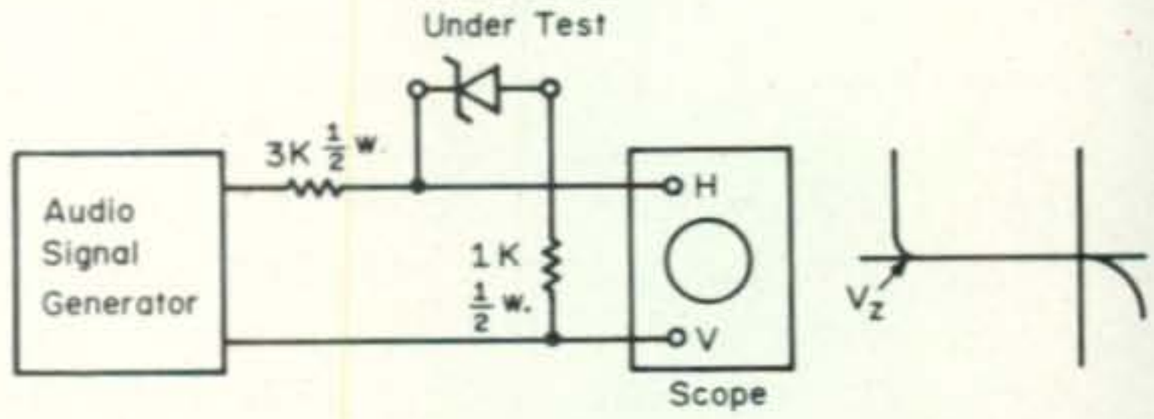

Fig. 2—A more graphic and useful determination of zener diode characteristics may be made using an audio signal generator capable of about 60 v. peak-to-peak output, and any inexpensive scope. A typical zener diode curve is shown at the right.

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GENERAL:

- **Front Panel Size:** 6½" x 2½"
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- **Power Supply:** 12 VDC System, negative ground
- **Current Drain:** Receive .09 amps Transmit: High 5.0 amps, Low 1.7 amps
- **Frequency Range:** 144 to 148 MHz
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- **Weight:** 5-lbs. (approx.)

RECEIVE:

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F. M.

BY GLEN E. ZOOK,* K9STH/5

THE rising popularity of portable f.m. units has brought forth a new breed of flying amateurs, namely those operating from commercial airliners. Numerous comments have appeared about the benefits of having the antenna 25,000 or so feet above ground. Also, much has been written about the pilots and airlines which have refused to let amateurs operate while flying. When this happens, the pilot takes the brunt of the wrath of the refused f.m'er. At the request of several amateurs who are both active f.m. operators and commercial pilots, the FAA regulations covering the operation of equipment on board the aircraft is printed herein. Although no attempt will be made herein to explain the legal ins and outs, I will say that after conferring with a ham type attorney, I personally will not operate while a passenger on a commercial flight.

FAA Part 91 (Revised 11-10-69)

91.19 Portable Electronic Devices:

(a) Except as provided in paragraph (b) of this section, no person may operate, nor may any operator or pilot in command of an aircraft allow the operation of, any portable electronic device on any of the following U.S. registered civil aircraft:
  (1) Aircraft operated by an air carrier or commercial operator; or
  (2) Any other aircraft while it is operated under IFR.

(b) Paragraph (a) of this section does not apply to:
  (1) Portable voice recorders;
  (2) Hearing aids;
  (3) Heart pacemakers;
  (4) Electric shavers; or
  (5) Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used.

(c) In the case of an aircraft operated by an air carrier or commercial operator, the determination required by paragraph (b) (5) of this section shall be made by the air carrier or commercial operator of the aircraft on which the particular device is to be used. In the case of other aircraft, the determination may be made by the pilot in command or other operator of the aircraft.

*410 Lawndale Drive, Richardson, Texas 75080.

W1AW Code Practice

Although code practice seems a most remote subject for the FM COLUMN, it none-the-less, is significant to all amateur radio operators. W1AW is the primary source of code practice material broadcast to the amateur radio fraternity. These practice sessions are used by potential amateurs as well as by those amateurs trying to upgrade their present license. Although many f.m. operators do not operate c.w. on the lower bands, a significant number can and do operate c.w. Anyone who has tried to copy code practice from W1AW in the past few years is quite aware of the deliberate jamming of these transmissions. I just hope that no f.m'ers are a part of attempts to cover W1AW. Take a good look at *QST* for the frequencies used for code practice and try to stay away from them during the periods of operation. Better still, take time and do a little practicing.

Technical Talk

One of the toughest parts of this column is keeping a good flow of technical material and construction projects. The last several "Technical Talks" have dealed in generalities rather than with construction. This has been due to a search for construction projects worthy of the FM COLUMN. Fortunately several have been lined up for columns starting with September. However, this month's "Technical Talk" will again deal with things of a theoretical nature.

Being warm, antenna building weather, lets talk about antennae again. This time, however, we will take a look at how the placement of the antenna on the supporting structure will affect the pattern. This subject is not new to the f.m'er commercially involved with two-way communications. For example the Motorola pamphlet 68P81115A69 gives radiation patterns based on

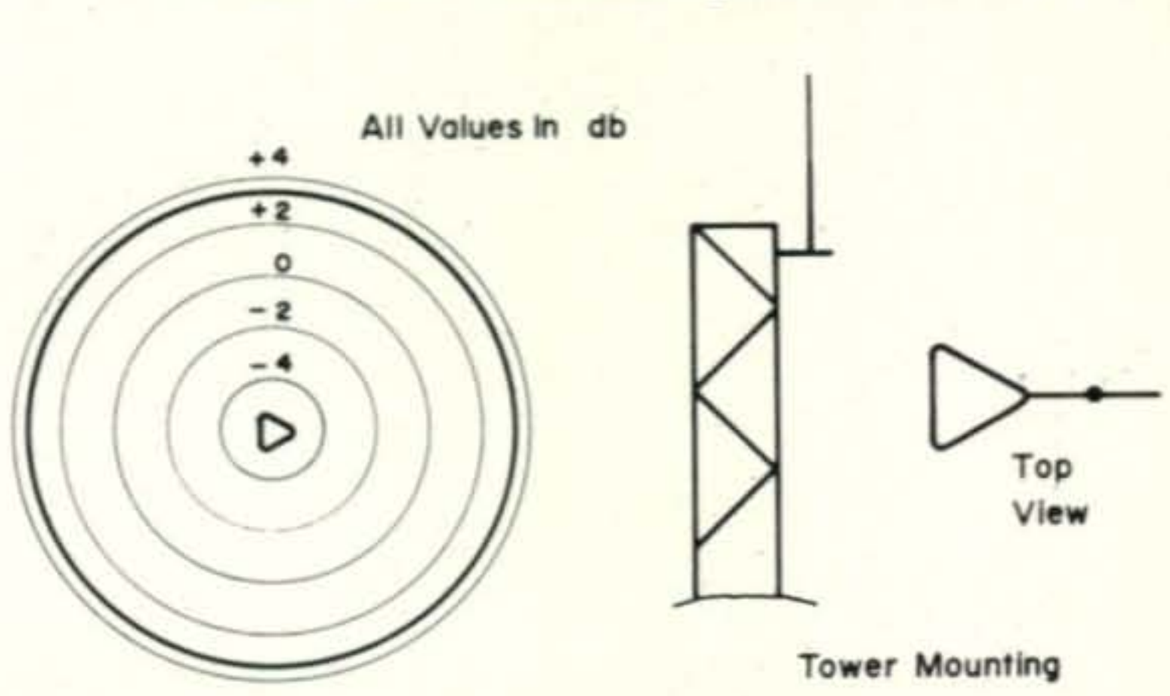

Fig. 1—Basic antenna pattern.

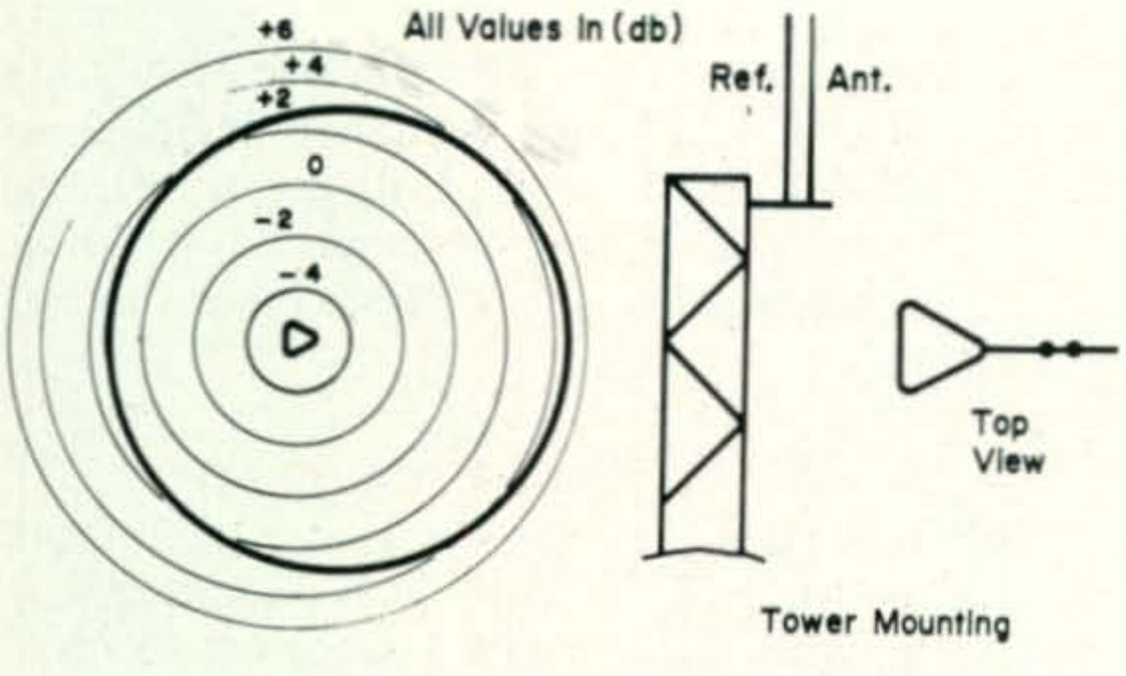

Fig. 2—The pattern with an added reflector.

the 5.75 db gain "Croppie Pole" type of antenna. The Motorola pamphlet shows how spacing the antenna certain distances from the tower and by using a reflector the effective gain can be increased in one or more directions. Also, the pattern can be modified to null out unwanted areas and to favor desired areas. This idea of selected coverage has been presented at least once in an article for amateur f.m. operations.[1]

Since the most popular 2 and 6 meter base antennae seem to have 3.0 to 3.75 db gain, the Motorola patterns have been interpolated to show approximate patterns with a basic antenna gain of 3.5 db. Of course things like other antenna on the tower, nearness of other objects, etc. could affect the pattern. However, if the f.m. vertical is relatively in the clear (except for the supporting structure) the patterns should resemble those in the diagrams. In the cases where a reflector is used, it should be about 5% longer than the antenna. Also, it should be spaced 0.25 wavelengths (about 20″ at two meters).

So, get out your rulers, tools, and climbing equipment, and lets use those modified patterns to best advantage.

News

One of the most active f.m. groups in civic affairs is the Miami Valley F.M. Association of Dayton, Ohio. This group participates in many drills, charity drives, athletic and sports events, and even model airplane contests (!) providing communications and other assistance. For example, the May bulletin of the MVFMA carries an excerpt from a letter from the National Foundation Walkathon, signed by Karen Edmundson:

"Once again I am faced with how to thank your organization properly for your generous and really outstanding help with the March of Dimes Walk on April 29th. There just aren't enough words to tell you how great you are. I have never met a finer group of people. I hope we can work together again, and thanks, thanks from the bottom of my heart."

This is the type of publicity amateur radio, and f.m. in particular needs.

Many bulletins make a plea for funds to help keep the repeater going. One of the most convincing was published in *CAREN'S WORLD* (Central Arkansas Radio Emergency Net, Inc.). Basically it says "How good would your two meter transceiver be without W5DI?" By the way, W5DI is the repeater call. Think about it. How good would your transceiver work without the local repeater?

Back on the public service side of the coin. The fellows on the West Coast have not been idle where service is concerned. For example, the Radio Amateur Mobile Society (RAMS) furnished communications for the Sacramento, Calif. Walk for Development on 8 April, then, on May 6, went over to Placerville to help out the El Dorado club.

In the Fresno area W6JPU and WB6HYL repeaters were used to assist the coordination of the United Cerebral Palsy Telethon on 11 and 12 March. About $6,000 was the results of the efforts of the f.m. operators and local CB operators!

The Grizzly Peak VHF Amateur Radio Club (WB6AAE) also was involved in assisting a March of Dimes March-A-Thon during the month of March in San Francisco.

Again, more good publicity for amateur operations. (Information from C.A.R.C. Relay).

DX

Karl, G5AGX, was again a visitor to this columnist's shack early in May. The news which Karl brought along is quite encouraging, for the foundation has been laid for repeaters in the United Kingdom. Karl; Chris Partridge, G8-AUU; and others have been hard at work for many months in getting repeaters in the U.K. The present arrangement is for repeaters to be licensed as beacon transmitters with the RSGB as primary licensee, with local beacon keepers (similar to our trustees). These repeaters will follow the German standards, probably by tone access, and relatively low-powered. Also, each repeater will undergo a probationary period with careful watching by the RSGB and the Min-Post-Tel (U.K.'s equivalent of FCC). The first re-

[1]Sessions; "The Two Meter Groundplane As A Gain Antenna"; *73* January, 1968; pp 18-19

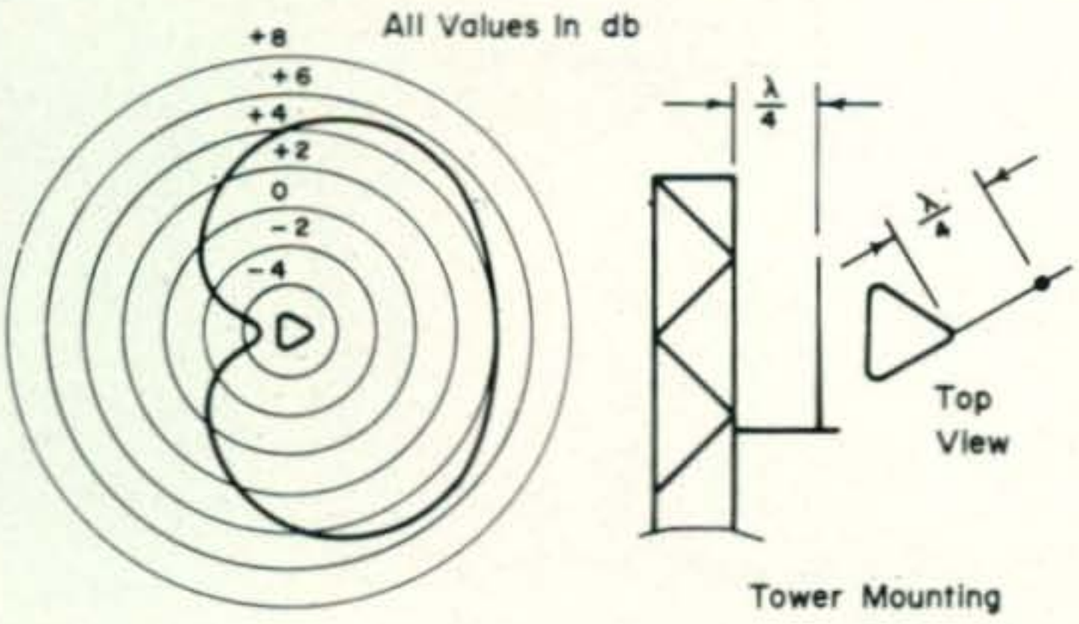

Fig. 3—The pattern with side mounted /4 spacing.

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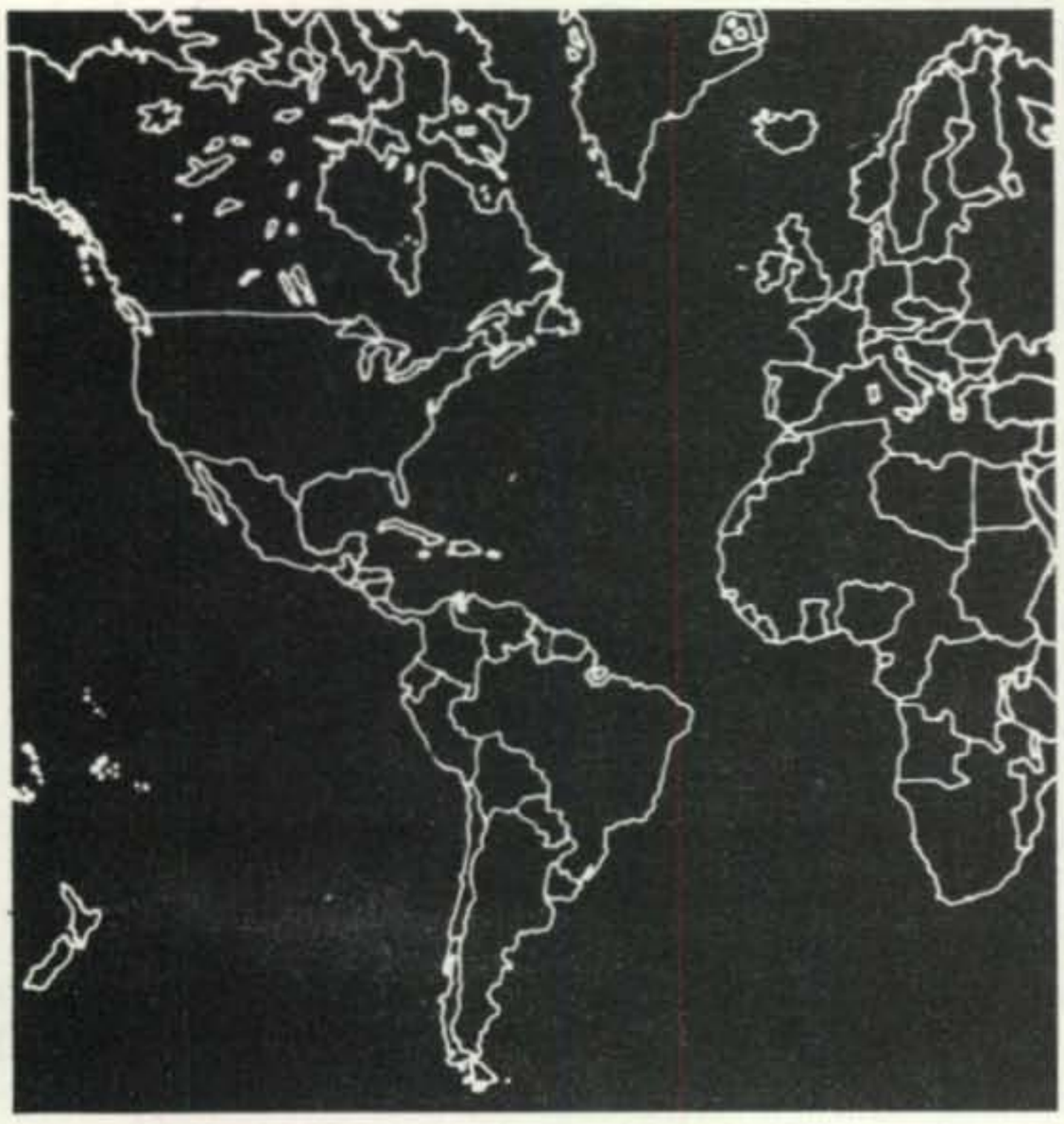

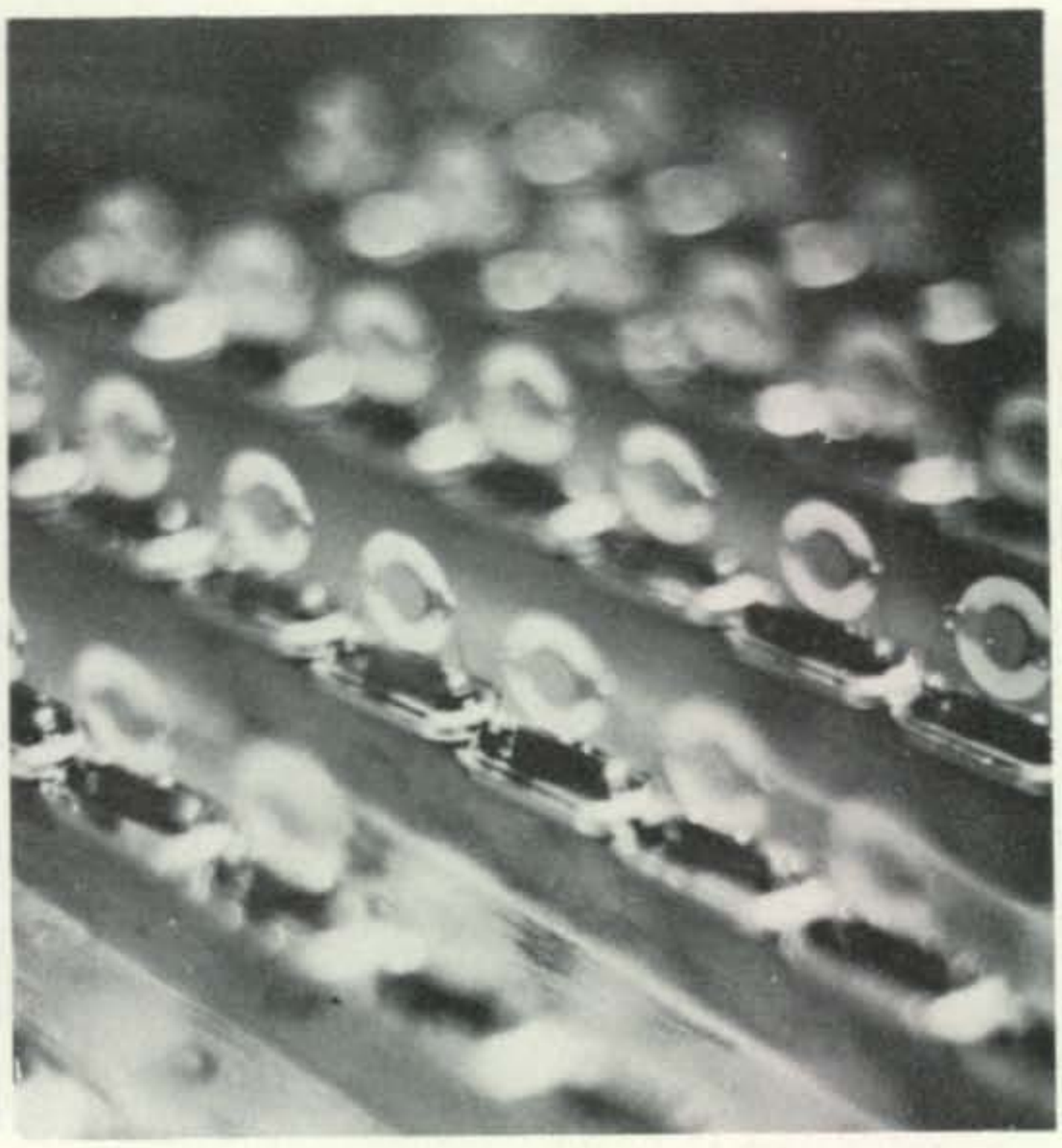

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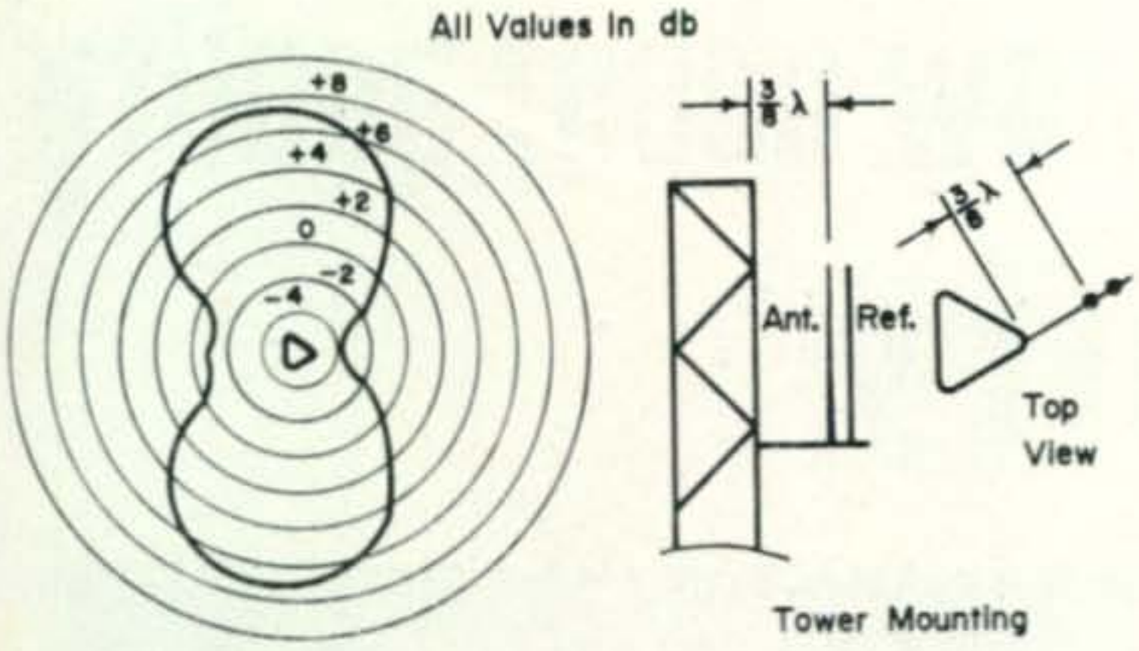

Fig. 4—The pattern with a side mounted antenna using a reflector.

peater will be built and operated by amateurs at the PYE factory. After the 6 month probationary period it will probably be moved to Royston, Hertsfordshire. Although some operation in the U.K. is ±15 kHz, deviation is now being pulled in to ±5 kHz and will probably end up at ±3 kHz (equivalent to our n.b.f.m. standards). Equipment is mostly Japanese imports with the Inoue IC2F, IC20, and IC21 being most common.

Q & A

Q. Must I use vertical antennae when talking to f.m. stations or can I use my present 2 meter a.m. beam?

A. It is always best for local contacts to use antenna polarization the same as the other station, for there is about a 20 db loss when cross polarization is used. However, many amateurs are having excellent results with low powered f.m. units and horizontal antennae, especially when working with a repeater. Since the "loudness" of an f.m. signal is dependent on the deviation rather than the absolute signal strength, if the signal is full quieting on the horizontal antenna it will also be with a vertical antenna. The receiver could care less about a higher powered signal if the signal is full quieting.

Q. Where can I obtain a "Touchtone"[2] pad to use on the local autopatch?

A. There are several sources for pads. Many clubs operating autopatches obtain pads at quantity prices and resell to members. Also, various suppliers who advertise in the amateur magazines sell pads. Take a look in the ads for the previous two or three months to locate a source. Finally, look in your telephone directory for a Graybar warehouse, for they stock or can order many telephone type parts and assemblies.

Q. I have seen several circuits for diode switching of crystals for multi-frequency operation. Does this really work?

A. It works, but much care must be taken in selecting the type of diodes to be used. Many low-priced, commonly available diodes such as the 1N34A, do not provide sufficient isolation, resulting in transmission or reception on two or more frequencies. A better method is to switch crystals (normally done either with relays in a trunk mounted unit or with switch in dash mounted units). Even better is to have separate oscillators as do most of the commercial f.m. units. Watch this column for an I.C. multiple frequency add-on circuit. However, if properly designed and built diode switching can be used.

Finale

Again we must close for another month. With the coming end of the vacation season news and other information will be picking up again. Let me know what circuits you are wanting to see in the column. Also, if you have a gadget or two which makes f.m'ing more fun or technically better, please send it along to help out others. Circuits in the process include a 30 to 40 watt output amplifier, I.C. multiple frequency deck, and some more test equipment. Also, next month's column will have another major repeater directory update. Have fun and happy f.m'ing. ■

[2]"Touchtone" is a registered trade-mark of the American Telephone & Telegraph Company

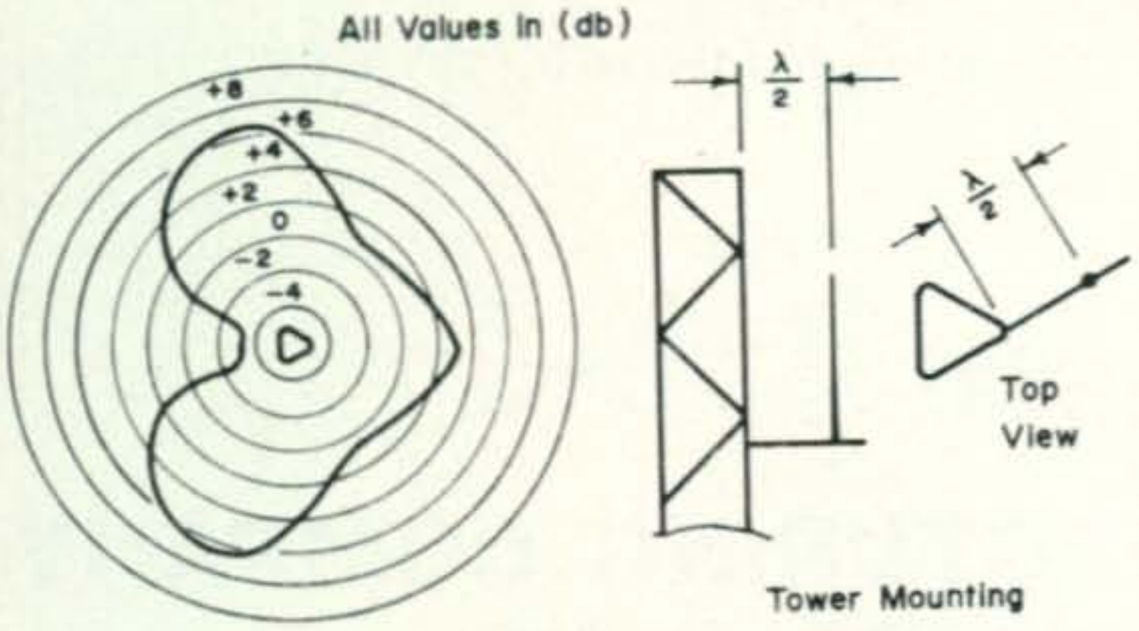

Fig. 5—The pattern with a side mounted antenna using /2 spacing.

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Toroid Characteristics

BY ELMER C. EASTON,* WA2JAR

MANY amateurs are experimenting with the commonly available surplus 88-millihenry toroids. Some may be making an error in assumptions regarding the inductance values which can be obtained from such coils.

The typical 88 mh toroid is composed of two separate, equal coils wound on a common core. If the two equal coils are connected in series-aiding the total inductance can be measured as 88 mh since the two series-connected coils are equal, and since the total inductance is 88 mh, the inductance of each separate coil may be assumed to be 44 mh. As everyone knows, when two coils are connected in series the total inductance is the sum of the separate inductances. Right? Wrong!

If the two coils on the toroids are connected in parallel-aiding the resulting inductance can be measured as 22 mh. From this one may conclude that the inductance of each separate coil is 44 mh. Two 44 mh coils in parallel give a total of 22 mh. Right? Wrong!

What is wrong with the above assumptions is that the two identical coils on the toroid are wound on the same core so that some of the flux from one coil will link the other. In other words, there is mutual inductance between the two coils. The simple formulas incorrectly used above apply only to coils which are so completely separated that none of the flux from one links the other.

The mutual inductances between two coils with separate inductances of L_1 and L_2 is $k\sqrt{L_1L_2}$ where k is the coefficient of coupling between the coils. If none of the flux from one coil links the other, then k is zero. If all of the flux from one links all of the turns of the other, then $k=1$.

The inductance of two coils connected in series-aiding is $L_s=L_1+L_2+2k\sqrt{L_1L_2}$. When $L_1=L_2$ as is the case in the toroid, $L_s=2L(1+k)$.

The inductance of two coils connected in parallel-aiding is $L_p=\dfrac{L_1L_2-k^2L_1L_2}{L_1+L_2-2k\sqrt{L_1L_2}}$

When $L_1=L_2$, $L_p=\dfrac{L(1+k)}{2}$

In the typical toroid $k=0.88$ and the inductance of one of the identical coils is $L=23.4$ mh, *not* 44 mh.

Thus, $L_s=2(23.4)\ (1+0.88)=88$

and $\quad L_p=\dfrac{23.4(1+0.88)}{2}=22$

So, experimenters, you can get 88 mh, or 22 mh, or 23.4 mh from one of those toroids, but not 44 mh.

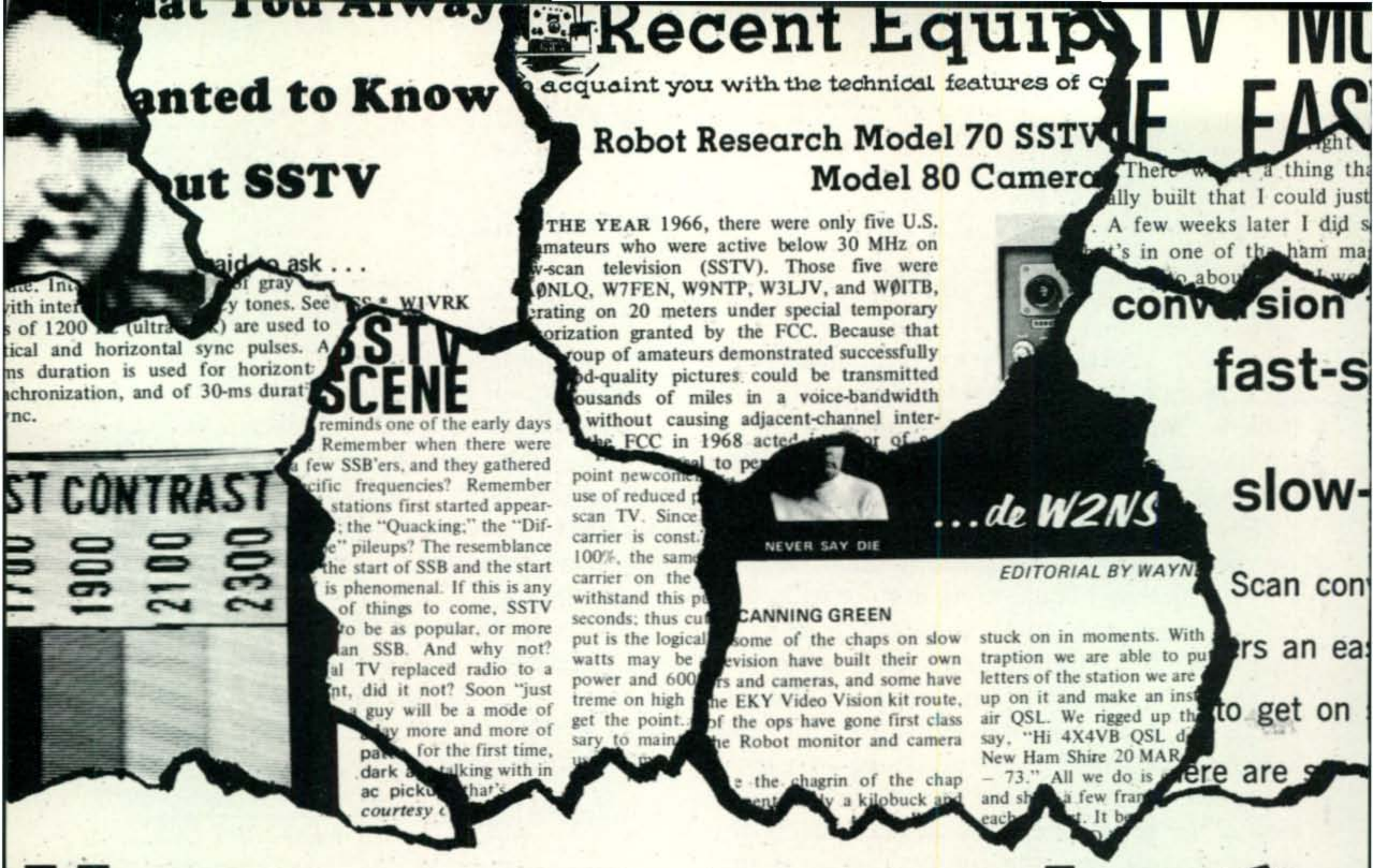
Incidentally the Q of the toroid with the coils connected in series-aiding is approximately 40 at a frequency of 1000 Hz. With the coils in parallel-aiding the Q is about 50. The d.c. resistance of each separate coil is 4 ohms. ■

* 4 Orchard Road, Piscataway, N.J. 08854.

Missing Certificate Winners

The following listing is our current collection of certificates that have been returned to us by various post offices the world over as undeliverable. If you recognize one or more as belonging to you or someone you know, please get in touch with us here at the CQ Editorial Office so that we may send them along.

1967 WW DX Phone Contest: SVØWP, YO3ZM, ZD8CC. 1967 WW DX CW Contest: HA2MM, KL7FRY, LZ2KRS, LZ2RF, ZD5M. 1967 WW Sideband (WPX): GM5ACE. 1968 WW DX Phone Contest: KR6KN, OM1ADP, VE2BV, VU2DKZ, 2D8Z, 6Y5CB, 8P6CV. 1968 WW DX CW Contest: DL4FB, all DM winners, JA1AEA, LZ1KPG, ZE9JN. 1969 WW DX Phone Contest: CT1WA, DJ4PT, EA2HW, EP2DA, FG7XX, GM5AME, HA7LF, I1NU, KA2RH, KA7CW, K8UDJ, OX5BL, PAØXPQ, TF2WLS, TF2WLW, ZF1CC. 1969 WW DX CW Contest: CR6GO, DLØKF, DM6AO, ~~K8UKJ~~, OX5BL, SK5AJ, ~~WØAIH~~. 1969 WW Sideband (WPX): OD2ABU, TA1MGP, VE7IG, WB8CDG. 1970 WW DX Phone Contest: HA6NA, HA7LF, HA9OU, VE8YE. 1970 WW DX CW Contest: FG7XF, G3NT, OH2FS, OH3MM, ON5GO, OZ1LO, PAØPN. 1970 160m Contest: W8VVE/8. 1970 WW Sideband (WPX): DL5QB, KR6RL, XW8DX.



Have you seen what's new in amateur radio?

Every major amateur radio magazine is now giving coverage to slow-scan television.

Every day finds more and more amateur radio operators converting to SSTV. There's been nothing like it since the advent of single sideband equipment. Operators report that Slow Scan Television has renewed their enthusiasm and fascination with amateur radio as much, or more, as when they first got their ham ticket.

Hundreds of SSTV operators provide almost continuous activity on the SSTV frequencies.

And these include many overseas stations, from the Netherlands to Italy, from South Africa to New Zealand. The Second Annual World Wide SSTV DX Contest was recently sponsored by CQ Elettronica (an Italian ham magazine). Tune to any of the SSTV frequencies, any time, and you'll hear for yourself how SSTV activity is literally exploding.

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Slow Scan TV

BY COPTHORNE MACDONALD,* WA2FLJ

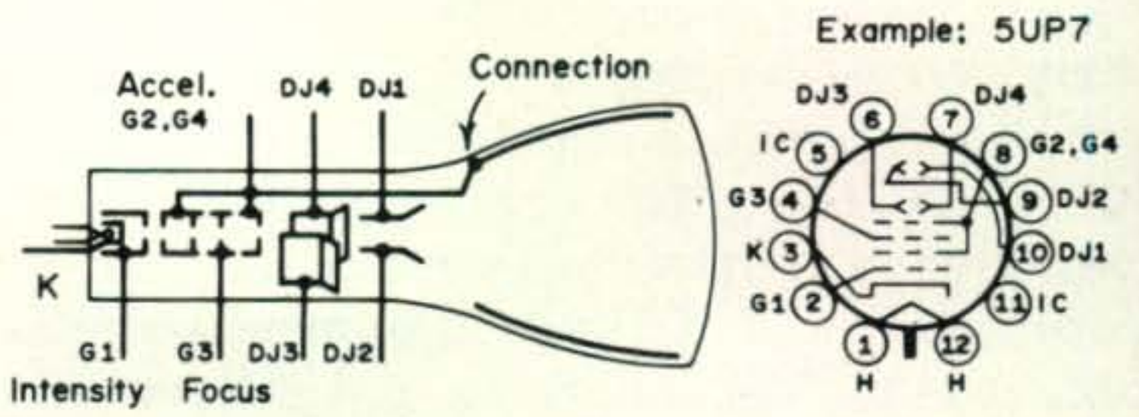
MANY areas of slow-scan technology are already familar to every ham. Most of the circuitry operates in the audio frequency range and the low voltage power supplies are conventional. To many hams; however, cathode ray tubes, d.c. coupled amplifiers, 8-second deflection circuits, yokes, and camera tubes are unfamilar enough to make slow-scan construction projects a bit scary. I plan to attack these mystery areas, one by one, until you feel as familiar with them as you do now with crystal oscillators, antennas, and final amplifiers.

Since each monitor or flying-spot scanner has as its heart a CRT, this seems a good starting point. CRT's come in two basic types: electrostatically deflected and magnetically deflected. In the electrostatic (E.S.) type the focussed beam of electrons from the "gun" of the tube is passed between two pairs of parallel metal plates (called deflection plates). One pair is oriented horizontally, the other vertically. If one plate of a pair is more positive than the other, the beam of negatively charged electrons will tend to be sent toward the positive plate and thus hit the screen in a different place. In a magnetically deflected tube, the electron beam passes between the coils of a "yoke" mounted on the outside of the tube neck. A current through one of the yoke windings generates a magnetic field through which the electron beam must pass. The beam is again bent—in this case at right angles to the direction of the magnetic field. Two sets of cails at right angles to each other in the yoke, permit independent horizontal and vertical deflection of the beam. Both types of CRT are capable of producing excellent pictures when properly utilized. The choice between them involves a comparison of several factors.

Electrostatic Vs. Magnetic CRT's

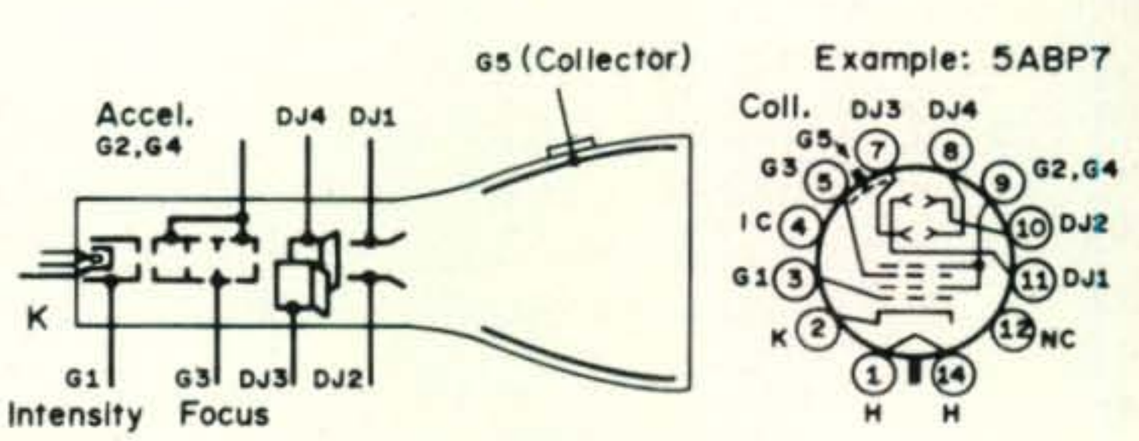
Availability is fundamental. Slow-scan monitors require CRT's with a long persistence phosphor such as the P7. A flying-spot scanner CRT must have a short persistence phosphor; P11, P16 and P24 are frequently used, though many other types will also give satisfactory results in scanners. Most large distributors carry some electrostatic tubes employing the phosphors of interest. Tubes such as the 5UP7, 3RP7A, 5ABP7 and 3WP11 are readily available. Distributors rarely carry magnetic tubes with any but P4 prosphors. Several manufacturers of magnetic tubes will make individual tubes with special phosphors to order; slow delivery and in some instances high cost being the negative factors here. The surplus market is variable these days. Magnetic tubes such as the 5FP7, 7BP7 and 12-DP7 can sometimes be found as well as electrostatic types, 5CP7 and 5ABP7.

The power supply for an electrostatic tube is normally the familiar 60 Hz transformer type using a tube or silicon rectifier, and oil



HEATER VOLTAGE	G1 CUTOFF VOLTAGE	G2, G4 VOLTAGE	G3 VOLTAGE	DJ1-DJ2 VOLT/INCH	DJ3-DJ4 VOLT/INCH
6.3	-90 MAX	2000	340/640	56/77	46/62

(A)



HEATER VOLTAGE	G1 CUTOFF VOLTAGE	G2,G4 VOLTAGE	G3 VOLTAGE	DJ1-DJ2 V./IN.	DJ3-DJ4 V./IN.	G5 VOLTAGE
6.3	-52/-87	2000	400/690	53/72	36/48	4000

(B)

Fig. 1—Electrostatic deflection cathode ray tubes. (A) Mono-accelerator type. (B) Post deflection acceleration type.

* P.O. Box 261, Forest Park Station, Springfield, Mass. 01108.

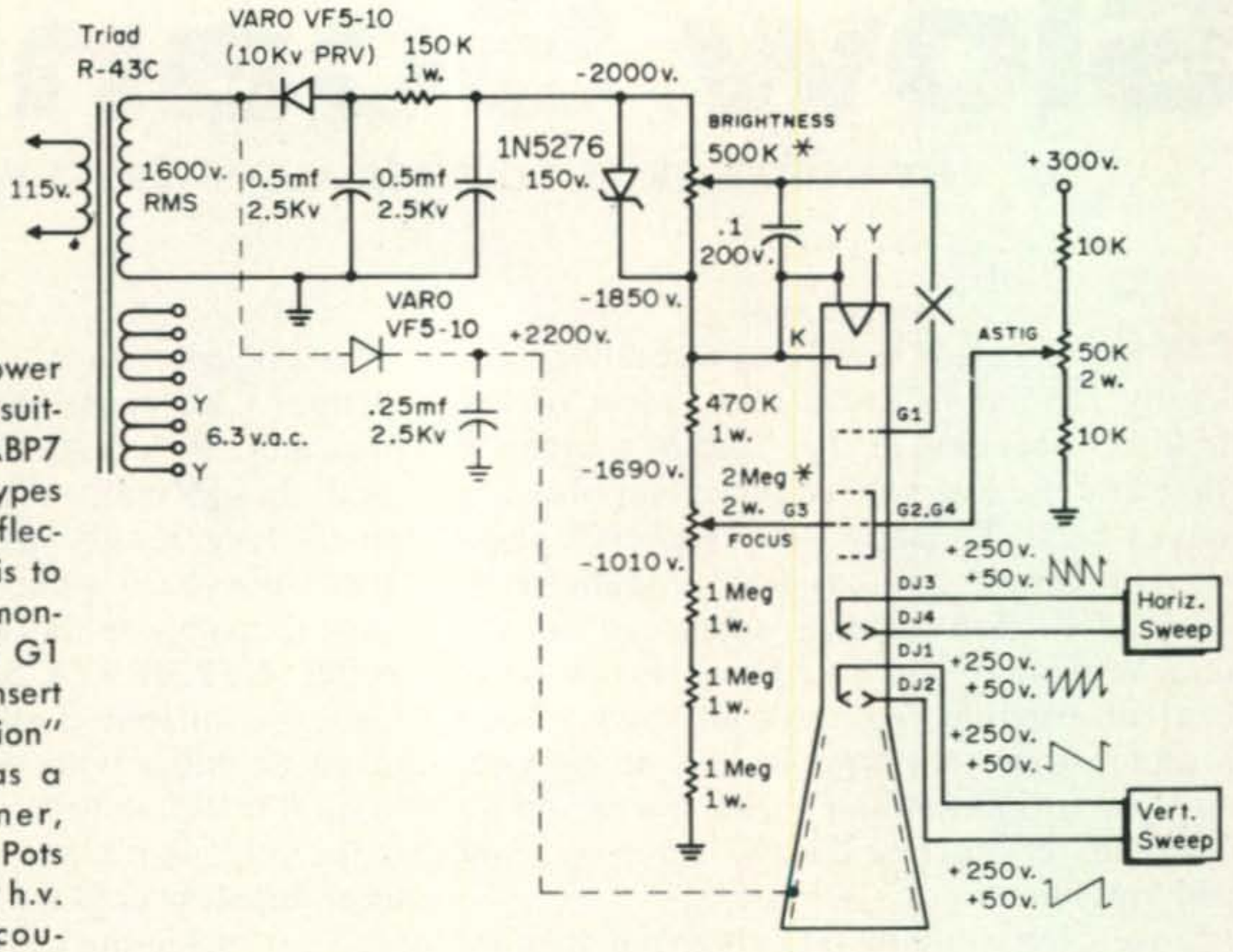


Fig. 2—Typical power supply and bleeder suitable for 5UP7, 5ABP7 and many other types of electrostatic deflection CRT's. If tube is to be used as SSTV monitor, break lead to G1 at point X and insert "floating modulation" circuitry. For use as a flying spot scanner, connect as shown. Pots marked * should be h.v. insulated shaft couplings (Millen 39023 or equivalent).

filled paper or mylar film capacitors for filtering. A typical electrostatic CRT power supply will deliver −1.5 to −3 kv at 1 or 2 ma. A magnetic tube will require +7 to +15 Kv at less than 100 μa. The size and insulation problems make 60 Hz supplies impractical at these voltages; and flyback or r.f. supplies are used. If you are converting an old TV set, the horizontal sweep/Hv section can be left intact and your problem is solved. Designing such a supply from scratch is quite a bit trickier than designing a 60 Hz supply, however.

Deflection of electrostatic tubes with transistors is quite practical if transistors having a *V*ceo of 300 v. or higher are used. Several low cost transistors, such as the Motorola MJE-340 are available, and will do a fine job. If a high impedance yoke is available, magnetic deflection is simple too, since the deflection current required will be low. Unfortunately, the yokes mass manufactured for TV use, while inexpensive, tend to be low Z and thus require high current. In conventional TV the current is sometimes supplied from a transformer winding or some other a.c. coupling scheme. With an 8-second sawtooth, direct coupling is essential, and almost so at 15 Hz. In an a.c. coupled system peak deflection current can be much higher than the average current drawn from the power supply. With d.c. coupling the peak currents must be supplied directly by the power supply; thus the importance of a high Z yoke.

Screen brightness is appreciably higher with magnetic deflection, for two reasons. First, brightness is a function of screen power —the product of the overall accelerating voltage times the beam current. Both screen current and voltage are normally higher in magnetic tubes. Second, modern magnetic tube phosphor screens are aluminized on the electron gun side. Much of the light from the phosphor that is normally lost inside the tube is reflected by the aluminum coating and appears as increased brightness to the viewer. (Early magnetic tubes such as the 5FP7 are not aluminized). Higher brightness would seem to be a strong argument for magnetic tubes since the low brightness of the afterglow is a definite problem. Unfortunately, the P7 phosphor acts in very non-linear ways. Although the brightness at the instant of scan increases considerably with increased power to the screen, the afterglow brightness does

not go up proportionately. The P7 data in the RCA Tube Handbook gives an example where an 11 times increase in power to the screen resulted in a 34 times brightness increase during scan, but only a little over 2 to 1 increase in afterglow brightness after 8 seconds. The reduced ratio of "afterglow" to "bright line" brightness actually makes viewing subjectively worse. When ambient light is eliminated by darkening the room or using a viewing hood, acceleration potentials as low as 1.5 Kv are quite adequate. Even with 20 Kv, a relatively low ambient light level will wash out the afterglow. With high voltage there is also increased danger of burning the screen. P7 is quite forgiving in this regard, but sweep failure with 10 Kv on the screen and the beam current up could produce a permanent burn in a hurry.

External magnetic fields from power transformers, etc., affect unshielded electrostatic tubes more than unshielded magnetic tubes. This is due primarily to the fact that in a tube with high accelerating voltage the electrons take less time to reach the screen and are under the influence of the unwanted field for less time. Short tubes are less influenced than long tubes for the same reason. On the other hand, magnetic shields are perhaps more readily available for electrostatic tubes; James Millen and JAN Hardware list shields for most of the popular E.S. varieties in their catalogs.

Video drive is easier to feed to a magnetic tube than an electrostatic one. This is because the grid and cathode of a magnetic tube are normally operated somewhere near ground potential, while the cathode of the E.S. type is normally operated at a minus 1.5 to 3.0 kv.

Resolution (focus or spot size) is adequate to meet the 120 line resolution requirements with any properly operated magnetic tube and most electrostatic types. (Some older 3" tubes such as the 3JP7 and 3FP7 don't quite make it. Newer 3" tubes such as the 3RP7A are fine.) Corner focus is normally better in magnetic tubes. They are also somewhat easier to set up since E.S. tubes have really two focus controls ("focus" and "astigmatism").

Screen size was at one time a "horsepower race" in conventional TV, with people wanting larger and larger screens. Now there is a trend back to smaller screens. There is an optimum size screen for every viewing distance and resolution level. If the screen is larger than optimum for our viewing distance we find the line structure objectionable and subjectively feel that the picture is "fuzzy." Bell Labs in some of their early picture-phone work felt that the optimum screen size for a low resolution display was that in which the

[*continued on page 95*]

Fig. 3—"Selective fading" type multipath propagation causing cancellation of the transmitted frequency as the forehead was scanned.

1971 CQ WORLD WIDE DX CONTEST: PHONE RESULTS

BY FRANK ANZALONE,* W1WY

WE'VE had better ones but this last one (Oct. 1971) wasn't so bad. W3ASK had predicted fair to good conditions during the contest week-end, even though the solar cycle was expected to be at its lowest level since 1965. For this reason George had expected scores would be below the record-breaking figures of the past few years. He was right (as usual) on the first count but not on the scores. You will find many new records when the all-time list comes out in October.

Of course 10 was down considerably from previous years, with only brief openings to most areas, but activity on the other bands was still very good.

A total of 1451 logs indicates a modest increase of less than 2%, but it was gratifying to note that most of this was contributed by state-side stations. This in spite of the fact that the Generals are still restricted on all bands except 28 mHz, which is way below par now.

So far the picture looks rosy. Not so however for the following stations. WA3HGV on all bands, K6LOM on 14 mHz, and SM5BLA on 3.8 mHz. These entries have been disqualified because of multipliers that could not be justified in a process of cross-checking of logs and written reports from claimed stations.

TOP U.S.A. SCORES

Single Operator

All Band	**W2PV**	**1,355,360**
28 mHz	W6QJW	124,020
21 mHz	K1VTM	296,331
14 mHz	W20NV	420,831
7 mHz	W3PHL	86,814
3.8 mHz	W4CRW	23,184
1.8 mHz	K1PBW	60

Multi-Operator

Single Trans.	WB2SQN	2,591,784
Multi Trans.	W7RM	6,682,620

It's a pity that each year we have to put in countless hours checking these questionable logs, time that could be better spent on matters that would be more useful to the hundreds of other contestants with clean entries.

The Committee is strongly considering making the penalty of disqualification more severe.

There were not as many Contest Expedition stations as we had last year. But there was quite a varied selection and it was the unanimous choice of the Committee and Stu Meyer, its donor, that the W2GHK Trophy should go to Walter Skudlarek, DJ6QT, for putting rare TZ2AV on the air. Rare? We think so. When was the last time you worked Mali? If you haven't already received a card for this one, try the DOTM.

Walter did not have an easy time of it. His first stop on his two week safari up the west coast of Africa was Mali. He was still negotiating for his license on Saturday morning the first day of the contest. The hotel at which he had planned on staying was fully occupied, and the only other available spot with 220 was a motel with low buildings and

*Chairman, *CQ* Contest Committee.

The KL7AIZ Multi group. Jerry, KL7HDW showing Jack, KL7HIV and the rest of the boys, Tim, WBØFJH, Rich, WB2WGX and Doug, W7ABX how log should be kept. Ron, WA7NWE was not around to receive instructions, so he can be blamed for all logging errors.

PLAQUE AND TROPHY WINNERS

Single Operator, Single Band

World—North Jersey DX Association. Dr. Harold Megibow, K2HLB Memorial. Won by Herb Schoenbohm, KV4FZ (14 mHz)
Canada—Gene Krehibiel, VE6TP Trophy. Won by Alex Desmeules, VE2AFC (21 mHz)
Carib./C.A.—Gus Huether, HR2GK Trophy. Won by John Alday, KP4DKX (21 mHz)
So. America—Brazil DXers Trophy. Won by Hipacio Marra, PY4AP (14 mHz)

Single Operator, All Band

World—Bill Leonard, W2SKE Trophy. Won by J. Scott Redd, 6D1AA (XE1IIJ)
U.S.A.—Potomac Valley R.C. Trophy. Won by James Lawson, W2PV.
Canada—Jack Baldwin, VE3BS Trophy. Won by Yuri Blanarovich, VE3BMV.
Europe—W4BVV Operators' Trophy. Won by George Cangas, EA4LH.
Carib./C.A.—Harold Fox, W3AA Plaque. Won by Dieter Spieth, YN3AAA.
Africa—Gordon Marshall, W6RR Plaque. Won by Bob Furzer, 7Q7CY (ZE1CY)
Asia—Japan CQ Magazine Trophy. Won by Vitaly Davydov, UW9WR.
Oceania—Northern Calif. DX Club Trophy. Won by Michael E. Bazley, VK6HD.

Multi-operator, Single Transmitter

World—John Knight, W6YY Trophy. Won by Station UK9ABA. (Oprs. UA9ACN, UA-9AN, UA9BB, UA9BE, UV9AK, UW9AF, UW9BC, UW9BY)
Canada—Calgary A. R. A. Trophy. Won by Station VE1DH. (Oprs. VE1ACU, VE1ANB, VE1ASJ, VE1DH)

Multi-operator, Multi Transmitter

World—Radio Club Venezolano Trophy. Won by Station 4M1A. (Oprs. YV1BI, YV-1IV, YV1LA, YV10B, YV1PP, YV1QF, YV1SA, YV1TP, YV1WH, YV1WY, YV5BTS)

Contest Expedition

World—Stuart Meyer, W2GHK Trophy. Won by Walter Skudlarek, TZ2AC (DJ6QT)

Special CQ Plaque

Oceania—All Band Champion. Station KH6-RS, operated by Philip Goetz, W6DQX.
DXpedition—Station CE6CA/Ø, operated by CE6BB, CE6EF, CE6HM.

high surrounding trees. Both tubes of his linear were broken in shipment, so he was stuck with low power and a vertical only 15 feet above ground.

Because of all these difficulties Walter wished he had planned his trip differently. I'm sure the Trophy will make him forget his disappointment.

We also think the special trip to Easter Island by CE6BB, CE6EF and CE6HM should be given special consideration. Therefore *CQ* is making a special award for the CE6CA/Ø operation.

Bob Furzer, ZE1CY made a trip up to Malawi and was issued a license just for the contest period. That 3rd world high score earned him the W6RR African award.

3AØFN (WA4WME and F6BBJ) had to travel for 21 hours to cover the 700 miles from Germany to put Monaco in the contest and hopes that their efforts are appreciated. They sure are Van; we also understand that getting a signal out of Monaco presents quite a problem, too.

And that KH6HCM/KH6 operation was not from Kuri as had been expected but portable from a favored spot in Hawaii. The boys had to call off the trip because of lack of transportation. Many took it for granted and took credit for Kuri. Scratch one multiplier.

That high score on 75 by VE3MR/4X was a planned operation to break the world record on that band.

With an 18HT HyTower atop a sixteen story hotel on a cliff overlooking the Mediterranean and all those 3 pointers to the West, how could he miss?

His signal into Europe was so potent that

This looks like a leisure week-end for the fellows who operated W2LEJ/2. Dick, W2LEJ is trying to show the boys that he did all the operating, but Bill, W2SKE and Ron, W2SUC don't seem to be impressed.

Single Operator - All Band

Station	QSO's						Zones						Countries					
	1.8	3.8	7	14	21	28	1.8	3.8	7	14	21	28	1.8	3.8	7	14	21	28
6D1AA		287	453	833	1107	1337		13	24	28	23	23		28	50	82	70	66
KH6RS	5	195	418	583	1607	849	2	14	19	31	25	18	2	16	21	57	46	33
7Q7CY		18	60	593	629	1147		7	18	32	27	25		13	32	116	74	87
VK6HD		39	154	585	1036	628		14	23	35	24	21		16	37	102	64	68
OB8V		123	203	539	612	935		15	20	31	24	23		24	40	56	57	56
XX6GA		10	83	719	516	892		5	15	26	24	23		10	26	87	58	52
UW9WR		186	233	640	580	134		10	20	38	24	17		40	58	108	69	52
UF6CR		100	244	512	604	232		6	14	30	23	19		26	48	89	75	52
EA4LH		217	260	593	749	290		13	14	28	32	18		46	44	68	70	45
CT1BH		95	118	383	471	520		10	15	25	27	26		41	45	61	52	59
Multi-Operator - Single Transmitter																		
UK9ABA		283	307	960	458	345		17	22	38	30	22		57	69	118	88	73
PJ1AA		179	296	932	1028	793		11	14	31	26	19		28	44	80	61	45
UK2BBB		508	264	1036	744	283		8	22	36	31	32		50	65	94	80	80
I4LCK		252	228	482	1369	311		9	20	32	31	25		43	58	88	74	51
4C1QB		270	543	766	1463	1086		12	17	29	26	16		23	32	81	63	22
WB2SQN	2	81	134	558	651	196	2	17	24	38	33	25	2	40	66	128	115	78
Multi-Operator - Multi-Transmitter																		
4M1A		611	659	2181	1814	1890		17	24	37	30	27		56	66	140	87	74
W7RM	30	325	511	1113	1718	364	5	24	33	37	34	26	4	51	72	133	109	60
4Z4HF	5	197	306	1374	983	1127	2	14	22	35	27	25	4	41	62	134	84	84
DKØWA	38	422	385	1427	1324	160	2	15	24	38	37	26	8	63	86	137	134	74
W3AU	16	178	304	998	1150	316	3	22	25	39	35	25	2	53	78	142	128	97
K6UA	8	133	468	971	1511	426	4	26	26	36	30	21	3	51	54	133	87	52

Band-by-band breakdown of top scores.

he was accused of being a "pirate." Incoming signals had to be cut down with an r.f. attenuator in the receiver line.

Martin is no newcomer to our contests, having competed in several from his home QTH, and has a collection of awards, including a *CQ* Trophy, to prove it.

After 12-odd years in the area of the Cooks and Samoa, Trev, 5W1AR has gone back home to New Zealand. However he has left a good replacement in Samoa, Phil, 5W1AU the other half of the multi team. It seems that Phil showed up at Trev's shack claiming TVI. Instead he got himself converted to ham radio and now is creating some TVI of his own.

The usual off-beat prefixes showed up, raising questions as to their location. Scott, 6D1AA thinks special calls are a trade-off. They attract attention but there is always the question of QTH. (In his case the Zone 6 I.D. should have cut that to a minimum.) Scott recopied his log before submitting it, all 4000 contacts by hand. Wow! That must have been a job. As I have said time and again, a carbon of the original would have beer. acceptable. An accurate and detailed Summary Sheet is the important item.

You will probably note that all three stations out of Ethiopia are listed in the Top Scores on 10, 15 and 20. The Kagnew boys usually participate as a multi group. Ron, F5QQ was shooting for world high on 14 mHz from ET3DS but Herb, KV4FoxZulu had the same idea. This was John's swan song from 9F3USA anl is now back stateside signing K3BSY.

Participation out of Canada is still disappointing and we wonder if awarding certificates by call areas is justified. Even with three Trophies to sweeten the pie there has been no improvement. Since the Trophies are donated by fellow Canadians we would expect the boys north of the border would show a little more interest.

The same can be said of Australia where practically every entry is a certificate winner. A little more competition from Down Under would make it more interesting for

[*Text continued on page 94*]

TOP SCORES

SINGLE OPERATOR ALL BAND

6D1AA	**3,541,714**	XX6GA	2,108,568
KH6RS	**3,041,924**	**UW9WR**	**2,077,540**
7Q7CY	**3,036,826**	UF6CR	1,793,872
VK6HD	**2,911,224**	**EA4LH**	**1,756,944**
OB8V	2,466,565	CT1BH	1,460,967

SINGLE OPERATOR SINGLE BAND

28 mHz

XX7IK	588,930	CR6II	278,460
9E3USA	442,000	OB4PE	204,952
4M4CDK	388,661	VK9XK	171,398

21 mHz

CX1JM	689,985	F2SI	412,707
CV9BT	533,239	DL6EN	367,416
9F3USA	455,400	KH6BZF	357,914

14 mHz

KV4FZ	**1,208,180**	ZE1CU	677,647
ET3DS	1,026,480	XX6IK	667,260
PY4AP	**1,012,506**	G3FXB	452,513

7 mHz

HR1RF	207,749	I1AIM	61,632
VK6CT	96,050	DL8DC	57,672
W3PHL	86,814	K6NA	47,092

3.8 mHz

VE3MR/4X	197,106	G3XVY	49,895
VE3ZZZ	83,997	CN8HD	44,200
HI8LC	56,903	W4CRW	23,184

1.8 mHz

GM3YCB	4,590	VE3BS	920
GM4ANR/p	3,204	DK2JX	639
DL1CF	1,2I46	GM3YOR	392

MULTI-OPERATOR SINGLE TRANSMITTER

UK9ABA	3,512,652	I4LCK	2,922,180
PJ1AA	3,407,987	4C1QB	2,855,295
UB2BBB	2,945,172	WB2SQN	2,591,784

MULTI-OPERATOR MULTI TRANSMITTER

4M1A	11,723,580	DKØWA	5,700,688
W7RM	6,682,620	W3AU	5,421,043
4Z4HF	6,106,290	K6AU	5,214,310

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

SINGLE OPERATOR NORTH AMERICA

United States

WA1JLD	**A**	**910,636**	**855**	**112**	**276**
W1FEG	"	653,490	700	98	220
WA1PID/1		447,840	574	86	202
W1ESN	"	261,685	360	83	180
G3XPM/W1		215,380	367	70	150
K1GUD	"	171,990	409	39	108
K1OME	"	75,696	188	62	104
W1IXL	"	57,340	172	43	79
WA1ANR	"	38,481	136	32	69
WA1HNI	"	31,030	116	39	68
W1PL	"	21,476	101	33	58
W1FLN	"	15,958	71	45	56
W1CNU	"	3,132	32	13	23
WA1HFN					
	28	**52,283**	**199**	**23**	**74**
K1VTM	**21**	**296,331**	**761**	**32**	**105**
K1HVV	"	146,556	427	29	89
WA1MCY	"	35,360	178	19	49
WA1MPP	"	28,656	146	19	53
WA3GHC/1		3,219	41	9	20
W1PLJ	"	1,633	26	10	13
W1OKA	**14**	**131,871**	**422**	**31**	**82**
W1HGA	"	7,248	54	14	34
K1ZND	**3.8**	**17,050**	**117**	**16**	**46**
W1MX	"	1,534	26	9	17
K1PBW	**1.8**	**60**	**18**	**3**	**2**
W2PV	**A**				
		1,355,360	**1144**	**116**	**314**
W2EHB	**A**	**288,405**	**408**	**73**	**188**
K2QIL	"	168,300	279	56	164
W2UI	"	135,552	263	63	129
WA2KTV	"	131,440	333	53	107
WA2LQZ	"	124,815	281	48	109
W2DT	"	108,360	227	53	119
WA2BAV	"	87,780	218	49	105
F2YS/W2					
	"	70,179	169	53	104
WA2RAZ	"	63,665	178	38	81
WB2AQC	"	53,732	164	47	86
K2DW	"	48,995	126	46	99
W2MB	"	38,794	110	39	81
K2CPR	"	34,979	115	53	80
WA2NDP	"	28,490	100	40	70
W2CKR	"	28,213	118	31	58
WA2BCK	"	25,990	90	47	68
W2ITG	"	23,005	88	45	62
WA2LOG	"	16,800	77	29	51
K2KGB	"	13,833	154	27	58
WB2JJN	"	9,180	55	25	43
K2JOC	"	8,710	50	24	43
WA2DNR	"	4,752	48	12	24
W2YT	**28**	**84,216**	**263**	**28**	**88**
W2DJI	"	31,590	134	24	66
WB2AIO	"	5,852	62	16	28
WB2VYA	**21**	**185,724**	**506**	**29**	**97**
W2NIN	**21**	**184,824**	**470**	**31**	**105**
WB2NXL	"	166,446	462	30	96
K2INP	"	105,316	322	27	86
WA2DZU	"	70,290	253	22	77
WA2AUB	"	37,315	155	23	62
WB2MQI	"	26,872	153	17	46
WA2RQH	"	26,432	152	16	43
W2EUQ	"	8,635	55	18	37
WB2KIQ	"	3,080	19	5	11
W2ONV	**14**	**420,831**	**849**	**39**	**132**
			(Opr.	W1GEY)	
WB2WJO	"	189,450	482	34	106
K3MBQ/2		22,149	115	18	51
W2KZN	"	352	12	9	7
WB2FJX	7	476	12	7	10
K2LWR	**3.8**	**21,204**	**111**	**23**	**53**
WA2EAH	"	2,652	33	10	24
WA2KWB/2		406	17	5	9
W3CRE	**A**	**873,000**	**808**	**115**	**273**
W3GPE	**A**	**746,845**	**660**	**111**	**296**
W3VT	**A**	**426,713**	**467**	**100**	**229**
W3YIK	"	313,920	403	90	198
W3GN	"	303,496	459	83	153
WA3NNA	"	302,768	428	75	179
W3KT	"	291,590	367	86	208
K3TGM	"	290,768	394	79	193
W3GRF	"	284,350	437	70	165
W3KMV	"	261,672	365	79	177
W3NZ	"	255,188	364	79	183
W3NX	"	209,328	299	90	177
W3DHM	"	176,841	259	69	164
K3AIG	"	146,025	290	54	123
W3BYX	"	139,438	287	51	122
W3MWC	"	105,364	225	67	124
W3AXW	"	86,751	193	73	116
K3JLI	"	86,335	207	57	98
W3MDJ	"	72,875	208	37	88
W3HVM	"	63,168	169	49	92
W3GHD	"	55,334	134	50	96
W3ZJ	"	42,570	135	52	77
K2QBW/3		40,296	119	53	85
W3YHR	"	33,384	119	38	69
WA3GZT	"	30,992	108	37	67
WA3AFQ	"	29,786	100	33	73
WA3QFN	"	26,583	180	43	84
W3DRD	"	25,122	89	41	65
W3EVW	"	21,630	87	43	60
W3SMX	"	18,912	115	39	57
K3KHL	"	12,740	61	30	40
W3CAA	"	5,762	45	13	30
W3MDO	"	1,920	23	15	20
K3NEX	"	1,737	37	13	24
W3VEQ	**28**	**70,512**	**253**	**26**	**78**
W3PZW	"	61,488	201	25	77
W3BRB	"	56,900	208	26	74
K3YVN	"	15,678	87	19	48
K3YUA	"	1,081	21	9	14
K3TUP	**21**	**82,740**	**272**	**30**	**75**

KA2USF is the club station of the Far East Auxiliary Radio League. That's Bill, KA2WB making the contacts and Dick, KA2RB logging 'em.

Mozambique was well represented in this year's contest, and that XX prefix had the boys guessing but made it more interesting. Aurelio, XX7IK took world honors on 28 mHz.

K3HZL	"	62,600	221	27	73
W3SDV	"	53,064	192	27	72
WA3NQJ	"	40,812	190	21	55
W3GRM	"	3,393	34	13	26
K6JVE/3		840	18	7	13
W3DBT	**14**	**121,600**	**307**	**35**	**106**
W3BWZ	"	113,847	294	36	101
K3ZOL	"	3,648	36	13	25
W3QLW	"	1,378	18	8	18
W3PHL	**7**	**86,814**	**276**	**29**	**88**
W3QOR	"	6,566	63	15	34
W9MIJ/4	**A**	**748,836**	**723**	**101**	**265**
WB4SJG	**A**	**503,400**	**616**	**88**	**212**
W4DUQ	**A**	**491,172**	**487**	**92**	**274**
K4APL	"	401,579	466	86	227
W4KFC	"	374,794	507	81	185
W4SYL	"	365,468	421	98	228
K4CEF	"	340,158	423	86	208
K4EZ	"	340,135	426	92	203
W4QAW	"	303,556	379	89	203
WA4YBV	"	275,236	386	79	189
W3ZBW/4		242,730	337	89	172
K4SHB	"	186,648	296	77	154
W4WRY	"	179,410	292	74	159
W4ZCB	"	173,952	323	57	135
W4TMR	"	168,514	302	77	141
K4OD	"	157,437	279	72	153
K4TIG	"	149,640	246	80	152
K4EKG	"	136,881	257	71	130
WA4MSU	"	127,656	220	74	142
WA4FFW	"	106,560	220	62	163
W4DRK	"	99,981	200	70	119
WB4QKE	"	94,668	244	36	102
W4YK	"	90,246	178	63	106
K4HHA	"	75,958	183	62	101
WB4NRI	"	74,676	198	55	92
W4OZF	"	70,760	187	53	92
W4KNW	"	45,694	131	50	84
WB4FEV	"	41,920	121	50	81
W4GTS	"	37,506	128	57	84
WB4TPI	"	34,675	133	37	58
WB4UYD	"	28,737	111	40	63
K4ORQ	"	23,193	85	39	60
W4FPW	"	22,196	124	67	112
W4DXI	"	19,572	86	30	54
W4OPM	"	18,809	71	34	65
WB4NVH	"	18,480	90	26	54
W4JVU	"	14,580	64	26	55
K4LDR	"	13,572	72	34	44
LU8AGT/W4		13,114	65	32	47
W4HOS	"	10,153	59	31	40
WA4ICB	"	8,453	72	26	53
W4OMW	"	8,442	56	28	39
W4IF	"	6,634	41	24	38
W4BFR	"	4,888	35	24	28
K4IIF	"	4,784	46	20	26
WB4RUA	"	3,663	39	15	22
W4GF	"	3,485	32	16	25
WB4RDV	"	2,128	28	18	20
K4GKD	"	2,116	29	15	20
W4BGH	"	1,890	27	15	20
K4OV	"	1,560	20	14	16
WB4VQO	"	960	15	11	13
W1WY/4	"	925	16	12	13
WB4OXD	"	611	19	7	13
K4PR	"	306	10	7	7
W4WSF	**28**	**98,210**	**304**	**25**	**90**
K4CYU	"	88,884	300	25	83
K4RLO	"	77,544	254	27	81
K4TTA	"	69,102	260	27	72
WB4SIJ	"	28,072	119	24	64
WB4VUP	"	18,612	108	21	45
W4WJJ	"	6,000	46	18	30
K4GXO	"	4,664	36	21	32
K4BMS	**21**	**168,073**	**445**	**28**	**103**
K4PUZ	"	153,402	500	27	84
W4ORT	"	145,125	409	30	95
K4WCC	"	118,910	372	28	87
			(Opr.	K4PQL)	
W4UPJ	"	118,560	372	27	87
K4AEH/4		3,685	67	17	38
WA4JQS	**14**	**12,415**	**75**	**22**	**43**
K4OEI	"	9,027	57	23	36
W4DM	"	4,902	40	14	29
K4EEK	"	400	10	10	10
W4UW	"	117	5	4	5
WB4UZT	**7**	**18,009**	**105**	**21**	**48**
WB4TPU	"	10,030	66	19	40
K4NFG	"	6,600	54	16	28
W4EZ	"	6,210	57	15	31
K5SNI/4		4,797	49	12	29
W4CWO	"	2,759	47	11	20
W4CRW	**3.8**	**23,184**	**153**	**22**	**47**
WA4LDM	"	7,008	67	14	34
W4DQD	"	700	15	7	13
W5WMU/5					
	A	**765,405**	**767**	**110**	**255**
W5NMA	"	350,168	459	105	191
WA3BZA/5		142,200	308	66	114
YV5AMH/W5					
		127,440	240	80	136
W5KKZ	"	107,800	226	60	115
K5YRK	"	96,073	205	76	115
W5LUJ	"	73,144	158	61	103
W5OB	"	68,060	171	65	99
W5KHP	"	67,848	187	50	82
WA5SUE	"	62,730	167	61	92
WB5AED	"	59,904	144	62	88
W5OSJ	"	49,140	138	69	87
VE6BU/W5		29,000	96	46	70
WA5WMD					
	"	24,696	96	43	55
WA5YFQ	"	5,985	49	29	34
WA5WEY	"	4,182	36	22	29
W5QAM	"	2,695	30	23	26
WB5CTH	"	1,750	21	17	18
K5DEC	"	280	12	8	6
WA5IEV	"	156	6	6	6
W5YPX	**28**	**73,920**	**274**	**26**	**70**
W5TKB	"	23,142	132	19	39
WA5EMH	"	17,408	108	21	43
WB5FIU	"	9,016	75	16	33
W5ZWQ	"	5,625	51	14	31
W5QGZ	"	2,145	24	16	17
W5RSZ	**21**	**66,339**	**260**	**25**	**66**
WB5EGQ	"	37,148	187	23	51
WA5CBT	"	20,130	109	22	44
W5RO	"	14,388	92	22	42
W5FC/5	"	4,788	47	14	22
W5EQT	**14**	**111,792**	**323**	**35**	**101**
W5OYH	"	89,760	250	34	98
WA5ALB	"	77,290	260	32	86
W5JWM	"	58,016	200	31	81
W4GHV/5		2,482	33	16	18
WA5RXT					
	3.8	**6,885**	**81**	**14**	**31**
K5PFL	"	5,676	69	13	30
W5KC	"	3,003	43	11	22
W5RTQ	**1.8**	**40**	**14**	**3**	**2**
K6SEN	**A**				
		1,330,912	**1326**	**113**	**239**
W6RR	**A**				
		1,173,356	**1157**	**114**	**250**
W6MAR	**A**				
		1,118,840	**1208**	**119**	**213**
WA6IVN	"	849,680	971	104	200
WA6EPQ/6		790,296	891	102	210
W6DGH	"	761,670	861	111	204
W6EJ5	"	37$,440	626	88	122
WB6PNB	"	343,116	508	88	155
W6NJU	"	330,264	461	98	166
W6JPH	"	303,468	486	86	142
K6QW	"	293,943	497	84	127
W6ESI	"	280,644	407	98	159
K6AN	"	215,936	339	92	149
W6EYY	"	207,705	441	65	100
K6DYQ	"	190,302	384	80	117
K6SSJ	"	161,100	269	92	133
WA6AHF	"	157,136	312	66	118
W6APW	"	149,100	417	53	87
K6PIH	"	143,934	331	61	88
K6SSN	"	138,690	268	84	123
K6TXR	"	129,192	265	61	107
WB6CCV	"	122,134	269	60	98
K6TP	"	121,940	307	58	76
WB6YLG	"	113,737	262	72	97
W6CS	"	109,047	251	62	101
K6ITL	"	105,300	237	67	89
K6LQA	"	101,655	261	55	80
WA6IUM	"	92,568	248	65	87
W6HQN	"	86,553	192	66	97
W6YVK	"	85,376	239	51	77
W6JZU	"	81,407	217	53	74
K6HIH	"	77,683	220	59	72
W6AM	"	76,422	206	62	79
WA6LLY	"	72,868	172	54	90
K6CCY	"	72,716	175	56	92
W6CNA	"	69,432	278	32	56
K6OC	"	66,025	165	58	81
WB6OOP	"	64,630	195	42	73
VE7XY/W6		58,644	194	47	61
W6ITD	"	51,458	194	43	55
WB6WAV	"	50,456	134	45	61
WB6ZSU	"	49,504	172	50	62
W6EJ	"	47,124	132	54	78
K6WR	"	46,360	114	62	90
W6LQC	"	43,290	142	48	63
W6CLM	"	42,120	154	45	59
WB6UNS	"	39,690	197	31	39
W6KYA	"	37,183	133	47	56
K6MHD	"	36,206	148	35	51
W6ZYC	"	33,394	109	49	69
W6ISQ	"	32,058	96	51	66
WB8AME/6		31,392	132	41	55
WB6CQY	"	29,187	145	28	41
K6AO	"	28,017	103	42	57
W6OL	"	25,527	131	30	37
K6MP	"	22,119	88	45	56
W6JKR	"	20,176	80	46	58
K6BW	"	15,925	86	24	39
WB6UOM	"	14,504	110	21	28
W6HRB	"	13,992	75	24	42
W6VPZ	"	10,560	176	29	31
W6OKK	"	10,149	74	25	26
W6BIL	"	9,720	51	34	38
W6UFJ	"	9,225	57	36	39
WA6YXP	"	5,960	54	19	21
W6RQZ	"	5,054	50	16	22
K6TU	"	336	11	6	6
W6QJW	**28**	**124,020**	**570**	**26**	**64**
W6ED	"	57,591	286	23	56
WB6VZI	"	38,702	197	24	50
W6HX	**21**	**285,120**	**911**	**29**	**79**
W6BH	"	226,240	689	33	79
W6DSQ	"	224,825	690	32	83
K6ZQP	"	153,363	511	30	79
K6QZ	"	58,176	215	28	68
W6AOI	"	11,205	94	17	28
WA6ZZK	**14**	**365,118**	**827**	**36**	**115**
K6SVL	"	244,134	632	34	103
K6YRA	"	190,847	487	34	105
WB6UDC	"	140,868	400	36	90
W6UA	"	109,335	340	30	81
			(Opr.	W6HOH)	
W6EUF	"	54,000	169	36	72
W6OK	"	35,112	144	30	58
W6KYJ	"	19,337	110	24	37
K6NA	**7**	**47,092**	**270**	**21**	**40**
K6FCY	"	29,463	173	22	39
			(Opr.	W6KFM)	
W6HVN	"	10,373	93	15	26
K6YFZ	"	5,280	66	13	19
K6AHV	**3.8**	**19,520**	**135**	**20**	**41**
K6ERT	"	16,269	137	16	35
WA6DKF	"	3,068	56	12	14
W7PHO	**A**	**329,150**	**511**	**89**	**138**
W7YBX	"	223,184	393	78	130
K7PXI	"	196,365	358	75	120
WA7JCB	"	165,201	368	64	95
W7BJ	"	161,576	379	56	96
W7OF	"	148,341	279	79	118
WA7MEO	"	117,376	346	57	74
W7BRU	"	94,454	216	65	101
WA7JBM	"	78,720	232	53	67
W7QK	"	49,560	133	54	86
W7EKM	"	29,944	139	31	45
K7YDO	"	19,845	104	32	49
K7CVL	"	6,099	41	23	34
W7QCV	"	3,145	34	16	19
W7ETZ	"	1,736	19	13	18
W7APA	"	162	6	4	5
K7RDH	**28**	**21,420**	**116**	**22**	**48**
W7AYY	"	13,110	103	17	29
W7PJL	**21**	**183,722**	**803**	**26**	**51**
WA7CGR	"	101,804	560	23	39
WA7MKC	"	13,776	123	16	25
K7ORN	"	11,300	34	19	31
W7YTN	**14**	**82,800**	**322**	**28**	**62**
K4ZOK/7		63,882	253	30	61
K7LVJ	"	22,008	137	21	35
W7LZF	"	13,908	83	21	36
W7AQB	"	8,484	72	17	25
W7VRO	"	1,352	21	13	13
W7APN	"	285	8	7	8
W7UI	**3.8**	**8,120**	**92**	**15**	**25**
K7UWT	"	585	25	7	6
K7IDX	**1.8**	**40**	**17**	**3**	**2**
K8IDE	**A**	**641,497**	**654**	**106**	**255**
W8JUJ	**A**	**358,540**	**516**	**86**	**174**
WA8OSE	"	334,893	429	86	191
K8UNG	"	302,160	450	74	166
W8TWA	"	267,300	367	88	182
WB8CCE	"	216,864	333	78	173
WB8FNE	"	144,300	275	56	129
WB8EUN	"	112,634	221	72	127
W8CFG	"	110,216	220	58	126
WB8IAY	"	87,720	206	58	112
W8ODV	"	88,005	198	54	109
W8KZH	"	85,565	206	52	105
WA8UUY	"	59,100	166	55	95
LA7HH/W8		43,368	124	47	92
WB8EEJ	"	24,232	98	43	61
WA8MCR	"	22,980	93	32	56
K8TMK	"	22,000	100	27	53
W8FJS	"	21,714	91	33	61
W8UMR	"	18,285	98	18	51
WA8MEM	"	16,555	82	29	48
W8ELB	"	9,586	50	30	41
W8HU	"	7,093	61	15	26
WA8QIY	**28**	**62,034**	**253**	**24**	**74**
W8WPC	"	56,494	225	25	69
W8IMZ/8		8,162	68	17	36
K8LEE	**21**	**189,100**	**528**	**26**	**98**
K8WWU	"	178,072	490	30	98
WB8BLL	"	153,090	439	30	96
WA8FCM	"	146,652	393	29	103
K8ULU	"	130,338	398	28	89
W8KOD	"	37,995	162	22	63
WA8TDY	"	20,703	110	21	46
W8JGU	**14**	**182,745**	**416**	**37**	**118**
WA8DXG	"	141,246	401	34	99
K8NGR	"	4,536	41	14	29
WA8ZDF	**7**	**45,214**	**191**	**25**	**69**
K8CRT	"	384	11	6	10
K8UDJ	3.8	450	12	6	9

W9LVT	**A**	**584,695**	**649**	**104**	**243**
K9KDI	**A**	**485,150**	**547**	**92**	**218**
W9IRH	"	395,343	527	90	189
W9ZRX	"	336,400	423	94	196
WB9BPG	"	137,268	278	65	121
W6LCO/9		131,404	268	67	115
W9DWQ	"	110,600	206	69	131
K9MMH	"	106,480	195	75	145
W9KDX	"	96,820	206	68	120
W9OHH	"	95,986	184	58	110
WA9UEK	"	69,204	168	57	101
W9CRW	"	50,949	136	59	94
W9SFR	"	50,250	142	49	76
WA9VGY	"	44,892	142	48	81
W9WYB	"	37,177	125	41	72
K9WTS	"	37,088	131	56	66
K9YXA	"	36,733	122	33	76
K9CLO	"	31,924	137	29	63
WA9FWY	"	27,544	117	32	56
WA9WMI	"	25,250	95	49	52
WA9UMH	"	20,394	108	22	44
W9GXH/9		14,240	67	32	48
WB9ETH	"	11,376	59	34	45
W9UTQ	"	7,040	41	26	38
W9DDL	"	4,335	35	21	30
WA9CYV	"	1,802	21	17	17
W9FU	"	1,395	22	14	17
K9BQL	"	972	22	12	14
W9YYG	**28**	**53,486**	**232**	**23**	**71**
WA9ZRP	"	7,592	60	17	36
W9LKJ	**21**	**206,870**	**525**	**31**	**106**
W9RER	"	202,640	527	31	105
W9IY	"	175,296	455	33	99
K3YWJ/9		112,840	309	31	99
W9KAS	"	46,158	166	26	72
WB9AOH	"	40,572	174	25	59
WB9DXW	"	35,964	165	23	58
WB9FJX	**14**	**157,526**	**388**	**38**	**120**
W9ZTD	"	123,480	334	35	105
W9NZM	**7**	**18,496**	**113**	**19**	**45**
WØHP	**A**	**304,947**	**408**	**91**	**188**
WØGYH	"	88,452	183	65	117
WAØVJF	"	70,196	184	64	98
WØJYE	"	43,904	137	39	73
WAØJBX	"	31,714	134	38	59
		(Opr. WA0FBQ)			
KØCMF	"	29,450	127	41	54
WØNUH	"	10,368	83	39	57
W4UDS/Ø		493	12	8	9
WØSEA	**14**	**57,276**	**200**	**48**	**63**
WAØYSK	"	96	6	4	4
WAØETC	**28**	**47,616**	**184**	**25**	**71**
WØMRN	"	42,160	171	25	71
WØLRU	"	33,698	149	25	58
WØJIG	"	10,266	67	21	37
KØDDA	**21**	**80,117**	**251**	**29**	**74**
WBØBBR	"	27,156	136	22	51
KØCXK	"	4,284	63	14	20
WØNQQ	**7**	**29,504**	**181**	**24**	**40**
KØCVA	"	4,559	46	16	31
WAØVDX	"	627	14	9	10

Alaska

WA7CWM/KL7					
	A	**122,544**	**857**	**25**	**31**
KL7GRP	"	114,945	551	45	52
KL7GRF	**14**	**153,504**	**918**	**24**	**48**
KL7GI	"	19,670	252	15	20
KL7HDW	"	1,914	76	5	6

Antigua

VP2AAP	**A**	**27,729**	**139**	**31**	**48**

Bahamas

VP7NH	**A**	**66,960**	**253**	**48**	**72**
VP7CQ	"	15,812	126	29	30

Barbados

8P6DR	**A**	**611,910**	**1139**	**67**	**167**

Bermuda

VP9BY	**A**	**636,212**	**1275**	**62**	**150**
G3YBH/VP9		3,684	153	6	6

Canal Zone

KZ5JF	**A**	**877,757**	**1645**	**73**	**156**
KZ5PN	"	78,132	342	42	60
KZ5HB	**21**	**26,765**	**231**	**19**	**34**

Canada

VO1AW	**A**	**153,760**	**313**	**50**	**110**
VB1MSA					
	3.8	**15,437**	**153**	**10**	**33**
VO2AF	**A**	**171,872**	**629**	**41**	**90**
VO2JB	"	105,420	779	33	37
		(Opr. WA1IQJ)			
WB2RLK/VE1					
	A	**30,793**	**184**	**30**	**53**
VE1EK	"	26,224	113	29	59
VE1AIH	**28**	**40,560**	**208**	**21**	**59**
VE1AL	**14**	**110,445**	**370**	**28**	**53**
VE2AYU	**A**	**256,476**	**571**	**65**	**136**
VE2WA	"	1,215	20	12	15
VE2AFC	**21**	**235,596**	**704**	**27**	**89**
VE3BMV	**A**				
		1,324,809	**1632**	**103**	**250**
VE3EDC	"	682,328	1140	83	185
VE3DVD	"	190,800	389	65	135
VE3BUV	**21**	**57,240**	**363**	**19**	**41**
VE3BMB	"	18,396	94	22	51
VE3GCO	**14**	**162,162**	**451**	**34**	**109**
VE3BSJ	"	25,920	141	26	54
VE3ZZZ	**3.8**	**83,97**	**491**	**26**	**55**
		(Opr. VE3CDX)			
VE3BS	**1.8**	**920**	**92**	**2**	**3**
VE4RP	**A**	**162,750**	**448**	**62**	**93**
VE4SD	**14**	**22,378**	**150**	**23**	**44**
VE5US	**A**	**514,809**	**1120**	**72**	**135**
		(Opr. VE5UF)			
VE6TP	**A**	**304,785**	**712**	**71**	**124**
VE6AP	"	146,393	309	56	103
VE6AFP	**28**	**32,994**	**332**	**14**	**25**
VE6NW	**21**	**56,892**	**330**	**23**	**43**
VE6AUH	"	30,366	296	15	27
VE6LV	"	26,750	227	18	32
VE6IN	**14**	**17,328**	**111**	**22**	**35**
VE6AYU	**7**	**3,726**	**101**	**11**	**12**
VE6AGV	**3.8**	**3,230**	**87**	**10**	**9**
VE7RN	**A**	**22,715**	**191**	**22**	**33**
VE7AJ	**21**	**10,220**	**110**	**15**	**20**
VE7AWT	**14**	**88,060**	**414**	**25**	**60**
VE7QC	"	7,500	73	18	32
VE8BB	**A**	**182,169**	**737**	**47**	**70**

Cayman Islands

ZF1WP	**A**	**100,800**	**423**	**33**	**72**

Costa Rica

TI2WX	**A**	**172,800**	**697**	**49**	**71**
TE2CF	"	59,332	560	24	28
TE2A	"	50,268	329	26	45

Cuba

CO2FA	**3.8**	**9,352**	**220**	**8**	**20**

Dominican Republic

HI3XAM	**A**	**134,264**	**624**	**37**	**67**
HI8LC	**3.8**	**56,903**	**349**	**24**	**53**

El Salvador

YS2CEN	**A**	**188,855**	**852**	**50**	**57**

Greenland

OX3WQ	**A**	**4,480**	**52**	**13**	**22**

Guantanamo Bay

KG4CS	**A**	**984,296**	**2230**	**75**	**129**

Guatemala

TG9YN	**A**	**321,393**	**989**	**55**	**94**

Honduras

HR2GK	**28**	**156,788**	**1035**	**22**	**54**
HR1RF	**7**	**207,749**	**1166**	**21**	**62**
		(Opr. WA5KPL)			

Jamaica

WA6GLD/6Y5					
	A	**673,225**	**1869**	**58**	**117**

Mexico

6D1AA					
	A	**3,541,714**	**4017**	**111**	**296**
XE1TU	**14**	**25,584**	**237**	**24**	**28**
XE1LLS	**7**	**28,840**	**372**	**14**	**26**

Puerto Rico

KP4DJI	**A**	**174,876**	**694**	**49**	**69**
KP4DIW	**28**	**40,236**	**715**	**13**	**15**
KP4DKX	**21**	**168,508**	**710**	**28**	**75**

St. Kitts

VP2KF	**14**	**44,408**	**348**	**17**	**44**

Nicaragua

YN3AAA	**A**				
		1,278,459	**2150**	**89**	**184**
YNØHSM	"	246,000	500	73	132
YNØVMD	"	218,730	712	46	92
YNØFI	"	134,862	315	68	114

Virgin Islands

KV4FZ	**14**				
		1,208,180	**2680**	**40**	**153**
KV4AM	**28**	**71,040**	**525**	**22**	**42**

AFRICA

Angola

XX6GA	**A**	**2,108,568**	**2220**	**93**	**233**
XX6JO	"	150,164	385	44	80
CR6II	**28**	**278,460**	**1030**	**24**	**67**
XX6IK	**14**	**667,260**	**1426**	**35**	**130**

Ascension Is.

ZD8CS	**7**	**38,372**	**252**	**19**	**34**

Botswana

A2CAB	**A**	**241,128**	**433**	**70**	**134**

Canary Islands

EA8GK	**A**	**744,702**	**873**	**82**	**212**

Cape Verde Is.

CR4BC	**A**	**787,826**	**892**	**91**	**223**
CR4BV	"	66,023	218	39	64

Ethiopia

9E3USA	**28**	**442,000**	**1153**	**30**	**100**
		(Opr. WB8JAK)			
9F3USA	**21**	**455,400**	**1035**	**33**	**117**
		(Opr. K3BSY)			
ET3DS	**14**				
		1,026,480	**1957**	**35**	**147**
		(Opr. F5QQ)			

Ghana

9G1WW	**A**				
		1,310,583	**1548**	**90**	**217**

Kenya

5Z4LW	**A**	**182,988**	**338**	**71**	**133**

Liberia

EL2CB	**3.8**	**5,282**	**53**	**15**	**23**

Madeira Is.

CT3AS	**A**	**274,228**	**545**	**62**	**117**

Malawi

7Q7CY	**A**				
		3,036,826	**2447**	**109**	**322**
		(Opr. ZE1CY)			

Mali Republic

TZ2AC	**A**	**1,123,395**	**1413**	**85**	**188**
		(Opr. DJ6QT)			

Morocco

CN8BB	**A**	**48,076**	**163**	**30**	**71**
CN8HD	**3.8**	**44,200**	**287**	**8**	**44**

Mozambique

XX7AC	**A**	**537,612**	**878**	**63**	**150**
CR7JS	"	29,432	134	35	69
XX7AF	"	18,164	88	35	41
XX7IK	**28**	**588,930**	**1502**	**32**	**102**
XX7DE	**21**	**39,236**	**204**	**22**	**46**
XX7FR	**14**	**272,032**	**769**	**30**	**99**
XX7IC	"	17,112	73	30	62

Rhodesia

ZE1JE	**28**	**51,153**	**338**	**17**	**34**
ZE1CU	**14**	**677,647**	**1380**	**37**	**133**
ZE2JE	"	395,505	978	34	107

South Africa

ZS6DE	**A**	**57,105**	**160**	**59**	**82**

Southwest Africa

ZS3KC	**A**	**958,784**	**1553**	**69**	**142**

Tanzania

5H3LV	**A**	**1,359,088**	**1373**	**98**	**248**

Zaire Republic

9Q5IA	**A**	**794,304**	**977**	**91**	**197**
9Q5RD	"	122,330	372	37	93

ASIA

Afghanistan

YA1OS	**A**	**341,532**	**750**	**59**	**153**

Cyprus

5B4IS	**A**	**295,136**	**569**	**47**	**137**

Israel

TA1SK/4X					
	A	**468,072**	**725**	**55**	**161**
VE3MR/4X					
	3.8	**197,106**	**742**	**22**	**69**

Japan

JA1EOD	**A**	**870,790**	**984**	**108**	**202**
JA4FHE	"	169,676	359	62	107
JA3MGX	"	152,490	389	53	85
JA7AD	"	117,920	265	62	98
JA2HNP	"	71,604	217	54	63
JA1DFQ	"	43,578	190	35	46
JR1HUA	"	37,290	130	44	66
JA7YOJ	"	28,860	156	35	39
JA1ALX	"	23,542	109	34	45
JA2QCA	"	23,310	127	29	41
JA1AAT	"	14,260	103	24	38
JA2BLJ	"	14,068	68	43	44
JA1IZ	"	13,200	92	23	27
JA6EFT	"	11,716	80	26	32
JA2BHQ	"	6,944	54	25	31
JAØJGH	"	6,747	54	19	20
JE1CUA	"	3,465	41	16	19
JA3BBG	"	1,624	39	17	22
JA7YCP	"	663	13	8	9
JA3FWT	"	578	13	8	9

Think we had better include a YL photo before women's lib gets on our backs. Eva, WA2BAV was a welcome addition to the below-average returns from the 2nd district. Eva recently returned from a safari up the west coast of Africa, putting a number of choice countries on the air with the OM George, WB2AQC.

JA7KIU	"	195	7	6	7
JAØLHJ	"	120	5	4	4
JA1LZR	**28**	**69,384**	**298**	**30**	**54**
JA9AG	**28**	**68,807**	**291**	**30**	**57**
JH1MRH	"	6,630	71	15	19
JA2VLX	"	6,279	60	19	23
JAØQCO	"	6,156	63	17	19
JA8FIZ	"	2,856	46	12	12
JA8HWF	"	1,720	36	10	10
JA1NEZ	"	874	15	11	12
JH3HDA	"	288	8	6	6
JA3ERG	**21**	**114,927**	**459**	**31**	**56**
JAØHTT	**21**	**109,674**	**477**	**29**	**52**
JA3MZH	"	95,787	339	28	59
JA6ELH	"	52,224	271	26	42
JH3CRT	"	37,128	190	26	42
JA8DFD	"	31,494	196	21	37
JH1DXM	"	27,083	179	21	32
JA7ABE	"	13,035	134	14	19
JA2HBF	"	12,876	109	18	19
JA3BUB	"	11,628	108	13	25
JA8WY	"	9,996	87	16	26
JA6ABG	"	7,733	73	16	21
JR1TLC	"	6,469	77	16	13
JA8FDB	"	4,445	47	16	19
JA8CNU	"	4,305	42	13	22
JAØFMB	"	3,920	41	16	24
JA7JQG	"	3,360	51	11	13
JH1AHU	"	2,295	51	7	8
JR1SWB	"	1,700	33	10	10
JH2FTH	"	1,525	26	11	14
JH3BJN	"	874	17	8	11
JR1VPU	"	770	19	7	7
JAØKOH	"	756	15	8	10
JR1VPO	"	480	20	3	5
JA3YJQ	"	468	12	6	7
JH3OII	"	456	10	9	10
JH1JUD	"	390	13	5	5
JA7ELT	"	6	2	1	2
JA2KLT	**14**	**262,752**	**662**	**37**	**101**
JA2PJC	"	111,327	312	37	92
JA1SKE	"	97,632	323	34	74
JA3KLI	"	11,550	98	22	29
JA5CEK	"	8,784	79	20	28
JA7ARW	"	5,538	57	17	22
JA8GR	"	1,980	38	11	11
JA4BTD	"	1,300	31	9	11
JA2HFB	"	836	16	10	12
JA6EYD	"	702	13	8	10
JA1OHV	**7**	**36,216**	**189**	**29**	**43**
JA1ELY	"	27,654	148	27	39

Korea

HL9VK	**A**	**393,480**	**1020**	**62**	**118**
HM1AQ	**14**	**90,432**	**632**	**25**	**47**
HM1EJ	21	3,652	42	7	15
HM1EA	**28**	**16,172**	**140**	**19**	**33**

Lebanon

OD5BA	**A**	**404,716**	**761**	**48**	**133**
OD5G5	14	1,608	23	9	15

Malaysia, West

9M2WM	**A**	**23,051**	**115**	**33**	**56**

Maldive Republic

VS9MF	**21**	**112,914**	**1107**	**25**	**77**

Nepal

9NCTY	**A**	**82,799**	**301**	**30**	**73**

Ryukyu Islands

KR6AY	**A**	**1,014,524**	**2131**	**98**	**168**

Singapore

9V1QJ	**A**	**58,685**	**312**	**41**	**56**
9V1QV	"	24,147	222	24	45

Thailand

HS5AFJ	**A**	**549,575**	**819**	**97**	**228**
HS3AFB	"	185,856	549	69	107
HS1ABU	**21**	**170,765**	**718**	**33**	**86**
HS1ACH	**14**	**98,280**	**323**	**34**	**92**
HS2AGF	"	204	9	6	6

Yemen

4W1AF	**14**	**98,209**	**349**	**28**	**81**

U.S.S.R. Asiatic

UW9WR	**A**	**2,077,540**	**1773**	**109**	**327**
UA9MP	"	60,114	298	26	60
UV9PE	**28**	**13,981**	**249**	**15**	**26**
RA9OCQ	**28**	**13,489**	**230**	**15**	**26**
RA9FGO	"	12,054	138	12	30
UA9MDY	"	9,944	151	14	30
UA9MQ	"	6,360	89	13	27
RA9FCA	"	5,810	64	10	25
UW9CR	**21**	**18,630**	**146**	**9**	**37**
UA9IF	**14**	**81,378**	**357**	**30**	**69**
UA9MT	"	20,410	124	22	43
UA9QAA	**3.8**	**5,238**	**68**	**6**	**21**
UAØDG	**A**	**51,376**	**423**	**31**	**45**
UAØMI	"	49,230	432	37	53
RAØSAV	**28**	**2,415**	**83**	**7**	**16**
RAØUBG	"	508	128	2	2
UAØSH	**21**	**40,932**	**469**	**16**	**38**
UWØIQ	"	38,556	869	19	23
UWØIE	**14**	**193,224**	**835**	**30**	**67**
UAØNS	"	45,276	543	22	27
UAØAI	"	22,495	191	24	31
UAØABC	**7**	**25,688**	**363**	**15**	**37**
UAØAAL	3.8	70	6	3	4

Armenia

UG6JJ	**14**	**29,400**	**182**	**17**	**43**
UK6GAE	"	29,200	206	11	39

Georgia

UF6CR	**A**	**1,793,872**	**1692**	**92**	**290**

Kazakh

UL7JA	**A**	**302,198**	**602**	**58**	**139**
UL7YR	"	146,200	439	48	102
UL7CH	"	65,614	250	36	70

Kirhgiz

UM8MAA	**28**	**24,216**	**385**	**18**	**38**
UM8FZ	**14**	**88,308**	**354**	**26**	**65**

Tadjik

UJ8JGJ	**A**	**64,612**	**283**	**47**	**69**
UK8JAD	**28**	**22,620**	**136**	**16**	**44**

Turkoman

UH8BO	**A**	**99,712**	**252**	**52**	**112**

Except for the receiver most of the equipment at HM1EA is home brewed. Hwang represented Korea on 28 mHz. With only a dipole and poor conditions, DX contacts were hard to come by. (HM9EA is the portable call.)

Uzbek

UI8LJ	**A**	**221,236**	**546**	**55**	**109**
RI8LAX	**28**	**11,970**	**132**	**13**	**25**
UI8AAS	**14**	**99,544**	**400**	**23**	**69**

EUROPE

Aland Island

OHØNI	**A**	**235,648**	**600**	**59**	**165**
OHØNJ	**3.8**	**2,324**	**77**	**5**	**23**

Belgium

ON4XG	**A**	**42,944**	**160**	**41**	**81**
ON6AK	**14**	**48,990**	**330**	**23**	**48**
ON8CG	**7**	**1,404**	**50**	**5**	**22**

Bulgaria

LZ2EE	**A**	**1,309,750**	**2091**	**89**	**249**
LZ2KRM	"	62,568	409	23	109
LZ1CW	**21**	**18,971**	**181**	**17**	**44**

Channel Is. (Guernsey)

GC3YIZ	**A**	**128,524**	**473**	**30**	**97**
GC3NLX	**3.5**	**5,868**	**158**	**4**	**32**

Czechoslovakia

OMØIQ	**A**	**441,099**	**968**	**72**	**207**
OK1ADM	"	156,880	260	84	181
OMØEE	"	145,392	536	56	152
OK1MPP	"	95,455	272	55	108
OMØEA	"	79,261	332	48	121
OK2ABU	**28**	**9,860**	**69**	**23**	**35**
OMØAGQ	"	8,066	76	13	24
OK1MGW	"	861	17	9	12
OK1TA	**21**	**124,890**	**427**	**33**	**82**
OM2QX	"	109,862	520	23	56
OK1APJ	**14**	**42,406**	**290**	**26**	**65**
OK1DVK	"	260	8	6	7
OK1MP	**7**	**10,800**	**149**	**12**	**48**
OK2SIR	**3.5**	**15,548**	**279**	**8**	**44**
OK2BLI	"	7,960	184	8	32
O2SMO	"	2,600	98	4	22
OK1MWW	"	714	33	5	16

Denmark

OZ8MG	**A**	**146,068**	**420**	**54**	**158**
OZ3PO	"	37,084	132	46	100
OZ7DX	"	29,160	141	40	80
OZ2NU	"	21,412	187	26	80
OZ7JZ	"	17,072	131	26	71
OZ4HW	"	7,498	113	13	33
OZ6HS	"	5,858	84	18	40
OZ8KU	"	2,944	64	11	37
OZ9OI	"	744	25	9	15
OZ5DX	**28**	**13,632**	**71**	**23**	**48**
OZ8BZ	**21**	**129,234**	**456**	**33**	**86**
OZ7HT	**14**	**108,665**	**525**	**32**	**71**
OZ4TA	"	33,120	183	28	68
OZ1CZ	**"**	**1,682**	**36**	**9**	**20**
OZ3SK	**7**	**14,091**	**181**	**14**	**47**

England

G3LNS	**A**	**1,414,336**	**1524**	**104**	**248**
G3VBL	"	544,027	956	61	148
G3SEM	"	218,648	568	54	127
G3PEU	"	169,764	429	55	133
G2AJB	"	31,581	231	26	73
G3MWZ	"	11,322	91	25	49
G3GXO	"	4,920	82	14	26
G2BOZ	**28**	**35,120**	**167**	**24**	**56**
G3YTU	"	2,520	40	9	12
G3KWK	**21**	**242,073**	**739**	**32**	**85**
G3YHB	"	60,168	323	20	49
G3FXD	**14**	**452,513**	**1154**	**36**	**113**
G3NSY	"	39,872	258	25	64
G3XMX/A		34,958	292	19	58
G3SSO	**7**	**25,568**	**245**	**16**	**52**
G3XVY	**3.8**	**49,895**	**438**	**19**	**66**

Faeroes Islands

OY7JD	**A**	**8,316**	**102**	**18**	**36**

Finland

OH2BC	**A**	**1,049,553**	**1014**	**105**	**316**
OH3MF	"	188,160	425	67	173
OH5YF	"	177,650	435	56	131
OH7RM	"	117,439	583	41	92
OH2BCV	"	114,234	239	67	174
OH2XF	"	105,092	291	59	148
OH6ZJ	"	16,554	140	23	70
OH2BJY	"	15,752	129	24	64
OH2BME	"	12,870	148	32	58
OH2VZ	"	8,500	78	24	44
OH6VR	"	7,056	65	21	42
OH2LU	"	2,688	49	14	28
OH2DN	"	289	11	7	10
OH5PA	28	1,728	28	8	19
OH6RH	"	1,705	28	9	22
OH5NB	"	1,196	21	7	16
OH2BHU	"	527	14	7	10
OH1LX	**21**	**98,440**	**330**	**30**	**77**
OH5PF	"	58,995	256	27	68
OH7PB	"	22,910	163	17	41
OH5WH	"	11,242	60	26	51
OH6YP	"	1,175	35	8	17
OH5YX	"	1,161	17	10	17
OH2KU	"	589	20	6	13
OH5VT	**14**	**263,190**	**811**	**34**	**121**
OH2BAD	"	23,850	145	23	67
OH6RX	"	4,896	138	8	28
OH2BFX	"	3,636	76	9	27
OH8OB	"	3,440	51	14	29
OH3JR	"	825	22	7	18
OH1VA	**7**	**6,536**	**137**	**9**	**34**
OH5PC	3.8	720	35	5	15
OH2BFF	"	260	18	3	10

France

F9GL	**A**	**301,096**	**496**	**75**	**169**
F5SE	"	92,655	459	26	61
F6API	"	65,152	264	40	88
F8NI	"	53,675	198	38	75
F3IJ	"	52,056	222	34	74
F9KP	"	12,862	112	19	40
F6BDJ	"	11,603	107	20	21
F6BCG	"	10,860	87	22	38
F2SI	**21**	**412,707**	**1065**	**36**	**105**
FØWJ	"	41,251	254	20	51
F6AUS	"	17,700	151	19	40

Germany

DL6WD	**A**	**652,080**	**866**	**90**	**222**
DJ4ZR	**A**	**560,949**	**787**	**82**	**207**
DJ8FC	**A**	**510,001**	**876**	**68**	**155**
DJ3HJ	"	355,313	683	79	184
DL1MD	"	253,440	517	73	191
DJ4UF	"	215,808	471	57	135
DK4OO	"	201,958	457	63	178
DJ2RB	"	183,260	417	58	129
DLØTD	"	182,672	435	65	131
DK2WY	"	142,072	338	56	116
DK1HV	"	132,664	295	59	117
DJ4PI	"	131,461	295	67	142
DL8NG	"	122,574	331	47	139
DJ2GG	"	110,980	354	39	85
DJ5DA	"	108,928	283	55	121
DL3OH	"	107,070	256	64	102
DJ9IA	"	105,342	279	61	120
DK1YK	"	99,452	330	48	140
DK5EZ	"	91,762	249	66	128
DLØII	"	79,820	346	36	94
DJ2UU	"	73,932	225	57	126
DL7EN	"	71,810	205	49	118
DL9JI	"	69,344	211	54	122
DK4YA	"	65,604	281	39	93
DJ5AVA	"	57,961	277	39	110
DK3ME	"	57,024	245	39	105
DJ9NW	"	54,058	184	45	134
DL7FP	"	52,500	189	46	104
DL8HA	"	51,405	184	47	102
DL1YA	"	49,980	203	43	97
DJ9JF	"	49,104	205	36	57
DL9EY	"	34,656	194	36	78
DJ2VZ	"	30,261	143	39	92
DK4QD	"	20,475	131	34	71
DL3RA	"	16,685	113	28	43
DL1HH	"	16,450	83	35	53
DK2BL	"	14,028	69	34	50
DK5GT	"	11,775	123	23	52
DJ1TS	"	9,030	111	19	51
DL8IH	"	7,290	77	19	35
DL1BO	"	5,795	48	24	37
DL1LD	"	4,005	70	17	28
DL3PN	"	880	15	10	12
DL3RK	"	483	13	10	13
DL7AA	**28**	**41,710**	**173**	**28**	**69**
DK3NH	"	5,808	54	15	33
DL9VS	"	3,640	38	13	27
DL6EN	**21**	**367,416**	**1027**	**34**	**92**
DJ5MC	"	30,675	167	23	52
DJ9ZB	"	24,464	120	29	59
DL3ME	"	988	31	6	7
DL8PC	**14**	**171,969**	**590**	**34**	**99**

DL8DC	**7**	**57,672**	**351**	**20**	**69**
DL8NU	"	41,449	360	18	69
DJ5JH	"	10,614	157	11	47
DJ1ZN	"	9,512	127	15	43
DK3SN	**3.8**	**7,050**	**140**	**8**	**39**
DK5DS	"	3,960	110	4	32
DL1CF	**1.8**	**1,246**	**94**	**2**	**12**
DK2JX	"	639	74	2	7
DA1LA	**A**	**421,590**	**805**	**63**	**172**
DL4JW	"	83,331	257	45	96
DL5DY	"	22,795	96	37	60
DL5EB	**14**	**7,439**	**99**	**10**	**33**
DL4ER	**3.8**	**1,560**	**57**	**3**	**23**
DM2BTO	**A**	**28,197**	**186**	**31**	**86**
DM2YLO	"	10,434	129	17	57
DM2DDN	"	5,665	61	16	39
DM2DEO	"	4,730	73	17	38
DM2CUO	"	1,885	32	12	17
DM2CHM					
	21	1,160	18	12	17
DM5SI	**3.8**	**752**	**49**	**2**	**14**
DM3TRF	"	42	4	3	4

Greece

SV1SV	**A**	**132,912**	**680**	**38**	**118**
SZØGA	**14**	**220,022**	**835**	**33**	**104**

Hungary

HA7LF	**A**	**296,628**	**898**	**53**	**175**
HA5CQ	"	104,832	404	50	132
HA6KNB	"	24,905	221	21	64
HA5DG	**21**	**10,614**	**95**	**17**	**41**

Iceland

W5ILR/TF					
	21	**76,664**	**543**	**18**	**56**

Italy

I6FLD	**A**				
		1,453,760	**1510**	**108**	**277**
IP1MOL	**A**				
		1,176,032	**1660**	**82**	**204**
I1BAF	**A**				
		1,082,918	**1213**	**106**	**257**
I4ZSQ	**A**				
		1,054,704	**1390**	**95**	**241**
I1ANP	"	58,322	340	32	89
I3DAB	**28**	**61,292**	**281**	**24**	**53**
I3AWK	**21**	**53,872**	**303**	**21**	**53**
I3MAU	**14**	**397,130**	**1055**	**37**	**114**
I4VOS	"	231,924	800	36	96
I3JR	"	191,516	826	34	93
I2ZTI	"	84,180	363	29	86
I1WKW	"	63,638	423	24	70
I4LRG	"	21,412	314	19	44
I1AIM	**7**	**61,632**	**415**	**22**	**74**
I8CAQ	"	31,825	311	17	50
I3BBZ	"	20,605	265	14	51
IP1WXY	"	14,307	236	11	46
I3PRK	**3.8**	**14,229**	**252**	**8**	**43**

Netherlands

PAØHBO	**A**	**472,192**	**1002**	**60**	**178**
PAØGIN	"	27,730	164	27	67
PAØGG	"	8,190	55	27	43
PAØTO	**14**	**8,160**	**114**	**12**	**39**
PAØLVK	"	5,772	80	13	26

Norway

LA6GF	**A**	**238,500**	**411**	**72**	**178**
LA5QK	"	42,558	255	33	90
LA2PO	"	22,895	163	30	65
LA2OH	"	11,764	99	21	47
LA9JD	"	5,587	113	8	29
LA8IM	"	3,724	65	15	34
LA7RB	"	2,394	47	13	29
LA1LO	"	1,824	37	12	26
LA9YO	"	1,020	26	7	13
LA1L	**21**	**15,423**	**141**	**17**	**36**
LA4LN	"	9,222	82	15	43
LA7CL	"	18	3	1	1
LA8RL	**14**	**10,043**	**59**	**22**	**47**
LA1SP	"	3,531	62	9	24
LA5KO	"	1,350	52	6	19
LA1LK	**7**	**3,120**	**48**	**4**	**15**
LA6XI	3.8	160	16	2	8

Poland

SP5AKG	**A**	**202,584**	**358**	**73**	**203**
SP5XM	"	105,616	316	54	130
SP6AOI	"	96,953	443	31	82
SP9ADU	"	90,652	320	54	119
SP8AWP	"	64,092	304	40	107
SP9QS	"	51,538	238	36	110
SP9BLF	"	45,360	335	30	96
SP7PZS	"	17,642	201	22	56
SP9AID	"	2,622	59	9	29
SP3DOI	**28**	**37,944**	**212**	**21**	**41**
SP6DXB	"	192	8	5	7
SP5ACN	**21**	**29,495**	**140**	**24**	**61**
SP6DVD	"	9,870	116	12	23
SP9DH	"	7,250	75	15	35
SP5BSV	**14**	**78,422**	**365**	**32**	**81**
SP5BAK	"	48,288	334	24	72
SP5DBW	"	28,101	171	29	58
SP9ABU	"	9,420	103	15	45
SP5BB	"	7,579	113	13	40
SP1BLE	"	4,752	103	10	23
SP7ASZ	"	4,680	81	11	29
SP5ELW	"	4,407	94	10	29
SP5PLL	"	1,200	46	6	19
SP3AUZ	"	486	23	5	13
SP5ENA	**7**	**2,135**	**42**	**11**	**24**
SP6BQF					
	3.5	**14,650**	**282**	**7**	**43**
SP5DZI	"	13,156	286	6	40
SP3BLG	"	12,224	246	8	40
SP9ZAF	"	3,828	120	5	28
SP5CTG	"	3,813	111	5	26
SP1II	"	90	10	4	5

Portugal

CT1BH	**A**				
		1,460,967	**1587**	**103**	**258**
CT1QN	"	671,751	1054	82	221

Romania

YO3AC	**A**	**34,720**	**197**	**32**	**92**
YO9APJ	"	33,734	264	27	74
YO6MD	"	31,332	342	34	50
YO2AFB	"	28,812	195	28	70
YO3JU	"	1,778	28	21	26
YO3AWY		**148,109**	**130**	**10**	**41**

Scotland

GM3BCL	**A**	**237,748**	**526**	**53**	**143**
GM3DZB					
	14	**81,880**	**392**	**32**	**83**
GM3ZXH	"	26,488	333	15	41
GM3RFR					
	3.5	**6,534**	**196**	**4**	**29**
GM3VTB	"	5,412	158	4	29
GM3YCB					
	1.8	**4,590**	**253**	**4**	**14**
GM4ANR/P		**3,204**	**268**	**2**	**10**
GM3YOR	"	392	56	2	6

Spain

EA4LH	**A**				
		1,756,944	**2109**	**105**	**273**
EA3OJ	"	26,474	223	17	45
EA3FN	"	17,400	153	24	51
EA7HZ	**7**	**13,320**	**150**	**17**	**43**

Sweden

SM5DBW	**A**	**540,394**	**855**	**70**	**244**
SM3BIZ	"	335,710	605	76	219
SM5GZ	"	335,503	634	77	210
SMØCER	"	122,304	348	60	148
SM7DNL	"	106,379	298	57	110
SM5BNZ	"	79,704	309	44	120
SM7ID	"	77,598	375	34	128
SM4EEA	"	46,240	175	48	88
SM6CRA	"	33,813	188	36	81
SM7EVM	"	29,988	138	36	66
SM7BEX	"	25,134	151	36	82
SM7DER	"	22,321	152	33	68
SM2CTY	"	6,968	60	23	44
SMØBDS	"	2,337	39	15	26
SM4CMG					
	28	560	17	5	11
SM5AD	**21**	**293,865**	**805**	**34**	**109**
SM6AEK	"	229,040	590	35	105
SM5CDY	"	163,500	590	31	78
SM6DHU	"	115,373	384	30	83
SM5BXP	"	50,876	206	27	65
SM7AIL	"	7,300	86	16	34
SM5CNQ					
	14	**86,757**	**381**	**32**	**89**
SM5CEU	"	55,146	318	29	72
SM5GA	"	25,718	148	25	52
SM7DQC	"	15,906	207	19	47
SM5QU	"	1,568	46	9	23
SM5CAK	**7**	**24,570**	**359**	**13**	**50**
SMØOY	"	121	11	3	8

Switzerland

HB9ZY	**A**	**145,418**	**269**	**70**	**168**

We would consider EA4LH a surprise winner of the European Trophy. However George was well equipped with a full KW to individual beams on 10, 15 and 20, and inverted Vee's on 40 and 80, he put out quite a signal.

HB9ASK	"	69,080	479	23	65
HB9IX	"	38,582	191	31	70
HB9UD	"	12,000	93	25	50

Yugoslavia

YU3CM	**A**				
		1,282,905	**1432**	**99**	**288**
YU5CX	"	309,100	1018	58	162
YU3NBO	"	87,381	406	32	101
YU1UM	"	73,200	390	47	103
YU3ER	**28**	**28,917**	**162**	**22**	**41**
YU2CIF	"	26,010	119	24	61
YU3EJ	**21**	**289,912**	**832**	**34**	**90**
YU3TST	**7**	**6,321**	**134**	**8**	**35**
YU3APR					
	3.8	**13,340**	**275**	**7**	**39**
YU2RAZ	"	10,350	207	9	41
YU4FDE	"	7,200	148	10	38

U.S.S.R.

European

UA6HZ	**A**	**369,279**	**901**	**79**	**212**
UA3XT	"	237,200	626	55	145
UA3QO	"	141,050	528	46	136
UA6PG	"	116,892	416	41	112
UW3HY	"	44,672	207	42	86
UA3NG	"	39,324	245	32	84
UA3GM	"	22,841	208	25	66
UW3DH	"	16,068	98	36	67
UV3FD	"	15,540	118	22	52
UA6GL	"	14,904	183	17	52
UA3XP	"	11,948	158	15	43
UA3IE	"	9,840	156	13	47
UW4CF	**28**	**30,444**	**209**	**20**	**39**
UA4CZ	"	18,950	159	18	32
UK6LDZ	"	18,850	125	17	46
RA3NAM	"	13,908	96	18	39
UW3UH	"	10,070	79	17	36
RA3MAH	"	7,695	66	13	32
UA4SR	"	1,920	26	14	18
RA3AFL	"	814	17	9	13
UA3ABK	"	551	11	9	10
UV3GM	**21**	**192,326**	**755**	**32**	**81**
UA4LG	"	79,376	415	25	57
UW1BM	"	58,900	379	25	70
UA1CS	**14**	**160,834**	**598**	**34**	**84**
UW1AR	"	150,060	632	32	90
UA6XQ	"	119,679	619	32	91
UA1CK	"	78,432	324	32	82
UA1IG	"	38,180	226	26	57
UW3CW	"	12,324	193	12	40
UV3NN	"	5,986	101	8	33
UA1DZ	**7**	**23,374**	**267**	**15**	**43**
UW6LC	**3.8**	**7,200**	**178**	**8**	**28**
UW6MT	"	5,082	158	7	26
UW3RR	"	2,856	96	6	22

Estonia

UR2ED	**28**	**3,780**	**65**	**9**	**26**

Latvia

UK2GAF	**A**	**86,178**	**378**	**41**	**118**
UQ2CR	"	19,019	200	21	56
UQ2IL	"	9,168	156	20	48
UQ2DV	"	6,678	88	18	45
UQ2MU	"	1,247	44	8	21
UQ2HO	**14**	**16,002**	**173**	**20**	**43**
UQ2NU	**3.8**	**4,867**	**144**	**6**	**25**
UQ2AQ	"	1,078	42	6	16

Lithuania

UP2NK	**A**	**562,276**	**920**	**77**	**209**
UP2MC	"	51,074	317	32	100
UP2PA	"	31,490	112	46	88
UP2PBK	"	27,072	258	21	51
UP2OJ	**14**	**28,791**	**345**	**20**	**43**
UP2WN	"	9,504	182	13	31
UP2NV	**3.8**	**5,744**	**169**	**6**	**27**
UP2ER	"	5,548	130	7	31
UP2OA	"	2,184	75	6	20

Moldavia

UO5SA	**14**	**129,780**	**672**	**32**	**94**

Ukraine

UB5CI	**A**	**496,418**	**964**	**80**	**233**
UB5ND	"	164,182	489	57	149
UB5VL	"	72,280	325	41	98
UK5EAE	"	57,456	251	39	94
UB5LU	"	44,280	296	34	101
UT5LY	"	15,370	212	12	46
UY5ZT	"	8,122	89	18	44
UB5QG	"	3,861	56	10	29
RB5EDU	**28**	**44,429**	**209**	**22**	**55**
RB5QAO	"	22,320	129	22	55
RB5QFO	"	13,644	128	14	30
UY5HB	"	12,060	83	17	43
UB5QAB	"	8,892	67	18	39
RB5HBC	"	3,213	53	10	17
UB5EM	21	6,864	52	10	20
UT5AM	**14**	**164,400**	**619**	**35**	**102**
UB5JK	"	31,755	343	16	57
UB5LL	**7**	**15,402**	**245**	**10**	**41**
UB5YAR					
	3.8	**4,185**	**122**	**6**	**25**
UY5AO	"	2,070	86	5	18

OCEANIA

Australia

VK1BC	**A**	**67,456**	**199**	**49**	**87**
VK2APK	**14**	**299,267**	**768**	**34**	**105**
VK2XT	"	66,595	249	29	66
VK3ARY	**14**	**14,722**	**86**	**21**	**38**
VK4PJ	21	5,248	56	11	21
VK4DO	**14**	**55,193**	**214**	**31**	**66**
VK4AK	"	42,642	144	33	70
VK4NS	"	3,330	38	14	16
VK5BW	**14**	**148,944**	**457**	**35**	**81**

World high on 21 mHz, Hugo, CX1JM is one of the few familiar contest calls out of Uruguay. What happened CX2CO, CX3BH and some of the others?

VK6HD	**A**	**2,911,224**	**2442**	**117**	**287**
VK6CT	**7**	**96,050**	**397**	**27**	**58**
		Christmas Is.			
VK9XK	**28**	**171,398**	**671**	**26**	**60**
		Gilbert Is.			
VR1AA	**A**	**145,794**	**433**	**60**	**81**
		Guam			
KG6JBD	**A**	**488,372**	**1024**	**61**	**105**
KG6JAR	"	421,320	1232	50	70
KG6ASP	**21**	**96,772**	**632**	**22**	**30**
		Hawaii			
KH6RS	**A**	**3,041,924**	**3657**	**109**	**175**
KH6IJ		1,337,898	2440	78	108
KH6BWT	"	132,730	544	38	47
KH6BZF	**21**	**357,914**	**1769**	**25**	**42**
		Indonesia			
YB3AAY	**14**	**291,550**	**985**	**30**	**89**
YB9UA	"	12,096	132	12	28
		Mariana Is.			
KG6SW	**A**	**73,950**	**438**	**24**	**34**
		Marshall Is.			
KX6IQ	**A**	**94,620**	**391**	**36**	**57**
		New Zealand			
ZL1BKX	**A**	**93,600**	**187**	**69**	**126**
ZL1AMM	"	29,241	127	30	51
ZL1TB	"	10,824	65	27	39
ZL1IL	**28**	**25,848**	**247**	**14**	**22**
ZL4BO	**14**	**335,824**	**789**	**35**	**116**
ZL1AAS	"	204,816	536	34	102
ZL1ARV	"	110,616	440	31	57
ZL2GJ	"	20,140	138	21	32
ZL1AGO	**7**	**27,234**	**185**	**22**	**29**
		Philippines Is.			
DU1POL	**A**	**44,744**	**290**	**24**	**32**

SOUTH AMERICA

		Argentina			
LU2FAO	**A**	**344,182**	**631**	**71**	**120**
LU2DEK	**28**	**163,125**	**735**	**24**	**51**
LU8AJG	**7**	**33,916**	**150**	**21**	**40**
		Bolivia			
CP1EU	**A**	**128,590**	**408**	**47**	**63**
		Brasil			
PY2BCQ	**A**	**541,200**	**930**	**67**	**133**
PY1DEF	"	179,394	370	59	115
PY3APH	"	162,206	294	78	124
PY1BAR	"	125,860	379	46	70
PY2BZD	"	95,175	253	48	87
PY2YC	"	86,802	300	29	73
PY7APS	"	52,920	179	32	76
PY1BOL	"	34,861	173	32	39
PY4AP	**14**	**1,012,506**	**1979**	**36**	**138**
PY7AZQ	"	130,980	408	28	83
PY7ACB	"	99,145	451	24	55
PY2FFG	7	3,354	38	17	22
		Chile			
CE8AO	**A**	**286,578**	**560**	**60**	**123**
CE3OE	**14**	**187,116**	**530**	**33**	**91**
CE6EQ	"	**184,030**	**585**	**32**	**78**
		French Guiana			
FYØNA	**21**	**15,725**	**170**	**14**	**22**
		Guyana			
8R1G	**A**	**1,092,025**	**1410**	**90**	**185**
		Paraguay			
ZP5AQ	**A**	**1,264,540**	**1884**	**70**	**160**
ZP9AC	"	120,483	419	41	58
		Peru			
OB8V	**A**	**2,466,566**	**2412**	**113**	**233**
OB4PF	**28**	**204,952**	**1085**	**21**	**47**
OA6CM	14	1,600	22	17	15
		Trinidad			
9Y4VU	**A**	**992,124**	**1345**	**84**	**168**
		Uruguay			
CX2CN	**A**	**783,409**	**1172**	**76**	**153**
CX1JM	**21**	**689,985**	**1728**	**35**	**100**
CV9BT	"	533,239	1532	29	90
CX8BZ	"	153,900	562	28	67
		Venezuela			
4M4CDK	**28**	**388,661**	**1474**	**25**	**66**
YV4GD	**21**	**82,808**	**325**	**26**	**62**

MULTI OPERATOR
Single Transmitter
NORTH AMERICA
U.S.A.

W1BPW	**752,475**	**686**	**111**	**284**
WA1KZE	588,236	653	85	234
WA1LXE	383,284	495	87	194
WA1LKU	90,589	216	51	106
WB2SQN	**2,591,784**	**1586**	**139**	**429**
K2UQT/2	837,211	800	106	273
W2LEJ/2	595,296	691	92	220
WA2IZS	465,674	513	97	250
W2YD	213,844	393	59	134
WA2SDY	129,325	272	59	116
W3WJD	**1,611376**	**1138**	**128**	**380**
WA3ATP	974,460	807	118	318
WA3OTV	337,477	492	76	183
W4FDA	**1,241,344**	**1063**	**114**	**302**
W4ATC	226,188	358	83	161
K4ZA	150,015	263	72	147
W4JK	104,499	256	54	99
WB4TON/4	77,970	212	49	89
WB5DTX	**430,731**	**560**	**100**	**201**
W5BJA	124,600	256	64	114
WA5VWH	86,355	198	66	105
W5YG	37,846	103	48	69
W5RKT	27,636	106	33	65
W6MAV	**1,146,140**	**1211**	**112**	**228**
W6ISA	**1,109,185**	**1271**	**112**	**223**
WA6BVY/6	670,770	933	95	162
W6DOD	639,710	857	96	169
K6UFT	295,460	570	74	112
K6HFQ	234,794	491	91	126
WB6EJV/6	127,218	562	26	62
WB6NSI	106,398	271	62	76
WA6GFY	104,448	281	58	78
W6ZBS	46,846	142	47	71
W7SFA	**1,176,130**	**1278**	**11**	**226**
WA7NIN	534,285	742	108	171
K7VAL	530,712	1000	75	114
WA8JUN	**878,050**	**772**	**116**	**309**
W8NGO	411,073	496	93	214
W8BVF	283,752	460	76	176
WA8SMR	139,346	262	72	121
WB9BWU	**960,480**	**823**	**120**	**315**
W9EXE	**913,120**	**819**	**121**	**295**
K9CUY	440,076	496	100	238
W9AXD	161,214	308	66	128
W9HWG	73,025	218	46	81
W9DY	42,699	133	50	79
WØMYN	**327,250**	**501**	**84**	**154**
WØGNX	173,019	304	83	148
KØIJL	120,666	283	66	116
WBØBBE	95,150	249	65	108
WAØEMS	32,230	129	60	50
WAØCPX	10,602	70	30	32
	Alaska			
KL7AIZ	**713,751**	**1986**	**76**	**83**
KL7GLL	25,150	231	26	24
	Canada			
VE1DH	**1,787,649**	**2382**	**97**	**224**
VA2UN	**1,579,391**	**2116**	**91**	**236**
VE4AA	**116,313**	**378**	**47**	**90**
VE5XH	**62,370**	**392**	**36**	**41**
VE6MC	**247,962**	**804**	**62**	**81**
VE6AEK	165,600	632	49	72
VE6AO	105,276	513	45	48
	Cayman Islands			
ZF1WF	**1,313,075**	**2364**	**80**	**185**
	Mexico			
4C1QB	**2,355,295**	**4101**	**100**	**221**

AFRICA

	Mozambique			
CR7LE	**2,106,116**	**1995**	**115**	**247**

ASIA

	Cambodia			
XU1AA	**509,600**	**1778**	**65**	**131**
	Iran			
EQ2FB	**402,624**	**763**	**60**	**132**
	Japan			
	Club Stations			
JA3YBF	**1,237,770**	**1659**	**96**	**159**
JA9YBA	769,098	1062	101	170
JH1YDT	716,650	919	101	174
JA1YBU	210,639	519	63	80
JA2ZAP	25,650	110	42	53
JA2ZBH	21,360	130	23	37
JA2ZBG	15,024	112	19	29
KA2USF	**254,733**	**734**	**44**	**79**
KA8FY	240,511	511	75	97
	U.S.S.R.			
	Club Stations			
	Asiatic			
UK9ABA	**3,512,652**	**2353**	**129**	**405**
UK9CAE	797,742	1072	82	215
UK9QAA	306,098	594	49	144
UK9FAA	206,090	543	52	133
UK90BI	103,776	323	45	96
UKØSAG	19,116	190	24	35
	Turkoman			
UK8HAA	**466,528**	**750**	**73**	**171**
	Uzbek			
UK8IAA	**17,808**	**135**	**20**	**36**
	Azores			
CT2BC	**750,915**	**1416**	**65**	**140**
	England			
G3WYX	**2,019,735**	**1999**	**108**	**297**
G3FVA	842,052	1251	81	201
G2KK	436,653	1014	66	173
G3TZH	260,920	633	67	153
G3YXR	235,872	548	53	115
G3RCV	181,738	528	52	126
	Finland			
OH1AD	**774,737**	**1096**	**99**	**268**
OH3AG	108,086	582	55	132
OH7AA	23,175	129	32	71
OH6AA	7,938	136	11	43
	France			
FØZZ	**1,102,559**	**1633**	**76**	**217**
	Czechoslovakia			
OMØKGI	**158,672**	**621**	**52**	**136**
	Germany			
DLØWU	**2,492,807**	**2112**	**128**	**363**
DLØWW	1,414,600	1409	123	317
DJ4GO	1,032,928	1362	87	223
DLØJRA	961,200	1028	112	288
DA1FI	677,157	990	83	208
DKØAA	618,470	1086	73	157
DL8CM	593,400	821	92	208
DLIHC	436,160	685	84	206
DL8YR	424,692	764	73	178
DJ6QP	388,172	695	69	143
DJ9MH	202,038	464	67	156
DL2MB	176,276	449	58	129
DLØZG	143,916	389	55	124
	Hungary			
HA5KDQ	**760,032**	**1202**	**91**	**221**
HA2KMR	44,040	340	26	94
	Italy			
I4LCK	**2,922,180**	**2643**	**117**	**314**
I1KBT	266,178	650	65	157
I4GMP	217,668	652	49	138
	Isle of Man			
GD3WJN/A	**506,020**	**1213**	**64**	**137**
	Lichtenstein			
HBØAFH	**357,380**	**892**	**59**	**161**
HBØXHS	229,590	767	68	167
	Monaco			
3AØFN	**121,119**	**519**	**35**	**106**
	Netherlands			
PI1PT	3,468	103	4	30
	Norway			
LJ2L	13,248	108	28	64
	Poland			
SP5PWK	**179,685**	**879**	**31**	**104**
	Sweden			
SK6AW	**828,990**	**976**	**96**	**270**
SM5DJZ	320,760	694	72	198
SM5AZU	150,911	394	61	168
SK3AH	52,268	259	39	107
SK2AT	50,960	399	25	87
	Wales			
GW3ZIL	**28,782**	**215**	**24**	**54**
	Yugoslavia			
4NØDX	**2,316,717**	**2601**	**115**	**314**
YU1AFQ	1,052,108	1505		240
	U.S.S.R.			
	Club Stations			
	European			
UK6LAZ	**1,520,225**	**1607**	**112**	**425**
UK3SAB	685,256	1234	74	212
UK3R	399,672	971	65	187
UK3YAB	161,253	484	53	154
UK3MAA	125,307	366	34	98
UK3LAD	81,090	576	32	70
UK6PAA	75,480	374	36	100
UK4WAB	53,626	303	29	95
UK4FAD	24,000	199	21	59

Estonia				
UK2TAF	**12,495**	**214**	**12**	**39**
Kalningrad				
UK2FAA	**1,426,096**	**1397**	**105**	**323**
Latvia				
UK2GAA	**218,736**	**816**	**47**	**139**
UK2GBT	81,736	441	32	104
UK2GAR	28,056	326	17	67
Lithuania				
UK2BBB	**2,945,172**	**2835**	**129**	**369**
UK2PAF	238,625	561	62	163
UK2BAV	57,292	167	25	93
UK2PAM	44,128	306	29	83
Ukraine				
UK5MAF	**1,597,988**	**1687**	**115**	**319**
UK5FAD	270,648	934	48	141
UK5VAA	189,945	616	54	147
UK5EAQ	128,650	565	35	120
U5ARTEK	109,911	473	38	111
UK5QAU	93,496	587	28	76
UK5VAE	88,672	481	37	99
UK5ZAA	38,724	350	23	61
White Russia				
UK2WAF	**242,760**	**749**	**51**	**153**

OCEANIA

Guam				
KG6ALV	**1,180,800**	**2081**	**60**	**132**
Western Samoa				
5W1AR	**748,836**	**1491**	**68**	**115**

SOUTH AMERICA

Brazil				
PY1BQK	40,326	179	32	46
Easter Island				
CE6CA/Ø	**959,728**	**1592**	**71**	**138**
Netherlands Antilles				
PJ1AA	**3,407,987**	**3228**	**101**	**258**

MULTI OPERATOR

Multi Transmitter

NORTH AMERICA

W7RM	**6,682,620**	**4061**	**159**	**429**
W3AU	**5,421,043**	**2962**	**149**	**500**
K6UA	**5,214,310**	**3517**	**143**	**380**
W5SZ	**3,617,515**	**2176**	**161**	**422**
W3GM	**2,513,357**	**1687**	**135**	**404**
W9YT	**1,831,696**	**1460**	**127**	**352**
K4CG	**1,648,464**	**1247**	**130**	**358**
W4WS	1,336,680	1066	127	343
K3HTZ	1,286,830	1057	120	325
W3SS	852,674	828	105	281
WA3ATX	784,020	786	102	263
WB6GFT	704,780	962	93	176
K8SMC	**506,412**	**636**	**98**	**226**
K3JYZ	256,964	425	71	156
WA9UCE	218,694	288	99	188
WB6JOD	180,314	407	76	102

ASIA

4Z4HF	**6,106,290**	**3994**	**125**	**409**
JA2YEF	**603,687**	**825**	**99**	**168**
HL9KH	**261,247**	**915**	**59**	**92**
JA6YCL	43,758	172	48	51

EUROPE

DKØWA	**5,700,688**	**3756**	**142**	**502**
OH5SM	**4,421,875**	**3515**	**151**	**474**
DLØPG	**4,346,622**	**3476**	**135**	**432**
OH1AA	**2,264,241**	**2892**	**121**	**390**
OH1VR	**1,554,938**	**1740**	**120**	**386**
4U1ITU	**1,212,219**	**1794**	**91**	**232**
YU2BHI	**814,332**	**1146**	**85**	**231**
SK5AA	**586,791**	**1214**	**81**	**228**
G3CXX	**325,836**	**712**	**66**	**186**
HAØKDA	**209,188**	**658**	**60**	**157**
SP6PZB	**112,098**	**473**	**41**	**116**

OCEANIA

KH6HCM/KH6	**3,719,361**	**4139**	**114**	**203**
VK9XI	**118,215**	**383**	**40**	**71**

SOUTH AMERICA

4M1A 11,723,580 7155 135 423

Our thanks to the following stations who submitted logs for checking purposes. CE5GO, CX4VA, DJ0TA, DK-3LM, DM2BGA, DM2BUL, DM2DOH, DM-5553, EA4KC, F6BJA, FP8AP, GC3EML, HA-3KMA, HA5YAH, HA6NN, HA7KLF, HKØBKX, HR2AFK, HR2WTA, K2DT, KG4EQ, KH6AQ, KV4AA, KZ50D, KZ5JF, LA6XJ, LA8NC, LA8-ZL, LA901, LZ1KSP, M1B, MP4BBW, OH7PB, OK1-15835, OK1MAD, OM2QX, OMØBFH, OZ1LO, OZ5JR, OZ6RT, PAØHHV, PY2FCX/W2, RA3MMY, RAØQAB, RA-ØQQP, SM5AQB, SM5CVC, SM5DEN, SM7QY, SM7TQ, SP5PQ, UA3DAO, UA3DB, UA3FF, UA4NAK, UA4NM, UA9OS, UB5ML, UK3AAI, UK3VAJ, UK3XAA, UK6XAA, UL7YP, UL7HB, UT5BC, UT-5DF, UV3DN, UW3NG, UW-4HW, UW4NH, VE6AKV, VE7BZC, VP8JT, VU2OMR, W1MDO, W2MLO, W7GUR, WØGGC, WA4DRU, WB4EOH, YO7-6608/DJ, YS10, YV4YG, YV5BPG, ZK1CD, 3AØGB, 5B4OH, 9H1BX.

Station Operators

Multi-Operator, Single Transmitter

CE6CA/Ø: CE6BB, CE6EF, CE6HM. **CR7LE** &CR7DB. **CT2BC:** 2 OPRS. **DA1FI** & DA1RE, DA1SU, DL3BA, DL5GJ, DL5JF. **DJ4GO** & DJ5FW, DJ6WO, DJØND, DK4OV, DL3LU, DL8RL, DL8RM. **DJ6QP** & DK1QQ. **DJ9MH** & DK1KC, DK3MG. **DKØAA:** DJ4XG, DK2ZL, DK4ST, DK5SZ. **DL1HC** & DK2OG. **DL2MB** & DJ40Z, DK1IN, DL2DB. **DL8CM** & DL8CH. **DL8YR** & DK3PA, DK5KY. **DLØJRA:** DL7BQ, DL7HN, DL7HU, DL-7OD, DL7ON. **DLØWU:** DJ4AX, DJ8SW. **DLØWW:** DC6FF, DJ2YF, DJ3YV, DJ4OQ, DJ4XN, DJ6DU, DK7FO, DL3ZA, DL6NK. **DLØZG:** DA2XS, DJ4FP, DK2RN, DL20R. **EQ2FB** & EQ2YL. **FØZZ:** F2QQ, F5HN, F5ZK, F5ZW, F6AZP. **G2KK** & G3GKI, G3PEJ, G3WTJ, G8AZA. **G3FVA:** G3FNM, G3RTU, G3TCA, G3WFT, G3ZKO, G4AFT, G8DMJ, G8DKE. **G3RCV:** G3VLX, G3WVP, G3XMD, G3YJW, G3YQG, G3ZAY, G4ACQ. **G3TZH** & G2FNK, G3HZL, G3TDR, G3VUQ, G3YCQ, G3YFF. **G3WYX:** G3HTA, G3RUV, G3RUX, G3TJW. **G3YXR:** G2DSY, G3BJQ, G30ZT, G3RUZ, G3WSL, G3ZQC, G3ZWJ, G8ERK. **GD3WJN/A:** G3RZI, G3WJN. **GW3ZIL** & GW4AES. **HA2KMR:** CLUB **HA5KDQ:** HA5DE, HA5FM, HA5HO, HA5J1. **HBØAFH:** HB9AEP, HB9AFH, HB9AIJ, HB9AMV, HB9ATD. **HBØXHS:** DK3SF, DL5DM, DL6UN. **I1KBT:** 2 oprs. **I4GPM** & I4GRH, I4CIL, I415420. **I4LCK** & I4AUM, I4BER, I4GAD, I4TAE. **K2UOT/2** & K2BQO, K2UYC, WA2ROJ. **K4ZA** & WA6OAU. **K6HFQ** & K6SMF, W6HRT, WB6JKW. **K6UFT** & WB6SRA. **K7VAL** & WA7OEX, WA7OXQ, WA7MJJ. **K9CUY** & WA9RQY. **KØIJL** & WAØZTU, WBØAJA, WBØBJZ. **KA2USF:** KA2AD, KA2AW, KA2DD, KA2MU, KA2QW, KA2RD, KA2RG, KA2VL, KA2WB, KA2WW. **KA8FY:** WA6GKJ, WA8WPW, WB4HKM. **KG6ALV:** K1MIJ, WA9HHJ, KG6JBZ. **KL7AIZ:** K7HIV, W7-ABX, WA7NEW, WB2WGV, WBØFJH, KL7HDW. **KL7GLL** & WA9PTG. **LJ2L:** LA7ZN, LA8BN. **OH1AD:** OHIPS, OHIPV, OHIQP, OHIRU, OHIVQ, OHIVT, OHIXX. **OH3AG:** OH3IF, OH3MK, OH3VJ, OH3YO. **OH6AA:** Club. **OMØKGI:** Club. **PI1PT:** 2 oprs. **PJ1AA:** PJ2ARI, PJ2CA, PJ2CL, PJ2CR, PJ2CU, PJ2CW, PJ2HT, PJ2MI, PJ9VR. **PY1BQK** & PY1DBE. **SK2AT:** SM2AHP, SM2AQT, SM2BJS, SM2DR, SM3UL, OH6YA/SM2. **SK3AH:** Club. **SK6AW:** SM6CAS, SM6CJK, SM6CKS, SM6CMU, SM6CNX, SM6CVE. **SM5AZU** & SM5-BGM, SMØATN, SMØMC. **SM5DZJ** & SM5EXE, KEN. **SP5-PWK:** SP5AVY, SP5DZJ. **VA2UN:** VE2DCW, WA2UPC, WA3-HRV. **VE1DH** & VE1ACU, VE1ANB, VE1ASJ. **VE4AA:** VE4BJ, VE4IM, VE4MP, VE4SK. **VE5XH** & VE5XJ. **VE6AEK** & VE6-AAD, VE6GS, VE6LB. **VE6AO:** VE5RC, VE6AGV, VE6AID, VE6AMR, VE6ARZ, VE6AUH, VE6AUI, VE6AUV, VE6AVO, VE6AZU, VE6CT, VE6GN, VE6WA. **VE6MC** & VE6DF. **W1BPW** & K1DIR, W1DAL, **W2LEJ/2** & W2SKE, W2SUC.**W2YD** & W2OST. **W3WJD** & K3YUA, W3PSM. **W4ATC:** WA2GBC, K3-ZSK, WB4IOJ. **W4FDA** & WB4EYX, WB4IAE. **W4JK** & WB4-FTI, K4OS. **W5BJA** & WA5OCG. **W5RKT:** Club. **W5YG:** WA5FTP, WA5LVJ, WA5TIY, WB5ADS. **W6DOD** & W6KG. **W6ISA** & K6SDR, K6UZA, W6ITY, WB6LBP, WB6OLR. **W6MAV** & K6AUC. WA6IQM. **W6ZBS** & W6ZTJ. **W7SFA** & W7DL, VE7ZZ. **W8BVF** & K8TVO. **W8NGO** & W8CLR, W8-ONA, W8SRK, WB8ADO, WB8ADP. **W9AXD:** K9JIY, K9WTS, WB9CHU. **W9DY** & W9DWQ, WA9OMN, WA9VOL. **W9EXE** & K9WEH, W9ICE. **W9HWG** & W9KSZ, WB9COY, WB9DBN, WB9EBZ. **WØGNX** & WBØCSR. **WØMYN** & WBØCMM. **WA1-KZE** & WA1NRV. WA1LKX.**WA1LXE** & WA1IRY. WA1JHO, WA1KBG. **WA1LKU** & WA1NKW. **WA2IZS** & WA2BLV. K3-KNH.**WA2SDY** & WA2BPH. WA2IUH, WA2BED, WB2TJO, WB2PWU, WA3DIS, W4NGU/2. **WA3ATP** & W3YCI, WA3-LRN, WA3LRO. **WA3ATX** & WA3GJZ, WA3KNB, WA3MME, WA3MPH. **WA3OTV** & WA3KZQ. **WA5VWH** & W5PBZ. **WA6BVY/6** & WA6GTE. **WA6GFY:** W6HJP, WB6-EXW. **WA7NIN** & WA7KNK, WA7OCR. **WA8JUN** & K8HLR, WA8GUF, WA8OBG, WA8VMQ. **WA8SMR:** WA8JQV, WB8IJI, W9AQW. **WAØCPX** & WAØNRE, WAØVFX, WAØZCE. **WAØ-EMS** & WNØGCP. **WB2SQN** & K2KUR, WB2OEU, WB2WSH. **WB4TON/4** & W4OZF, WB4CKY, WB4EJE, WB4HML, WB4-LZQ, WB4SZS. **WB5DTX:** W5KTR, W5ONL, W5QWF, WA5-UCT, WB5AAR, WB5AOF, WB5BFZ. **WB6EJV/6** & WB6VUZ. **WB6NSI** & WB6LFL, WB6LFN. **WB9BWV** & 6 oprs. **WBØ-BBE:** Club. **XU1AA** & JA1BK **JA1KSO,** JH1JGX, VE7IR, XU1VS, Students. **YU1AFQ:** YU1JRS, YU1NFP, YU1NPZ, YU1OAU, YU1OAX, YU1OFM, LUKOVIC. **ZF1WF:** W4GIW, W4MCM, W4SSU. **3AØFN:** F6BBJ, WA4WME. **4C1QB:** W5-QBM, WA5JMK. **4NØDX.** YU1BCD, YU1NQM, YU1NZW, YU1PCF, YU1QBC, YU1SJ, YU3TCB, YU3ZV. **5W1AR** & 5W1AV.

Station Operators

Multi-Operator, Multi-Transmitter

DKØWA: DF1WA, DJ1ER, DJ2BW, DJ2HH, DJ2YA, DJ4VV, DJ6RX, DK2BI, DK2BJ, DK9WB, DY9OH. **DLØPG:** DK2JX, DJ9TQ, DJ9IE, DK3BJ, DL6WE, DJ6TK, DK1FW, DJ1FC, DJ1LP, DJ4PT, DL8OH, DL6QH. **G3CXX:** G3YXN, G3YRU, G3ZSS, G3WUX, G3YSG, G4ABT. **HAØKDA:** Club. **HL9KH:** HL9T0, Jim, Neil, HL9VO. **JA2YEF:** JA2UJC, JA2QBZ, JA2-KKA, JA2JUE, JA2QOF. **JA6YCL:** Club. **K3HTZ** & WA3LNM, W3GLY, VE3BAW. **K3JYZ** & WA3GUI, WA3MJF. **K4CG:** K3-WUW, W3JPT, WA4KJR, W4HIR, K4LDR, WB4UYD, WB4-FDT. K6OZL. **K6UA** & K6RU, K6QPH, K6BCE, K6PUR, WB6VFJ, W6NLZ, WB6WIT, WA6OHJ. **K8SMC** & W8OQH, WA8QDY, WA8YJR. **KH6HCM/KH6** & KH6GMP, KH6GQW, KH6HGP, KH6HDA, KH6HDH, KH6HOY, KH6HJG, K7VEH. **OH1AA:** OH1KF, OH1LQ, OH1SS, OH1NH, OH1UZ, OH1NK, OH1SY, OH1RG. **OH1VR** & OH1UR, OH3TM, OH3TQ, OH3-TT, OH3YI, OH3KX, OH3UN, OH3WN, OH3XZ. **OH5SM** & OH2BCP. OH2BM, OH2BO, OH2BX, OH2KK, OH2MM, OH2-SB, OH2WI, OH5NW, OH5TS, OH5UQ, OH5VY, OH6RM, OH9OM. **SK5AA:** SM5ACQ, SM5EDX, SM5EOO, SM5ESP, SM5EHV, SM5ENP, SM5EZV, SM5EOS, SM5EUL, SM5ERP, SM5FDD. **SP6PZB:** SP6FAF, SP65057, SP65053. **VK9XI:** Club. **W3AU** & K3EST, W3ZKH, W3AZD, WA3AMH, W3IN, W3BQV, K3NPV, WA3HAQ. **W3GM** & W3NOH, W3KV, W3GHM, W3FHR, W3JSX, K3ZOL, W3FSC, W3LTU. **W3SS** & K3JLK, K3LJZ, WA3OAY, WA3JLT. **WA3ATX** & WA3KNB, WA3MME, WA3MPH, WA3GJZ. **W4WS** & K4NE, K4CL, K4EXT, K4THA, W4LCP, K4ONO, K4AUA. **W5SZ** & K5BOC, K5HYI, K5ZJK, W5KGJ, W5KYD. **WB6GFJ** & WA6DIL, W6-HQN, WA6IAF. **WB6JOD** & W6KHS, WA6HCL, K6QJZ, WA6-OAA, WB6SZY, WB6FFB, WB6RWU, WB6TPU. **W7RM** & W5QQQ, K7VPF, K7JCA, K7FDF, W7YGN, K7HTZ, VE7SV. **W9YT:** K9LBQ, K9ZSE, K9KGA, WA9GMK, K9OXY, K9PQG, WA9TPV, WA9SUU. **WA9UCE** & K9YNF, WA9WEN, WN9-FYW, WA9YOY. **YU2BHI:** Club. **4M1A:** YV1PP, YV1TP, YV1IV, YV1BI, YV1QF, YV5BTS, YV1SA, YV1OB, YV1WY, YV1WH, YV1LA. **4U1ITU:** SM5CJP, WB9EUR. **4Z4HF** & 4X4NJ, WA2-BVU, 4X4WP, 4X4UL, 4X4MU, UP2OE, 4Z4JT, 4Z4JX, 4Z4GV, WØZRX, W6DLE, WB2ZZA, 4X4FV.

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

BEFORE beginning our discussion this month I would like to indicate several items that will be of interest to the experimenter. First of these is a new, miniature solid state buzzer (if that is the right word) now available from Projects Unlimited, 1926 E. Slebenthaler Avenue, Dayton, Ohio 45414. This device, measuring only .88" by .61" by .39" puts out a nice loud 400 Hz tone that is probably perfect for code-practice oscillators, call sign identifying timers, alarm indicators, test equipment, etc. It is available for d.c. voltages of 1.5 or 12 and, the 1.5 volt version only requires 15 milliamperes for full output. The cost for small quantities is on the order of $5 each.

Those who are interested in building some of the devices mentioned in the May column should take a good look at the items R & R Electronics, 311 East South Street, Indianapolis, Ind. 46225 has to offer. Not only do they have a fairly complete stock of TTL and RTL circuitry at reasonable prices, but also offer a decade divider with readout tube in kit form for only $14.45 for quantities of 1-3, $12.95 for 4-9 and $12.49 in lots of 10 or more. These kits contain all necessary components including a P/C board and are just the thing for frequency meter or digital clock builders.

The best buys in digital logic we have seen yet come from Digi-Key, P.O. Box 126, Thief River Falls, Minn. 56701. Their price sheet shows such bargains as 7400 2 input gates (4 to a chip) for only 30¢, 7442 BCD to decimal decoders for $1.50, 7490 decade counters for $1.25, and 74121 40 nsec to 40 sec one shot multivibrators for only 75¢ each. Furthermore, if you spend more than $50, you get another 15% discount. While we have not actually checked sample lots from Digi-Key, if all chips are good, as they say they are, then the prices are truly amazing.

With all of this emphasis on digital integrated circuitry, the question quickly arises as to just how to power them. It is obvious that batteries cannot be used so the task of powering the frequency meter or digital clock must be relegated to an a.c. line operated power supply. Without going into long discussions about the relative merits of all kinds of circuitry we have indicated several basic types of regulators that are perfect for IC users. It should be noted that the following information can also be used to design simple regulated supplies for all types of solid state circuitry.

Figure 1 shows a simple, completely workable 5 volt zener diode regulated supply. In this example, as in all of the following, we will employ the 5 volt r.m.s. filament winding that was made available when "modernizing" vacuum tube equipment such as described in the April column. It is, of course, obvious that other a.c. voltages can be used with suitable changes in circuit values.

The circuit of fig. 1 is the simplest that can be used for integrated circuit work. The output voltage is completely dependent on the zener diode and therefore a 5% tolerance unit should be used. A full wave voltage doubler was used here to get enough input voltage for proper zener action. Actual part numbers are not given for the semiconductors as there are so many suitable types available. Simply read the catalogs! For those who wish to design zener regulators for other voltages, the following formulas will be of great help:

$$\text{Value of } R_1 = \frac{E_1 - E_2}{I_{load} + 2\text{ma}}$$

Use next higher standard value.

$$\text{Wattage of } R_1 = (E_1 - E_2) \times (I_{load} + 2\text{ma})$$

Use next higher wattage resistor.

$$\text{Wattage of Zener} = E_2 \times (I_{load} + 2\text{ma})$$

Use next higher wattage zener.

RTL users can make this regulator into a 3.6 volt supply with the same current ratings

* 5 Melville Lane, Great Neck, N.Y. 11023.

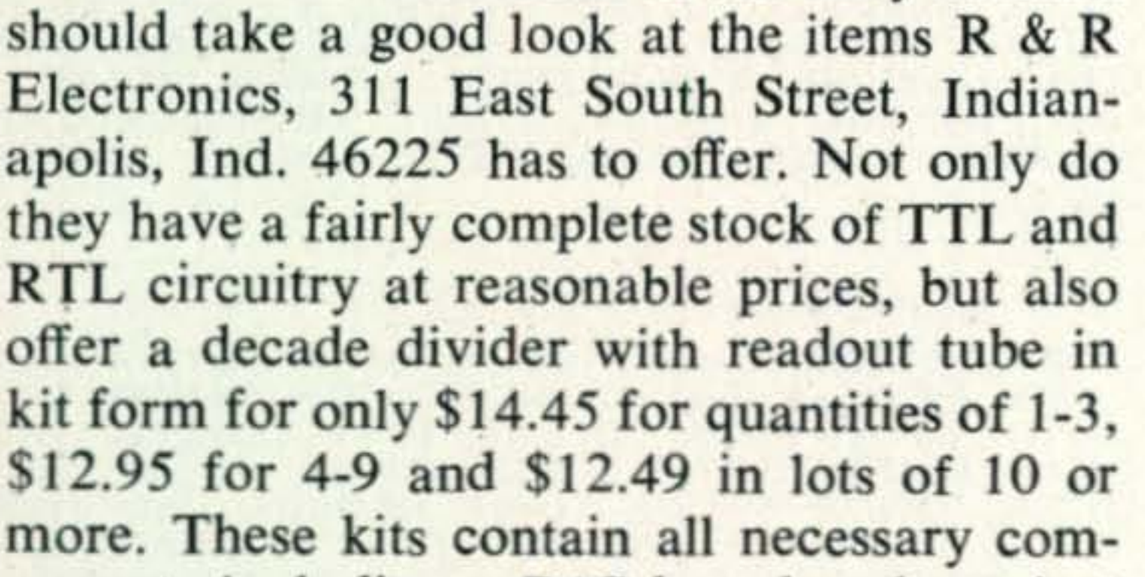


Fig. 1—Simple 5 volt regulator delivering up to 50 ma.

by using a 3.6 volt 5% 1/2 watt zener and a 150 ohm 1 watt resistor.

For those who require more than 50 milliamperes for their equipment, the regulator in fig. 2 will do the trick. Currents of up to 1/2 ampere can be supplied by this circuit. Here, a power transistor, Q_1, has been employed to handle the higher current. The zener now determines the base voltage of Q_1 and its emitter voltage, by virtue of transistor action, must be approximately 0.6 volts below its base voltage. The type of transistor employed for Q_1 can be any NPN silicon power unit with a minimum current gain (hfe or B) of 20 and a collector to emitter breakdown voltage of at least 25 volts. Since the transistor will dissipate about 3 watts at full load, it would be wise to use a transistor such as the RCA 40613 that can be clamped to the chassis for heat sinking purposes.

Again, for those who wish to design their own:

$E_2 = E_3 - 0.6$ volts

$$I_b = \frac{I_{load}}{\text{hfe of transistor}}$$

$$R_1 = \frac{E_1 - E_3}{I_b + 2\text{ ma}}$$

Wattage of $R_1 = (E_1 - E_3) \times (I_b + 2\text{ ma})$

Use next higher wattage

Dissipation of $Q_1 = (E_1 - E_2) \times I_{load}$

Breakdown of $Q_1 = E_1 - E_2$

Use transistors with at least 2 × this value

For the 3.6 volt users, R_1 should be 220 ohms 1/2 watt and the zener, a 4.2 volt 1/2 watt 5% unit.

Figure 3 is our last regulator. It is adjustable for those applications where the output voltage must be "right on the nose." In this circuit, which we have designed to have a maximum output of 1.5 amperes at 5 volts, the high current is carried by Q_1 which, in turn, is controlled by the zener and Q_2.

When power is applied to the circuit, Q_1 is initially forward biased by R_1, causing its emitter voltage to rise approaching the collector voltage. At the same time, however, the voltage divider consisting of R_3, R_4, and the pot supplies a voltage to the base of Q_2 and R_2 biases the zener diode to 3.6 v.

Now, since the base voltage of Q_2 cannot exceed its emitter voltage by more than approximately 0.6 volts (according to transistor theory) Q_2 starts conducting and "draws away" base current from Q_1. This causes the emitter voltage of Q_1 to drop to a value that will maintain the 0.6 volt differential between

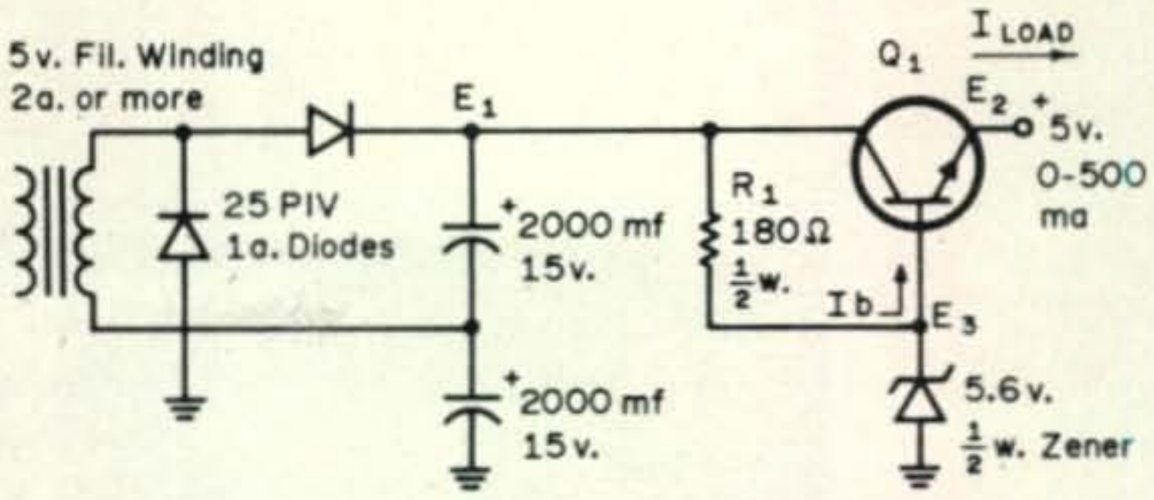


Fig. 2—Higher current (500 ma) 5 volt regulated supply.

base and emitter of Q_2 (don't forget that the emitter of Q_2 is fixed at 3.6 volts by the zener). If the arm of the pot is moved toward the +5v. line (R_3) less voltage will be required to properly bias Q_2 and the output voltage will fall. If the arm is moved toward ground (R_4) then more voltage will be required and the output will rise. The 100 ohm pot can be used to set the voltage to exactly 5 volts.

The design equations for this regulator are:

$$I_b \text{ of } Q_1 = \frac{I \text{ output maximum}}{\text{hfe of } Q_1}$$

$$R_1 = \frac{E_1 - E_2}{I_b}$$

Use next lower value

Wattage of $R_1 = (E_1 - E_2) \times I_b$

Use next higher value

$$R_2 = \frac{E_2 - E_3}{5 \text{ milliamperes}}$$

Use next lower value

Wattage of $R_2 = (E_2 - E_3) \times 5$ ma

Voltage of Zener = 10-20% less than output voltage required

Wattage of Zener $= E_3 \times (5\text{ ma} + I_b)$

$$R_3 = \frac{E_2 - E_3 + 0.6}{I_{output} \times .02}$$

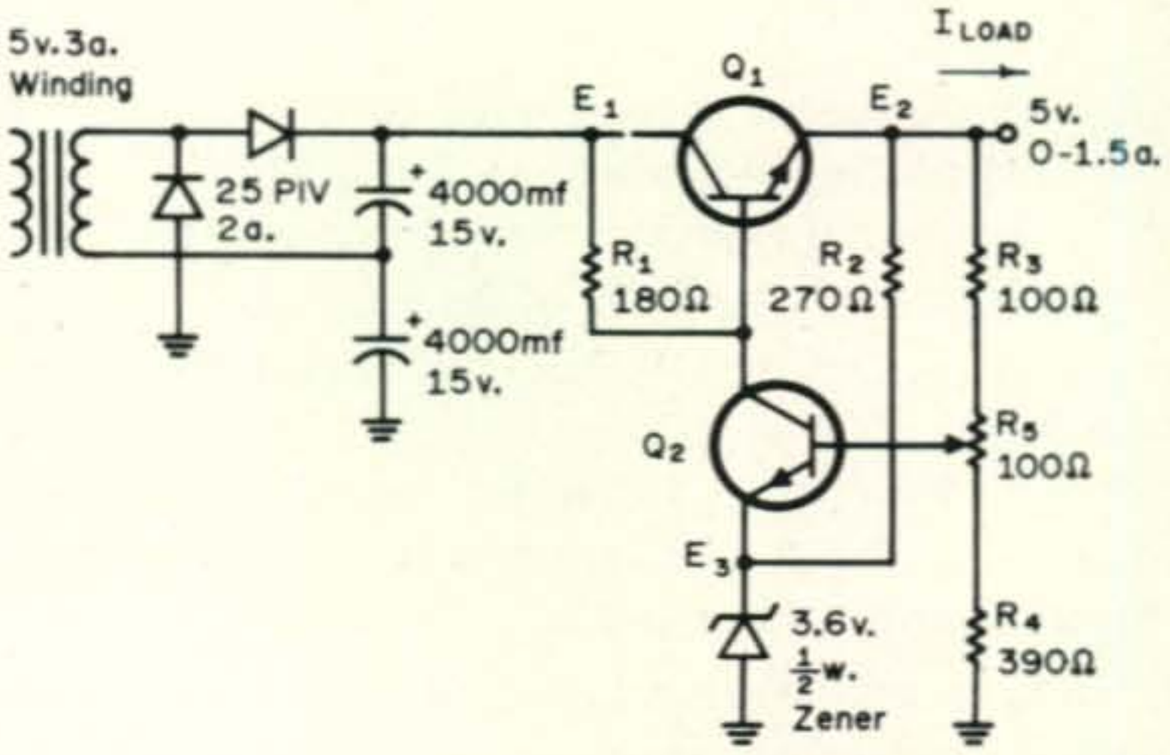


Fig. 3—Addition of Q_2 and resistors R_3, R_4 and R_5 to the supply of fig. 2 allow output voltages to be varied.

Wattage of $R_3 = (E_2 - E_3 + 0.6) \times (I_{output} \times .05)$

Use next higher value

$$R_4 = \frac{E_3 + 0.6}{I_{output} \times .02}$$

Wattage of $R_4 = (E_3 + 0.6) \times I_{output} \times .05$

Collector-to-emitter breakdown rating of $Q_1 = E_1 - E_2$

Use transistors of at least 2 × this value

Dissipation of $Q_1 = (E_1 - E_2) \times I_{output}$

Collector to emitter breakdown of $Q_2 = E_2 - E_3$

Use transistors of at least 2 × this value

Dissipation of $Q_2 = (E_2 - E_3) \times I_b$

Current gain of $Q_2 = 50$ minimum

$R_5 = 10\%$ to 20% of $R_3 + R_4$

For the 3.6 volt users, the zener can be a 1N5221 (2.4 volts) and R_2, a 220 ohm resistor. You may have to "play" with the values of R_3 and R_4 to obtain 3.6v. near the mid setting of the pot.

The previous regulator circuitry was given primarily to show how easily such circuits can be designed. While they are not by any means the ultimate that can be designed, they should solve many problems and be useful for a host of devices. Be aware of the fact however, that many of the formulas given are approximations (to keep things simple). They can be used as starting points, however, and a little "cut and try" will quickly determine the final components values.

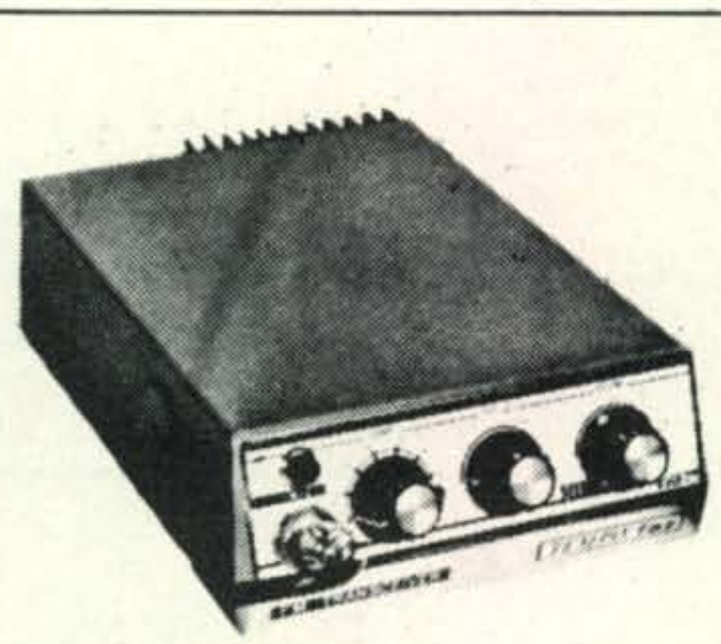
In addition many of the components for this type of circuit, such as large value filter capacitors, can be obtained from the various surplus sources we have been mentioning all along and should serve as a way to introduce these outlets to new "homebrewers".

For example: 2000 mf at 15 volts from new sources such as Sprague, Mallory, Cornell Dublier, etc., are about $2.40 each. M. Weinschenker, Bob 353, Irwin, Pa. 15642, has 3000 mf 30v. new units at only 75¢ or 3 for $2.00 (postpaid) while Barry Electronics in New York City (512 Broadway) will sell you a 4500 mf 40 volt unit for $1.25. The equivalent standard catalog item retails for over $4.00 each. These, and other similar sources can also supply all kinds of transformers for other voltage power supplies so get busy and "build-build-build!"

See you next month.

73, Irv, WA2NDM

TEMPO...a quality name...a growing family



TEMPO/fma

the top of the Tempo VHF line. This transceiver offers all of the famous Tempo quality and performance at 25 watts of power output. The unit also features a low power position for 10 watts output to conserve battery power. Here is a true value in VHF FM; Tempo presents high power operation for only $349.00.

TEMPO "ONE"

SSB TRANSCEIVER

. . . . . represents the culminating achievement of many years of experience in the amateur radio field. Modern design, superb performance, high styling, sturdy construction, outstanding reliability, exceptional value.

Tempo "ONE" Transceiver	$319.00
AC/ONE Power Supply (117/230 Volt 50/60 cycle	$ 99.00
DC/1-A Power supply (12 volts DC)	$110.00

TEMPO DKT ELECTRONIC KEYER

The Tempo DKT keyer is the latest in electronic keyer design. Using integrated circuit techniques it provides the unique features of dot memory and single dot injection which, with a specially designed twin lever key assembly, affords effortless sending and perfect character formation regardless of speed.

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TEMPO FMP

Truly mobile, the Tempo fmp-3 watt portable gives amateurs 3 watts, or a battery saving ½ watt, FM talk power anyplace at anytime. With a leather carrying case included, this little transceiver will operate in the field, in a car, or at home with an accessory AC power supply. The battery pack is of course included. Price:$225.00.

TEMPO LW 1500 DUMMY LOAD WATTMETER

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A Seven Year Study of 50 mHz Sporadic-E Propagation

BY PAT DYER,* WA5IYX

Beginning in December, 1946 with a series of articles by Oliver P. Ferrell, CQ has encouraged radio amateur research in sporadic-E propagation on the v.h.f. bands. The following special report by Pat Dyer, WA5IYX, brings up to date previous observations made by Ferrell, and by Morgan and Dorothy Monroe during the 1950's and early 1960's. The report summarizes the results of a seven year study made in the 50 mHz amateur band, and is another example of the important role amateur radio plays in the field of scientific experimentation and research. The report is especially timely since the occurrence of Sporadic-E propagation intensifies during the summer months.

W3ASK, Propagation Edition, CQ

DURING the early 1960's the author's interest in sporadic-E (Es) propagation on the amateur 50 mHz band was aroused considerably by two articles appearing in *CQ* and written by Morgan and Dorothy Monroe [1, 2]. Using the procedures described by the Monroe's, an intensive study of 50 mHz Es propagation was undertaken at WA5IYX during the period January 1, 1964 through December 31, 1970. This report summarizes the results of this seven year study.

Though several goals were in mind at the start of this study, only three of them are summarized in this report, namely the hour-to-hour (diurnal) variations observed, seasonal variations and variation within the solar cycle. Analyses of geographical distribution and drifts of sporadic-E clouds were not made, though the raw data is available.

Observations were conducted from San Antonio, Texas from January, 1964 through early August, 1966 and again from November, 1969 through the end of December, 1970. In the period between August, 1966 and November, 1969, observations were conducted from Austin, Texas, some 85 miles northeast of San Antonio.

Although the equipment used during the study varied from time-to-time, it was all commonly available 50 mHz amateur gear. Receivers used had sensitivities on the order of 1 μv, and antenna systems had gains in the 7-9 db. range. Equipment outage caused the loss of data between September and November, 1966.

*P.O. Box 27376, San Antonio, Texas 78227

[1]Monroe, M., and Monroe, D., "50 Mc Propagation Effects", *CQ*, June, 1962, p. 37.
[2]Monroe, M., and Monroe, D., "50 Mc Propagation Effects", *CQ*, Nov., 1964, p. 82.

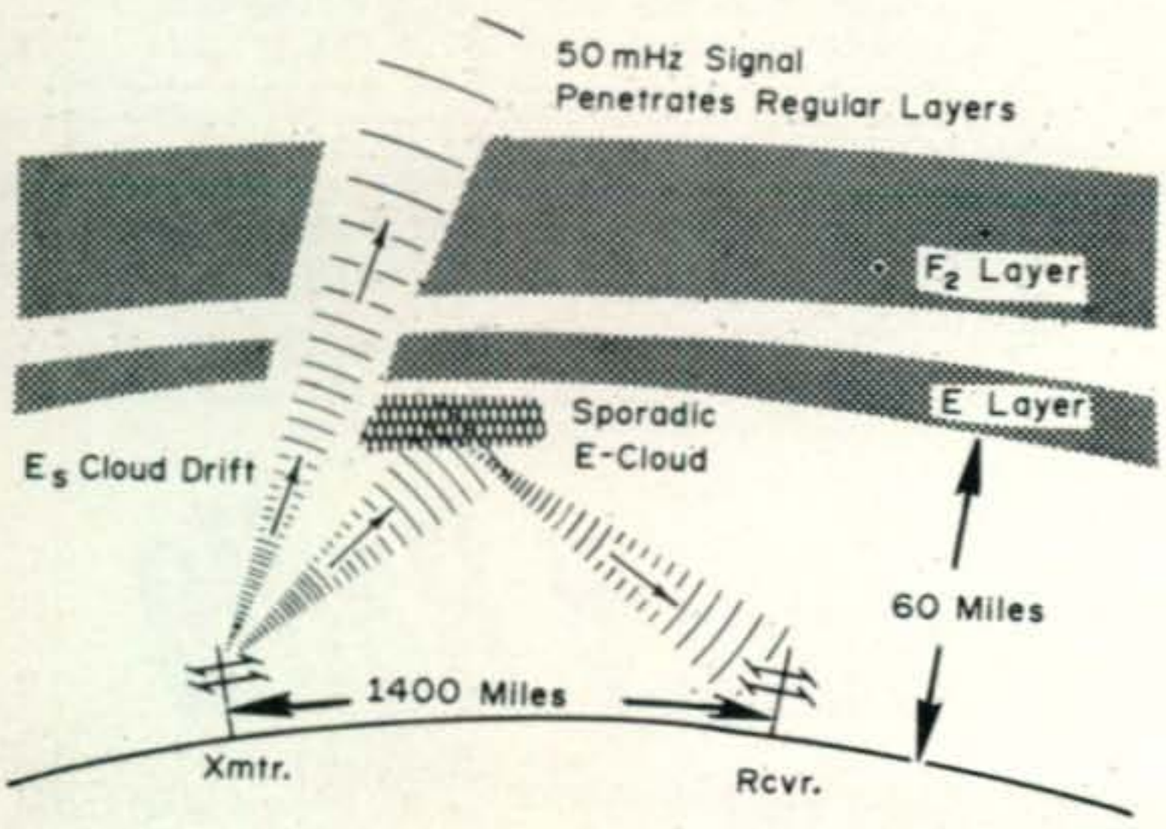

Fig. 1—50 mHz short-skip propagation by means of sporadic-E reflection.

Sporadic-E Propagation[3]

There frequently forms in the vicinity of the normal E-layer of the ionosphere, clouds or patches of abnormally intense ionization, which are capable of reflecting radio waves of frequencies much higher than those reflected by the regular E or F layers. These clouds usually cover a rather small geographical region, approximately 50 to 100 miles in diameter. They occur more or less at random and are relatively short lived, usually dissipating within a few hours. This *sporadic* ionization generally occurs about 60 miles above the earth's surface, at about the same height as the regular E layer. For this reason it is called *sporadic-E* ionization, or Es.

As a result of an intensely ionized sporadic-E cloud, it is at times possible to communicate over relatively long distances on the 50 mHz amateur band, and on some occasions on 144 mHz as well, (see fig. 1).

The height at which sporadic-E ionization occurs limits one-hop propagation to a maximum distance of approximately 1400 miles. During periods of widespread Es ionization, two-hop propagation may sometimes be possible up to distances of approximately 2500 miles. Band openings due to Es are often referred to as *short-skip* openings for this reason.

Reflection from sporadic-E clouds takes place with very little signal loss, resulting in exceptionally strong signal levels during most openings. Quite often it is possible to maintain communications considerably off the great circle path between two stations by means of back and side scatter from a sporadic-E cloud.

What causes sporadic-E ionization is not yet fully known. Since it occurs more often during the hours of daylight, it seems that ultra-violet radiation might play some role in its formation. Since it also occurs at night, especially during the winter months, auroras and meteor trails are often suggested possible sources of ionization. More recent theories indicate that the ionization might be caused by shearing forces associated with rapid wind movements in the ionosphere.

Since little is known about the ionizing sources for Es, its behavior cannot be predicted by positive means at the present time.

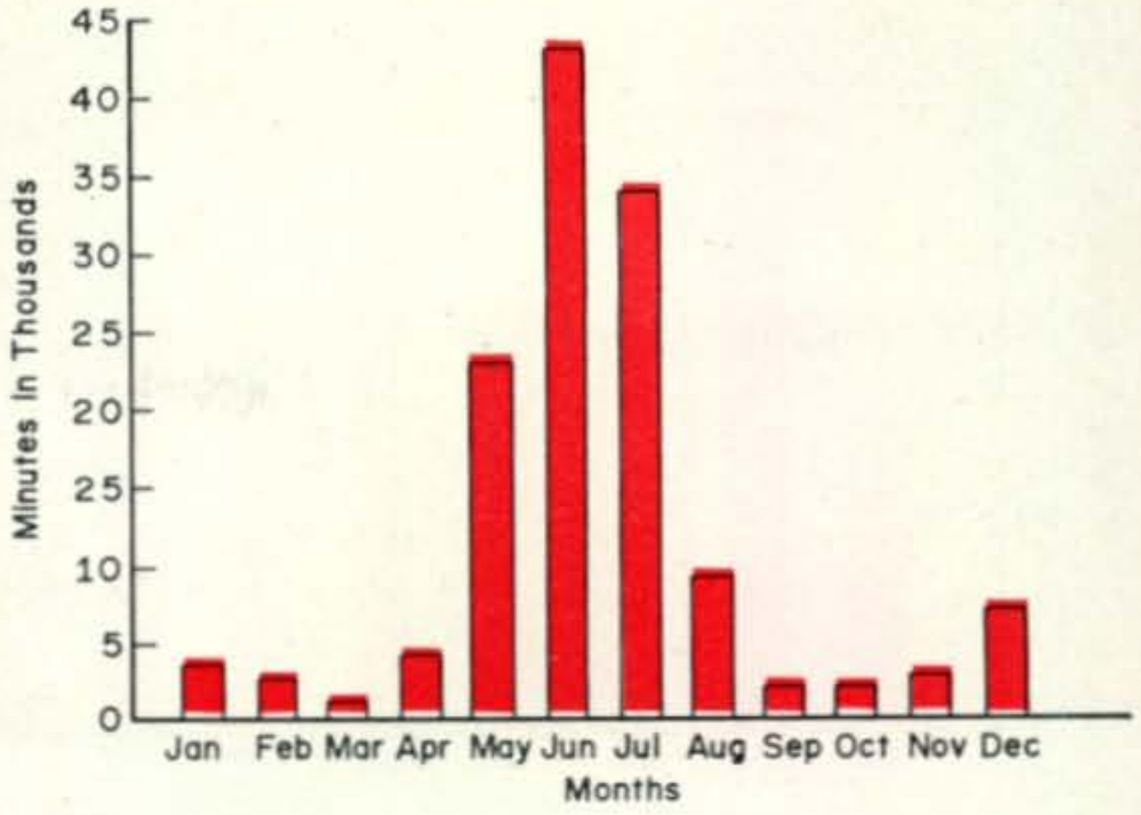

Fig. 2—50 mHz E, monthly sums 1964-1970.

Statistical studies, of the type discussed in this report, are the only means by which the characteristics of sporadic-E propagation can be determined.

Observation Criteria

For the purpose of this study only the *occurrence* of Es propagation on the 50 mHz band was noted. Onset and dropout times were recorded, but openings *were not* rated according to strength, quality, distance, bearing, etc.

An Es "opening" was considered to be any signal (except those identified as groundwave or tropo-ducting), including backscatter, received over a distance up to the one-hop limit of 1400 miles. Signals received from beyond 1400 miles were classified as multi-hop Es only when the season of the year or time of day eliminated the possibility of F layer reflection.

Onset and dropout times were recorded for all openings, with signals checked every five

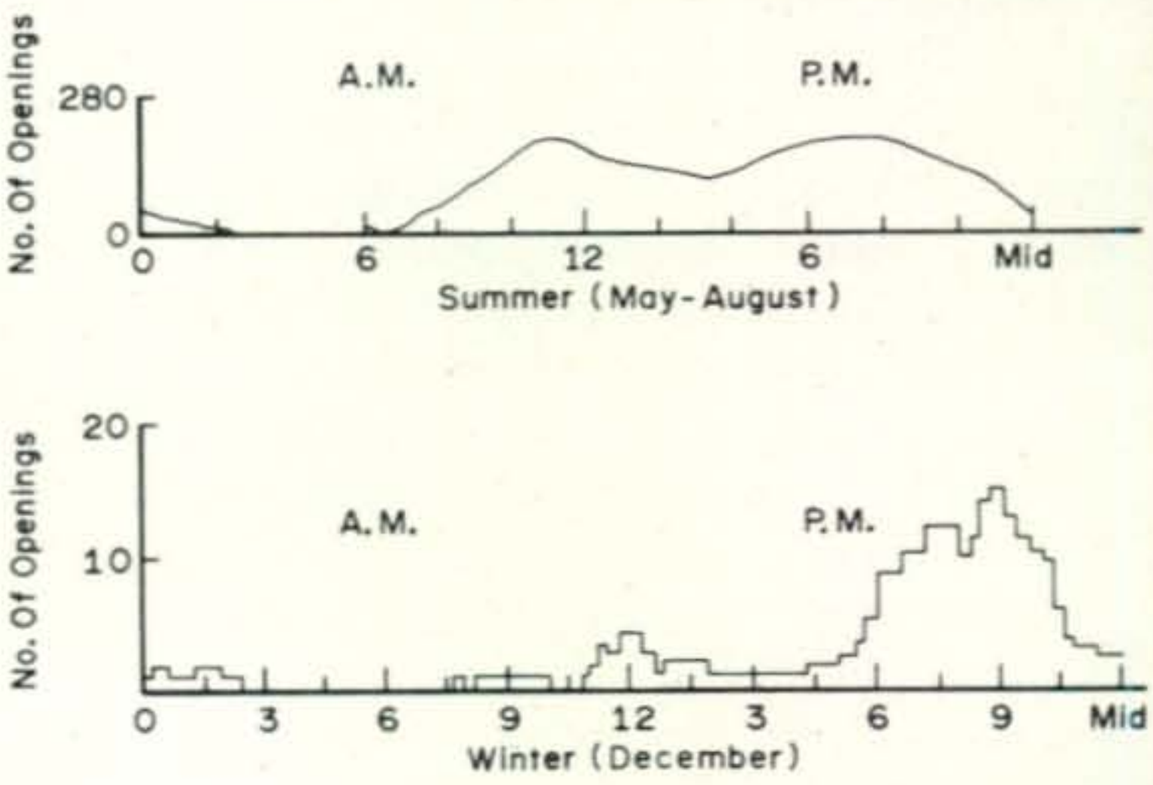

Fig. 3—Hour-to-hour variation in Es, summed for summer and winter, 1964-1970. (Note scale change in winter plot.)

[3]This section provided by George Jacobs, W3-ASK, *CQ's* Propagation Editor. See also Jacobs, G. and Leinwoll, S., "V.h.f. Ionospheric Propagation," *CQ*, Nov. 1969, p. 37.

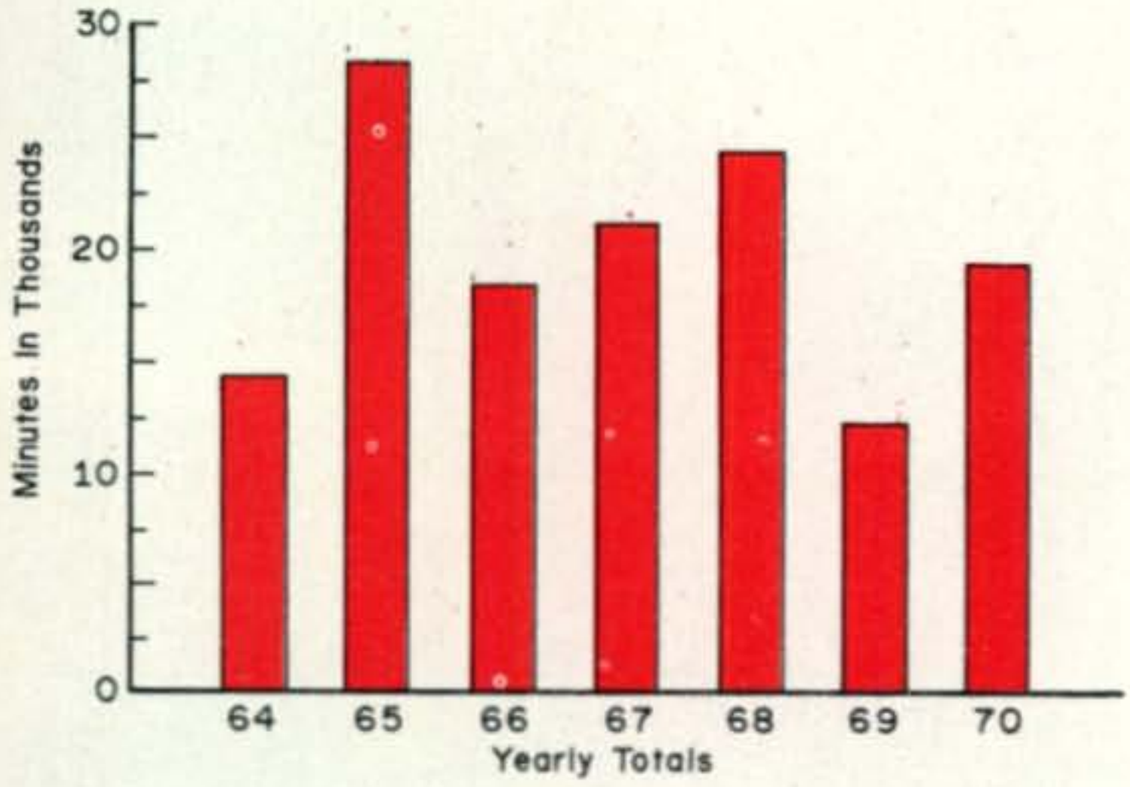

Fig. 4—50 mHz Es, year totals.

minutes. A 30 minute fade-out period was defined as terminating a given opening.

No attempt was made to separate openings according to the ionization patches that might have been involved, and during some occasions reflection from several different patches was evident. A given opening may have lasted from 5 to 500 or more minutes, and may have had one or two signals present, or hundreds of signals.

As the author was a high school and college student for the period of this study, the times available for monitoring would vary greatly in a given year. The summer periods, however, can in many ways be considered near continuous and complete.

Though a few days of data were lost incident to the station location changes, the only long-term outage of equipment was in the September-November 1966 period.

The following conclusions concerning the behavior of Es propagation on the 50 mHz band can be drawn from this study.

Seasonal Variation

Figure 2 shows the total time, in minutes, that 50 mHz Es propagation was observed for each month, summed for the 1964-1970 period. A summer maximum with a secondary winter peak are clearly noted. Nearly 80% of the yearly total of Es propagation took place from May through August, with a statistical maximum occurring in June (although July of a given year may have exceeded June). A secondary maximum is evident in the month of December, with a definite minimum occurring in March. This agrees with the long-known seasonal trends of Es propagation.

Diurnal Variation

The diurnal, or hour-to-hour variation in Es propagation is shown in fig. 3, for both winter and summer. The "double-hump" diurnal characteristics of Es propagation can be seen clearly. During the summer months, a peak occurs between 10 A.M. and noon, local time, and again from 6 to 8 P.M. Es propagation is primarily a daytime phenomenon during the summer months, decreasing rapidly after local sundown.

During December, while the peaks occur at about the same local time as they do during the summer months, the later period is well beyond sundown and into the hours of darkness. This December peak may be due, at least in part, to increased meteor activity associated with the Ursids shower which occurs during the middle of this month.

Solar Cycle Variation

Figure 4 presents the year-to-year variation in Es for the 1964-1970 period. Es was very high during 1965, at a time when solar activity was very low. Es was very low during 1969, when solar activity was at its peak. This might imply some sort of inverse relationship between Es and solar activity, but this is upset by the high level of Es which was observed during 1968, when solar activity was near maximum. According to this study, there is no clear cut relationship between Es and the solar cycle.

DX Heard and Worked

During the seven year study WA5IYX heard or worked 48 of the 50 states via 50 mHz Es propagation. Only Delaware and Alaska were missed. Hawaii was worked just once on what seemed to be a 3 hop Es opening, although it could have also been an F_2 layer-Es combination. The following foreign prefixes were also heard or worked during the study period:

CO2, CO5, FG7, HI8, KP4· KV4, TG9, VE1, VE2, VE3, VE4, VE5· VE6, VP7, XE1, XE2 and ZF1.

In covering so large a span of time it is difficult to pick out only a few highlights. During June of 1965 there was a four day period of Es during which openings occurred on three days which lasted for more than 800 minutes each—a level nowhere else found in this study. On one afternoon the rare spectacle of simultaneous reception of the states of Washington and Massachusetts was made

[*Continued on page 93*]

DX

BY JOHN A. ATTAWAY,* K4IIF

THE eyes of the DX world are focused north and west this month to the great Northwest DX Convention, W7-VE7 land's answer to Fresno and Dayton. This outstanding DX gathering is alternately hosted by the Vancouver, British Columbia Amateur Radio Club, The Willamette Valley DX Club of Portland, Oregon and the Western Washington DX Club. 1972 is a Western Washington year and a 2-day affair is planned for Seattle's Double Tree Inn on August 5th and 6th, and some exciting surprises are in store. Details regarding accommodations, activities, program and speakers may be obtained by contacting W7APN or W7AUK.

Other coming events in the northwest area include the Tacoma Amateur Radio Club Hamfest on August 19 and 20, and the Washington State QSO Party Sept. 16 and 17.

De Extra

In line with our policy of encouraging the expression of both sides of controversial questions, this month's De Extra is devoted to replies from those who disagree with the comments of Don Tyrrell, WØMYK, which appeared in De Extra on pg. 56 of the April, 1972 issue. OM Tyrrell's comments involved criticism of the "Old Timer's Accent."

de Ed Kirchhuber, K4JK: "I take umbrage to the sentence 'If you hear someone calling CQ 20 meter phone ask him why.' In this day of multiband antennas which take any signal fed to them, you could be on 40 and radiate a signal on 20 also. For a good demonstration of this, listen between 7400 and 7500 kHz some night for signals from Novices on 3700-3750. As to the phone bit, it may be correct that the man couldn't copy c.w., and the amount of trivial conversation on the phone bands tears me up. Nothing but routine small talk stretched out *ad infinitum.*"

de Michael R. Goul, K5TVU/3 (USAF): "WØMYK's comments were totally unnecessary. I am *not* an old timer, 1958 license, but see no point to the criticism. If the old timer wants to call CQ 20 meter phone, so what! Also, there's nothing wrong with announcing that a phone patch is in progress and a clear frequency would be appreciated. I always stay away from phone patches to avoid interfering with them. Apparently the only thing wrong with the procedure is that it comes from non-DXers."

DX Information Sources

Every active DXer, even the lucky stiff who is on the bands for several hours every day, needs a good source of DX news. Nobody can monitor both phone and c.w. continuously on every open band. You've got to know when the rare ones are usually operating and on which frequencies you will most likely find them, and to do so you should subscribe to one of the small news sheets devoted exclusively to DX.

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

The KG6ALV gang at the club station on the south coast of Guam. Left to right are Tom French, KG6-JBG; Tom Newberry, WA9HHJ; Chuck Purdy, K5-LAU; and Joel Chambers, K1MTJ. The station has a S-lone, 2KD-2 linear, a 3-wire rhombic terminated toward W6, and a TH6-DXX up 90 feet. (Official Navy photo via Tom, KG6JBG)

The CQ DX Award Program

C.W. DX

92.....I5IZ

S.S.B. DX

206.....W8SET
207.....G3OLY
208.....TG9GF
209.....WA8VXE
210.....WB4SIJ

CQ DX Award Endorsements

C.W.: I5IZ—150, W4WSF—Low Band
S.S.B.: G3OLY—200, WA6TAX, W8SET and TG9GF—150, W8SET and WBSIJ—Low Band

Complete rules for the CQ DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722, or to the DX Editor.

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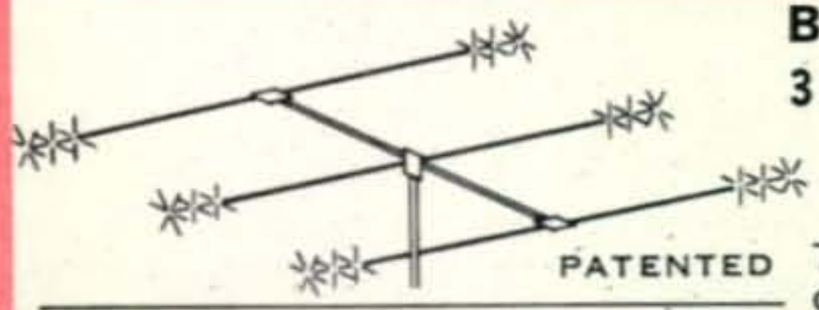

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Power Rating	1400 Watts P. E. P.
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Total Weight	23 lbs.
Single Feed Line	52 ohm
SWR at Resonance	1.5 to 1.0 max.

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Height	11′
Single Feed Line	52 ohm
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WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application is strict conformance with the *CQ* Master Prefix List. Scores are based on the current Prefix total regardless of an operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1162
VE3GCO	Garry V. Hammond	925
W8LR	Michael A. Bakos	912
ON4QX	Bob Berge	886
PAØSNG	G. Mulder	882
F9RM	Jean Pierre Guillou	881
DL1CF	Heinz Hildebrand	872
DL1MD	Heribert Rechl	844
WA6MWG	"Pete" Billon	837
W3PVZ	Joseph M. Olnick	836
K1SHN	Chuck Banta	835
W8ROC	Frederick W. Riecks	831
W9WHM	John R. Leary	811
YU1AG	Djura Borosic	811
G3DO	D.A.G. Edwards	810
DJ7CX	Leonhard Poelt	808
W4IC	George A. Mack	803
W3GJY	John F. Wojtkiewicz	797
WØAUB	Bill Bergmann	785
I6SF	Serafino Franchi	780
W4BQY	G. B. Fisher	773
W4CRW	Robert C. Sommer	753
K8UDJ	Charles L. Hutchinson	750
CT1LN	Paulo J. S. Coelho Vieira	749
KØBLT	Frank Cahoy	733
PY4AP	"Biu" Marra	715
WA5LOB	James Edwards	699
K2AAC	J. O. Archibald	686
W8GMK	John Marhefka	683
WA6EPQ	Larry Brockman	676
SM7TV	Boris Goransson	674
WAØCPX	Edward Gray	656

SSB

W4OPM	Joe Hiller	1075
W4NJF	Gay E. Milius	980
W9DWQ	Edward A. Goodbout	826
DL9OH	Karl Muller	813
IØAMU	Alfonso Porretta	759
PAØSNG	G. Mulder	758
WØYDB	Bill Higgins	751
HP1JC	Juan G. Chen	750
DL1MD	Heribert Rechl	748
I8KDB	Giampaolo Nucciotti	743
K2POA	Arthur B. Johnson	733
G3DO	D.A.G. Edwards	719
F2MO	Michel Dort	711
W4IC	George A. Mack	702
K1SHN	Chuck Banta	697
W3DJZ	Arden B. Hopple	694
WA5LOB	James D. Edwards	692
ZL3NS	T. Ositis	685
W6RKP	Jim Chavarria	622

CW

W4OPM	Joe Hiller	950
W8LY	Michael A. Bakos	909
W8KPL	William W. Simpson	853
W2HO	W. Vollkommer	825
W2AIW	Charles W. Rogers	813
DL1QT	Helmut Baumert	810
VK3AHQ	Henry Denver	809
ON4QX	Bob Berge	804
W9FD	W. Johler	740
WB2FMK	Robert J. Rasche	720
OK2DB	Jaroslav Dufka	693
DJ7CX	Leonhard Poelt	680
K1SHN	Chuck Banta	673
G2GM	F.D. Cawley	667
YU1AG	Djura Borosic	663
SM5BNX	Ake Sundvik	652
W4IC	George A. Mack	652
K2AAC	J. O. Archibald	650
I6SF	Serafino Franchi	639
K1LWI	F. Wendell Boyden	629
W8GMK	John Marhefka	628
VO1AW	Clarence Mitchell	605
VE4OX	D. E. McVittie	600

There are two general classes of DX publications: weekly and monthly. The latter are usually club oriented and contain news of club meetings as well as DX reports. To insure a steady flow of fresh information we suggest that you subscribe to the weekly paper which best suits your needs. If you also have access to a monthly you will find them to be good sources of addresses, QSL Manager listings and background information.

The following is a brief description of the weekly publications now being received by the DX Department of *CQ*, listed alphabetically. There are others, notably Geoff Watts DX News-Sheet, but we are not on the mailing list for all of them. If you would like a sample of any of these, a self-addressed envelope and 5 International Reply Coupons (IRC's) should do the trick.

DXers Magazine: As the name implies this is a small magazine, usually about 20 pages, and includes photographs. The content is mostly late information on rare stations and DXpeditions as well as band reports showing general DX conditions. It is edited by DX Hall of Famer Gus Browning, W4BPD, P.O. Drawer "DX," Cordova, S.C. 29039.

DX'Press: If you like your DX with a European flavor this 6-page flyer is a good bet. It has been published continuously for many years by V.E.R.O.N., the Dutch national amateur radio society, and is edited by PAØINA, F. Th. Osthoek, Vluchtenburgstraat 34, Middelburg, The Netherlands.

Long Island DX Association Bulletin: A 4-page, legal size flyer issued twice monthly which is a gold mine of current information on rare DX stations. The present editor is Larry Cohen, K2KGB. For further information write to Bud Dolfinger, WA2HSX, 31 Sandalwood Drive,

Smithtown, New York 11787.

Long Skip: This well-organized, 6-page paper, published by the Canadian DX Association, has the neatest printing job of any publication in its class. It is a dependable source of up-to-date DX news equally valuable to W/K and VE DXers. Contact Nick Sawchuk, Editor, 78 Chapel Street North, Thorold, Ontario.

West Coast DX Bulletin: A 4-6 page weekly published by WA6AUD and a small group from the Northern California DX Club. It is very prompt, quite knowledgeable and is widely quoted by other publications. All types of hot DX information are included. Contact West Coast DX Bulletin, 77 Coleman Drive, San Rafael, CA 94901.

The monthly publications we now receive include the following:

FEARL News: The voice of the Far East Auxiliary Radio Operators. KA2LL has done an outstanding job as editor for many years. The club address is PSC Box 1414, APO San Francisco, CA 96525.

Florida DX Club Report: DX news and club reports with a sub-tropical flavor, edited by Chuck Bolvin, K4KQ. Official club address is Box 81, Melbourne, FL 32901.

160 Meter DX Bulletin: The most complete source of 160 meter DX news available. It is published during the fall, winter and spring months by Stewart Perry, W1BB, 36 Pleasant St., Winthrop, MA 02152.

QUAX: Edited and published by Alan Taylor, G3DME, South View Rd., Crowborough, Sussex, England, this is the only amateur radio newsletter devoted entirely to the 28 mHz band.

Southern California DX Club Bulletin: Club news and good DX information, edited by Jay Holladay, W6EJJ, 5128 Jessen Drive, La Canada, CA 91011.

The DXer: Excellent, but available *only* to members of the Northern California DX Club.

The Milliwatt: Devoted exclusively to "under 5-watt amateur radio." Maintains a list of country totals of QRPp operators. News items to Adrian Weiss, K8EEG/1, Editor, 117 Central, Acton, MA 01720.

Here and There

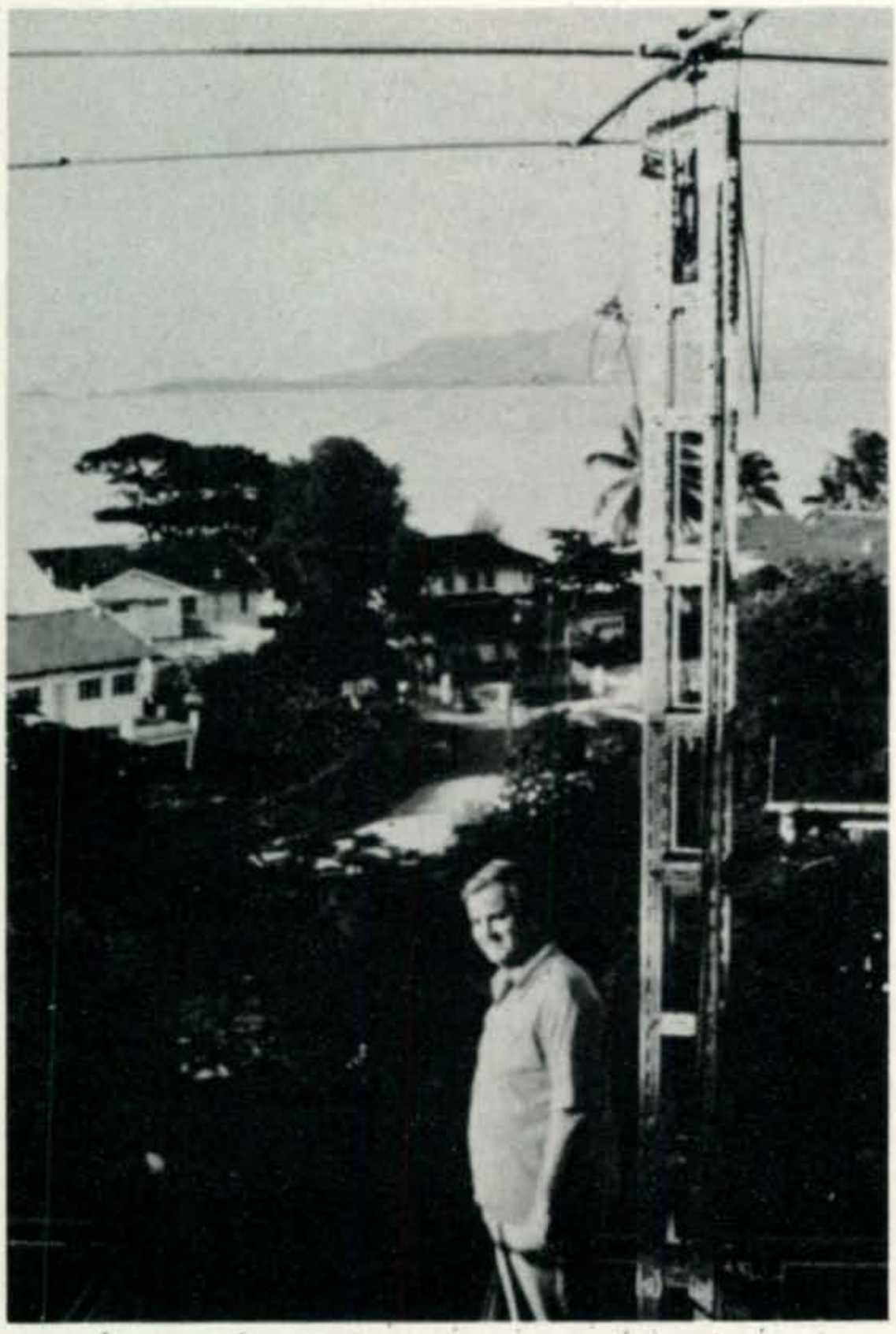
Rare Prefix News: KD6—QSL KD6USA to W6ANN, Star Route 2, Box 241, 29 Palms, CA 92277. *KE4*—QSL KE4ITU to K4ZA, 102 Hickory Rd., Sterling Park, VA 22170, and KE4FLA to W4OZF, 2311 W. Nassau Dr., Miramar, FL 33023. *PA6*—PA6ARU was on May 12-19, 1972 during the IARU Region I meeting at The Hague. Operators included PAØTO, PAØFX and PAØUB. *U5*—U5ARTEK is located at a technical school in the Crimea. Another unusual Soviet call is UPOL-19, assigned to a station on an Arctic Ocean iceberg. *WG3*—QSL WG3SFC to Box 86, Greenbelt, Md. 20770. *WM4*—QSL WM4SFC to K4PET. *WP6*—QSL WP6JPL to W6ZGC, P.O. Box 262, Barstow, CA 92311. *XQ*—This prefix was issued by the Chilean government to honor the U.N. Conference on Ecology. XQ6EQ was CE6EQ, etc. If you send 2 QSLs to XQ stations you will receive a certificate from the Chilean government as well as a QSL from the station contacted.

Guy, VE8MD, one of the operators of the Canadian weather station at Isachsen. (Photo courtesy VE2AFC)

Ten Meters: Reports of stations worked or heard under unusual or unexpected conditions on 28 mHz are being solicited by Alan Mills, GW3NNF. Alan is doing band reports for *QUAX*, the 10 meter newsletter.

DXpeditions: Franz Josef Land—The UK1ZFI effort in May was a great success with many working this rare country for the first time. QSL to Central Radio Club, P.O. Box 88, Moscow, U.S.S.R. *San Felix*—W9IFW and K9KNW made over 5000 QSO's with 120 countries. The first contact was with W9FIU and the last with JA3AAW. There were 150 QSO's, mostly c.w., on 40 meters. QSL to K3RLY. *Bouvet Island*—At presstime it is rumored that OH2BH is planning a trip to this rare country. *St. Pierre*—The July 19-27 operation was by K1BCG and W3LWE assisted by FP8AP. *Liechtenstein*—The

Ted, W1RLV, operating portable SP9 from the QTH of Lucjan, SP9VU, who is looking on in the background.



Jim Pershouse, 9M2DQ, is very active on 10, 15 and 20 from Penang Island, Malaysia. Penang is off the northwest coast of West Malaysia about 400 miles north of Singapore. Founded in 1778, it was one of the earliest British colonies in the east, predating both Singapore and Hong Kong. Jim says its a nice place for a holiday, less expensive than Singapore or Hong Kong and not nearly so crowded.

HBØXJQ operation was by W3PSM and company.

Amateur Radio in Israel

Information for this article was furnished by the Israel Ministry of Posts via Mike, WN6AIU:

Israel has 3 classes of amateur radio licenses: Grade C, Grade B and Grade A. Candidates for each class of license are required to pass the examinations for radio amateurs conducted by the Director General of the Ministry of Posts. A license is required for possession, installation or operation of all radio equipment.

Applicants for the Israeli Grade C license must demonstrate their knowledge of safety procedures, electrical units, simple circuits, frequency and wavelength, inductance and capacitance of a.c. circuits, components, methods of tuning transmitters, transmitter faults, the use of basic Q signals and operational abbreviations, recognition of call signs of prohibited countries (4X amateurs may not communicate with YI, YK, OD, HZ, JY, 4W or SU amateurs), and must pass a 6 words per minute code test. A Class C licensee is restricted to a crystal controlled c.w. transmitter with up to 10 watts power over the frequencies 7065-7085 and 21100—21150 kHz. Thus the Israeli Grade C license is roughly equivalent to our novice license.

To move up to the Grade B license, roughly the equivalent of the U.S. General license, the Israeli amateur must demonstrate in depth

The WPX Program

S.S.B. WPX

682.....KL7HDB
683.....W8SET
684.....I2PHN
685.....YV1YC
686.....DL9PH
687.....ZL1AMN
688.....W3IF
689.....EA2IG

C.W. WPX

1168.....DL9PO
1169.....OK3YCE
1170.....OE3AX
1171.....WA5VDH
1172.....DM3PEL

Mixed WPX

331.....HA4KYB
332.....WA5VDH
333.....WØYVA/4
334.....JA1WPX

WPNX

48.....WN9GIT

WPX Endorsements

S.S.B.: WØYDB—750, W8GKM—650, WB6-DXU—600, W4WSF—600, WA6AHF—600, YU1KZ—600, CR7IK—550, G3-OLY—450, W2EHB—450, YV1YC—400, I2PHN—400, KL7HDB—350, and ZL1-AMN—300.

C.W.: K6SDR—600, KØEKR—450, and W9-HE—400.

Mixed: W4WSF—750, K6SDR—650, K9-YXA—550, WA3GNW—550, and W9-EVD—450.

Phone: CT1HF—1000 (May be all time record).

WPNX: WN1ORL—150 (Highest total reported by any novice to date.)

80 Meters: DM3PEL

20 Meters: WØYVA/4, KL7HDB, YV1YC, and 12PHN

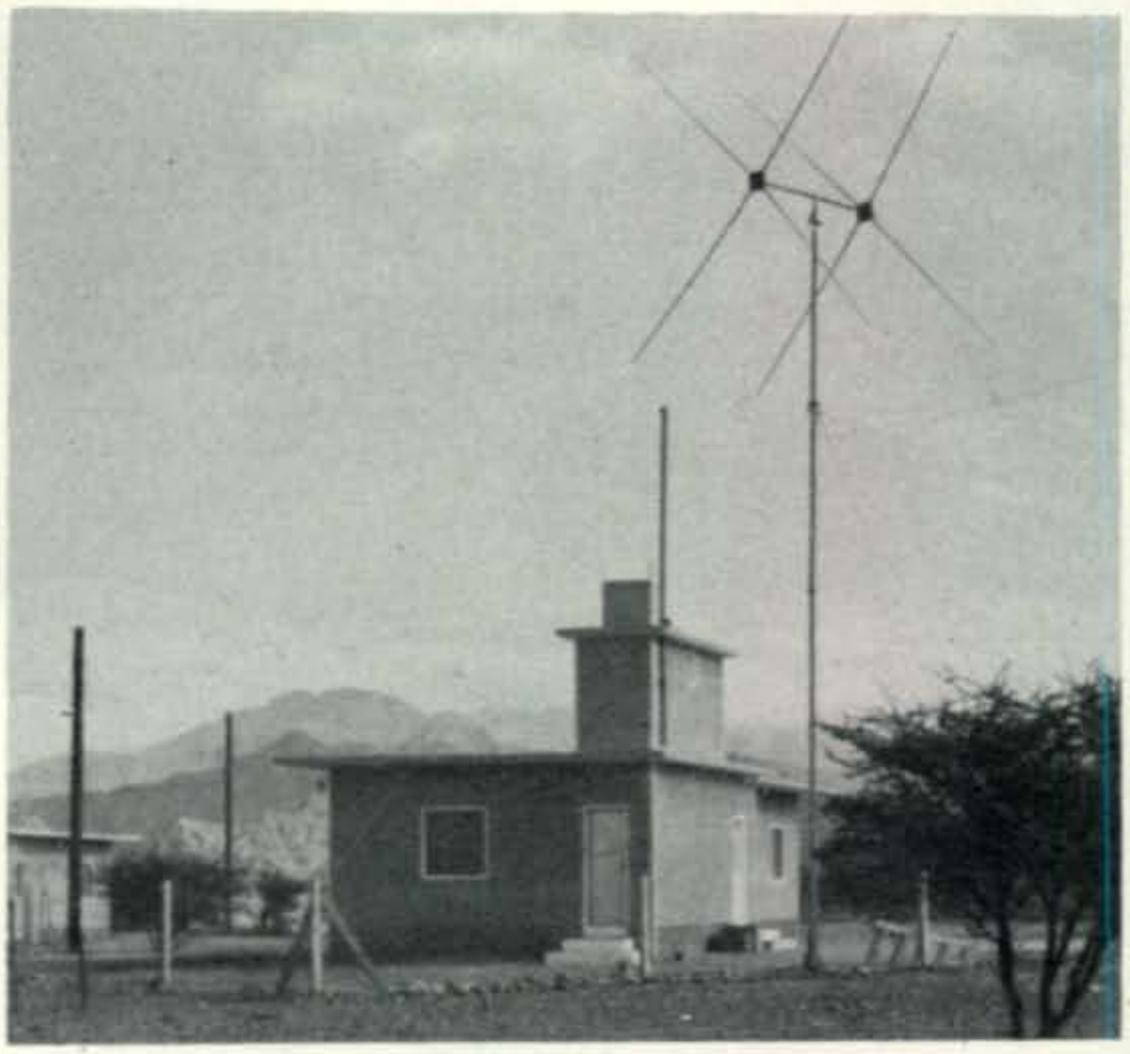
10 Meters: YU1AG

Asia: JA2LA and W4WSF

Europe: KØWWX, DL9PO, YV1YC and 12PHN.

Complete rules for WPX, WPNX, and VPX may be found on pg. 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size, self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722, or to the DX Editor.

Here are the Hams who founded the SIRA (Sociedad Internacional de Radio Aficionados) on Dec-4-71 in Miami, Fla. They also elected a provisional Board, in order to elaborate the Articles and By-laws. Sitting left to right are: WN4VQH, Orlando Martin (Treasurer), HK3CJD, German Ordonez (Delegate), HK3CAB, Hernan Melo (Secretary), WA4ZZG, Rafael M. Estevez (President), WB4TED, Tony Urbizu (Delegate) and HC2IP, Hector Patino (Delegate). Standing left to right: CO2AB, Genaro Rguez, WN4PXA Marta Estevez, CO2VE Publio Maldonado, WB4SNC Alberto Coya, s.w.l. Edgar Bueno, YN1AEO Adrian Espinosa, CO5TM Tomas Munoz, WB4JSS Mike Caruncho, CO3JR Raul Fdez, WN4VSX Eduardo Glez., WN4UIL Jorge Quintero, K4CAG Carlos Hdez and TG9MP Rene Alvarez. Picture taken by HP1FH Fernando Henrique. The SIRA welcomes any radio amateur who wishes to join their Society. Mailing address is: SIRA, P.O. BOX 71, Miami Intal. Airport; Miami, Fla. 33148



The QTH of Sam Rees, MP4TDM, of Ras Al Khaimah, Oman. Sam's antenna is a homebrew quad (10, 15, 20) and tower with dipoles for 40 and 80. Sam hopes to be active for another 6 months before returning home to Wales. QSL MP4TDM, via K1DRN who supplied the photo.

knowledge of electrical and radio principles, the stages of receivers and transmitters, and propagation of high frequency waves. He must understand transmitter tuning and operation, frequency determination and measurement, and elimination of sources of interference. He must demonstrate familiarity with good communication practices and pass a 12 words per minute code test. Privileges of the Grade B operator include the use of all amateur bands with up to 75 watts power. Power is defined by the Ministry of Posts as the d.c. input in watts to the anode of the transmitter stages supplying power to the antenna.

The highest Israeli license, Grade A, is comparable to the U.S. Advanced Class license, there being no equivalent to our Amateur Extra Class. The Grade A licensee must demonstrate a thorough knowledge of all material required for the Grade B and C licenses, in greater depth, and must pass a 16 words per minute code test. He has no additional frequency privileges but may use up to 500 watts power.

Mobile or portable operation by Israeli amateurs is very strictly controlled. Changes in the station or its location require the prior approval of the Director General of the Ministry of Posts. When a mobile station is operated more than 25 kilometers (about 17-18 miles) from the permanent location for a period in excess of 24 hours, the Director General must be notified in advance stating the intended places and times of opera-

[*Continued on page 94*]

The WAZ Program

S.S.B. WAZ

991.....F3EA
992.....W7GOC
993.....W8ZOK
994.....WA2HSU
995.....K4APL
996.....JA7GDU
997.....K4AEB
998.....W8LBM
999.....CE3OE

C.W.—Phone WAZ

3362.....F9YZ
3363.....WB2GQK
3364.....W3FUM
3365.....WB6VZI
3366.....DK2RP
3367.....W9VPE
3368.....W9YYG
3369.....W3YIK

Phone WAZ

473.....K1DRN*
474.....W1HGA*
475.....W5PWW
476.....ZL2AFT
477.....W6CYO

*K1DRN (son) and W1HGA (father) are the first father-son DX team to earn consecutive WAZ Certificate numbers.

Complete WAZ rules are shown on pgs. 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.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

July	29-30	County Hunters C.W. Contest
July	29-31	Kentucky QSO Party
Aug.	12-13	European DX C.W. Contest
Aug.	12-13	Maryland/DC QSO Party
Aug.	19-20	New Jersey QSO Party
Aug.	19-20	QRP ARC Inter. Contest
Aug.	19-20	S.A.R.T.G. RTTY Contest
Aug.	26-27	All Asian DX C.W. Contest
Aug.	26-28	Delta QSO Party
Sept.	9-10	European DX Phone Contest
Sept.	9-11	FOUR Land QSO Party
Sept.	16-17	Pennsylvania QSO Party
Sept.	16-18	Washington State QSO Party
Sept.	20-22	YLRL "Howdy Days"
Sept.	23-24	VE/W Contest
Oct.	7-8	RSGB 21/28 mHz Phone
Oct.	8-9	LU American Contest
Oct.	7-8	VK/ZL/Oceania DX Phone
Oct.	14-15	VK/ZL/Oceania DX C.W.
Oct.	18-19	YLRL Anniv. C.W. Party
Oct.	21-22	RSGB 7 mHz C.W. Contest
Oct.	**28-29**	**CQ WW DX Phone Contest**
Nov.	1-2	YLRL Anniv. Phone Party
Nov.	3-6	CHC/HTH/FHC QSO Party
Nov.	4-5	RSGB 7 mHz Phone Contest
Nov.	12	Czechoslovakian Contest
Nov.	11-12	ARRL SS Phone Contest
Nov.	18-19	ARRL SS C.W. Contest
Nov.	**25-26**	**CQ WW DX C.W. Contest**

Kentucky QSO Party

Starts: 2000 GMT Saturday, July 29
Ends: 0200 GMT Monday, July 31

This is the first QSO Party for the Bluegrass Amateur Radio Club.

Exchange: QSO no., RS(T) and QTH. County for Kentucky, State, Province or Country for all others.

Scoring: 1 point per QSO. Ky. stations use states, provinces and countries for their multiplier, all others Ky. counties. (max. 120)

A station may be worked on each band and mode and Ky. stations may work in-state.

Frequencies: Phone—3910, 7265, 14285, 21-360, 28600. C.W.—60 kHz in from low edge of each band.

Awards: Certificates to high scorers in each state, province, country and top five Kentucky scores. A plaque to the Top Ky. station. And highest Novice scores.

Mailing deadline Sept. 5th to: WB4SIJ, P.O. Box 5433, Lexington, KY 40505.

County Hunters C.W. Contest

Starts: 0000 GMT Saturday, July 29
Ends: 2400 GMT Sunday, July 30

Complete rules in last month's CALENDAR. Mailing deadline is Sept. 1st to: C.W. County Hunters Net, c/o James E. Hoffman, K1ZFQ, 42 Gresham St., Milford, Conn. 06460. Include a large s.a.s.e. if results are desired.

European DX Contest

C.W.—Aug. 12-13 Phone—Sept. 9-10
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

It's highly recommended that you study the rules given in details last month. They are a bit complicated and a modification has been made in the multiplier.

Mailing deadline for logs is Sept. 15th for C.W. and Oct. 15th for Phone. Send to the DARC European Contest, D-895 Kaufbeuren, P.O. Box 262, Germany.

Maryland/D.C. QSO Party

Starts: 2200 GMT Saturday, August 12
Ends: 2200 GMT Sunday, August 13

The 7th MD/DC QSO Party is again sponsored by the Maydale ARC. The same station may be worked on each band and mode for QSO points. Phone and c.w. are separate contests.

Exchange: QSO no., RS (T) and QTH. County for MD/DC, ARRL Section or country for all others. (Baltimore and Wash. count as separate counties.)

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

Frequencies: C.W.—3575, 7075, 14075, 21-075. Phone—3920, 7275, 14275, 21325. Novice—3735, 7175, 21110. Tech.—50.175, 145.175.

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

Logs: Should show date/time in GMT, QSO nr., station worked, RS (T) sent and received

*14 Sherwood Road, Stamford, Conn. 06905

and QTH. A summary sheet with name and address in BLOCK LETTER and a signed declaration that all rules and regulations have been observed is also requested.

Mailing deadline is Sept. 15th to: Carl E. Andersen, K3JYZ, 14601 Claude Lane, Silver Spring, MD 20904. Include s.a.s.e. if copy of results is desired.

New Jersey QSO Party

1900-0600 GMT Sat./Sun. Aug. 19/20
1200-2300 GMT Sunday, August 20

This is the 13th party sponsored by the Englewood ARA. Phone and c.w. are considered part of the same contest. The same station may be worked on each band and mode, and N.J. may work in-state stations.

Exchange: QSO no., RS(T) and QTH. County for N.J., ARRL section or country for others.

Scoring: *For N.J.*—US and VE contacts 1 point, DX 3 points. Multiply total by ARRL sections worked. (max. of 75) *Out-of-state*—Multiply number of N.J. contacts by N.J. counties worked (max. of 21)

Frequencies: 1810, 3555, 3740, 3940, 7060, 7170, 7270, 14075, 14280, 21100, 21375, 28575 and 50-50.5, 144-146. (Phone on even hours)

Awards: Certificates to the top scorers in each N.J. county, ARRL section and country. Novice and Technicians will also be awarded.

Indicate each multiplier the first time worked. A summary sheet and check list of QSO's made is also requested.

Stations planning activity in New Jersey are requested to advise EARA by Aug. 5th so that coverage of all counties may be planned.

Logs must be received no later than Sept. 16th by the Englewood ARA, 303 Tenafly Road, Englewood, N.J. 07631. Include a large s.a.s.e. if results are desired.

QRP ARC International

Starts: 2000 GMT Saturday, August 19
Ends: 2400 GMT Sunday, August 20

This contest is open to all amateurs whether or not they are members of QRP ARC International, and all are eligible for awards.

Exchange: RS(T), state, province or country, QRP number and input power for members. Non-members use same but "NM" for number.

Scoring: Each QRP member worked counts 3 points. Non-member QSO's 2 points. The multiplier is determined by the states, provinces and countries worked on each band. The same station may be worked on each band for QSO and multiplier credit.

There is also a power multiplier as follows: Over 100 watts input, no multiplier. 25 to 100 × 1.5; 5 to 25 × 2; 1 to 5 × 3; and less than 1 watt × 4. (p.e.p. double)

Final score: QSO points × multiplier × power multiplier.

Results 1971 All Asian Contest

U.S.A. All Band

W7RM	**110,000**
WA6DKF	**52,416**
WA6NGG	**38,315**
W6DQX	22,650
W9EWC	**19,602**
W3GM	**18,396**
WA5QZG	**13,680**
W1MX	**9,630**
W6GEB	9,072
WA8DXA	**6,615**
WB6PCO	4,587
W3TV	3,220
WA2DHS	**2,937**
W1QV	2,790
W6RQZ	1,357
W7NQ	1,176
WØBMM	**800**
W4JUK	**703**
W5OB	666
W6CLP	570
WB2JYM	493
K5MHG/6	468
W2DF	434
W2CVW	323
W7GAF	216
WB4OGW	180
W8MXO	126
W6KYA	117

28 mHz

WA6BVY/6	**18**

21 mHz

WA6QGW	**7930**
W6HQN	6025
K6OZL	5,775
W6RGG/6	4,032
WB5BHN	1,008
WA5WPB	572
WA3HMM	216
WN6JKK	91
WA6PMK	40

14 mHz

W1BGD/2	**14,520**
W3WJD	**13,995**
W1FBY	12,298
W6AFI	11,115
K3JYZ	8,362
K3YUA	4,716
WA6CXK	4,060
W7RT	3,614
K6IH	3,444
WA1LKX	2,772
WA5ZNY	2,552
WA7JCB	2,520
W9WKU	1,950
K7JYE	1,638
WB4QKE	1,500
W6HRB	992
K8NMG	840
WB8EUN	620
W4WSF	312
W3GID	285
W2CKR	72
W9QWM	16

7 mHz

W6MAV	**7,032**
W6KJG	5,600
WA6IVN	5,334
W6ZGM	4,642
WA6HRS	4,263
W5SBX	495
WA7OBL	91

3.5 mHz

K6CQF	**795**
K7HTZ	185
W1SWX	2

1.9 mHz

W6NUT	**12**

Multi Opr.

K4BVD/6	**84,760**
W6MAR	70,866
WB6KBI	40,248
WA7MEO	10,878
WA6DHM	5,434

Canada All Band

VE2NV	**6,396**
VO1AW	**4,956**
VE1AI/3	**480**

14 mHz

VE1AE	**420**
VE6AVO	238

Frequencies: C.W.—3540, 7040, 14065, 21040, 28040, s.s.b.—3980, 7280, 14330, 21430, 28600, Novices—3710, 7160, 21120.

Awards: Certificates to the highest scoring stations in each state, province and country. Also 2nd and 3rd place where activity warrants. The lowest power station with at least 3 skip QSO's will also be awarded.

A summary sheet with equipment description and a declaration is also requested.

Mailing deadline is Sept. 25th to: Jim Hadlock, K7JRE, QRP ARC Contest Chairman, 3701 SW Morgan St., Seattle, Wash. 98126.

S.A.R.T.G. RTTY Contest

Starts: 1500 GMT Saturday, August 19
Ends: 1800 GMT Sunday, August 20

This is the 2nd contest run by the Scandinavian Amateur Radio Teleprinter Group.

Use all bands, 3.5 thru 28 mHz. The same station may be worked on each band for QSO and multiplier credit.

Classification: Single operator, (a) less than 100 watts input, (b) over 100 watts. (c) Multi-operator, single transmitter. (d) s.w.l.'s.

Exchange: QSO no., and signal report.

Points: QSO with own country, 5 points. Other countries but same continent, 10 points. Other continents, 25 points. QSO's with Scandinavians have **double** value.

Multiplier: Each country worked and each district in W/K, VE/VO, PY, LU, VK, ZL and JA. (Use DXCC and WAE country list)

Final Score: Sum of QSO points times the sum

of the multiplier from each band.

Awards: Certificates to the top stations in each class in each country and above call districts. Additional awards if warranted.

All QSO's with Scandinavians are valid for the "Worked Scandinavia RTTY Award." Points and position achieved in this contest may be included in the 1972 World RTTY Championship.

Scandinavian country/prefixes: LA, JW, JX, OH, OHØ, OX, OY, OZ, SK/SL/SM, TF.

Mailing deadline is Sept. 18th to: S.A.R.T.G. Contest, Att: Bo V. Ohlsson, SM4CMG, Box 1258, S-710 41, Fellingsbro, Sweden.

All Asian DX C.W. Contest

Starts: 1000 GMT Saturday, August 26
Ends: 1600 GMT Sunday, August 27

This is the 13th annual contest sponsored by the JARL. The exchange will be between Asian countries and the rest of the world. All bands 1.8 thru 28 mHz, on c.w. only.

Classifications: Single operator, single and all bands; multi-operator, single transmitter, all band only. (Multi transmitter operation not permitted).

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

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

Final score: For Asians, sum of contacts on each band multiplied by the Country multiplier from each band. For non-Asians, sum of contacts on each band multiplied by the Asian Prefixes worked on each band.

Awards: Highest scoring stations as follows: Single operator, all band—Certificates and plaques with medals in each continent. And 1st, 2nd and 3rd place certificates in each country. And 1st place in each USA call area.

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

Multi-operator—Certificates and plaque with medal in each continent. And 1st place in each country.

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

Things to remember: Non-Asian stations use prefixes for their multiplier. Multi-operator stations are restricted to single transmitter operation, contacts on different bands in the same time period are prohibited. (Club stations are considered multi-operator). Each operator of a multi station will give his age in the exchange. Contacts with KA stations do not count.

Disqualification: Violation of the regulations in the country of the contestant, or the rules of the contest, or unsportsmanship conduct, or taking credit for incorrect QSO's or multipliers, or duplicate contacts in excess of 2% of the total made, will be deemed cause for disqualification. The Committee's decision is final in all disputes.

Logs must be **received** no later than Nov. 30th and go to: J.A.R.L. Contest Committee, Central Post Office, Box 377, Tokyo, Japan. Include one IRC and s.a.e. for copy of results.

Delta QSO Party

Starts: 2000 GMT Saturday, August 26
Ends: 0200 GMT Monday, August 28

This is the 3rd annual QSO party sponsored by the Delta division of the ARRL. Delta stations (Ark., La., Miss., Tenn.) may work stations both in and outside their boundries, others only Delta stations. The same station may be worked on each band and mode, mobiles each county change.

Exchange: QSO no., RS (T) and QTH. County and state for Delta, ARRL section for others.

Scoring: For Delta, QSO's times ARRL sections worked. (max. 75) Outside Delta, QSO's times Delta counties. (max. 316) DX stations may be worked for QSO points only.

Frequencies: C.W.—3550, 7050, 14050, 21050, 28050. s.s.b.—3990, 7290, 14290, 21390, 28590. Novice—3775, 7175, 21125.

Certificate Awards:

A. Achievement: All stations contacting 5 stations in each of the 4 Delta states.

B. Delta: To the 3 highest scoring stations in each of the 4 states.

C. Others: To the highest scoring station in each ARRL section and country.

D. Plaques to the top scorer both in and outside the Delta division. Also to the top scoring portable and mobile station.

Additional awards where warranted.
Mailing deadline is Sept. 25th and logs go to: Malcolm P. Keown, W5RUB, 213 Moonmist, Vicksburg, Miss. 39180

Editor's Notes

I'm much too busy trying to meet the deadline for the C.W. Contest results. Hope you are having a pleasant summer.

73 for now, Frank, W1WY

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

Propagation

BY GEORGE JACOBS,* W3ASK

SOLAR activity appears to have experienced another temporary plateau, and is now running somewhat higher than originally expected.

A monthly mean sunspot number of 64 was reported for April, 1972 by the Swiss Federal Solar Observatory. This results in a smoothed sunspot number of 67 centered on October, 1971. A level in the mid-fifties was originally forecast for October, so the cycle is running about 10% higher than expected. This accounts for the better than expected propagation conditions experienced on all the h.f. bands during the spring months.

Between May and October, 1971 the sunspot cycle remained practically constant, but it is now believed to be decreasing at a slow rate. A smoother sunspot number of 47 is forecast for August, 1972.

August Propagation

H.f. propagation conditions undergo a transition during late August and early September, and this period is the most difficult for which to make an accurate forecast. On some days typically summertime conditions will exist, and the bands will behave much as they did during July. On other days, conditions will be more typically fall, with higher daytime and lower nighttime frequencies.

For a period of about a month, from mid-August to mid-September, h.f. propagation conditions are expected to be changing back and forth between summer and fall conditions. For this reason, this month's DX Propagation Charts cover only this *one month* period, rather than the usual two month span. Short-Skip Charts appearing in last month's column are also valid through the month of August.

During this transitional period, there should be an increase in 10 meter openings, mainly to areas of the world in southern or tropical regions. Excellent DX openings are forecast for 15 meters to Latin America, most of Africa and the Australian and South Pacific areas. East-west openings to Europe and the Far East should improve considerably by late August, becoming quite good by mid-September. Fifteen meters should remain open through much of the daytime hours, and into the early evening hours as well. Exceptionally strong signal levels can be expected during many openings, and this band should be optimum for DX openings to many areas of the world from a few hours after sunrise, through the late afternoon hours.

Good-to-excellent world-wide DX propagation conditions are forecast for 20 meters during much of the daytime and evening hours. Peak

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

LAST MINUTE FORECAST

August, 1972

Days	Rating & Forecast Quality (4)	(3)	(2)	(1)
Above Normal: 2, 8-9, 12, 21, 23, 29	A	A	B	C
Normal: 1, 3, 6-7, 10-11, 13, 18-20, 22, 24-26, 28, 30	A	B	C	D
Below Normal: 4-5, 14, 16-17, 27, 31	C	D	D	E
Disturbed: 15	D	D	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 parentheses 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.; 1 kw p.e.p. 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 short skip Charts are valid through Aug. 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 August 15, 1972, through Sept. 15, 1972 and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

conditions should occur during and shortly after sunrise, local time, and again during the late afternoon and early evening hours. To many southern and tropical areas the band should remain open through most of the hours of darkness as well.

Static levels are expected to decrease steadily after mid-August, and some fairly good 40 meter DX openings are forecast during the early evening hours, with conditions improving during the hours of darkness and through the sunrise period.

Fairly good 80 meter DX openings are forecast to some areas of the world during the hours of darkness, with conditions expected to peak just as the sun begins to rise on the "light" side of the path.

It's still too early in the season for 160 meter DX openings, but an occasional one may be possible during the hours of darkness and the sunrise period.

V.H.F. Ionospheric Openings

While sporadic-E propagation is expected to taper off by mid-August, some 6 meter openings are likely to occur over distances of approximately 750 to 1300 miles. During periods of intense sporadic-E ionization, two-hop 6 meter openings may also be possible up to about 2500 miles, and 2 meter openings may take place over a range of about 1200 to 1400 miles. For more detailed information concerning sporadic-E propagation on 6 meters see, "A Seven Year Study Of 50 mHz Sporadic-E Propagation," by Pat Dyer, WA5IYX, which appears elsewhere in this issue of *CQ*. According to Dyer's study, while sporadic-E openings may occur at just about any time, there is a tendency for them to peak between 10 A.M. and noon and again between 6 and 8 P.M., *local standard time*. The occurrence of sporadic-E ionization should decrease considerably by mid-September.

Trans-equatorial (TE) openings on 6 meters should begin to increase during late August, and become fairly frequent by mid-September. Optimum time for TE openings between the USA and Latin America is between 8 and 11 P.M., *local standard time*.

The *Perseids*, a major meteor shower, is expected to take place between August 9 and 13, with maximum intensity occurring at about 11 P.M. EST on August 11. Another, but less intense, meteor shower is expected during the first few days of the month. During the Perseids shower, an average of 50 meteors should enter the earth's atmosphere every hour. Ionization produced by these meteors, especially during peak intensity, should be sufficient to make possible numerous meteor-scatter type openings on the 6 and 2 meter bands. The range of these openings should be up to several hundred miles.

Conditions during late August and September should be fairly good for some auroral-scatter type openings on both 6 and 2 meters. These openings can range from a few hundred up to about a thousand miles and are most likely to occur during those periods when h.f. propagation conditions are either disturbed or below normal. Check the "Last Minute Forecast" appearing at the beginning of this column for the days that are expected to be in these categories during August. ■

August 15-September 15, 1972

Time Zone: EST (24-Hour Time)

EASTERN USA TO:

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

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

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

Time Zone: CST & MST (24-Hour Time)

CENTRAL USA TO:

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

Time Zone: PST (24-Hour Time)

WESTERN USA TO:

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

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

THE awards PROGRAM

BY ED HOPPER,* W2GT

FOR the August, "Story of The Month", I wish I could use the entire "Story" of *'County Hunting History'* compiled by Don Brickey, W7OK. Unfortunately, space limitations make that impossible, but I will squeeze in as much as possible. This history was compiled for MARAC members and those who attend the Annual ICHN Convention in Peoria, Ill. Many thanks to Don for sending me an advance copy. For those unable to attend the convention, Don has promised to honor requests for copies if you send him 16¢ in stamps to cover postage. Those outside U.S., Canada and Mexico could presumably receive a copy for the equivalent of 26¢ U.S. stamps.

"Amateur Radio Operators since the beginning have always been striving for achievement in that part of the hobby which appealed to them. In the beginning, the struggle was to achieve success whether it was a construction project, a QSO across town or across a continent or ocean. While many have been satisfied with 'chewing the rag' with local friends, others desiring to achieve operating accomplishments led to the Awards Programs which have proven so popular down through the years.

"Starting in the 1930's some of the original operating awards were WAC, WAS, WAZ and WPX, shortly followed by the DX Century Club.

"A natural to follow these was the County Hunters Program, oh yes, each and every Country, State and etc. . . . soon had their own clubs etc. . . . to promote programs.

"In 1960, County Hunting was well under way. The first amateur to qualify for the USA-CA-500 was K2PFC, immediately followed by W8IBX, WØMCX (now WØBK), PJ2AF, W8-NAN, ZL1TB, K6SXA, K6YMZ, VE3BKL, W5PSB, KL7MF, W4UF, TG9AD, K5DGI, DL9PF, SM5WI, W8WT, K9EAB, WA3BQX, W1GKJ, W5AWT, W5NXF, W4WSF, W6YC, KH6DKA and VE2-8679.

"At first there were no specified frequencies or nets for the County Hunters and no one ever dreamed of working all USA counties, but few gave much thought to mobiles.

"Some of the far sighted County Hunters who created the 7,225 Net in August 1963 were K8CIR, K9UTI, K8IQB, K9EAB, K8IWI and K8KOM. It was at this time that mobile units started their real contribution to county hunting. On Sept. 5, 1963, K9UTI contacted W5JUG/M on 40 meters and stayed in contact with him through 40 counties.

"With the help of the many mobile operators, County Hunters totals really started to rise. K9EAB was the first outstanding County Hunter and he did it all from an iron lung! Yes, on August 15, 1965, Cliff Corne, Jr., was the first to contact All U.S.A. Counties."

Wish I could list all the outstanding Mobileers, Net Control Stations, All County Winners, County Awards, ICHN Conventions, County Hunter Organizations such as MARAC, but most of this has been covered in my *CQ* columns. Don does wish to thank all those who contributed information to him to make his history possible. These include *CQ* Magazine, K3LXN, WØKZZ, K9UTI, WØBL, WA4BMC, W9JR, K4LSP, WAØSHE, W4HA, W7PXA, WA4MGC, K4-FPF, K9KKX and WB2FVO. Naturally, County

*P.O. Box 73, Rochelle Park, N.J. 07662.

Special Honor Roll
All Counties

#74—Loyola High School ARC, WB6CPE, 4-14-72.
#75—John McCaa, W4HA, 5-4-72.

USA-CA HONOR ROLL

3000		2000		1000	
WB6CPE	94	WB6CPE	150	WB6CPE	266
WPE9ETT	95	K1OAZ	151		
K1OAZ	96	K1ZSI	152		
W4HA	97	W6CLM	153	**500**	
2500					
WB6CPE	128			K6GNZ	892
K1OAZ	129	**1500**		WB6IEX	893
K1ZSI	130	WB6CPE	183	OD5LX	894
WB4FBS	131	K1ZSI	184	LZ1KAA	895

L to r—Tom Harrell, K4TSJ and Ted Truszkowski, OD5LX on recent visit to USA.

Hunting is *not* exclusively a male hobby, we have many FB YL/XYL County Hunters and WA4-BMC was the first to acquire All Counties followed by WA7IRD, WAØSHE and WØAYL. The two stations outside the U.S.A. who have won All Counties Plaques are ZL1KG and TG9UZ. Congratulations to all, and as Don said, "Good luck, good hunting, County Hunters and Happy travels!"

Awards Issued

All Counties Award/Plaque #74, endorsed All Phone to the Loyola High School Amateur Radio Club, WB6CPE, Rev. Terence Koch, S.J., K6HZT Trustee. Also USA-CA-3000, 2500, 2000, 1500 and 1000 endorsed All 20 2×SSB Mobiles. Yes, you guessed it, most of the operating falls on the shoulders of Father Terry who has handed out a lot of counties on his many mobile trips. Now Father Terry is working on Awards for K6HZT.

All Counties Award/Plaque #75, endorsed All Phone to John McCaa, W4HA. Also USA-CA-3000 endorsed All 14, All 2×SSB, All Mobiles. John has been burning up the roads handing out a lot of counties to the Net.

Arthur Dority, K1OAZ was issued USA-CA-3000, 2500, and 2000, endorsed All SSB.

Andy Draeger, WPE9ETT qualified for USA-CA-3000, endorsed All Phone. This is #2 to an s.w.l., #1 went to Fred Woodley, VE3-9301, January 7, 1970.

Eddie Grogan, K1ZSI was sent USA-CA-2500, 2000, and 1500, endorsed All 14 SSB Mobiles. (Unfortunately I seem to want to spell Eddies name as Gregan, don't feel bad Eddie, many insist on calling me Hooper or Harper, Hi!).

Cliff Taylor, WB4FBS/WA5ZUV/exDL4BO, won USA-CA-2500, endorsed All SSB.

Bill Winnegar, W6CLM applied for USA-CA-2000.

Bill Paige, K6GNZ sent for USA-CA-500.

Larry Rose, WB6IEX was sent 500 Award endorsed All 14 A-1.

Ted Truszkowski, OD5LX finally applied for USA-CA-500, endorsed All A-1, #1 to Lebanon and #5 to Asia. The reason I say finally is because Ted could have been the 1st Asian to receive USA-CA as his *Record Book* was completed and Certified in May 1965 but he never sent it in until April 1972. Other Asian stations to receive USA-CA were KA9MF, Club Station on April 5, 1968; JA1KSO, Nob Itoh, December 16, 1968; JA2WB, Shohel Numoto, January 7, 1969; and JA1ACA, Shigeru Haga, November 19, 1970.

LZ1KAA, Amateur Radio Club of Sofia received the first USA-CA-500 issued to a station in Bulgaria.

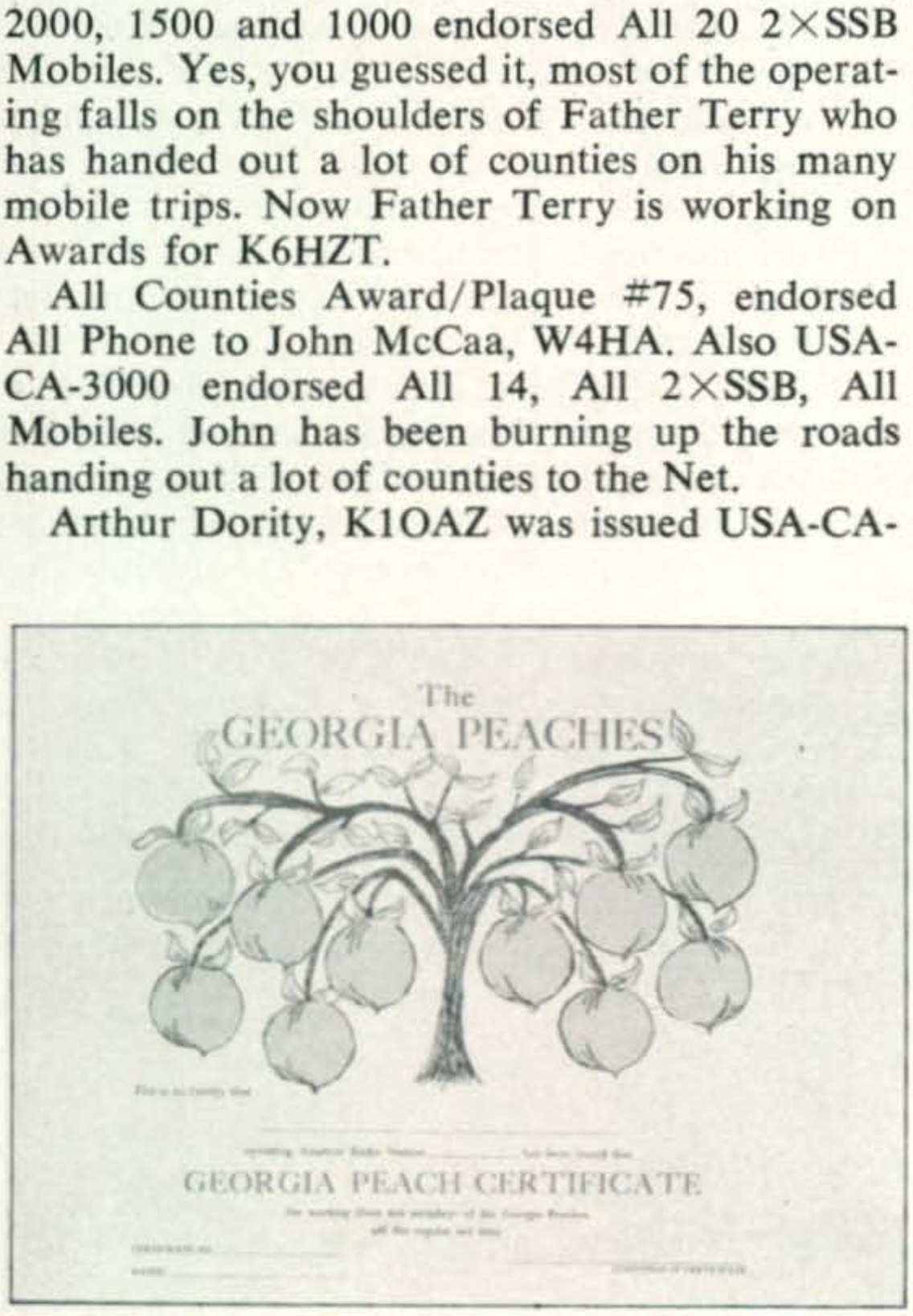
Awards

Georgia Peach Certificate: For basic award, work ten (10) members of the Georgia Peaches, endorsement seal is given for working 10 additional members. Send list of stations worked, giving date and time, certified by 2 other amateurs (GCR) and 25¢ to: Carrie C. Lynch, WA4-BVD, Route 2, Cochran, Georgia 31014. I assume a list of members could be obtained from Carrie for s.a.s.e.

The Ten Ten Club Award: To stimulate the use of 10 meters to keep it for amateurs, this Award is being offered for working 10 members of the 10 10 Club. Send log data, including their name and number to: Claude Martin, W6LRY, 3603 Syracuse, Baldwin Park, California 91706. Be sure to include $1.00 for membership for 1 year.

Six Meter Key Club Award: To stimulate activity on 6 meters, this award is offered to any ham guttsy enough to try operating c.w. on six meters (Try it, you'll like it, says, Dennis). Any 10 QSOs with 10 different stations on c.w. qualifies one for the certificate. 10 QSOs for each endorsement. Send log data and 25¢ or 2-IRCs to cover postage to: D. McCormack, K1PLX, RR2—Box 329, Salem, New Hampshire 03079.

The Lake Erie Award: Sponsored by The Lake Shore Amateur Radio Association and issued for working counties bordering Lake Erie. There are 13 counties in 4 states. They are Monroe and



Georgia Peach Certificate.

The most powerful signals under the sun!

hy-gain

Redesigned

HAMCAT

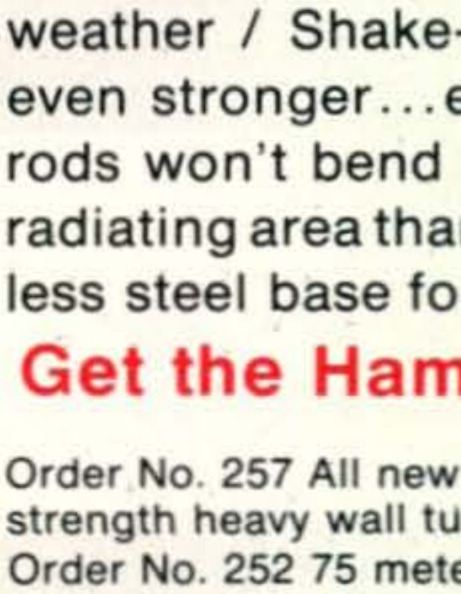
Out-hustles them all!

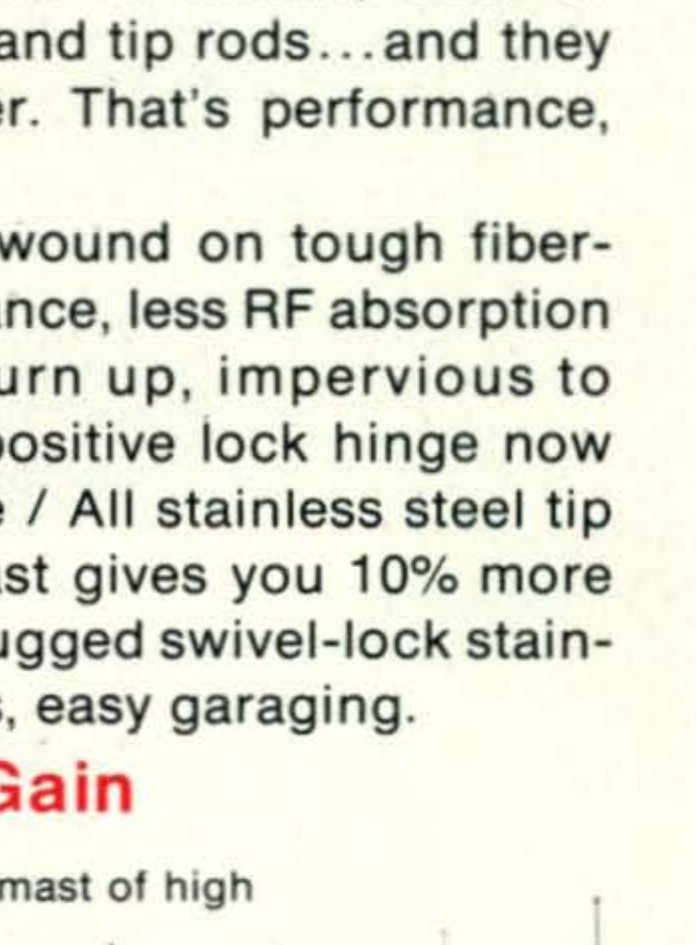
The famous HAMCAT...now redesigned for greater performance...*equals* or *exceeds* the performance of any other Amateur Mobile antenna. *We guarantee it!* And you need buy only one mast...whether you mount it on fender, deck or bumper. There's just one set of coils and tip rods...and they all stand up to maximum legal power. That's performance, that's value...*THAT'S HY-GAIN!*

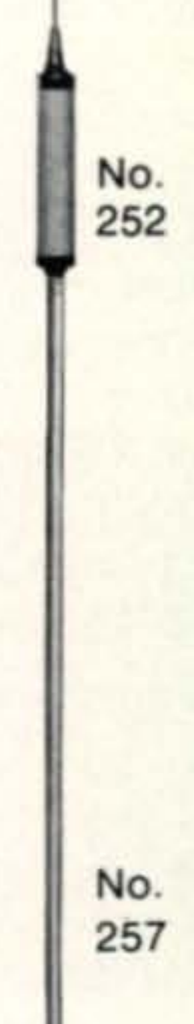
Original Hy-Q "quick changer" coils wound on tough fiberglass coil forms for greater heat resistance, less RF absorption / Fiberglass shielded coils can't burn up, impervious to weather / Shake-proof, rattle-proof, positive lock hinge now even stronger...eliminates radio noise / All stainless steel tip rods won't bend or break / Full 5' mast gives you 10% more radiating area than the competition / Rugged swivel-lock stainless steel base for quick band changes, easy garaging.

Get the Hamcat...from Hy-Gain

Order No. 257 All new design 5' long heavy duty mast of high strength heavy wall tubing	**$16.95**
Order No. 252 75 meter mobile coil	**$19.95**
Order No. 256 40 meter mobile coil	**$17.95**
Order No. 255 20 meter mobile coil	**$15.95**
Order No. 254 15 meter mobile coil	**$12.95**
Order No. 253 10 meter mobile coil	**$10.95**
Order No. 499 Flush body mount	**$ 6.50**







HY-GAIN ELECTRONICS CORPORATION

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

Six Meter Key Club.

Wayne in Michigan. Chautaugua and Erie in New York, Erie in Pennsylvania. And in Ohio there are Ashtabula, Lake Cuyahoga, Lorian, Erie, Sandusky, Ottawa and Lucas. Amateurs in New York, Penna., Ohio and Michigan work 10 counties with all four states represented. The rest of the U.S. including VE work 8 counties with all four states represented. DX including KL and KH work 6 counties with 3 states represented. The Award is also available to s.w.ls. No starting time and no endorsements. Fee is 50¢ and for DX, 3 IRCs. Send list (GCR) with log data certified by two licensed amateurs showing they have sighted the QSLs, and fee to: David M. Maynard, WA3EZN, P.O. Box 229, Fairview, Penna. 16415.

The Pennsylvania Award Series: A series of five awards also sponsored by the Lake Shore Amateur Radio Association.

1. **Pennsylvania Cities:** For working 10 largest cities in Pennsylvania. Philadelphia, Pittsburgh, Erie, Scranton, Allentown, Reading, Harrisburgh, Bethlehem, Altoona, Chester. DX stations **only** need 8 cities and may substitute Wilkes-Barre, Lancaster, York and Johnstown.

Penna Series Award.

2. **V.H.F.:** For Penna contacts on 6 meters and above. Penna. stations work 25 stations in 15 counties. Rest of U.S. and VE work 20 stations in 10 counties. DX work 10 stations in 5 counties.

3. **Novice:** Penna. stations work 25 Novices in 15 counties. Rest of U.S. and VE work 20 Novices in 10 counties. DX work 10 Novices in 5 counties.

4. **YL Award:** Penna. stations work 25 YLs in 15 counties. Rest of U.S. and VE work 20 YLs in 10 counties. DX work 10 YLs in 5 counties.

5. **Mobile:** Penna. stations work 25 mobiles in 15 counties. Rest of U.S. and VE work 20 mobiles in 10 counties. DX work 10 mobiles in 5 counties.

Note: No endorsements, no starting time. Fee is 50¢ for U.S. and VE. DX 50¢ or 5 IRCs. Send list (GCR) with log data certified by two licensed amateurs showing they have sighted the QSLs and fee to: David M. Maynard, WA3EZN, P.O. Box 229, Fairview, Pennsylvania 16415. *Please Note* the *New Custodian*. The Lake Shore Amateur Radio Association admit they have had bad delays in the past, if anyone has applied for any of these awards and have had no action, please write to the new custodian, WA3EZN.

Notes

Yes, the *CQ* supply of *USA-CA Record Books* has been depleted, just think, some 10,000 were printed when the program began. New books should be available by the time you read this, and hopefully should be on the way to those with orders already sent in. Remember they are sent via special book rate and can take 2 to 4 weeks to arrive. Yes, there will be some changes in the books and rules, in an effort to keep costs down. Due to the rising costs of plaques and engraving, starting with All Counties Application #85, a fee of $15.00 will be charged for the plaque. (this will cover about half the cost).

Also due to the rising cost of printing and postage, the cost of 500 County Hunter QSL cards from Jack Brenner, WA2AMM, 162 Meisel Ave., Springfield, N.J. 07081, is now $4.50 postage paid for delivery east of the Mississippi River and $5.00 for delivery west of the Mississippi River. (And no one makes money at these prices). County Hunter Mobile reply QSL cards are also available from K7LTV and WA7MVY, but I have no data on their cost.

A reminder to County Hunters about the two QSL Bureaus. For complete data send s.a.s.e. to The Clearing-House for County Hunters (WA2-AEA), 4 Pinewood Circle, Corning, N.Y. 14830 and/or to ICHM QSL Agency (W6CCM), P.O. Box 146, Lakeside, California 92040.

Some data from the Radio Society of Great Britain's magazine *Radio Communication:* mail for the CN8 (Morocco) Award sent to B.P. 2060,

[*Continued on page 92*]

SURPLUS sidelights

BY GORDON ELIOT WHITE

SURPLUS is alive and well in Ohio. While urban decay and redevelopment has displaced radio row in New York and other big cities, the business seems to be flourishing in smaller towns such as Dayton. The Dayton Hamvention, last spring, had a flea market that covered two acres. Most of the wares were surplus and business was flourishing.

It is not only during a one-day hamfest that surplus sales do well in Dayton. That medium-sized city supports four surplus dealers, three of them full-time, and apparently growing, and another operating part-time.

We were welcomed particularly warmly by Dayton Electronic Surplus, 1001 East 2nd Street. Chubby, the proprietor, helped me locate some surplus items he didn't have in stock at the time, and showed me some interesting parts for my Command Set collection. Like most of the new breed of surplus houses, the retail end of the business is heavily in components, rather than complete receivers, transmitters, etc. Dayton Surplus had a good supply, at low prices, of the Korean war-vintage gray Command Sets.

Mendelson's Electronics, a few blocks away, also specializes heavily in components, spread out in bins in a large warehouse.

I did not find anyone in at Research Equipment Co., 1731 Springfield St., and Mr. Littell, of Engineering Associates, was out of town.

Dayton is fueled of course by the big Wright-Patterson Air Force Base complex. With shipping becoming ever more costly, I am finding the best surplus sources are close to the military bases which generate the material, rather than in downtown, crime-ridden cities. I visited Tallen Electronics, 300 Seventh St., Brooklyn, N.Y., and found that the proprietor, Tom Allen, was getting ready to sell out and retire. One of his problems was his location, in a New York slum where small children extort quarters in "protection money" or toss rocks at the employees.

The change in the surplus market involves the urban problem, redevelopment, such as the World Trade Center which displaced Radio Row in New York, and the simple problem of age. The proprietors who went into surplus in its heyday in 1946, are a quarter-century older now, and are thinking of retiring. At the same time surplus has moved into a class of over- specialized equipment such as computers and radar, which are not usable in their original configuration.

The result is a new crop of surplus dealers, specializing in components, new or pull-outs, or in aircraft parts, test gear, or military equipment, used by U.S. Military allies. The World War II surplus is going fast—better grab the last dregs while you can. There are no more Command Sets being made!

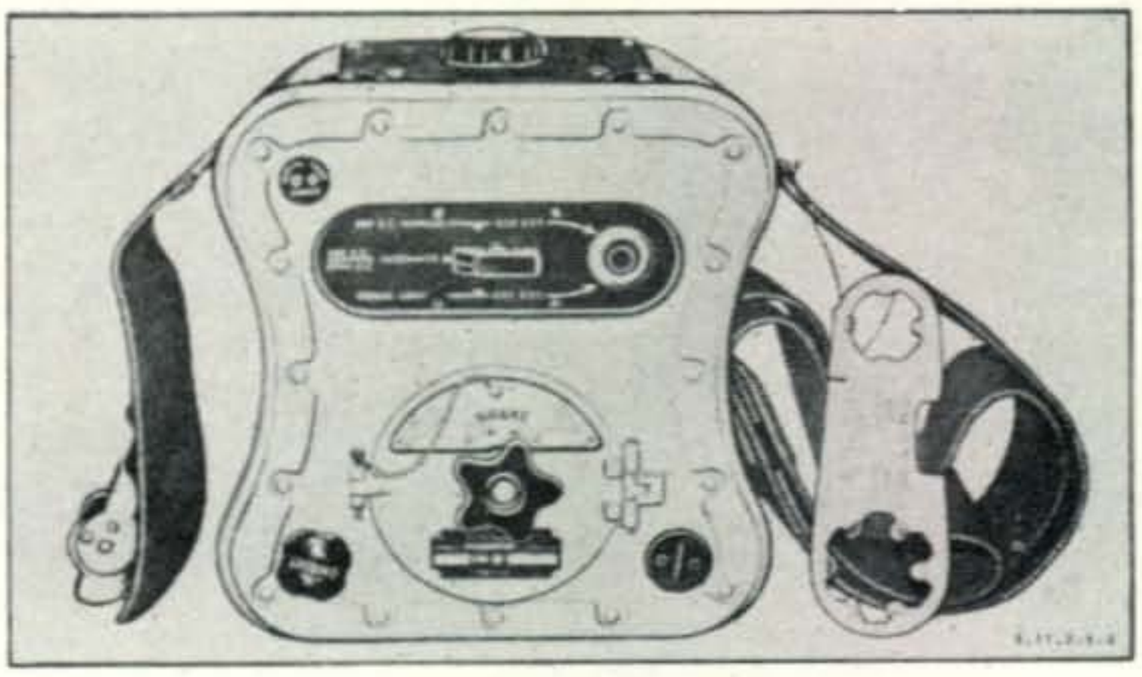
One of the left-overs from 1944 that is being disposed of by the military now is the AN/CRT-3, the familiar "Gibson Girl" emergency liferaft transmitter. This set has been standard equipment in emergency gear for nearly 30 years, but has been superseded recently by solid-state transceivers of greater range and less weight, so batches of the Gibson Girl (from the shape) are being sold now. I make no suggestions as to the usefullness of this set, but it has attracted some interest.

The AN/CRT-3 is the latest version of the SCR-278, which was a British copy of the German N.S. 2 Notsender, captured in the English Channel in 1941. Bendix Radio built the U.S. copy about the time of Pearl Harbor, so that downed airmen could crank out an automatic distress signal.

The CRT-3 puts out either a 500 kHz signal, that being one of the international distress frequencies, or on the 8364 kHz emergency channel, (others include 121.5 and 243 mHz). Earlier models of the Gibson Girl had a frequency of 8220 kHz.

The mechanism of the set switches automatically from the 500 kHz signal to 8364 kHz every 45 seconds. The lower frequency is 1000 Hz tone-modulated; the higher frequency is c.w. Both are keyed with "S O S" plus a long dash.

Cranking the set is something of a chore. I always wondered how long a downed airman could keep it going as he became weaker and weaker with hunger or thirst. Must be despera-



The AN/CRT-3 "Gibson Girl" emergency transmitter. Adapted from the German N.S. 2 "Notsender," in 1941, it gets its name from the curvaceous shape, designed to be easily held between the knees of a downed airman who is furiously cranking the power generator.

*1502 Stonewall Rd., Alexandria, Va. 22302.

tion gives strength. The voltages used are 28 at 175 ma and 300 at 40 ma. In the T-74/CRT version, the two windings are in series, to give 330 volts at 40 ma for transmitting that last 1/2 watt of power. Rated power is 2½ watts on 500 kHz and 2 watts on 8364 kHz.

The manual—T.O. 12R5-2CRT-3-2 is full of helpful advice on how to set up the antenna in the jungle or the arctic, and how a search plane should home on the signals, considering the short ground-wave and the 36 meter skip zone. One warning that should be taken to heart by anyone tinkering with the CRT-3 is care in handling the hydrogen generators for the antenna balloon. Known as gas generator M-315-A or -B, this little canister can be dangerous if treated roughly. If gotten wet, it makes hydrogen, a highly explosive, but odorless gas. Remember the Hindenburg disaster? That Zeppelin was filled with hydrogen, which exploded, probably from static electricity sparks. Handle it carefully.

In addition, the lithium or calcium hydride in the generator is quite caustic, and can burn the skin if the canister is broken open.

Really, the best use for this set is as a present for your uncle who flies his own plane. If he is ever forced down, it could save his life, particularly if he flies over uninhabited areas. Otherwise, it could make a QRP set, if you replace the hand-cranked dynamotor with a simple diode power supply similar to the a.c. units built to power Command Sets. The meager current requirements should be easy to provide with battery power for field day work, transmitter hunts, etc.

Warning number two: **Those emergency frequencies must not be used,** even for QRP. Change the crystals to amateur bands first thing. Even if you don't get in trouble with the law for transmitting on international distress frequencies, you can cause a lot of grief to search and rescue people if you inadvertantly crank up on their bands. You might even block out some poor soul who was trying to send a real distress message.

Another caution: without a proper antenna connected, the 500 kHz transmitter puts out power on its second harmonic, 1,000 kHz, which would not be appreciated by your local Broadcast station.

The Air Force has long had much smaller, battery-powered emergency transmitters, such as the AN/URC-4, AN/URC-11, etc. on 121.5 and 243 mHz, but these are too short-ranged to be useful over long distances, such as at sea, so the Gibson Girl survived these many years. Today, transistors and better batteries have finally outmoded it, and hundreds have shown up in surplus sales.

Surplus Dealers' Directory

The following is a continuation of my Surplus Dealers' directory, which I plan to run each

month as long as new addresses continue to *come in:*

California:

Mountain View, 94040, Haltek Electronics, 1690 Plymouth Ave.

El Cerrito, 94530, R.T.T.Y. Electronics, Box 655, phone 527-4847, mainly Teletype.

North Hollywood, 91609, Columbia Electronics, Box 9266, 7360 Atoll Ave.

Norwalk, 90650, Vern's Electronics Surplus, 12159-61 E. Front St., Mostly new surplus parts, some aircraft, few complete sets.

Sacramento, 95825, Selectronics, 1912 Fulton Ave.

Inglewood, 90301, H & K Sales, 815 W. Arbor Vitae, Box 254. Primarily excess industrial electronic components.

Sacramento, 95276, Sacramento Surplus Sales, 4801 Hedge Ave., general surplus.

Sacramento, 95813, Metro Aero-Tron, Box 15436, airborne equipment, test sets, components.

Culver City, 90230, Airborne Sales Co., 8501 Stellar Dr. Chiefly aircraft parts.

Arcadia, 91006, Aircraft & Component Equipment, Box 134, 25 N. Fourth Ave. Chiefly airborne parts.

Los Angeles, 90024, ARS Electronics, 616

Holmby Ave., tubes, test sets, airborne communications gear.

Sun Valley, 91352, Kal Nelson Aviation, 8124 San Fernando Rd. Chiefly aircraft electronics.

Massachusetts:

Hardwick, 01037, Onil J. Landry. Widow of WB5FAP is clearing out URR-13, LM-21, TSC-12, TSC-13, TN-233-SRC, ARN-31, ARC-27 sets and components.

Wilmington, 01887, Marshall Associates, 121 Main St., machinery and electronics.

Brockton, 02402, Materials Recycling Inc., all sorts of surplus.

Dorchester, 02125, Electro-Craft Inc., 1124 Dorchester Ave., commercial and military surplus, aircraft, and Teletype surplus electronics.

Ohio:

Columbus, 43201, Starr Surplus Sales, 1038 N. High St. Full line of military surplus, old standby units, command sets, and new test gear.

Columbus, Topper Steel & Supply, 2108 High St. Chiefly surplus tools & Hardware.

USA-CA [*from page 86*]

Casablanca returned. No reply to mail sent to the Anchorage Radio Club, P.O. Box 211, Anchorage regarding their Alaskan DX Club Award. The RSGB Certificate Manager (HF) is Charles R. Emary, G5GH, Westbury End, Finmere, Buckingham, England. RSGB Certificate Manager (VHF) is Jack Hum, G5UM, 27 Ingarsby Lane, Houghton-on-the-Hill, Leicester LE79JJ, England.

I am sure you all had a wonderful time at the ICHN Convention Peoria, Ill., I will gladly pass along data on it for those unable to attend, as soon as I get it.

Remember write, tell me, How was your month? 73, Ed., W2GT.

Adjusting and Cleaning Speed Keys [*from page 37*]

times. You'd be amazed by the number of hams who use this method. If you're in a hurry, the flip-up cover of a matchbook works equally well instead of the bond.

If the contacts look so badly pitted and burned that they seem beyond repair, try this approach: instead of bond paper, use in order (a) fine emery paper, (b) a fine finishing paper, such as "Wetordry," (c) a crocus cloth, and finally, (d) the bond paper.

For removing any leftover debris from polishing, moisten a swab stick in ordinary rubbing alcohol and clean the areas thoroughly. From this point on, the easiest trick to keep your bug clean is to put a dust cover over it when it's not in use. ■

Announcements [*from page 10*]

interest. Two national meetings have been held. A net is in operation at 2300Z on 14.280 mHz every Sunday. Tom Shelby, WA8CWA, is the net control.

Levelland, Texas

There will be a Swapfest and Picnic on Aug. 13, at the City Park in Levelland, Texas. It is sponsored by the Northwest Texas Emergency Net and the Hockley County ARC. Plenty of activities for the whole family. Talk-in on 3950 & 146.28-88 (Levelland repeater, WB5EMR) and 146.34-94, the Lubbock repeater. For more information contact John R. Bell, W5NGX, 208 Pat St., Levelland, Texas 79336.

Linwood, New Jersey

The Southern Counties ARA plans to activate WX2MAP again for the Miss America Pageant in Atlantic City New Jersey for the period of Sept. 1 thru the 15th, 1972. Operation is planned for 80 thru 10 meters c.w. and s.s.b. C.w. frequencies will be 30 kHz inside the band edge and s.s.b. will be 15 kHz inside the General class portion of the band. Operation will be from Haddon Hall Hotel (Pageant Headquarters) and a special QSL will be issued. At this writing the application for a special license has been applied for and no problems are anticipated.

Aurora, Illinois

The Fox River Radio League will sponsor an Aurora Area hamfest on Sunday, Aug. 27th at Phillips Park Pavillion. Tickets are $1.50. There will be swap tables, picnic grounds, playgrounds for the kids, food and shelter. For more information contact the Fox River Radio League, P.O. Box 443, Aurora, Illinois 60504.

50 mHz Propagation Study [*from page 68*]

—from Texas this was double hop to each coast!

June, 1968 saw the shortest Es opening, 280 miles, between Big Springs and Austin, Texas. Then longest single Es opening of the study came on May 30, 1970 with onset recorded at 7 A.M. and final fade out of signals at 1:45 A.M. on May 31, or nearly 19 continuous hours. On November 8, 1970 the longest multiple hop Es opening was observed (though some claim it was a combination of F_2 and Es), with KH6 signals at close to 4,000 miles roaring in.

Conclusions

This seven year study of Es propagation brings up to date similar studies made previously in the 50 mHz amateur band by Ferrell, the Monroes and others. It further confirms

the diurnal and seasonal behavior of Es, but still leaves unanswered the relationship between this mode of propagation and the solar cycle, if any.

There is still need for further, perhaps more specialized long-range Es propagation studies. Perhaps similar studies in the future will establish some sort of relationship with solar actvity, or point more positively in the direction of those phenomena which might be responsible for producing this sporadic ionization.

There is now general acceptance in the scientific community of the wind-shear theory of Es formation.[4] However, as yet there remain several points which have to be resolved. Long-range studies of signals in the 50 mHz band conducted by radio amateurs, particularly in cooperation with professional scientific investigation such as was carried out with ESSA a short time ago,[5] may hasten the answers to presently unresolved questions concerning this theory.

The author would like to express his gratitude for the valuable assistance, comments, and encouragement received from many fellow amateurs during this study—in particular: George Jacobs, W3ASK; Morgan, K7-ALE, and Dorothy Monroe, K7ALF; Bob Cooper, W5KHT; Mel Wilson, W2BOC; Bill Smith, KØCER; and Lorn Matheson, WAØ-EKO. ■

[4]Wilson, M.S., "Midlatitude Intense Sporadic-E Propagation—Part I," *QST*, Dec. 1970, p. 52.
[5]"Radio Amateur Volunteers Needed For 6-Meter Propagation Research," *CQ*, May, 1970, p. 31.

The System [*from page 28*]

Two months after that first encounter with the FCC examination, Charley was ready to try for that Class B ticket again. This time his sending was clean and true; his fist knew the difference between an H and a 5: his receiving was on good solid *terra firma*, too. Charley passed that Class B in a breeze. Candler graduated another one into the world of ham radio.

Epilogue

If young Charley's efforts with the FCC inspector remind you of your own lackluster efforts at reaching 13 w.p.m. or maybe 20 w.p.m., maybe you should try using this disciplined winning system, too. With little embellishment, you could build on the Candler type of material, improvising as you see fit.

Where's Charley? Oh, he's around the bands, mostly within the lower 50 kHz of 40. Whenever he hears me calling, he always QRS's to about 35 WPM for a friendly QSO. ■

Phone Results [*from page 54*]

everybody, and certainly make us happier.

Trying to cover all the highlights of an event of this magnitude is impossible in the limited space allotted. I know I have overlooked many deserving operations.

However I feel that our complete listing of scores, showing the leaders in the world, trophy winners, band by band breakdown, etc., tell a pretty thorough story.

We have added a new member to the Committee, Bob Cox, K3EST who knows what contest operating is all about. Now he knows what it's like after the shouting is all over. The rest of the gang have known that for years. Even Joan at the office can now speak with some authority on the subject.

The rest of the Committee, Fred Capossela, W2IWC; Bob Entwistle, W1MDO; Ralph Nichols, W1CNU; Andy Malashuk, W1GYE; Gene Walsh, K2KUR; and Bernie Welch, W8IMZ.

The C.W. Story next month.

73 for now, Frank, W1WY

DX [*from page 75*]

tion. If an amateur expects to leave the country, even for a brief period, he must insure that there will be no unauthorized access to his transmitter in his absence, and shall notify the Director General in advance of the expected times of departure and return.

4X-land amateurs must transmit their call signs at regular intervals for the purpose of identifying their stations. If the callsign is transmitted by telegraphy, the code speed cannot be faster than 20 words per minute.

QSL Information

Rubin, WA6AHF, announces that he is closing the books on the following stations. If you need a card from any of these I suggest that you get in touch with Rubin immediately: HS3AM, HS3GG, KA2AI, KC6EJ, KW6EO, KW6GA, PZ1DC, VK9RA, VQ9DH, VQ9GA, ZD8GA, ZD8GA, ZD9BL and WF6NNW.

A2CAL—Via DK2FI
A35FX—To ZL2AFZ
A35JH—Via WB5BHN, 2020 Guthrie Place, Las Cruces, N.M. 88001
A35LT—c/o VK6WT
CR5XX—Via WA3HUP
CR6LF—To W3HNK
CT1SQ—c/o WA5UHR
DF1WA—Via DK2BJ
DU1FH—Cards for CQ WPX test via WA8TDY

EA6DJ—To DL7FT
ET3DS—c/o VE2DCY
ET3JH—To WB8ICV, 545 Spring Lane, Flushing, MI 4-8433
FM7AA—Via WA8TDY
FR7ZU/E—To F9MS
GD3RFK—c/o K4TSJ
HD1RF—Cards for CQ WPX test via WA8TDY
HS3AFB—Via WA2WMT
HU2CEN—To WA8TDY
HUØA—c/o—WA8TDY
HZ1AT—Via G3DYY
KG6JBO—To K1JHX
KG6SI—c/o WA6AHF
KG6SW—Via W7YBX
KH6EDY—QSO's from Jan. 1, 1961 to Feb. 14, 1972 via KH6BZF
KJ6BZ—To 2194 Comm Sqdn, APO, San Francisco, CA 96305
KS4BH—c/o K3RLY
KX6EB—P.O. Box 997, APO, San Francisco, CA 96555
KZ5JF—Via WA8TDY
LU1AZO—To W2GHK
LU3AU—c/o WA3HRV
OB8V—Via W9GFF
PJ8DX—(Zone 8)—To K2FJ
PJ0AT—c/o W3RNO
PY1DBE—Via W3HNK
PY1ZAL—To K4DO, 9304 Hamilton Dr., Fairfax, Va. 22030
SU1MI (Zone 34)—c/o W3HNK
SVØWEE—Via W3HNK
TG9NJ—To K4UQC, Box 5033, Tulane Station, New Orleans, LA 70118
VK9LV—c/o G5RV
VKØMX—Via VK5TY
VP2AAC—To WB4GGA
VP2AAT—c/o WA5UHR
VP2AN—Via WA2RZB
VP2AR—To WA8TDY
VP2NU—c/o VE3HD
VP2LAT—Via WA9UCE
VP2VAN—To K2FJ
VQ9N—c/o W6IAE
VQ9WF—Via W4NJF
VR1AC—To K3RLY
VR2GC—c/o W7YBX
W9IGW/CEØ—Via K3RLY
WA2BVU/3D6—To 4X4WP
WA6JZL/TI2—c/o WA8TDY
WA7TFO/VE8—Via U.S.C.G. Station, Clyde River, NWT, Montreal AEF, Quebec, Canada
WB4ZIR—VE8—To U.S.C.G. Station, Clyde River, NWT, Montreal AEF, Quebec, Canada
WJ4AZF—c/o W40PM
WS3VOA—Via WS3VOA, 30th Anniversary Voice of America, Washington, D.C. 20547
YNØHSM—(1972 only)—To WA8TDY
YS2CEN—c/o WA8TDY
YUØN—Via YU3EY
ZD3R—To WA2BAV
ZD3S—c/o WB2AQC
ZD7BB—Via WA0WKW
ZE1DX—To WA9UES
ZF1AA—c/o K2MUB
ZS5PG—Via K6AQV, Box 932, Idyllwild, CA 92349
3D2FM—To W7YBX
3D6AD—c/o KP4DKY
4M5ERA—Via WA8MAA, 3746 S. Central, Cicero, IL 60650
5H—Due to the closing of the QSL Bureau for Tanzania and Zanzibar on Dec. 31, 1971, QSLs should be sent as follows: 5H1LV—VE3BIZ, 5H3FQ—Box 168, Dar es Salaam, 5H3JJ—5Z4JJ, 5H3JL—W9NNC, 5H3JR—W2SNM, 5H3KA—Box 939, Arusha, Tanzania, 5H3KF—9J2CS, 5H3KG—Italian Bureau, 5H3KJ—LA6GF, 5H3LV—VE3BIZ, 5H3LZ—G3LQP, 5H3MA—VE2DCY, 5H3MB—WA2UYX, 5H3ML—VE30DX, 5H3MM—SM5ERJ, 5H3MT—LA6PF, and 5H3MV—VE7SE.
5J4RCA—To HK4BZQ
5N2AAU—c/o WA9UFV
5W1AM—Via W7YBX
5W1AU—To W6KNH
5X5NA—c/o G3LQP
6Y5GB—Via VE3GMT
7X2MD—To I0IJ
8R1G—c/o WA4UOE
9G1YA—Via W5EGH
9H3B—To VE3MR
9N1MM—c/o Ed Blaszczyk, W3KVQ/2, 2308 Branch Pike, Cinnaminson, N.J. 08077
9Q5PF—Via W4WHF
9V1OE—To G3VAO
9V1QJ—c/o WA5UHR
73, John, K4IIF

Our Readers Say [*from page 7*]

the situation described may occur, leaving us amateurs in a very poor situation. If foreign (commercial) broadcasting is done on 20, 15 and 10 meters, it will probably discourage many amateurs from using c.w.—that is, amateurs in the US who are extremely limited in bandspace as compared to those in foreign lands.

One problem, if commercial broadcasting takes place on popular amateur bands, will it go without protest? That is, if the broadcasting lands on popular US amateur frequencies (which is doubtful—since we don't have that much), protest will come from US amateurs and those who enjoy working them. However, should they "buckshot" the entire band, including popular foreign frequencies, the little country of Rhumbuwaba will have quite an opposition. With the opposition of all nations represented at "the meeting," I think that the democratic system will not allow the abolition of the most popular of the amateur bands.

6 and 2 meters (and even through the gHz range) may be fine for mobile, portable, and autopatch setups, as well as for experimentation, but they certainly should not take the place of the lower frequencies, where DX operating is more feasable. One thread holding the nations of the world together is amateur radio. Elimination of the lower frequencies, where this thread is strung, may result in only two things:

The biggest and most horrid structures ever seen by the "friendly" neighborhood, towering high over their houses and threatening demolition o f that end of the city; or, the demolition of that end of the city; or, the nations of the world, unless we want super multi-multi-frequency input/output repeaters spread every so often throughout the nations.

I am not trying to violently oppose the opinion of the unknown writer of that article, but the above is what I feel *could* also be the result of such a move made by the representative of Rhumbuwaba. With best regards to this writer and all concerned, I think that we have the proper representative for us in the negotiative meetings concerning international frequency allocations. If not, we should tap the source of the poor results and not try taking over the entire thing ourselves. Such a thing might have the opposite of the desired effect!

Thank you very much and 73.

Thomas Behrens, WB6MDP
Sacramento, CA

SSTV [*from page 51*]

picture element size matched the resolution limit of the eye at the distance of most distinct vision (about 10 inches). This resulted in

"optimum" pictures as small as an inch in height. With low resolution TV you have a choice: a large fuzzy-looking picture, or a small sharp-looking one. That large screen monitor project using a 12 or 17 inch magnetic tube is a great idea for auditorium use, but I don't think you'll like to use it on the operating table! Picture diagonal size (round tube diameter) from 3 inches to 7 inches seems the most satisfactory. (Raster sizes ranging from 2"X2" to 5"X5"). Both E.S. and magnetic types cover this size range.

Electrostatic CRT'S

Figure I illustrates the construction of two typical electrostatic tubes with base diagrams and data. The 5UP7 is typical of the mono-accelerator type. The beam current is controlled by the voltage on G1 which is negative with respect to the cathode, just as in a receiving or transmitting tube. The accelerator electrodes, G2 and G4, are connected together internally and come out to one pin on the tube base. These electrodes accelerate the electrons, and in conjunction with the focus electrode G3, form an electron-optical lens to focus the beam. DJ_1 and DJ_2 are one pair of deflection plates, DJ_3 and DJ_4 are the other pair. It does not really matter which pair is used for vertical deflection since the tube can be rotated. (Incidentally, CRT's must be supported at the front and rear, never by the socket. CRT shields normally supply the required support as well as a clamp for the tube base to prevent rotation and back and forth motion once the tube position is properly adjusted.)

The average voltage at each pair of deflection plates should be the same as the accelerator (G2, G4) voltage. This means that we cannot ground the cathode of the tube and operate the accelerator at +2000 volts. The deflection plates would also need to be at +2000 volts, which is a bit high for transistor drive! The usual approach is to work backwards from the deflection system. Assume our deflector amplifier is designed to give a push-pull sawtooth output swing at each plate extending from +50 volts at the most negative point of the sawtooth to +250 volts at the most positive point. The average deflection plate voltage is thus +150 volts. If we want an overall acceleration potential of 2000 volts, the cathode must be operated at −1850 volts; since the accelerator (G2, G4) must operate at +150 volts, the average deflection

plate potential. If a −2000 volt power supply is used we have an extra −150 volts which can be used to provide a variable G1 bias. Figure 2 shows a power supply suitable for either the 5UP7 or 5ABP7. (The dotted circuitry is not used with a monoaccelerator tube such as the 5UP7.)

The voltages shown in fig. 1 apply when the overall cathode-to-(G2, G4) voltage is 2000. Where two voltages are shown for one electrode, it reflects possible limit values caused by manufacturing tolerances. The gun (G element) voltage's are measured with respect to the cathode. The deflection plate voltages are measured between the plates of a pair. The ratio of voltages between the various tube electrodes is determined by the physical construction of the tube. The actual numerical value of the voltage needed at each electrode depends on the actual G2, G4 voltage used. For example, if the available power supply gives a cathode-to-(G2, G4) voltage of 1500 volts instead of 2000, multiply the voltages in the table by 0.75 (1500÷2000=.75). This applies to the deflection plate sensitivity also, as less voltage is needed to deflect the beam when the electrons are moving more slowly.

Deflection plate sensitivity is a bit tricky to understand. Look at the push-pull sawtooth waveforms applied to DJ_1 and DJ_2 in fig. 2. At the beginning of the sweep, DJ_1 is 200 volts positive with respect to DJ_2. Using the worse case 5UP7 data, we expect the beam to be deflected 200÷77=2.6 inches upwards from the center of the tube—just barely off the screen of this 5" dismeter tube. Midway in the sweep both waveforms cross at +150 volt point. The voltage between the plates is zero and the beam is in the center of the screen. At the end of the sweep, DJ_1 is 200 volts more negative than DJ_2, putting the beam 2.6 inches below the center. The peak-to-peak waveform at each deflection plate is only 200 volts, but because the waveforms are 180 degrees out of phase, we have *400 volts* worth of deflection (400÷77=5.2 inches). Note also that the average voltage of the pair of plates is maintained at +150 volts at all times. This keeps focus optimized. Some sort of deflection amplitude control should be designed into the sweep amplifier so that the raster can be made the desired size, but the average voltage of the deflection plates should remain constant as the peak-to-peak sawtooth amplitude is varied. In practice, the two pairs of deflection plates need not operate at exactly the same average potential. It is also okay if the negative-going sawtooth of a pair is not the same amplitude as the positive-going sawtooth. The "astigmatism" control is adjusted in practice to give the smallest, roundest, spot when "focus" is optimized, and will compensate for minor sins in the deflection circuits.

A few comments on the circuit of fig. 2. The voltage shown at the ends of the focus pot are approximately −1690 and −1010 volts with respect to ground. These voltages are of course 160 and 840 volts, respectively, referenced to the cathode—a greater range than necessary to focus most CRT's. The circuit should operate without parts value changes with transformer secondary ratings as low as 1100 volts RMS. If you use a transformer that puts out much more than 1600 volts RMS, the filter capacitor voltage ratings must be increased. The capacitors can have a capacitance greater than that shown, if that's what your junk box yields, and they need not be of equal capacitance. The primary advantage of getting some of the beam acceleration after deflection (as in the 5ABP7) is the improvement in deflection sensitivity. The electrons are moving relatively slowly as they pass between the deflection plates, and are speeded up to final velocity after deflection takes place.

More info on using CRT's next month.

Q & A

Q. Sometimes the SSTV pictures I receive are distorted even though signals are above S9, there is no QRM, and the sync lock is solid. Why?

A. You are probably viewing the effects of multipath propagation, particularly if this "distortion" occurs more frequently on 75 and 40 meters than the higher frequencies. Sometimes signals reach a distant point by several paths at one time. If the lengths of the paths are very different, "ghosts" or spurious images to the right or left of the primary image can sometimes be seen. If the path lengths are more nearly the same, one can get "selective fading" where specific frequencies will cancel, but other frequencies a few hundred cycles away will be unaffected. Figure 3 illustrates this second effect. For about a second, whenever the frequency corresponding to the shade of grey in the forehead was transmitted, it cancelled, or nearly so, giving the noisy breakup evident only in that area of the picture.

73, Cop, WA2FLJ

Heath Kit Transceivers [*from page 21*]

conventional pots for fine tuning if your junk box has no multi turn pots, or if you are unable to obtain these pots from the surplus houses. The pots do not have to be the same value if you find it difficult to obtain matching pairs. These pots are most often found associated with precision instrumentation as opposed to the military radio surplus equipment. Another possbility is to use a vernier dial with a standard pot. The vernier dials are available for about $1.00.

The speaker was mounted on the original wooden baffle board. A large notch was cut out of one of the corners of the baffle to allow the cabling for the v.f.o. and the power meter to pass through to the rear of the cabinet.

The modifications to the HW-101 cabinet are minimal, and do not deface the rig or reduce its resale value. There is a square hole in the rear of the rig that is used to mount a plug if you use the SB-500 2 meter transverter. Using a nibbling tool, I enlarged the hole slightly so I could install a Cinch-Jones type S-308-AB jack for the power connections to the v.f.o. The other modifications to the chassis are to drill five additional holes in the rear apron. Two 1/4" holes are drilled between the speaker jack and the a.l.c. jack into which two phono jacks are installed. SB-series rigs already have two jacks in these locations, and need not be modified. Three 3/8" holes are drilled just to the right of the antenna jack (looking from the rear) to accommodate the additional BNC connectors for the antenna circuit modification. The fourth jack fits nicely in the hole that's already there for the original antenna jack. The SB-series rigs have two jacks already, and need only two more located between the existing holes.

By being aware of these modifications before the rig was assembled, I was able to drill the holes before the parts were attached to the chassis. If your rig is already assembled, use care in drilling, so as not to damage the components located just behind the chassis apron. Line the holes up with the existing holes, and the looks of the rear of the rig will not be degraded.

Relay K_1 was mounted to the rear of the main v.f.o. utilizing one of the sheet metal screws holding the v.f.o. chassis together. A suitable right angle bracket was formed out of a small piece of scrap sheet metal. The orig-

inal coaxial cable connecting the v.f.o. to the circuit boards was thoughtfully left a little long anticipating this modification, however in most cases you will have to add a little wire. RG-174/U is quite suitable if you didn't save the left over wire at the completion of the kit construction. If you find that the existing cable is short, cut it off near the circuit board, and connect that end to the normally closed relay contact, and leave the other end plugged in the v.f.o. Connect a new piece of coax between the circuit board and the relay common, and add an additional piece between the normally open contact and one of the spare phono jacks on the rear apron.

The diodes used for the relay voltage supply were placed through some of the unused holes in the audio circuit board, and soldered to the appropriate printed circuit lands. The other end of the diodes were attached to a tie strip mounted on the top of the chassis using one of the screws holding the audio circuit board to the chassis. The zener diodes and appropriate dropping resistors were attached to the underside of the chassis in much the same way. A bridge was constructed by connecting the two resistors together, soldering one end of the pair to the 300 v. land, and the other end to a tie strip. The junction of the two resistors was held off the board by the first zener diode, which was connected between the junction and a ground land conveniently located below. Although none of the wiring is critical, short, point to point wiring is usually neater, and picks up less stray signals.

Conclusions

The variations that can be made using some of the ideas presented here are infinite. The incremental tuning can be applied to any v.f.o. without regard to make. The fact that the frequency control is d.c. means that the pot controling the frequency can be placed anywhere, even at some distance from the rig. This is useful for the mobilers who must place their rig in the trunk, or back seat, and want a simple way to vary frequency or tuning over a small range. The incremental tuning system can be added to the main v.f.o. in the same manner as was described for the external v.f.o. A photo shows the station of K2ZRO. He used two miniature 10-turn pots mounted on opposite sides of the meter on his HW-100 for incremental tuning. He mounted his extra v.f.o. in a 19" rack panel and used an Eddystone dial for exceptionally smooth tuning. He also monitors s.w.r. and plate current with the meter mounted on the same panel.

The cost of the v.f.o. parts was under $30. The SB-600 speaker cabinet can be obtained from Heath for $8.70, and the front panel is $2.10, if you want to use the cabinet, and do not wish to purchase the entire SB-600 speaker kit. An LMB model CO-2 cabinet will also work, although it is slightly larger.

The v.f.o. has an output of 5.5 mHz to 5.0 mHz. It is compatible with both the HW-100 and HW-101 as well as the SB-100, SB-101, and the SB-102. It can also be used with the SB-110 6-meter transceiver, although the layout varies slightly from the other rigs. Other rigs using a similar v.f.o. frequency can use this v.f.o. also, but the voltage output requirements should be checked before you plunge into this project.

The usefulness of the additional v.f.o. will not take long to realize. Some examples of how valuable it can be are easy to come by. Most rare DX stations, and many DXpedition stations do not receive on the frequency they transmit on. I have logged DX stations receiving as much as 100 kHz higher than their transmitting frequency. The ±3 kHz offset tuning found on a few rigs can't come close in that type of situation. The only solution is a separate v.f.o., or a separate receiver. As another example, during contest operation, there is always that needed section with a pile-up on him. Should you wait until the pile-up clears, and sacrifice points for a multiplier, or hope to find him later? With the switchable external v.f.o., you simply place one v.f.o. on him, use the other v.f.o. to work the points, and a flick of the switch allows you to check on the status of the pile-up, and you can work him without having to hunt around

Acknowledgements

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Bruene, W., "An Inside Picture Of Directional Wattmeters," *QST*, Apr., 1959.

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HS4AFN, Chuck, QRT as of April 14, 1972. All QSLs sent to Buro before this date. If not recd, re-QSL to WA6GZZ. Tnks.

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Want: Aug 68 Popular Electronics. Will buy or trade Oct 69 CQ. Victor Francis, 8812 Delamar Ave. NE, Albuquerque, NM 87111

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Sell: 14AVQ, 12AVQ, heavy masts, 200ft, RG-8U foam cable - $30. T. Gosman, 143 Roxton, Plainview, NY 11803.

Collins 75S3B mint condx $450. Heathkit SB-401 excellent condx $250. 11 Montrose Terrace, Allendale, NJ 07401. Estate of WA2OBT.

National NCX-3 xcvr w/NCX-A AC PS/spkr excellent condx w/manuals $170. Ed Quinn, K2SIS, 62 Marquette Dr., Smithtown, NY 11787.

Wanted: Taylor tubes, also 204A, 849. W7JI, 235 East 15th St., Tempe, AZ 85281

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Wanted: Tower 75-100ft, prefer crank-up, but will consider other. WA9HRN, 5 Whitehall Ct., Buffalo Grove, IL 60190. (312) 537-4655.

Freq mtr TS-173/UR, incl calibration book & PS - $25 plus ship. Bullock, 306 Stonebrook, McMurray, PA 15317. (412) 941-5099.

For sale: Collins 75A4, 3 filters, spkr - KWS1; Hunter bandit linear 2000B, manual; Gonset vfo 2&6 & Communicator III; photo & radio eqpt. Sase for list. Forman, c/o General Electric, 2001 Jeff Davis Hwy, Arlington, VA 22202.

Sell: Hallicrafters Sky Buddy recv - cheap; Command sets; beam antennas, pwr supplies, more. Sase for list. Roberson, Box 218, Terrell, TX 75160.

Recording tape, scotch brand 1.5mil. 3" reels 50 cents, 7" $1.25. Disc on quanity. 15w PA & record-players $15 Fob WA7NUZ, Box D, Springfield, OR

For sale or swap' Kodak pageant, 16mm sound projector, like new - $400. John Kerster, W0BGK, 717 Crest Ave., Fort Dodge, IA 50501.

Crystals: Sase for list. Want D-104, 572B's, BC-221 w/book, T-60 xmtr. K8LJQ, 351 Mower Rd., Pinckney, MI 48169.

Hornet tri-band beam 10, 15 & 20 mtrs w/rotator in gud condx $400. Hammarlund HQ-129X all band recv, gud condx $50. Dorough, 117 Pecan St., Terrell, TX 75160.

Want: RME HF 10-20 converter w/manual; TCS mxtr, RAX-2 rcvr. T. Algier, Cornor Dr., Damascus, MD 20750

Wanted: Precision ES-550 scope for parts. Need not work, as long as pwr transformer is in perfect working condx. State price & condx 1st letter. Wendel, 160-20 Grand Central Pky., Jamaica, NY 11432.

Canadians: equip. repair & alignment. Lic'd technician. Kits wired & serv'd. Bob Fransen, VE6RF, 227 Cottonwood, Alberta, T8A1Y3, Canada.

Want: 1960 ARRL handbook, gud condx, will pay $1.50pp. VE3CKU, 139 Floradale Dr., Cooksville, Ontario, Can.

Sale, Knight KG635 DX-5 mc scope mint $90. Also Homebrew 5" scope w/switch $25. W9TVV, Mich. City, IN, 2028 Oriole Tr.

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5" scope; Heath IO-18 lab scope & probes $70 ppd, or swap for HW22 or HW32. 8302 Rathburn, Northridge, CA 91324.

Wanted: 2M conv w/6M output for HQ110A RX. Manual needed for Heath Seneca VHF-1. Pat Sheedy, WA2QQO, Box 89, Groveland, NY 14462.

For sale: Thompson coaxial switch 115v, 60cy for 3 antennas. John R. Watson, W4GD, 3087 Carnes, Memphis, TN 38111.

T43GGV 3 frequencies supplied $200. HB2X4 - 400 linear commercial size $450. WA5CMC, 2309 Bullington, Wichita Falls, TX 76301.

Wanted: Swan 350C, 500C, or 500CX w/117XC & 14C pwr supplies. WB2JYM, 699 Linden, Teaneck NJ 07666.

For sale or trade for Robot 70 monitor, all mint: Heath SB110 6M xcvr complete w/all xtals (8) plus Mars (1) & manual $325. SB610 $85; SB620 $125. Will split shipping cost. KH6HMA, W. Orth, Box 135, Lawai, Hawaii 96765.

Ameco type CN 2M converter & ac pwr supply type PS-1 $37.50 or trade? Fob Les Basham, Cave Junction, OR 97523.

Sell or swap: Tektronics 315D scope, gud cond, needs align. Best offer cash - trade for gud gear. TX, RX, tnsvr, etc. Offer by sase. P. Andreasen, RFD 1, Machias, ME 04654.

For sale: complete set CQ, first issue thru Dec 59. Nice condx, ready for binding. $100. Fob W4ID, CBA.

Heath SB-310, ex cx, spkr, filter, extras $280. Hallicrafters SX-146, gud cx $160. Steve, WA3SAD, 301/627-4933.

Signal One cw filters wanted: Sell: Eico 717 keyer, HP-23A, Ham-M. R. Nevers, 2100 Stanley Street, Apt. 202, New Britain, CT 06053.

Wanted: Drake 2-C recv. Sell: HB, 6m xmtr. 100w. 829B w/807 mod./PS. Bud rack mtrs $75. K8YNO 5632 Haughey S.W., Wyo., MI 49508.

Send sase for surplus list. P. Greeson, 720 Gentian Dr., Pensacola, FL 32503.

Sell: Mosley TA-36 $120. best offer or 2 mtr gear. Tom Hammond, K0RPH, 707 Ihier Rd., Jefferson City, MO 65101. Ph 314/893-2813

For sale: BC-348 receiver w/ac supply $45. W7INR, 360 Sharry Ln., Santa Maria, CA 93454.

Sell: Johnson 124 and Msgr. III CB rigs. Want VHF or hi/lo scanner rcvr. Dalton, Box 641, Easley, SC.

Heathkit Two'er plus xtal & mike. Gud cond. No scratches. Best offer over $30. WB2JYM, 699 Linden Ave., Teaneck, NJ 07666.

Sell: Collins R-388, exc cond w/built-in product detector $325. Also sell SRT-16 $200. Pick up only. W4AIS, 300 Thornwood, Taylors, SC 29687.

Sell: Mini-mast, raising fixture; ground post, $190. 75A-2 mech filters, $150. All fob Santa Clara, W6OKK. 408/241-4637.

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Wanted: National SW-3 receiver; old QST's (before 1923). W3QII, 5899 Barnes, Bethel Park, PA 15102.

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Heath HR-10B rcvr w/cal. Factory aligned; Heath DX-60B. Both mint. Both for $130. Bill Martel, Poultney St., Whitehall, NY 12887

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Sell: HQ110C and spkr, Ranger II. Both w/manuals and mike. R. Oras, 3636 South 59th Ave., Cicero, IL 60650

RCA RF gen, WR-49A, 85 khz - 30 mhz - $25. Drake hi patch 584A - $25, manuals, ppd UPS. W9DI, 22 S. Clay St., Hinsdale, IL 60521.

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Swap: Eico 460w, 232, Fujica 35, Globe Scout xmtr. T. Gosman, 143 Roxton Rd., Plainview, NY.

51J4, 3 filters - $375. W6RQZ, 1330 Curtis St., Berkeley, CA 94702. (415) 526-7345.

Ameco records 104-33 and 106-33 w/answers. First $6. E. Jeltrup, Box 361, Mamaroneck, NY

Excellent station: Collins 75A-4 updated, recently overhauled & aligned. 3 filters vernier knob. HT-46 transmitter. $550. Or swap for mint Swan 500 CX 117XC, TR4 ac. Joe Rotunno, 1816 Parkview Ave., Bronx, NY 10461.

Allied desk mike w/pre-amp $15. Crown reel to reel recorder $35. Make offers also. WN4YQR, 2751 SW 82 Ct., Miami, FL 33155

Heath keyer, Twoer, vtvm, etc. Davco DR-30. Sase Jurow, Box 183, Olympia Fields, IL 60461.

Wanted: Collins gear for cash. State condx and lowest price prepaid to my QTH. WA7PPN, 13615 N. 17th Dr., Phoenix, AZ 85029.

931A photo multiplier tubes wanted: Lionel L. Sharp, VK4NS, 19 Kelso Street, Chermside, Queensland 4032, Australia.

Drake TR3, AC3 and DC4, very gud condx -Write. Instructograph code machine, gud condx - $35 w/ 10 tapes. W4GIW, 3949 Menlo, Atlanta, GA 30340

Merchant Marine radio opr/ham correspondents wanted. Write me for info I need. Bob Murphy, Box 57732, Webster, TX 77598.

RTTY Model 15 - $85. Ten-Tec PM2 - $35. Paco S-55 scope - $50. Seneca 6-2 - $75. All clean, all fob W7IUA, 2539 Crozier, Kingman, AZ 86401.

Sell: Jennings vac var UCSXF-1500 - $25; Teletype FRXD w/O cov $40; 14 reperf w/o cover - $15. K8CSG, 4858 Sharon Hill, Worthington, Oh43085.

For sale: 75A4, modified per CQ Jun 65, 0.5, 3.1, 6.0 khz filters, spkr, immaculate - $500. TR-4, N.B. AC-4 - $600. 75S-1, 32S-1, 516F2, 312B-4, manuals cables - $850. Craig, 29 Sherburne Ave., Portsmouth, NH 03801.

Sell: National 200 xcvr w/xtal calibrator & ac sup. Mint condx. Sacrifice at $250 or U deal. U ship. Vern Weiss, WA9VLK, 719 W. Water St., Kankakee IL 60901. (815) 939-0036.

Wanted: TV Booster. Old tuneable RF amp type or TV CH number 7 pre-amp. Price? WA0KKC, 7139 Hardy, Overland Park, KS 66204.

E-Z Way tower RBS-50G for sale - $100. Pickup only. Peter Butler, W1BPW, 3 Elizabeth Dr., Merrimack, NH 03054. (603) 424-7373.

EV 664 with EV419 desk stand, $35. J.M. Hoffer, 24 Cherry Rd., Framingham, MA 01701. (617) 872-5084.

Wanted: Collins 51S-1, R390 recv or equivalent. Needed immediately, will pay cash. W3DXV, 620 Hastings Rd., Towson, MD 21204.

VHF: Ameco TX62 trans - $100. Ameco 621 vfo - $45. Clegg interceptor - $245. All mint. WA2ACA, 432 Pine Grove Cir., Scotch Plains, NJ 07076.

For sale: KWM2, 399C1, 30L1, supplies, SB301, HW16, HG108. Neat, clean. Sase details. Offer. K5FJZ, Bx 1614, College Station, TX 77840.

Boxed, unused 3E29 - $6. 4PR60B - $10. 832A - $4 832 - $3. Want early wireless and telegraph gear, literature. Spence, 10 S 771 Clarendon Hills Rd., Apt. 201, Hinsdale, IL 60521.

Chess: Would like to contact anyone who has played chess by radio. K3RCF, Adams, Box 1747, Prince Georges Plaza, Hyattsville, MD 20788.

Sell: HQ-129X - $65. Eico 711 - $40. Xtal cal - $10 Heath GH12 mic. WA2HPB, 1801 S. Clinton, Trenton, NJ 609/396-8503

HELP! Need vernier knob for RME4300/4350/ 4350A. Will take scrap recv complete for right price Ade Weiss, K8EEG/1, 117 Central F10, Acton, MA

DK-1 digital keyer w/dot-dash memories, pwr sup, spkr, book, mint - $85. James Permaflex key lever, new - $15. Schwella, 42 Madrid, Tustin, CA

Digital voltmtr NLS Model 484 $85 or Bird type wattmtr w/slug. WA3CPH, 859 Goucher St., Johnstown, PA 15905.

Wanted: mint R-390 recv or 75S3C at reasonable price for cash immediately. State serial numbers. W4AIS, 300 Thornwood, Taylors, SC 29687.

BC-221 freq mtr, calib book, reg pwr supply $55pp Want good scope. WA2FFZ, 335 Blvd., Pitman, NJ

Sell: Jennings vac var type U, 10 - 300 PF $25. Master Mobile micro Z match $10. Fob K5RME, Box 74, Ingram, TX 78025.

128 Contest Club has opening for new members. No dues, just enjoy contests for contest sake. Contact W1BPW, 3 Elizabeth Dr., Merrimack, NH.

Johnson desk KW $375; Clegg 99 $55; Mode 19 RTTY machine $150. W0MZN, 2365 Carter Ave., St. Paul, MN 55108

Sell: Waterman pocketscope, exc $27. Weston boxed 4 1/2" 100-0-100 microamp, panel mtrs, latest type $4.50, unused 4X150A's $5. Add shipping. Samkofsky, 4803 Brenda, Orlando, FL 32806.

RT-82/AN/APX-6 rcvr-xmtr-radar, mint. If you don't know what it is, you don't need it. Trade, etc. Tom, 2432 Johnson Rd., Atlanta, GA 30345.

Sell: Valiant II, xtal mike 160-10 asking $150. Deliver 75 miles, or you ship. Alan Fink, 143 Terry-Ellen Lane, New Lenox, IL 60451.

For sale: HW12A, transceiver HP13 mobile PS, both exc condx $125. K8HLH, B.J. Heim, 1216 Vine, Sandusky, OH 44870

Factory new, never used, Galaxy GT550 guaranteed $330. Also Lafayette HA410 xcvr for 10 meters. Built-in ac & dc $105. Colella, WA2HQD, 105 18 131 St., Richmond Hill, Ny 11419. 212/641-2559.

US & DX QSOed w/WB6MDP pse QSL. Still 100% QSL to all rcvd. Need QSLs for WAC, WAS, DXCC. If in US, your QSL is waiting at World QSL Bureau.

Galaxy 5 transceiver w/ac sup, mike & spkr. Mint. $325. Call Mike Harris, 615/528-1490

For sale: HA144, all transistor 2m am transceiver, perfect w/mic, manual, leather case, etc $70. Bird dummy load, 80A, 20w, N fitting $10. Vilardi, 14 Oakwood Terr., Spring Valley, NY 10977.

Sell: 2m xcvr HW-17A factory built, HWA17-1 pwr sup and HWA17-2 FM adapter. G. Harrison, P.O. Box 467, Bolivar, MO 65613.

24V 40A Reg. Ps., 4 wire coiled cords, xtal marker generator, 2 mtr xmtr TDQ, PC card assys, Conrac 14" monitor, ball bearing casters. Paquee, 53 Jerome Ave., Trumbull, CT 06611

Wanted: National SW 3 recv, coils, ps, op manual. Price buy or to copy any or all. Pennington, W4UIN 800 First St., Macon, GA 31201

Railfans: Swap slides of N&W, B&O/C&O, PC, EL, N&SS for those of your area. Colbert, WA8MLV, 1008 Englewood Dr., Parma, OH 44134

Sell or trade: Heath SP-300 rcv, mint - $175. Want Oscilloscope, DC to 5 mhz, trigered. WB6QNW, 1047 Jay St., Marysville, CA 95901

Beckman freq counter plus 2 scalers to raise range to 100 mhz. Seven digits, freq period, count, time, etc. 100% ok - $150. R. Mendelson, W2OKO, 27 Somerset Pl., Murray Hill, NJ 07974.

Wanted: Hy-Gain 10-15m duo-band ant. For sale: Heath metal locator. Mike Ludkiewicz, 143 Richmond Rd., Ludlow, MA 01056

Sell: HT-40, 75w AM-CW - $40. New, boxed Mosley Classic, 33 beam - $115. Pick up only. WA3-JXX, Paul Smonskey, 3535 California Ave., Pittsburgh, PA 15212

Wanted: Instruction manual and/or schematic of Tecraft 2M converter, Model CT-144 with 14 mhz if J. MacGahan, 46 Crane Av., Bloomingdale, NJ

For sale: SR-400 with AC and fan - $800. W9SQM, Cochrane, Wisc 54622. Tel. (608) 248-2516, if no answer (612) 388-2516. Call eves only.

Wanted: Meter only for Collins 302C-3 directional wattmtr - advise price and condx. W.E. Reynolds, 4228 SW 75 Ave., Miami, FL 33155

FR dx 400, 2m, 6m, FM, 100-25 cal., wwv, CB, fixed osc., 600 hz, 5 khz filters. Loaded to say the least $350. W7UD, 3637 W. Grandview, Tacoma, Wash.

Last chance, or years of CQ & QST will add to ecology. Reasonable, sase for list. W1FLN, 99 San Hill Dr., N. Kingstown, RI 02852.

Need Ham-M control unit. Pse advise cond & price. WA5TYB, Box 19522, Dallas, TX 75219.

Help: Need PS-150-120 ac pwr supply to get on air wid SR-160. State cond es reasonable price. WA3-LPK, 2300 Louise Ave., Balto., MD 21214.

For sale: One Ringo 2 meter antenna, used very little, local pick up only. K3YMN, $12.

For sale or trade: General Radio standard signal generator Model 805B, 50KC to 50MC. Make offer. Ed Baker, WA6ZSB, 1575 Lark St., Hanford, CA.

Drake 2C plus M54-spkr, used under 10 hrs. Turner ceramic P.T.T. mike $239 all, will ship. Box 72, Buffalo, NY 14207.

For local sale: KW ham gear TV service instruments etc. Bob Grill, W6NGA, 2464 N. Strathmore Ave., Rosemead, CA 91770. 280-0945.

Liquidating: Engineer disposing of yrs of accumulated instruments & parts - sase for list. ex-KA6FB, 920 W. Foothill, Azusa, CA 91702.

For sale: Swan Cygnet 270 mint cond $325. WB2-CZB, 6115 Blvd E., West New York, NJ 07093.

Stereo tape recorder 4 track, records sound on sound; 3-3/4 and 7-1/2 speeds, portable, like new w/manual RS755S. Cost $190, sell $125. Fellows, 2821 Honesdale, Cincinnati, OH 45239.

Sell: xvtr, xcvr, xmtr, antenna, mikes, etc. Send sase for complete list. K5ZUV/4, P.O. Box 7502, Miami, FL 33155.

Sell: HW100 & HP23A supply, mint cond. Unit has the Swan tuning mech. $275. WA9HRN, Craig Pitcher, 5 Whitehall Ct., Buffalo Grove, IL 60090.

Volt-ohmeter, RCA, "Volohymst", older Model $12 K2POA, 29 Boone St., Bethpage, NY 11714.

Millen, SWR bridge, Model 90671, serial 182, antique, orig inst. & chart w/orig 0-1 MA in case, w coupler. $12. Postpaid. W2ASI.

Want to buy Atwater Kent bread board parts. John Smith, 1924 Dolphin Blvd., St. Pete, FL 33707.

For sale: Heath GDO $12. Swan Mk I linear $295 or offer. Want: Drake C4, W4, Hallicrafters SR2000 w/pwr, Collins KWM2, 516F2, spkr. Cushing, W6-LXZ, 5224 Bobbie Ave., San Jose, CA 95130.

Wanted: 75A2 or 75A4, SX101 Mark III, 160mtrs, Ranger II or AF67. Prefer pick up w/in 100 miles, also wanted 40-80 novice xtals for new hams. Kusterman, Pinecrest Dr., RFD1, Goffstown, NH 03045

Sell FM gear Gladding 25, standard 146 walkie-talkie; also SB301, SB401. Leaving for Europe. Want FT101. W5QNQ, 2025 O'Donnell, Los Cruces New Mexico 88001.

Wanted: Drake SW4A receiver. Tappehorn, 2536 Kings Hiway, Louisville, KY 40205.

Mint Drake xtr T4XB rec R4B spkr/PS, MS4, AC4, cables, manuals $850. Kressel, WA2FSS, 1260 Westcott, Syracuse, NY 13210.

Gen. coverage rcvr w/ham bandspread Hammarlund HQ145XC clock, xtal control, S200 spkr $160. Fellows, 2821 Honesdale Ct., Cincinnati, OH 45239.

Sell: QST from 15, CQ from 45, handbooks, callbooks, early radio & Wireless books & magazines. I want early wireless mags, books & receivers. Erv Rasmussen, 164 Lowell, Redwood City, Ca94062.

Wanted: Two - 2 meter transceiver (FM), Drake TR-22 or equivalent. Bundy, Box 786, North Wilkesboro, NC 28659.

Hewlett Packard for trade: Model AR122 rack mt dual trace, WB4UBA, 404 Henderson Dr., Jacksonville, NC 28540.

Wanted: Meter for a DX100. State price. Racicot, W1ABW, Bartlett Voc. High School, Box 38, Webster, MA 01570.

Two Knight TR-108 & V-170 vfo 2 mtr rigs. 12V/110V mikes, manual. $100 ea. Both $175, postpd. Roy Cone, W9YLU, 6731 N Hermitage, Chicago, IL

New Jersey QSO Party August 19-20. See July contest Calendar for details.

Wanted: Apartment in Chicago area w/access to roof for small antennas. Jim Fleming, 7528 W. Bryn Mawr, Chicago, IL 60631.

Sell: plate transformers, 3600-0-3600 at 1 amp $25 1.7 amp $40, w/120/240 primary. All fob. W0AIH, Paul Bittner, 814 4th St. S, Virginia, Minn 55792.

Sell: Xvtr, xcvr, xmtr, antenna, mikes, etc. Send sase for complete list. K5ZUV/4, P.O. Box 7502, Miami, FL 33155.

Heath DX-60B, manual, 2 xtals $75. New, only 15 hrs use & excel rpts on cw & am. Deliver w/in 70 mi M. Erb, 207 Honeysuckle Ln., San Antonio, TX.

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So why settle for less? Exclusive noise limiting circuits reduce ignition interference and insure quiet operation. And the ultimate in new solid state circuit design gives you top reach, selectivity and dependability.

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NO DEALERS OR DISTRIBUTORS, PLEASE!

Order Today.

The supply is limited.

HOUSE OF POWER

P. O. Box 306, Merrick, N. Y. 11566

And here's an added bargain. A beautiful Cobra telescoping whip antenna that regularly sells for $8.95 yours for just $4.95 with your PF-1 monitor. This antenna is designed to mount directly on the PF-1 antenna terminal.

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AUGUST, 1972

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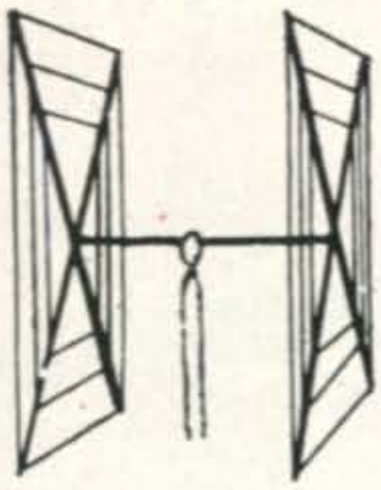
ADVERTISER'S INDEX

WHICH ANTENNA WINS THE CONTEST ?

In open competition against thousands of commercial and home-brew antennas, WA1JFG won the New England championship with a Gotham beam, by a margin of 5,982 points! WB2JAM won the sectional award for the Sweepstake contest in 1969 and 1970 with a Gotham 4-element 15 meter beam! Hundreds of unsolicited testimonials from grateful hams are our proof that Gotham antennas give you the best design, and the best materials. Forget our low prices - rely on the results of open, competitive contests. Ask yourself: Why do Gotham antennas win?

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

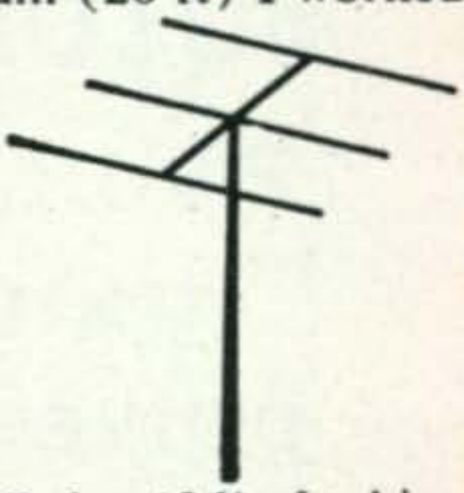
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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**

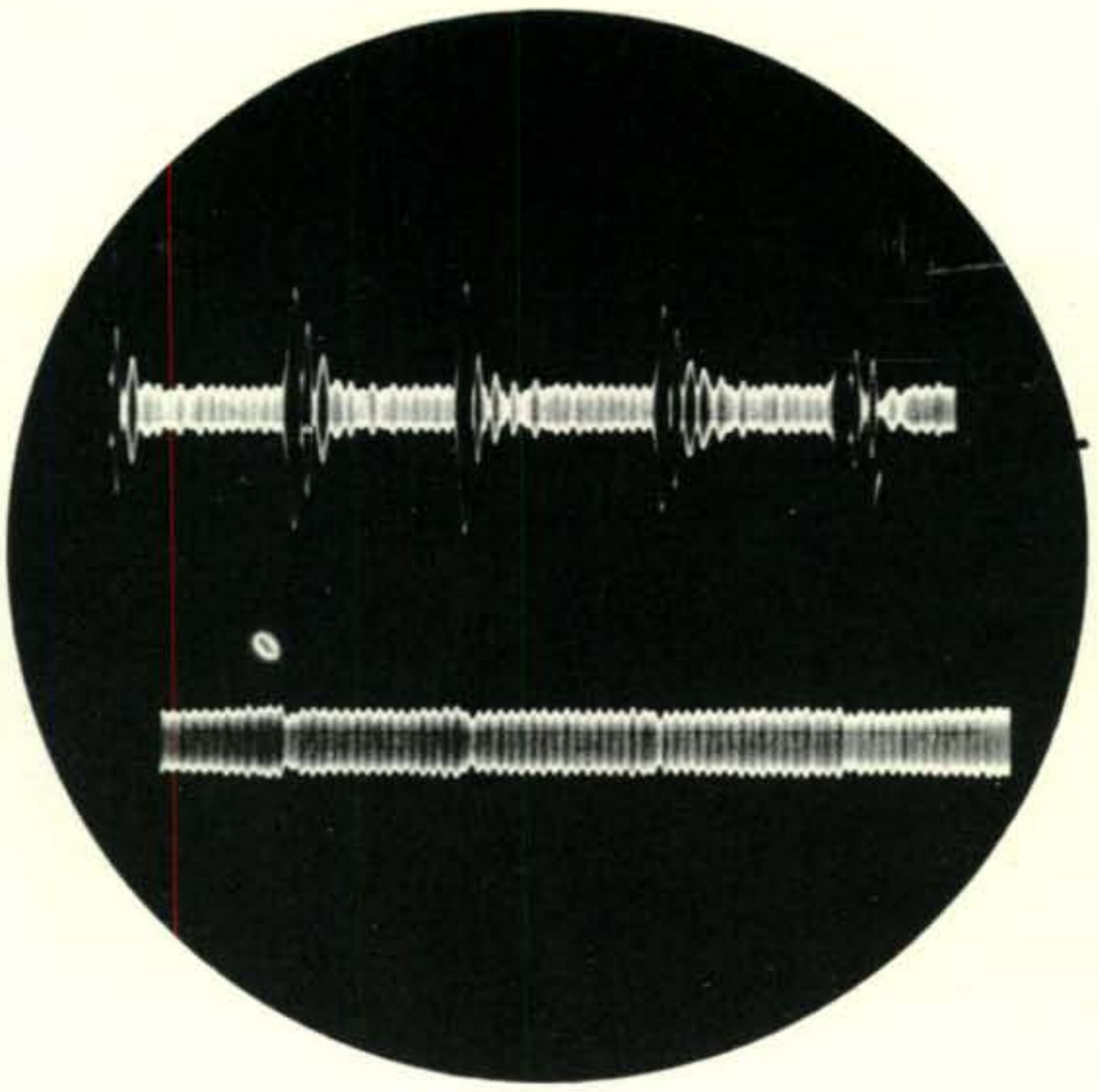
ALL-BAND VERTICALS

"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

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

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



Is the FTdx 570's noise blanker reason enough to spend $550 for this new rig?

You bet it is. Here's a complete rig, including a noise blanker — on other rigs you pay about $100 extra for the blanker alone. On other rigs, you read the glowing specs and they sound fine. Of course, to get them on the air you pay extra for such essentials as a power supply.

Well, the FTdx 570 includes a built-in power supply and 25 and 100 KHz calibrator. And built-in VOX. Plus a special WWV receive band on 10 — 10.5 MHz. And a clarifer — a receiver-offset tuning feature that lets you move ±5 KHz from a preset transmitter frequency. There's even a built-in cooling fan and a built-in speaker.

Last but certainly not least is the power: 560 watts PEP SSB, 500 watts CW input power.

The whole transceiver is guaranteed for one year. No other rig, preassembled or kit, gives you anywhere near the value or performance you get in the FTdx 570.

We have a brochure on the 570 that really gets down to the nitty-gritty on the subject. Send for it. Better yet, send for the rig itself. Don't you owe yourself a bargain?

SPECTRONICS WEST

Dept. C, 1491 E. 28th, Signal Hill, Ca. 90806 / (213) 426-2593

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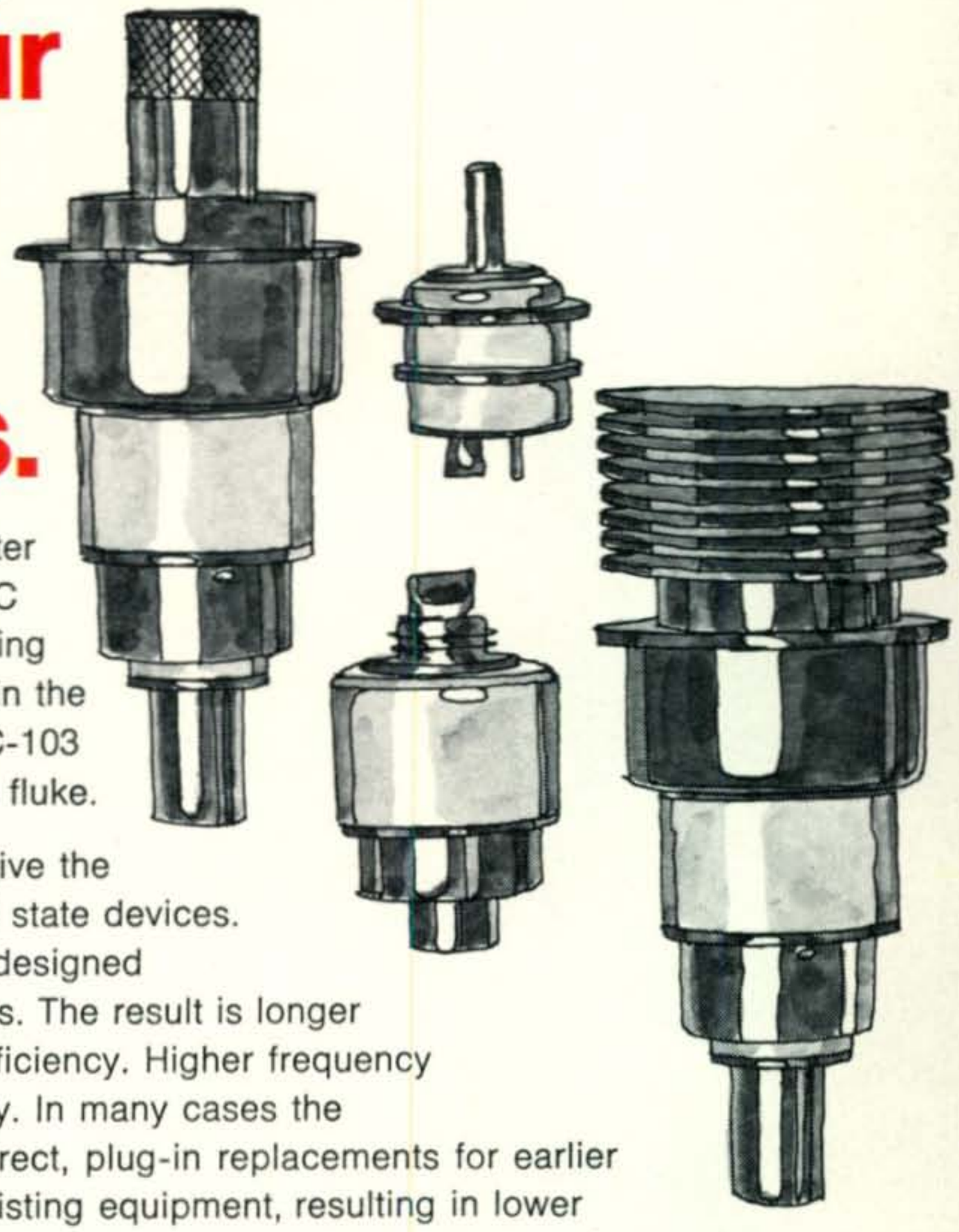
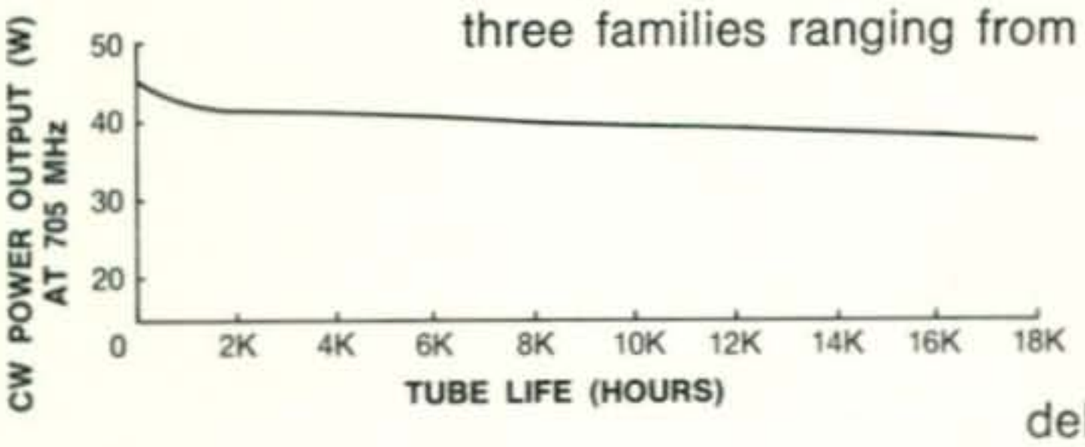
Plug more life into your system with EIMAC planar triodes.



To make a long story short, after 18,000 hours of life test EIMAC improved 7211's were still delivering over 35 watts CW at 705 MHz in the r-f cavities for the Army's GRC-103 Radio Set. And that's no fluke.

Several design improvements give the 7211 life comparable to solid state devices. These improvements have been designed into all EIMAC planar triodes. The result is longer life. Higher power and efficiency. Higher frequency operation. And better linearity. In many cases the improved tubes are direct, plug-in replacements for earlier models in existing equipment, resulting in lower cost per operating hour to the user.



Right now EIMAC has more than 70 planar triode types in three families ranging from the 2C39A types through the latest miniature planar triodes. In CW, EIMAC frequency capability goes up to 5 GHz and powers to 450 watts. For pulse applications, EIMAC has models capable of delivering up to 1 kilowatt peak at 6 GHz.

When it comes to planar triodes for retrofit or new equipment, only EIMAC has full capability. For a copy of our planar triodes applications manual, get in touch with EIMAC, 1678 Pioneer Road, Salt Lake City, Utah 84104. Or your local Varian/EIMAC Electron Tube and Device Group Sales Office.

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