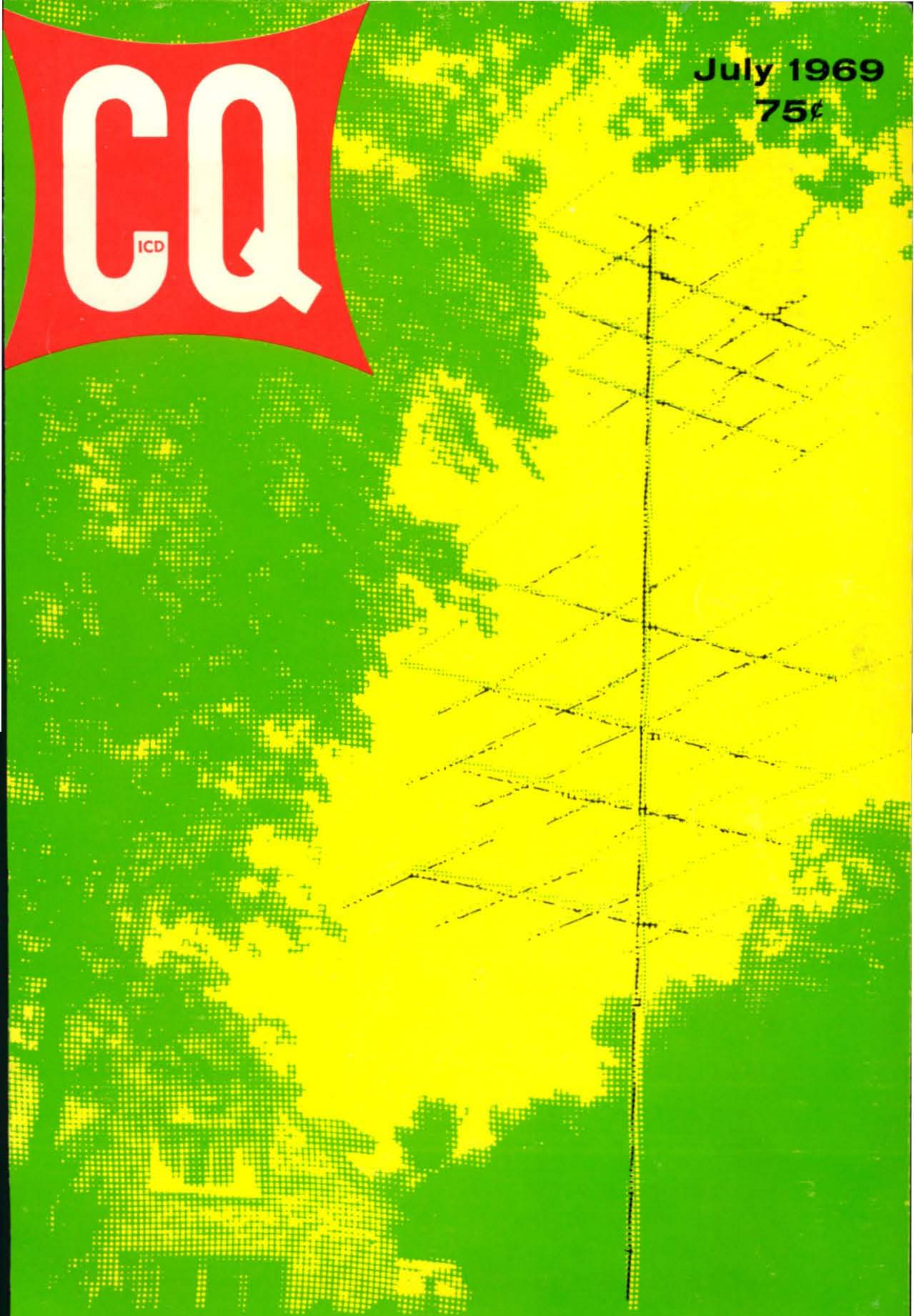
CQ

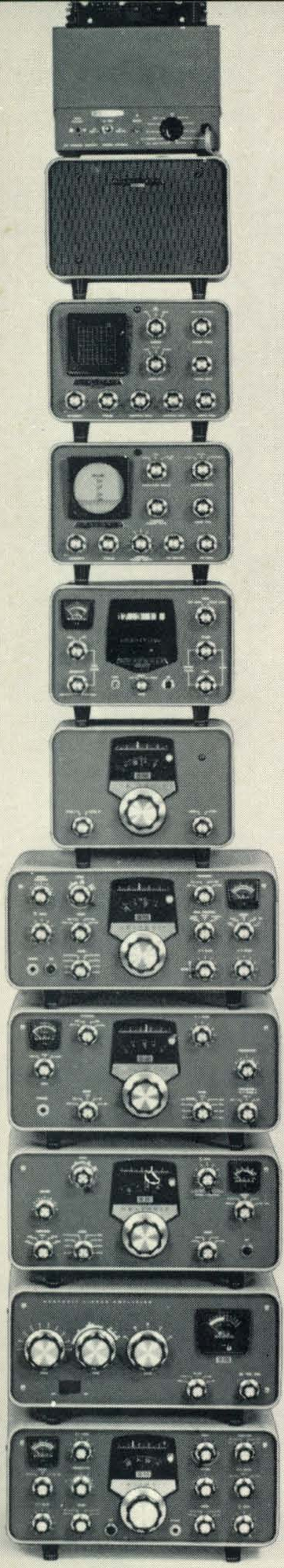
ICD

July 1969

75¢



The Radio Amateur's Journal



STACK THESE UP AGAINST THE OTHERS...

This Complete Heathkit SB-Series 80 thru 6M Mobile And Fixed Rig Costs Only $1936.70

A bit impractical to install in one place perhaps, but so is spending nearly $2000 on new equipment and not getting the maximum amount of operating versatility and performance. For the price of a few pieces of gear from most others, you can buy every piece of SB-Series gear Heath makes, plus both mobile and fixed power supplies. Many hams don't have $2000 handy though, and that's why Heathkit sells each of these pieces separately. We believe that you should still be able to get a stack of gear without spending a pile of money. For performance, versatility and top dollar value, the others just don't stack up.

The HP-13 — mobile power supply for the SB-101 & SB-110A. All solid-state construction. 7 lbs. **$64.95**

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The SB-620 — "Scanalyzer" for monitoring band activity up to 500 kHz each side and bench testing transmitters. 15 lbs. **$119.95**

The SB-630 — Station Console with 24 hr. digital clock, SWR meter, resettable timer, etc. 10 lbs. **$74.95**

The SB-640 — External LMO for the SB-101. The 640/101 combination will operate in five different modes. 9 lbs. **$99.00**

The SB-101 — world's finest 80-10 M transceiver. 180 watts PEP SSB input, 170 watts CW. 23 lbs. **$370.00**

The SB-301 — world's finest AM, CW,SSB & RTTY receiver. 80-10 M +15 MHz WWV coverage. 0.3 uV sensitivity. 25 lbs. **$260.00**

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The SB-110A — the best 6 M rig anywhere. 180 watts PEP SSB input, 150 watts CW. 23 lbs. **$299.00**

TOTAL $1936.70

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The Adaptable 2-Meter Rig...

Heathkit HW-17A
a fixed 2-meter rig ready to run mobile when you are

Wouldn't it be nice to have a 2-meter base station that installed in the car in seconds when you wanted to go mobile? The HW-17A is your piece of gear, OM. Has a built-in 117 VAC supply for fixed use, and once you've installed the optional HWA-17-1 Mobile Power Supply in your car, you're ready to run mobile. Just snap the HW-17A into the gimbal mount supplied, tighten the two thumbscrews, plug in the antenna and power plug . . . and fire it up. Here's the rest of the story on the 2-meter fixed rig that goes mobile in seconds . . . the HW-17A.

The Heathkit HW-17A is really a separate receiver & transmitter on one chassis (only the power supply and audio output/modulator are common). Covers 143.2 to 148.2 MHz . . . ideal for MARS & CAP ops. The solid-state dual conversation superhet receiver with a prebuilt, prealigned FET tuner has 100 kHz calibration, ANL, squelch and 1 uV sensitivity. Selectivity is 27 kHz @ 6 dB down. A front-panel meter monitors received signal strength and relative power output. The 3-position front-panel switch has a "Spot" position for finding transmit frequency, a Receive/Transmit position and a Battery-Saver position that cuts current drain way down during those long periods of mobile monitoring. A space-saving 3 x 5" speaker is built in.

On the transmitting end is a hybrid tube-transistor circuit with a 25-30 watt input and a healthy 8-10 watts AM output. Modulation is automatically limited to less than 100%. A front-panel selector switch chooses any of four crystal frequencies or an external VFO (the Heathkit HG-10B at $39.95* is ideal). Tune up is quick and easy.

The HW-17A goes together in about 20 hours with circuit board construction & measures a slim 14⅛" W x 6⅛" H x 8½" D with everything in place. Ceramic PTT mike included. Start having one rig in two different places . . . order your HW-17A now.

Kit HW-17A, 18 lbs..... **$129.95***

HWA-17-1 Solid-State Mobile Power Supply

If you're going to be running mobile with your new HW-17A, you'll need this compact, reliable solid-state power supply. Supplies all necessary operating voltages and uses a "C" core transformer for efficient operation. Extra large heat sinks give cool operation with a 50% duty cycle. Built-in circuit breaker protection for your 12 volt mobile battery source too. All cables and connectors for mobile installation are included. Measures only 3⅞" W. x 7 5/16" L. x 2½" H. for easy installation almost anywhere in the car.

Kit HWA-17-1, Solid-State mobile power supply for neg. gnd. systems only, 5 lbs.. **$24.95***

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*Mail order prices; F.O.B. factory. AM-220

See page 110 for New Reader Service

First class or tourist... Swan gets you there loud and clear.

THE SWAN 500C

5 BAND — 520 WATT TRANSCEIVER SSB-AM-CW HOME STATION — MOBILE — PORTABLE

You're really operating 'First Class' with our 500C. It combines all the features you require to have a complete SSB-AM-CW transceiver with performance, quality, and reliability second to none.

The P.E.P. input rating is conservatively rated at 520 watts, but actually, with the pair of 6LQ6 blast rated tetrodes in the final amplifier stage, peak input exceeds 570 watts before flat-topping. With this kind of power, S-9 signal reports from the far corners of the world are commonplace. Audio quality of the 500C is definitely superior to most other transceivers on the market today. This is due to the high frequency crystal lattice filter used in the 500C that is made especially for us by C-F Networks. This filter provides excellent channel separation, combined with the smooth, natural voice quality for which the Swan 500C is so well known. Velvet smooth dual ratio tuning is achieved with our custom machined planetary drive, machine tooled to extremely close tolerances. Refinements of the Swan VFO have resulted in superior mechanical and thermal stability and more precise dial calibration. For the CW operator, the 500C includes a built-in sidetone monitor, and by installing the SWAN VOX accessory, you will also have break in CW operation.

The Swan 500C is a deluxe transceiver with proven reliability and performance, yet is priced substantially less than competitive gear. See it at your Swan dealer soon. **$520**

MATCHING AC POWER SUPPLY
Model 117XC $105
12 VOLT DC POWER SUPPLY
Model 14-117 ..... $130

THE SWAN *Cygnet*

5 BANDS—260 WATT SSB TRANSCEIVER WITH BUILT IN AC-DC SUPPLY AND LOUDSPEAKER

It's a complete radio station in a lightweight, easy-to-carry package, that even includes the microphone, and yet costs only $395. Just connect a power source and an antenna, and you're on the air. Plenty of power to work the world with a strong, clear signal on phone or CW, and with excellent receiver sensitivity second to none.

The Swan Cygnet has been an instant success since we first introduced it in February. Experienced hams find it ideal for taking along on business trips or vacations since it can be operated from a motel room, boat, car, or practically anywhere. Newly licensed hams find that the Cygnet provides a complete amateur radio station at a minimum investment.

If you're one of those practical people who knows that the back of the airplane gets there the same time as the front . . . you, too, will like our Swan Cygnet.

See it, and try it at your Swan dealer soon.

$435

SWAN
ELECTRONICS
For better ideas in amateur radio.

OCEANSIDE, CALIFORNIA • A subsidiary of Cubic Corporation

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JULY, 1969 VOL. 25, No. 7

CQ The Radio Amateur's Journal

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DEPARTMENTS

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

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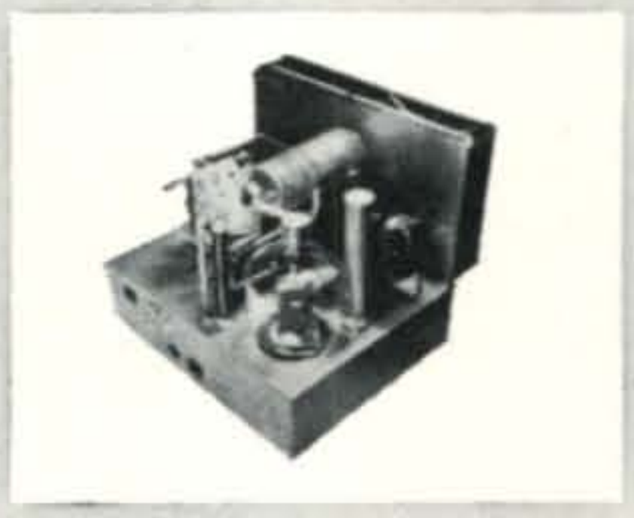
Postmaster: Please send form 3579 to CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

See page 110 for New Reader Service

Hafstrom Technical Products' heavy duty BTI LK-2000 linear amplifiers complements extra class design with compact modern circuitry built around an Eimac 3-1000Z high-mu power triode. The amplifier achieves full 2 kW PEP SSB input and 1 kW input on CW, AM and RTTY.

Hafstrom chose the rugged 3-1000Z zero-bias triode because it offers a conservative 1000 watt anode dissipation rating and provides up to 20 times power gain at moderate plate potential. This tube, widely used in commercial FM and HF broadcasting, is ideal for heavy duty around-the-clock operation in cathode-driven grounded-grid service, eliminating any need for bulky and expensive screen and bias supplies.



For more information on the 3-1000Z and other Eimac tubes for advanced transmitters, write Manager, Amateur Services, Eimac Division of Varian, 301 Industrial Way, San Carlos, Calif. 94070, or contact your nearest Varian/Eimac distributo

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Extra class design starts here.

ZERO BIAS

THE May ARRL board meeting was evidently a most productive and creative gathering as indicated by "League Lines" in June *QST*. The range of actions voted upon by the directors is most impressive, and seems to suggest a change of approach by the board, possibly as a result of constituent pressure. But regardless of "why" it all happened, it did, and bodes much good for the future of amateur radio.

Among the actions taken were several in the area of licensing and regulations. The FCC will be petitioned by ARRL to expand Technician privileges to cover the entire 2-meter band, as well as a 200 kc segment of 10 meters. It will be requested—again—that the exclusive c.w. segment on 2-meters be shifted to the low edge of the band, and newcomers will once again be allowed to hold Novice and Tech tickets simultaneously if the board has its way.

CQ strongly supports all of these proposals. They indicate a new conciousness of the needs and desires of the newer amateur, and a greater interest in attracting more youngsters to the hobby. Highlighting this latter point are two prospective League projects aimed directly at the teenager: 1-A new ARRL publication for the 12-16 age group . . . (unfortunately of unspecified content), and 2-A program to make amateur radio a part of high school cirriculums.

While all these "good intensions" could easily fall prey to Headquarters "bureaucracy," they do offer hope for a further renaissance in League thinking. We heartily commend the Directors for their constructive action.

Enter the Lunar Age

Some time this summer American astronauts will open a small door on a frail spidery spacecraft, step out on its "front porch" and view live and at pointblank range—the Moon. The combined efforts of thousands of engineering firms and tens of thousands of craftsmen will have finally succeeded in meeting John Kennedy's 1961 challenge to place an American astronaut on the moon before the end of the decade. *CQ* is proud, as indeed we all should be, of the role played by so many of our fellow amateurs in this staggering achievement. Amateur industry sources put at nearly 10,000 the number of amateurs whose jobs involve them in the aero-space industry and who are therefore entitled to puff out their chests with a little extra pride at being once again in the front rank of scientific development. We salute you.

Apollo Frequencies

V.h.f.'ers and any other amateurs fortunate enough to possess suitable receiving equipment may be able to tune in on history by receiving communications directly from the Apollo 11 moon probe. Detailed information on the nature of signals from the Apollo Command Module (CM) and the Lunar Module (LM) were given in articles in *CQ* for March and June 1969. Below are the frequencies most likely to be of value to amateurs:

296.8 AM Voice, data, CM to LM, & EVA*
259.7 AM Voice, data, CM to LM.
243.0 AM Recovery beacon.
10.006 SSB Voice. Backup recovery link.

XE1BT Appointed Mexican Consul

It is with great pleasure that we report the appointment of Antonio Cruz Uribe, XE1-BT/PBN as Consul of Mexico in the Green Bay, Wisconsin area. Tony has been a great friend of American amateurs for many years, and has been instrumental in assisting hun- of American ham visitors to Mexico to obtain permission to operate their equipment from Mexico, although a bi-lateral agreement does not exist between the two neighbors.

Tony's appointment reinforces his ability to assist in the improvement of US-Mexican relations, and any US amateur contemplating a vacation "south of the border" is urged to contact him at 901 Howard Street, Green Bay, Wisconsin 54303.

73, Dick, K2MGA

---

*EVA – Extra Vehicular Activity (astronauts walking on Moon's surface).

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OUR READERS SAY

Incentive

Editor, *CQ:*

In the days when incentive licensing had yet to become a *fait accompli*, its more rabid opponents raised anguished cries, day in and day out, to the effect that it would be the ruination of amateur radio in the United States. The average amateur, they asserted, had neither the ability to pass the examinations for the higher class amateur licenses nor the time to pursue the arduous studies necessary for success in them. Thus, they contended, the great bulk of amateurs would be permanently and irretrievably deprived of the enjoyment of choice frequencies which would then become the exclusive domain of a handful of "professionals:" electronics engineers, holders of first class commercial telegraph certificates, etc.

Now that teenagers still in high school, and "senior citizens" of 70 years and over—to say nothing of large numbers of the ordinary, or garden variety of amateurs in between—are joyously passing the extra class examination and pinning those attractive licenses to the walls of their shacks; and now that the number of holders of the extra class which just prior to incentive licensing was around 5,000 has already doubled and should reach 13,000 (more than the total amateur population of Canada!) during the current year, the force of their original argumentation has singularly diminished.

For all that, the hostility of the die-hard opponents of the new regulations remains unabated. For them, incentive licensing is an invention of the devil and deserves to be treated as such. Therefore, instead of putting forth the modest effort required to obtain their own higher class license (and in the process making better radio amateurs of themselves by improving their knowledge and skills in this field) they continue to devote their time and energies to the ultimate aim of abolishing incentive licensing. To this end they eagerly seize upon any other argument, no matter how absurd, against the new order of things.

Thus it is that K4IIF, DX Editor of *CQ*, has "in the interest of international good will" petitioned the FCC to reduce by 50 percent the c.w. segments of the 14 and 17 mc bands to be reserved for extra class license holders, while at the same time suggesting that they be reduced eventually by 80 per cent. (*CQ*, March 1969) These are known as "salami tactics:" a slice at a time.

My own observations have led me to conclude that so far from inflicting " a most severe blow on international good will, the new regulations have immeasurably improved it, insofar as international relations are affected by the operation of United States radio amateurs.

No radio amateur anywhere in the world,

See page 110 for New Reader Service

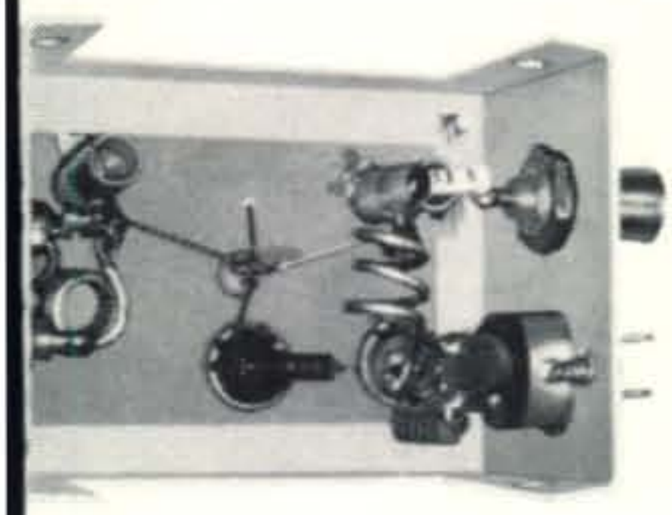
Here are two ideal VHF projects—pre-amps to "soup up" older receivers and help dig for the tough ones almost down to noise level. Both take advantage of the outstanding performance of RCA MOS/FET units—metal oxide semiconductor field effect transistors... high gain, low noise, improved sensitivity.

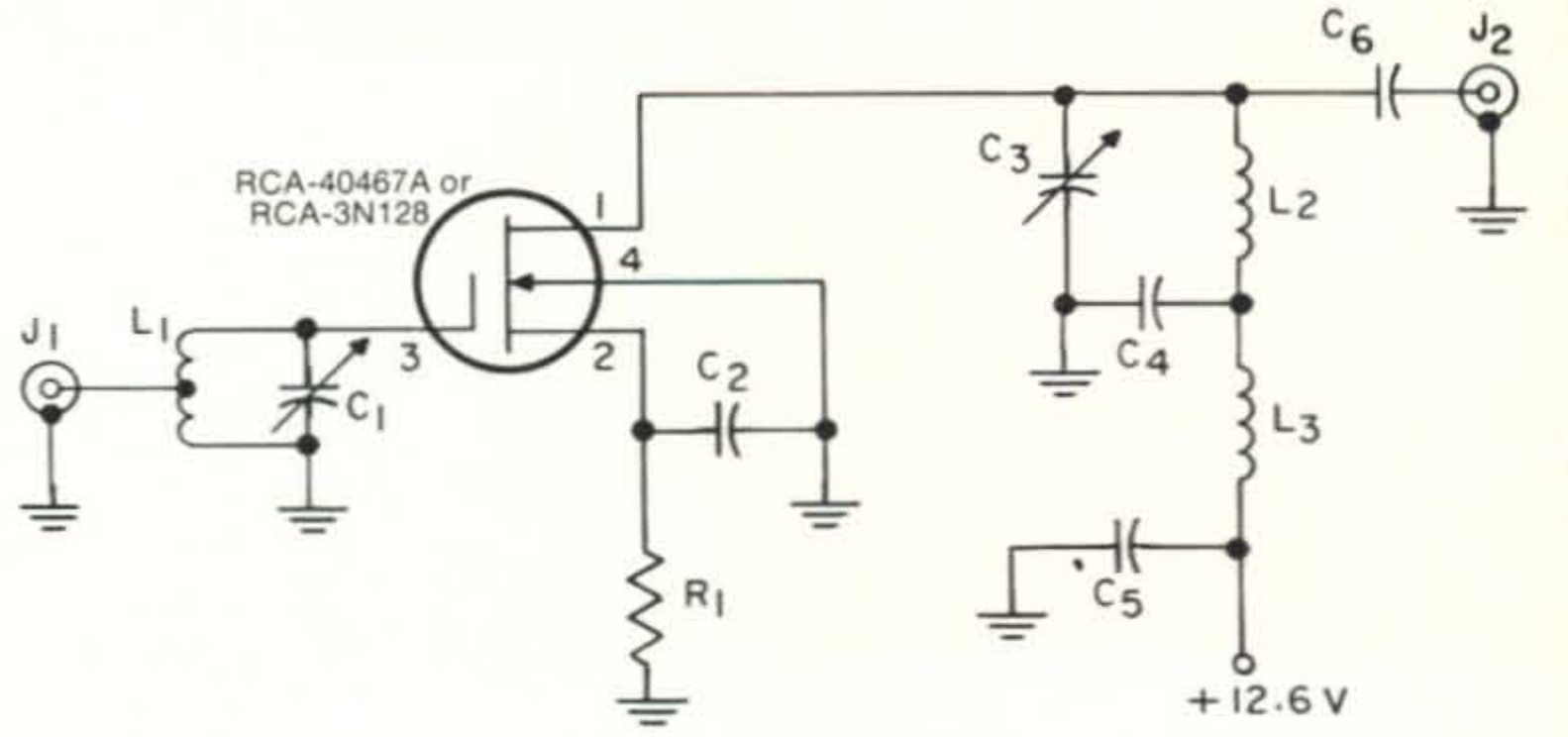
Full details are available in the November and December 1968 "Ham Tips". Write RCA Electronic Components, Commercial Engineering Section **6-15M,** Harrison, N. J. 07029 for copies.

All RCA devices listed are available from your RCA Industrial Solid-State Distributor.

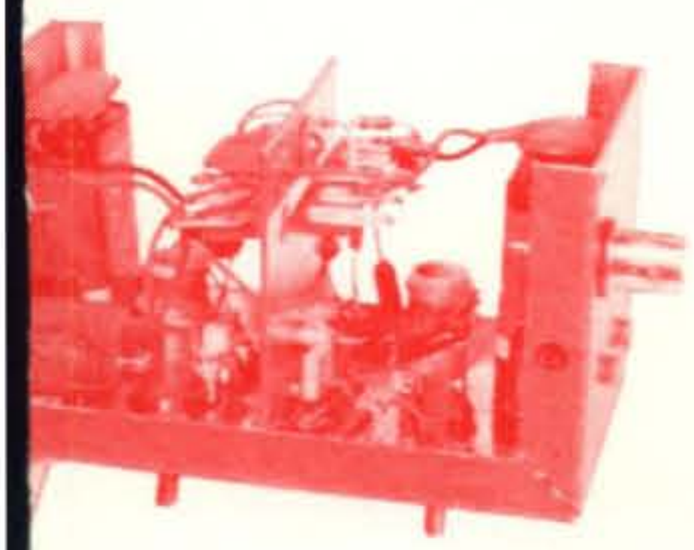
meter and 2 meter Pre-Amps

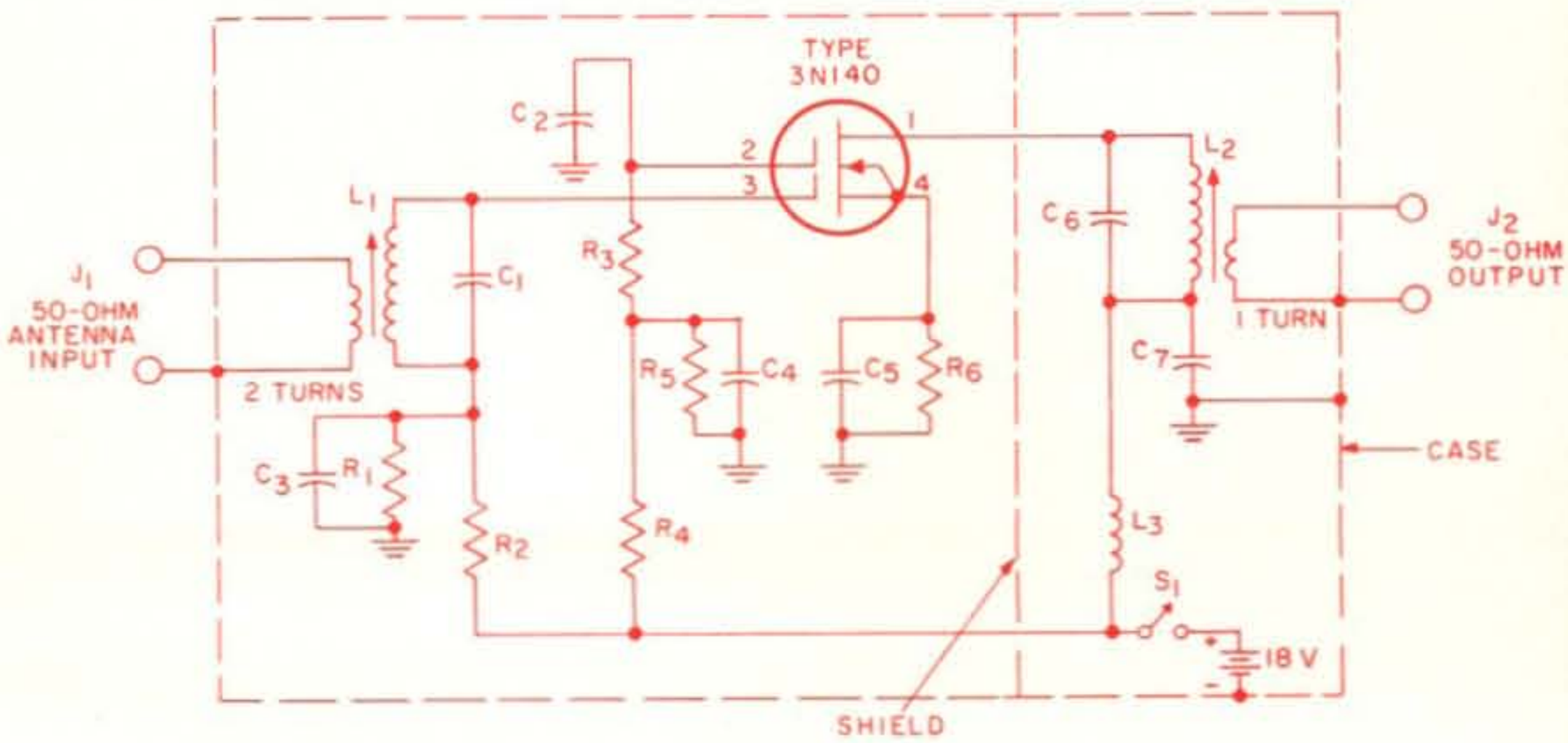
Gate MOS/FET 2M Pre-Amp





ate MOS/FET 10M Pre-Amp





RCA

think, need be reminded of the state of affairs at the low end of the 14 mc band-which remains by far the most popular band and the one most used for international contacts-prior to the entry into force of the new regulations. That whole portion of the band was cluttered up, day and night, by inexperienced American operators sending slow, interminable "CQDX's". And should, perchance, the signal from a rare country appear, there, certain would-be American DX'ers, showing an utter lack of courtesy and using their "Store boughten" kilowatts and beams to clobber all opposition, would inevitably show up to break into established QSO's or resort to such obnoxious "tail-ending" as to assure themselves a contact by brute force.

Since the 14000-14025 kc segment has been reserved to extra class holders in the United States, the improvement in the quality of c.w. operation in this band has been no less than amazing. On any evening, one can monitor 14000-14025 kc and find there not only good, snappy American-American and American-foreign exchanges, carried on courteously and in accordance with the best operating practices, but also find "rag-chews" in which an amateur abroad can broach a technical subject with the quasi-certainty that his U.S. correspondent will at least know what he is talking about! And it has been months since I have heard an American call CQ DX in this segment.

This improvement has not been lost on the foreign amateur. As a result, the image of the American radio amateur, not only as a competent technician and top-flight radio operator but also as a gentleman, has been enhanced. And the enjoyment of operations by foreign amateurs, not only in contacts with other foreigners operating in this portion of the band with Americans as well, has been greatly increased. It is difficult to see how one can honestly contend, as does K4IIF, that the new band arrangements brought about by incentive licensing constitute "a most severe blow" to international good will when they have received, insofar as I have been able to determine, the unanimous approval of amateurs elsewhere in the world.

As an American amateur who has lived abroad for many, many years and who during that time has been—and still is—in close personal contact with European amateurs not only by on-the-air contacts but through active participation in radio clubs, hamfests and the like, I will perhaps be forgiven if I deem my opinion on this subject quite as valid as that of K4IIF. In any event, my observation thereon shall also be brought to the attention of the FCC.

Rupert A. Lloyd, Jr. F5SF/W3LR
Argeles-sur-Mer, France

De Extra is suprised that some thinking people still espouse this argument. While there are not now 13,000 amateur extra class license holders, the most recent Callbook shows 8,000 out of a total of 280,000 U.S. hams have ob-

[*Continued on page 98*]

See page 110 for New Reader Service

JOIN THE ARMY...

the Air Force, the Navy, the Astronauts, the FAA, most major airlines, police and fire departments, and hams everywhere who've improved their 2-way communications with noise-canceling microphones and handsets from Electro-Voice.

Why do they choose E-V? It is the company that pioneered the noise-canceling principle. And Electro-Voice set the highest standards of reliability, year after year.

To stop noise right at the source, put a dependable Electro-Voice noise-canceling microphone to work today. It can be the start of a quiet revolution!

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Announcements

Farragut State Pk., Ida.

Amateur radio and shortwave listening will be prominently featured at the National Jamboree of the Boy Scouts of America July 16 through July 22, 1969. The site is Farragut State Park, Idaho (home of K7GS in 1965 and K7WSJ in 1967) and the call this year is KF7BSA. Probable hours of operation, beginning about July 14, are 1600 to 0500 GMT.

KF7BSA QSO Freq.		*Traffic Freq.**	
c.w.	*phone*	*c.w.*	*phone*
3590	3940	3590	3970
7050	7240	7040	7280
14090	14290	14040	14280
21140	21360		
28190	28990		

***Important:** No messages will be handled by KF7BSA; instead, amateurs in eastern Washington and the "Panhandle" of Idaho have volunteered to act as a message center for the Jamboree.

Oak Ridge, Tenn.

The Oak Ridge Radio Operator's Club will sponsor the 20th Annual Crossville Hamfest at the Cumberland Mountain State Park July 26-27. For information, write the Oak Ridge Radio Operator's Club, Inc., P.O. Box 291, Oak Ridge, Tenn. 37830.

McKeesport, Pa.

The Two Rivers Amateur Radio Club will hold its fifth annual Hamfest on Sunday, July 27, 1969. This event will be held at the Balkan Hotel, 801 Coulter Road, McKeesport, Pa. Hams from the Tri-State area are expected to attend.

Edmonton, Alberta

Hamfest '69 will be held the weekend of August 1-3 at the Edmonton Inn, Kingsway & 11 Street, Edmonton. Early registration for you OM could mean a HW 12 Heath transceiver and for the XYL an opportunity to be the recipient of a mink stole in the shade of her choice.

Technical sessions will be held, one of which will feature Z. H. Krupski on "The Canadian Communications Satellite System."

For more information write Hamfest '69, P.O. Box 2692, Postal Station A, Edmonton 15, Alberta, Canada.

Idaho Falls, Ida.

The 37th Annual W1MU Hamfest will be held at Mack's Inn, Idaho, 23 miles south of West Yellowstone, Montana. It will take place the weekend of August 1-3.

[*Continued on page 98*]

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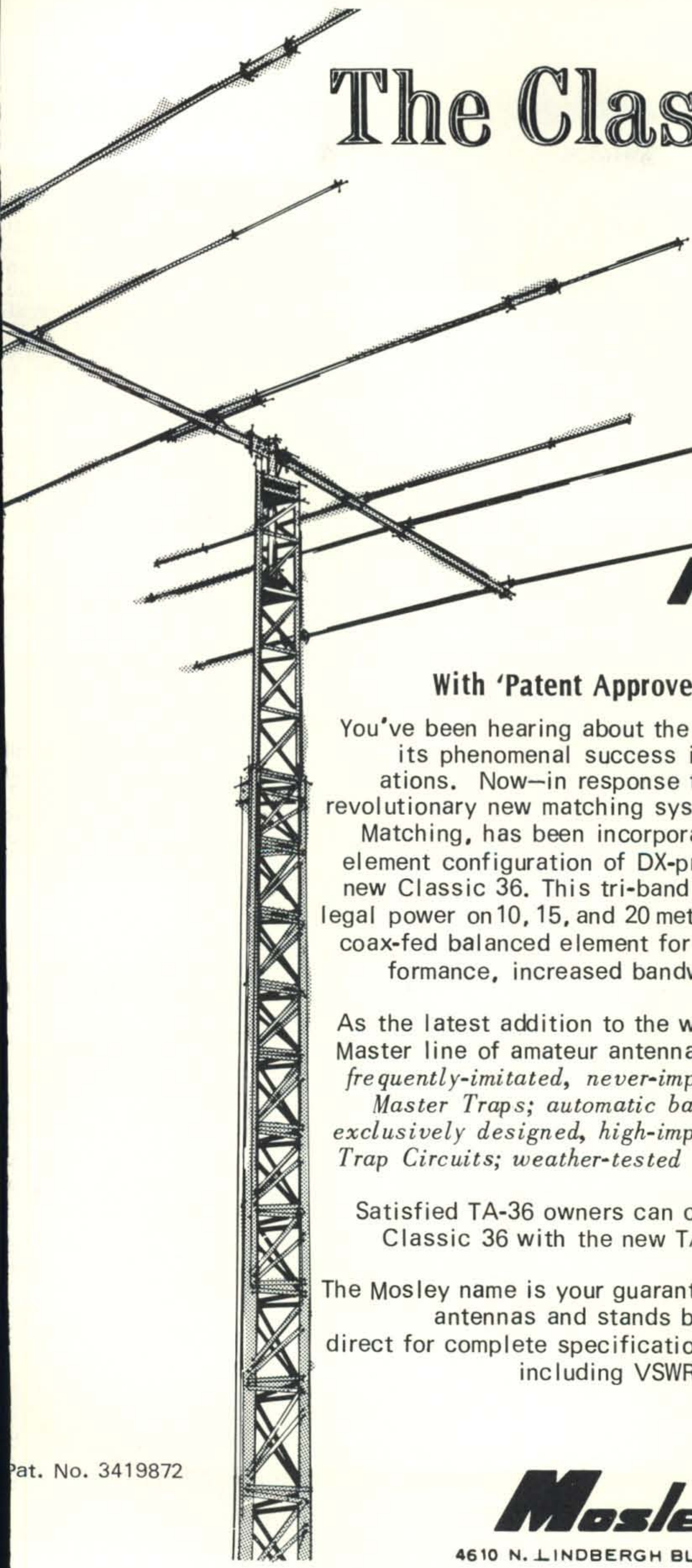
The Classic 36



Mosley TRAP MASTER

With 'Patent Approved' Classic Feed System*

You've been hearing about the Classic Feed System and its phenomenal success in three-element configurations. Now—in response to repeated requests—this revolutionary new matching system, Balanced Capacitive Matching, has been incorporated into the original six-element configuration of DX-proven TA-36 to create the new Classic 36. This tri-band beam, rated for maximum legal power on 10, 15, and 20 meters, features the Classic coax-fed balanced element for more efficient beam performance, increased bandwidth, and maximum gain.

As the latest addition to the world-famous Mosley Trap-Master line of amateur antennas, the Classic 36 offers: *frequently-imitated, never-improved-upon Mosley Trap-Master Traps; automatic bandswitching by means of exclusively designed, high-impedance parallel resonant Trap Circuits; weather-tested Trap-Master construction.*

Satisfied TA-36 owners can convert their beams to the Classic 36 with the new TA36/CL36 Conversion Kit.

The Mosley name is your guarantee: Mosley builds quality antennas and stands behind them. Write factory direct for complete specifications and performance data, including VSWR curves and gain figures.

Dept. 181B

*Pat. No. 3419872

Mosley Electronics, Inc.

4610 N. LINDBERGH BLVD., BRIDGETON MO. 63042

See page 110 for New Reader Service

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Hokendoke Hackensake!! Your Hon. Rag are surely cawsing me a lot of trubble. In fackly, I so mad I would cancelling my subscripshun, only can't an acct. not having one. I even thinking of subscribing just so I can cancelling, only not having much bux rite now.

One reason I riting is to keeping any other of your Hon. Reeders from having self-same problem I having. It all starting when you running that artickle in the March issue of Hon. Seek-You about a mini transmitter hunt. Some guy telling how he making reel tiny rig and putting it in a pickle. He certainly getting me in a pickle, I telling you.

I reel excited when I reeding how to making tiny rig, on acct. I want to making one and fooling everybuddy in local amchoor club next meeting. So I scrambling like furies for next cupple weeks, buying parts and trying out several vershuns of little rig. Are finely getting a reel slicky one working on breadboard. Next are having to deside what to putting it in.

Are thinking about pickle, but not needing that much room. After lotsa thought, are getting nice large walnut, cutting it apart carefooly, taking out all insides, and putting mini rig in it.

I adding one extra thing. Getting tiny mercury switch to turning it off and on, and putting that inside also. That way, when walnut are rite side up, xmitter are on, and when wrong side up, xmitter are off and battery not being used up. Glewing hole walnut back together when everything are inside. Reel slicky!!

Hon. Brother Itchi out on side porch, so I taking mini rig out and showing it to him. Even demonstrating with portable transistor radio how it working—I having rig tuned to broadcast band. We talking a bit about it

See page 110 for New Reader Service

The world's best Ham Antenna

The Hy-Gain DX Long John high frequency beam is far and away the best amateur beam in the world.

It comes in 5 models from 10 to 40 meters. (See specs.) The DX Long Johns are optimum spaced parasitic arrays that are designed to deliver the maximum theoretical electrical performance and greatest mechanical strength and durability attainable on the amateur bands.

You won't find another like this the world over. That's because Long Johns are built like the commercial antennas Hy-Gain makes.

So, each is built to a very rigid commercial specification, using only the finest aluminum and stainless steel.

And, every Long John comes with Hy-Gain's exclusive Beta Match and a super-power balun to make sure you get the top electrical energy transfer with minimum SWR.

When you really start getting serious about DXing, you'll be ready for the Long John. Because with one, you'll have the whole world at your hands.

The DX Long John from Hy-Gain*

SPECIFICATIONS	Model 204B 4-Element 20 Meter	Model 403B 3-Element 40 Meter	Model 205B 5-Element 20 Meter	Model 106B 6-Element 10 Meter	Model 155B 5-Element 15 Meter
ELECTRICAL					
Forward Gain	10.33db	9.45db	13.45db	14.5db	13.45db
Front-to-Back Ratio (Average)	23db	25db	28db	22db	20db
Front-to-Side Ratio (Average)	40db	35db	40db	30db	30db
Maximum Power (RF)	5 KW	5 KW	5 KW	5 KW	5 KW
VSWR (at resonance)	1.2:1 Max.	1.2:1 Max.	1.2:1 Max.	1.2:1 Max	1.2:1 Max.
Feedpoint Impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Half-Power Beam Width (E Plane)	53	59	48	42	47.5
Half-Power Beam Width (H Plane)	72	79.5	64	54	60
Frequency Range (Megacycles)	14 to 14.35	7 to 7.3	14 to 14.35	28.0 to 29.7	21.0 to 21.150
Approx. Bandwidth at Resonance (2:1 SWR)	325 KC	225 KC	370 KC	600 KC	600 KC
Polarization	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.
MECHANICAL					
Longest Element	38 ft.	73.5 ft.	38 ft.	18 ft.	24'8"
Element Diameter (Largest)	1½ in.	2½ in.	1½ in.	1½ in.	1½ in.
Boom Length	31 ft.	46 ft.	46 ft.	32 ft.	31'10"
Boom Diameter (Largest)	4½ in.	4 in.	4 in.	3¼ in.	3½ in.
Turning Radius	24.1 ft.	42.2 ft.	29.7 ft.	17.6 ft.	20.3 ft.
Maximum Wind Survival (No ice)	125 MPH	125 MPH	125 MPH	125 MPH	125 MPH
Wind Load (100 MPH)	360 lbs.	720 lbs.	555 lbs.	224 lbs.	274 lbs.
Total Wind Surface Area (Square Feet)	12.8	23.6	18.1	5.6	6.9
Net Weight (Assembled)	116 lbs.	250 lbs.	185 lbs.	151 lbs.	151 lbs.
Total Number of Elements	4	3	5	6	5
Shipping Weight	160 lbs.	300 lbs.	250 lbs.	167 lbs.	167 lbs.
Shipping Volume (Packaged BCP)	8.9 cu. ft.	21.9 cu. ft.	12.5 cu. ft.	7.8 cu. ft.	7.8 cu. ft.
Shipping Cartons	3	4	3	2	2

For recommended rotators and supporting structures, see Hy-Gain Technical Data Reports on Model RP75 rotating steel pole and Model R-3501 rotators.

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then, it being a nice afternoon, Itchi suggesting we take a ride to Joe's Triple-Dip Hunky Dory Ice Creem and Used Magazine Parlor for a soda. So, we taking off, having big old soda, and coming back about an hour later.

I going to side porch to getting mini rig and—Hon. Ed.—it gone!! No walnut! Radio still there, but no walnut mini rig!! Itchi coming to help me look. Looking on floor, under pile of magazines, in fackly we looking all over the porch. No mini walnut rig. We both kinda stumped until we see a gopher running around corner of house. Itchi and I both getting same idea at same time. Some gopher thief are taking off with my walnut mini rig, thinking it just plane old walnut!

Itchi and I taking off after him, but gopher see us chasing him and diving into his hole in the ground. Somewhere down there is my mini rig! I quick-like getting transistor radio to listening over hole. Not heering any signal. Of coursely, not knowing if mini rig are rite side up and on or wrong side up and off.

Meanwhile Itchi are getting two shovels. We digging and cussing and cussing and digging. After several false starts we finding the way the hole goes. Down we dig . . . down . . . down. Soon hole getting bigger and we coming to hollow place in ground.

Hon. Ed., you not buleeving it! There are hundreds and hundreds of walnuts in that hole. Must be at least eleventeen hundred walnuts there. That crazy gopher are nut hoarder. I trying out radio, but not getting any signal. Of coursely, walnut with mini rig in not having to being rite side up and on—it could be wrong side up and off.

Itchi and I are spending next cupple hours hauling out walnuts into bushel baskets. Now all I have to do is take each walnut and turn it one way up, and listen on radio, then other side up and listen on radio. When finding walnut with mini rig in, I should heering signal.

Or, Itchi and I could cracking all walnuts and finding mini rig that way. And maybe, just maybe, my mini rig not there at all. In that case we having nice big hole in ground which I can using for foundation for new beem.

So, Hon. Ed., putting notice in your Hon. Mag. that if anybuddys bilding mini rig—don't put it in any walnut shell. Espeshyoually if having gophers *around—or anyone else* that are nut-happy.

Respectively yours,
Hashafisti Scratchi

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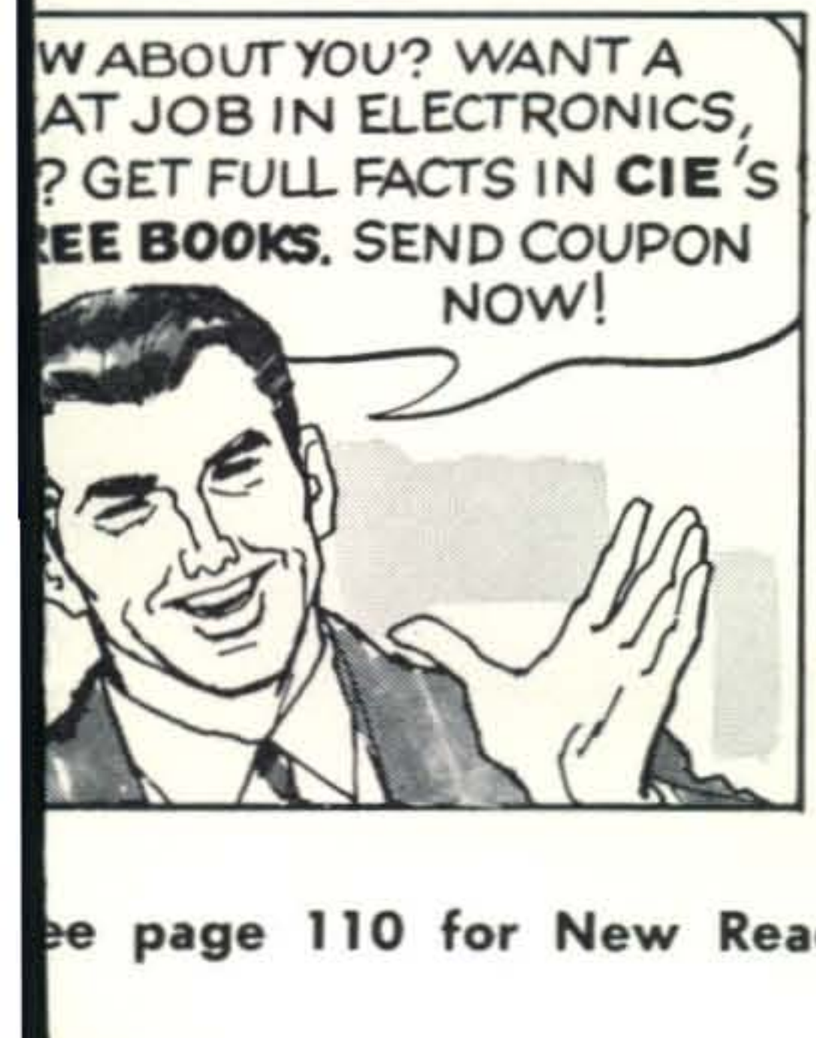
HIS CAN BE YOUR "BIG BREAK"

ou're a man who's ever said...



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CQ-45

SLOW SCAN TELEVISION

BY DON C. MILLER,* W9NTP

Part I

A New Frontier of Amateur Communication

With the advent of new communications mediums such as synchronous satellites and possible moon TV relay links, an aspect of picture transmission not often thought of is being investigated by a serious group of radio amateurs. Almost ten years ago a young engineering student at the University of Kentucky, Copthorne MacDonald, WAØNLQ, dreamed of sending pictures around the world by means of radio. A system of picture transmission, requiring only normal voice bandwidths, was conducted mainly with surplus equipment. With a special authorization by the FCC, tests were conducted from the United States to England.[1] It should be pointed out that this was several years before transcontinental satellite transmission of TV signals.

The last two years have been the most productive because the general public has begun to see the value of good quality slow scan pictures. Transatlantic cables have been used for picture transmission on several occasions. In recent years, a well known company ha used the system design obtained from th original MacDonald article[2] to transmit th first "live" pictures of an astronaut recovery Space probes have been forced to use a simi lar system of picture transmission, althoug not in real time, because of the small anten nas and limited power sources availabl aboard the space crafts. The pictures sen back from the moon and Mars in recent time testify to the quality obtainable with slo scan techniques. The transmission of weathe pictures, from Nimbus and other spacecraft is the most recent example of the use of slo scan techniques in the space program.

One of the most practical applications o slow scan television has been recently demon strated by the transmission of pictures be tween amateur radio operators in the Unite States and McMurdo Sound, Antarctic Military officials have been pleased by th tremendous boost in morale given to person nel at this remote location. As other govern ments approve of slow scan television tran missions by their amateurs, far-reachin improvements in international good will coul result. Only time will tell. Now let's look a the technical aspects of slow scan televisio

Bandwidth

The prime requirement of slow scan tel vision is the need to fit the base bandwidth o the video into the bandwidth of a voice com munication channel. Since amplitude modu lation requires at least 6 kc, this bandwid was chosen as the maximum available. In th

*Waldron, Indiana 46182.

[1]MacDonald, C., "First Amateur Transatlantic Transmission," *QST*, March 1960, p. 75.

[2]MacDonald, C., "Narrow Band Image Tran mission System," *QST*, Part I Aug., p. 11, Pa II Sept., 1958, p. 31.

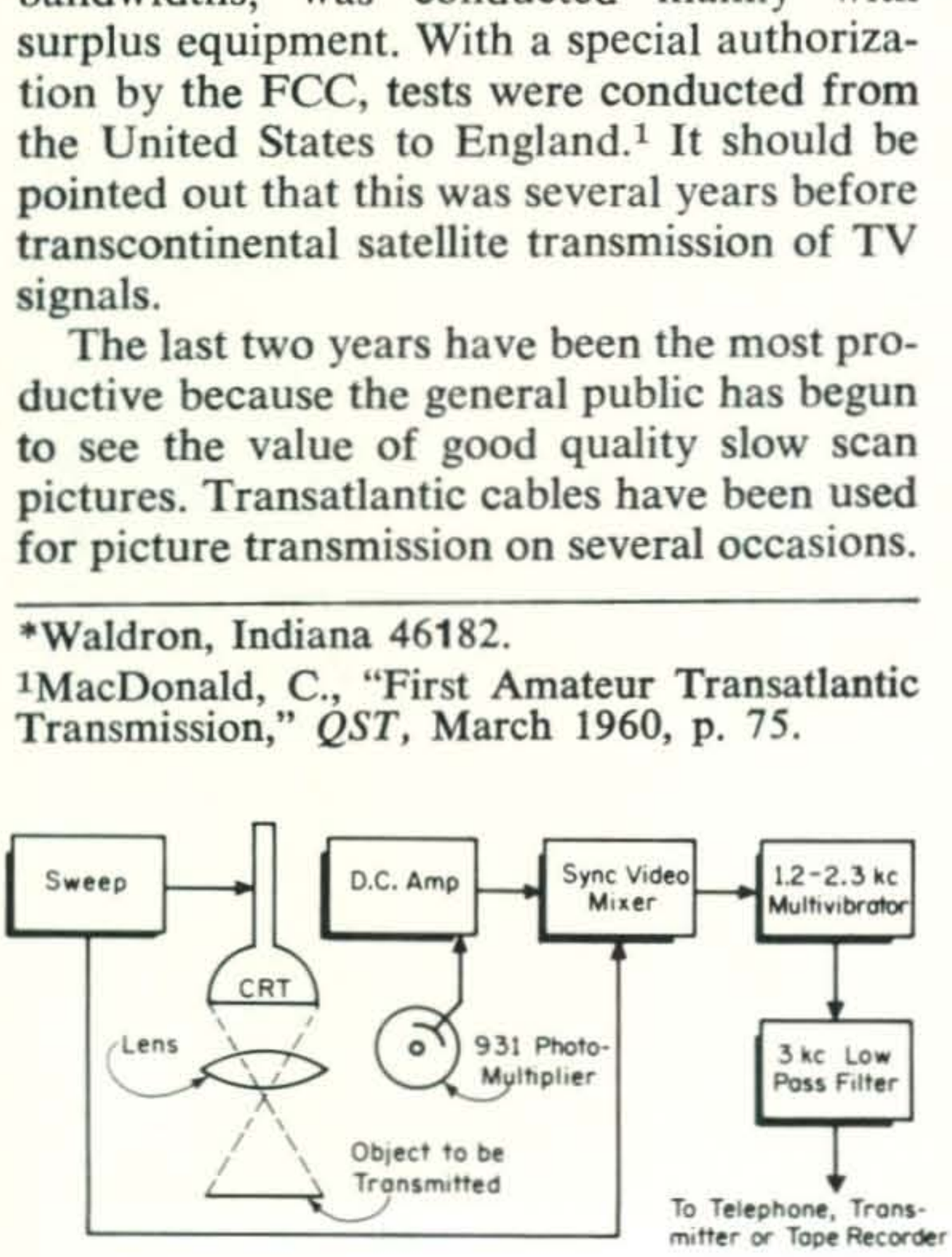

Fig. 1—Block diagram of an opaque slow scan flying spot scanner.

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final system the full 6 kc bandwidth was utilized but it was used to transmit *both sound and picture* over the same channel simultaneously. The video standard chosen for the slow scan system was that the video base bandwidth should not exceed 3 kc.

Indicator

Of great importance in any TV system is the indicator. Facsimile systems are similar to slow scan television but usually require sensitized paper or other recording media to produce a recognizable picture. Amateur experimenters have used P7 phosphor radar tubes since large quantities of these tubes were available as surplus from World War II. These tubes were tested for storage time and it was found that such tubes could store images for 8 seconds and longer with reasonable brightness. A frame time of 8 seconds was therefore chosen, based on video bandwidth and viewer acceptance. It should be pointed out that other experimenters have decreased the frame time from that of 8 seconds when the transmitted picture was to be sent over a high fidelity telephone line or audio tape recorder. This is desireable and provides a brighter non-decaying picture.

Too fast a vertical scan rate gives flicker. The present 8 second frame time provides "fascination" not "flicker" to the viewer.

Scanning and Aspect Ratio

Other technical specifications that needed consideration were the aspect ratio and the direction of the 8 second scan. A one-to-one format was chosen to get the largest picture on the small picture tubes. The direction of scan was finally chosen to go from top to bottom rather than left to right or bottom to top because of the desire to transmit printed material. Scanning from top to bottom gave the view needed to read printed words and lines.

Resolution

The transmitted picture is reasonably small on these tubes (5-9 inches) and the spot size of the beam is the principal limiting factor in resolution. The standard for horizontal resolution was derived from viewer testing. The public is not very critical of resolution and these tests showed that 120 lines would provide satisfactory images similar to home TV viewing.

Frequencies

Using the basic standards, 120 horizontal

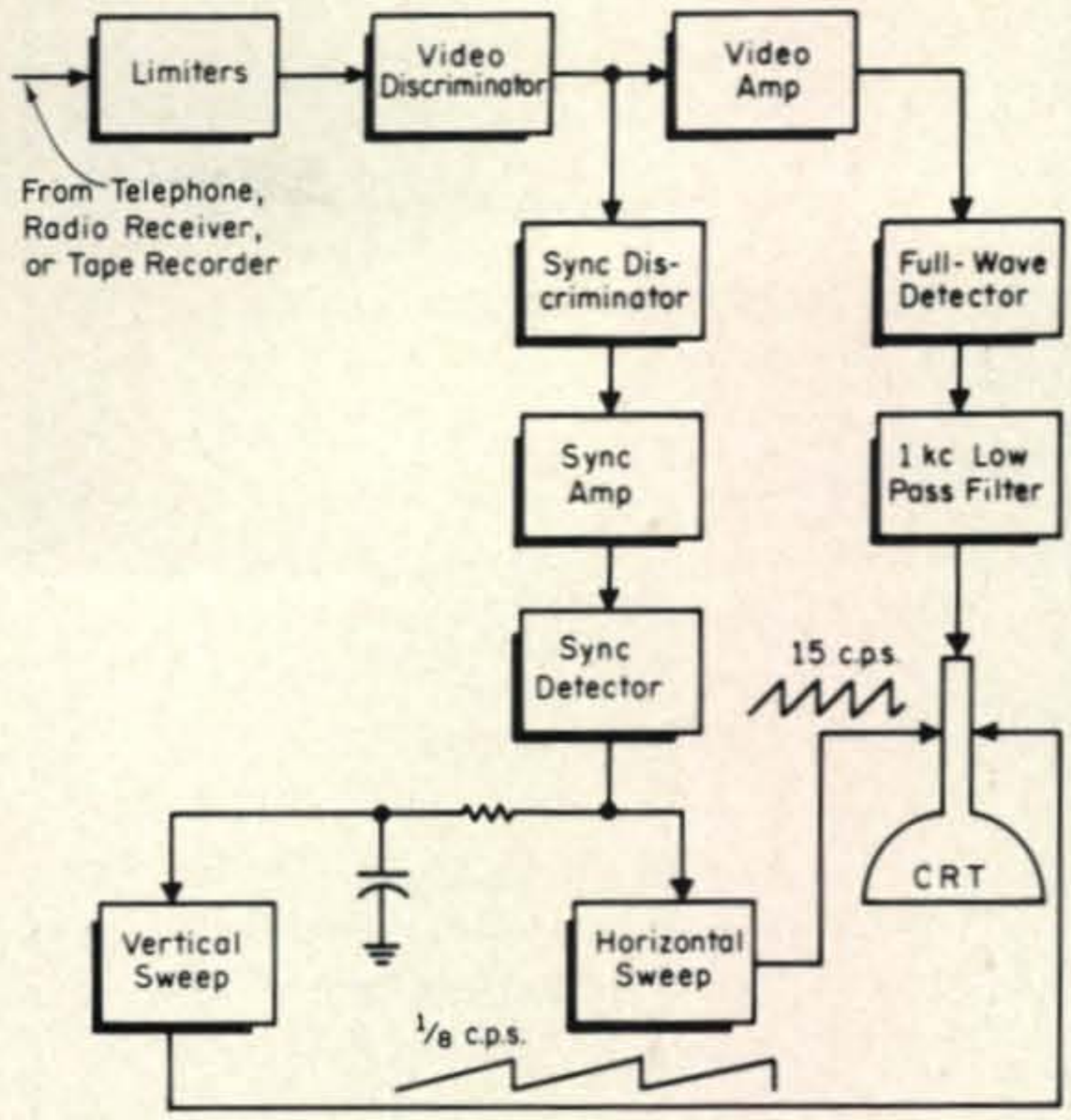

Fig. 2—Block diagram of a slow scan TV Monitor.

lines, 8 second vertical frame time gives a horizontal line frequency of 15 c.p.s. A one-to-one format therefore gives the basic video bandwidth to be:

$$\frac{120}{2} \times 15 \text{ c.p.s.} = 900 \text{ c.p.s.}$$

Since the video information is very near d.c. in frequency, some means had to be provided to give amplification and linear phase shift to these signals. Consequently, for the early transatlantic tests, a simple amplitude modulated subcarrier was placed in the middle of the available bandwidth. The subcarrier was modulated with the 900 c.p.s. video so that the effective bandwidth was

Fig. 3—A picture of W9CNW, sent from W9-NTP to VK3AHR, 10,000 miles, on 20 meters with a 2.5 kc bandwidth.

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SWEEP RATES:	
Horizontal	15 c.p.s. (60 c.p.s./1)
Vertical	1/8 c.p.s.
SCANNING LINES:	120
ASPECT RATIO:	1/1
SCA DIRECTION:	
Horizontal	Left to right
Vertical	Top to bottom
SYNC PULSE DURATION:	
Horizontal	5 milliseconds
Vertical	30 milliseconds
SUBCARRIER FREQUENCIES:	
Sync	1200 c.p.s.
Black	1500 c.p.s.
White	2300 c.p.s.
REQUIRED TRANSMISSION BAND WIDTH:	1.0 to 2.5 kc

Table I—Standards used for slow scan TV.

approximately 2 kc. When transmitted the r.f. bandwidth was approximately twice that. In no case did the bandwidth exceed that used for normal voice transmission. These tests showed the need, however, to provide better noise rejection. It was for this reason that the subcarrier was changed to an f.m. subcarrier.[3] Since the deviation was limited the f.m. subcarrier did not consume much more of the available video bandwidth than did the a.m. case.

The specifications discussed above were derived theoretically and field tested for psychological and practical considerations. Hundreds of viewers have modified original specifications and suggested improvements to make the system what it is today.

The standards for countries with 60 cycle power mains are summarized in Table I.

Cameras

The simplest of all cameras is a flying spot scanner. Perhaps this type of camera is the most useful since slow scan television has a non-moving format. Later two other types of real time cameras that permit transmission of images in near real time will be described. The flying spot camera[4] block diagram is shown in fig. 1.

This simple camera is capable of reproducing slow scan pictures from opaque objects with excellent resolution. A raster is created on the cathode ray tube (c.r.t.) and is projected on the object or picture to be televised. The 931 photo multiplier tube senses the light reflections and converts them to a 0-900 c.p.s. signal. The d.c. amplifier provides a video signal for mixing with the sync signal from the sweep generator. This combined amplitude-varying signal is then used to control a multivibrator from its normal 1500 c.p.s. "black" frequency.

Sync signals will drive this multivibrator to 1200 c.p.s. and white signals will drive it to 2300 c.p.s. Since the multivibrator is a square wave generator it is necessary to add a low pass filter to reduce the bandwidth to less than 3 kc. It should be pointed out again that the slow scan signal has its total information in the frequency variation of the generated signal. Noise added by amplification or by interference can be greatly reduced by the use of limiters at the receiver. It is for this reason that slow scan television has used an f.m. subcarrier since 1959[3]. The tests of the a.m. subcarrier system had far less immunity to interference.

Slow Scan Reception

Before describing live vidicon cameras, it is appropriate to examine the receiving, detection and display system of slow scan television. Figure 2 shows a block diagram of a typical monitor.[5, 6]

As mentioned before, the actual picture and TV information is modulated on an f.m. subcarrier. Upon reception by the appropriate

[3]MacDonald, C., "SCFM—An Improved System for Slow Scan Image Transmission," *QST*, Feb. 1961, p. 32.

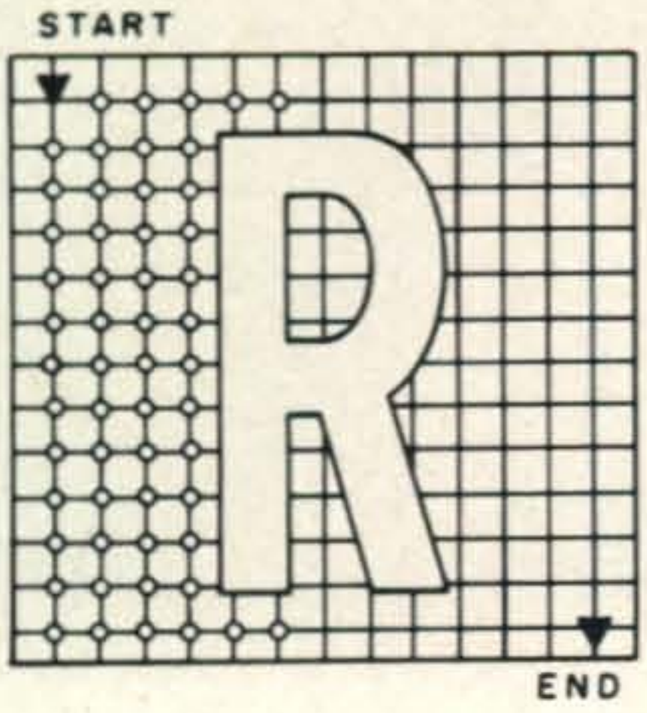

Fig. 4—Cross scanned TV raster.

[4]Hutton, L., "A Slow Scan Picture Converter," 73, Oct. 1967.
[5]MacDonald, C., "Compact Slow Scan AV Monitor," *QST*, March 1969, p. 45.
[6]Cohen, T., "Economical Slow Scan Monitor," 73, July 1967.

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radio receiver (s.s.b., a.m., f.m., *etc.*) the recovered audio signal is passed through heavy limiters in the monitor. The video discriminator next detects the f.m. subcarrier by means of a slope detector. At this point the sync signals are separated from the video and used to synchronize the horizontal and vertical circuits. It should be pointed out that it is still necessary to amplitude detect the sync and video signals because they are in the audio range (1200 c.p.s. for sync, 1500-2300 c.p.s. for video).

The c.r.t., therefore, presents 1:1 format with 120 lines, rescanned every 8 seconds. The P7 phosphor of the c.r.t. holds the intensity modulated image for an eight second period. A brighter, non-decaying image could be presented by use of a variable persistence storage tube. Some investigators have used a fast scan camera to re-scan the stored image so the slow-scan picture can be displayed on a fast scan monitor.

Figure 3 shows a picture[7] that was transmitted to Melbourne, Australia on a 3 kc s.s.b. channel. Very little deterioration is evident and many levels of gray scale can be seen in the original picture. The picture is of my XYL, W9CNW and was received in Australia by VK3AHR.

Scanners

A simple flying spot scanner is adequate for the transmission of printed material and the "shuttered slow scan camera"[8] can be used for the transmission of live non-moving images.

The shuttered slow scan camera can be used in "open shutter." Of course in this mode the storage action of the vidicon target is not fully utilized. It is interesting that some experimenters have actually substituted ordinary vidicons (7038, 7735), in place of the slow scan 7290 vidicons. Some of these tubes can be used to give "open shutter" slow scan images. It is not easily explained why some vidicons work and others do not. Here is an area where investigators would be welcome.

7290 Vidicon

Before introducing a different method of generating a slow scan image let us consider some of the disadvantages of using a 7290 storage vidicon.

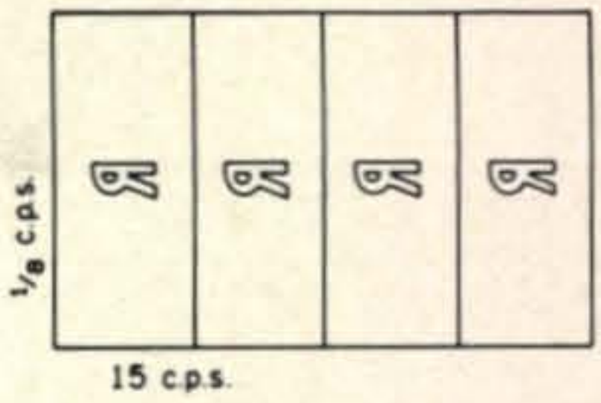

Fig. 5—Slow scan monitor image displayed from the sampling of a fast scan image. (60 cycle frame rate.)

This vidicon is expensive and can cost up to five times the cost of an ordinary fast scan vidicon. The second disadvantage is the inability to focus quickly. In the adjustment of the camera, 8 seconds must pass before corrections can be made. Focusing can consume hours if an initial setup is being made or a tube or yoke replacement is made. The best way to focus the slow scan camera is to paint a white vertical line on a black background and focus for sharpest rise time on the waveform displayed on an ordinary oscilloscope.

On the electronic market are many varieties of fast scan closed circuit TV cameras. Experimenters began to think about the possibility of using these cameras in a slow scan mode. If the advantage of fast scan focus, target adjustment, *etc.*, could be carried over into the slow scan mode, one of the disadvantages of the slow scan camera could be overcome.

The ordinary closed circuit fast scan camera ($200 variety) has a crystal controlled horizontal time base (15,750 c.p.s.) and a vertical time base of 60 c.p.s. which is synchronized with the 60 cycle mains. The fields are randomly interlaced.

If it is assumed that the picture being televised is stationary for 8 seconds, it is possible to sample a few resolution elements from each fast scan field and put them together to produce one slow scan frame over the 8 second period.

In order to understand exactly how the system works consider the raster shown in fig. 4.

A sample is taken at the upper left corner of the raster. Samples are continuously taken at each fast scan horizontal line intersection of the vertical slow scan sampling line. After one fast scan field the cross scan function returns to the top of the raster and starts the sampling over again. This time the samples are taken slightly to the right of the previous samples.

MacDonald, C., "Twenty Meter Slow Scan TV Tests," *QST*, Sept. 1966, p. 38.

MacDonald, C., "Vidicon Slow Scan Camera," *QST*, June, p. 11, July, p. 15, and Aug., p. 24.

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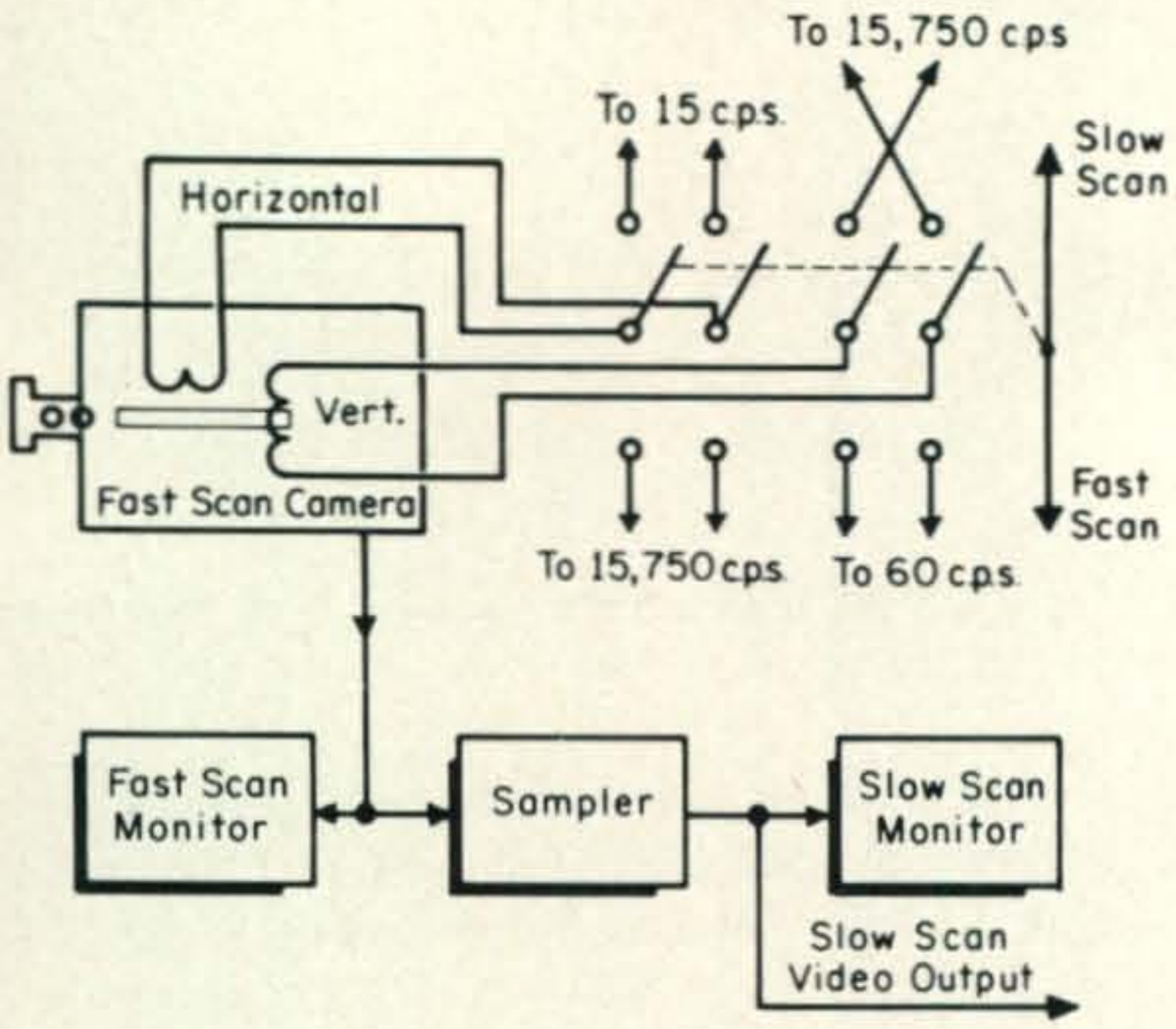

Fig. 6—Block diagram of the switching in the sampling camera.

Samples are continuously taken over each fast scan field, always moving a resolution element to the right until the right side of the fast scan raster is reached. The time for the sampling function to reach the right side is 8 seconds.

The time function created in this manner is identical to the 7290 vidicon camera slow scan video after proper filtering.

There is a surprise when the picture is viewed on a slow scan monitor as shown in fig. 5. Notice that the capital letter "R" is the image on the fast scan monitor.

Instead of one image on the slow scan monitor there are four. Evidently we forget that the slow scan standards dictate a 15 cycle slow scan horizontal scan rate. A little thought will result in the realization that the fast scan field rate must equal the slow scan horizontal line rate. The solution is to change the field rate of the fast scan camera to 15 c.p.s. (still sychronized to 60 c.p.s.) after fast scan focusing is done. The fast scan monitor used for focusing will not show a presentable picture when the fast scan camera is using a field rate of 15 cycles.

Another defect is also evident in fig. 5. The picture is rotated 90° and is a mirror

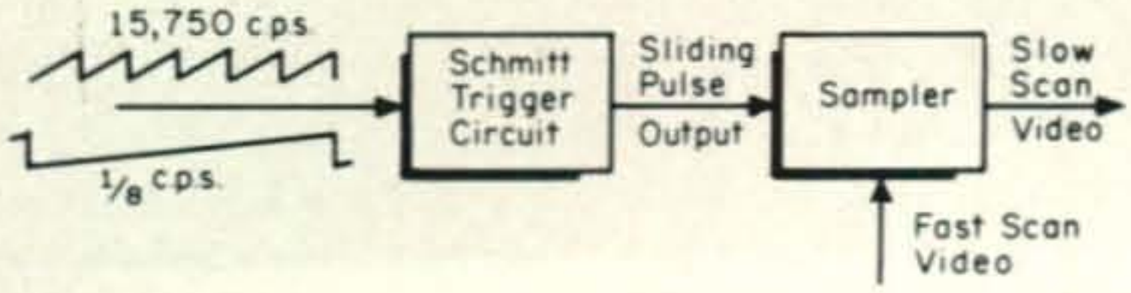

Fig. 7—Block diagram of the generation of the sampling function.

image of the original picture on the fast scan monitor. Fortunately the solution to this problem is easy. When the mode switch is thrown to go from fast scan to slow scan, the horizontal and vertical deflection coils in the fast scan camera are interchanged and the wires to one set of deflection coils are reversed. It is necessary in some cases to have identical horizontal and vertical deflection coils in the fast scan camera. This does not present a design problem since transistors are available to drive the coils in a variety of scan frequencies. The entire block diagram is shown in fig. 6.

The sampling function is an interesting time function since it must be synchronized to the 15,750 c.p.s. line rate and must slowly move in time from one side of the fast scan field to the other. The block diagram of the circuit is shown in fig. 7.

The addition of the 8 second ramp function with the 15,750 c.p.s. saw tooth function produces a sliding trigger output from the Schmitt circuit that moves in time with respect to the original 15,750 c.p.s. signal. This causes the samples to be taken at different times during the fast scan horizontal line time.

There are several other interesting circuits that can be used instead of the one shown but they are more complicated and should be used when a very high resolution slow scan picture is needed.

Voice and picture transmissions are currently being made at the same time by using an independent sideband transmitter (i.s.b.) where each sideband is transmitting different information (audio and video).

The principles of slow scan television have been discussed in this article. The hardware has been built and demonstrated publicly all over the United States and England. It is important to realize that the system was designed, developed, and constructed without the aid of commercial labs or test equipment. The results are comparable to any long distance, narrow bandwidth television system operating today and the total cost of the hardware is probably less than $300. A following article will give the circuitry to build a sampling camera.

In the meantime why don't you tune down to 14,230 kc each Saturday afternoon at P.M. EDT and join the slow scan TV net. There are about 80 amateurs calling and looking i

[*Continued on page 96*]

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SWISS RADIO AMATEURS HELP THE INTERNATIONAL COMMITTEE OF THE RED CROSS TO HELP HUMANITY

BY WALTER L. BAUMGARTEN,* HB9SI, 4UISU etc.

BELIEVE it or not, radio amateurs in many countries all over the world are often a little envious of those amateurs, who are fortunate enough to have incentive licensing in their countries, who may handle third party traffic, operate phone-patches and immediately come into action during emergencies.

Yes, in many parts of the world radio amateur activities are only just tolerated in various degrees by the authorities and examinations are often deliberately stiffened to keep the numbers of those enthusiasts down. Of course the old and still valid argument that radio amateurs form a never-ending reservoir of good technicians and operators is always brought forward, but if one is not normally allowed to show what one could do when necessary, it is obvious that any opportunity to demonstrate the radio amateurs' useful abilities is accepted enthusiastically.

*9, chemin Maurice Ravel, 1290 VERSOIX-GENEVE, Switzerland.

HBC 88, the Headquarters radio station of the International Committee of the Red Cross at Geneva, Switzerland, Planned, installed, operated and maintained by radio amateurs. It looks familiar, doesn't it?

Our Chance

Such an opportunity was offered to the Radio Amateurs of Switzerland when back in 1963 the International Committee of the Red Cross–ICRC–was called upon to organize and operate a field hospital somewhere in Yemen, where Republican and Royalist partisans were fighting each other cruelly, and where practically no medical assistance was available. As usual in such cases, the civilian population was also suffering very much and the stationing of a hospital, complete with operating theatre, X-ray installations power generators etc., staffed with fully qualified physicians and other medical personnel was a Godsend.

Where There Is A Will . . .

However, normal communications installations to keep this medical team in constant touch with the headquarters of the ICRC at Geneva, Switzerland, were many hundreds of miles away from the hospital. And that is "how it all started". Alert leaders of the Red Cross consulted two of the most experienced Swiss amateurs. Messrs. Kurt Ruesch, HB9ET and Edouard Maeder, HB9GM, first in regard to the transmitters and receivers to be used. The job had to be done with absolute

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reliability, as the well-functioning of the entire plan and the well being of the personnel depended upon it. The task had to be carried out with equipment which could be obtained at a cost much less than that of official commercial transmitters and receivers. Red Cross organizations unfortunately never have been very rich, and if they were, the money would rather be spent for humanitarian purposes than on anything else.

Secondly, personnel had to be found to install and operate the necessary stations, both at the field missions and at headquarters at Geneva. And the third—and most difficult problem—was to find and monitor frequencies outside the radio amateur bands, and the local authorities in the countries concerned had to agree to their use for this new communications service.

Official Cooperation

The Swiss PTT authorities gave their full cooperation from the very beginning and at the request of the ICRC assigned official frequencies just outside the lower band edges of the amateur bands for two main reasons. Firstly, the use of such frequencies was possible with normal amateur equipment. Secondly, it was hoped that this should make the creation of a future world-wide Red Cross emergency service easier, as radio amateurs everywhere—with the agreement of their own Red Cross and their licensing authorities—could simply use their existing equipment for emergency contacts with the headquarters station of the International Committee of the Red Cross at Geneva.

It Works!

What the amateurs always knew but what nobody else apparently would have thought possible: in the shortest practicable time the new service was working. An excellent headquarters station was planned and installed at Geneva by HB9ET and HB9GM requested Swiss amateurs to volunteer for short operating periods at field missions, where they could demonstrate their excellent knowledge of c.w. and s.s.b. phone procedures.

Danger And Privations

The work at such troublespots is of course never without danger, as the accident with HB9AET showed. He was wounded in the left arm during his stay in the Yemen and his recovery was slow. Last year Red Cross per-

The main radio station in a tent in South Yemen.

sonnel were killed during a bombing raid in Biafra and others were wounded while on active duty in Israeli-controlled territories. Living conditions are often more than primitive. For many months a Red Cross radio station and living quarters were placed deep in a hollow in the Yemen, to escape almost daily bombing and strafings by aircraft of the "other side". But despite all this, there has never been a moment when there were no volunteers to continue the good work.

Yemen, Nigeria, Biafra, Congo Etc.

Today, the system still operates to every-

After a bombing raid: motor-generator smashed, antenna down and the transceiver out of order.

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The Red Cross radio station at Santa Isabel, Equatorial Africa. Note the "luxurious" bed of the operator in the background.

bodys complete satisfaction and many Swiss amateurs have already helped to make this worthy idea a resounding success. Not only are a main field station and several substations still operating in the Yemen, but some time ago another main station was successfully installed at Santa Isabel in Equatorial Africa, with substations in Biafra/Nigeria. Also, much good work was done some time ago in connection with the evacuation of the white mercenaries and their families from Africa to Europe by a radio amateur at Kigali, who was especially licensed to work almost daily with the Red Cross radio station at Geneva. And earlier temporary communications between the Congo and Geneva were as successful as all the others.

HB9AET, who was wounded in the left arm, is carefully placed in the ambulance after being flown back to Switzerland.

Mission Continued World Wide

With a large rotary beam and other short wave transmitting and receiving antennas on the roof of its Geneva headquarters, the International Committee of the Red Cross proudly wears a familiar badge. Having joined the world brotherhood of radio amateurs, the ICRC looks forward to cooperate ever more closely with the amateurs of the world and to benefit by their wealth of experience and their devotion to humanitarian ideals. It is now known beyond any doubt that reliable radio contacts are a prerequsite in any far-flung relief action. The regular two-way communications service carried out by Swiss amateurs between ICRC headquarters and its field missions has proved an invaluable contribution to the success of numerous Red Cross operations. On the basis of the experience gained during the last five years under the most strenuous conditions, it is hoped that the next step will lead to the developement of a Red Cross emergency world network which will make it possible to establish and maintain radio communications in case of conflict or natural disaster with Red Cross, Red Crescent, Red Lion and Sun societies all over the world.

In the important tasks HBC-88, the ICRC's short wave headquarters station may be called upon to perform, radio amateurs will have a continued prominent part to play in the service of humanity. The radio amateurs of Switzerland are proud of the fact that they were given the opportunity to show what can be done by "mere amateurs" when called upon to do a mans job. ■

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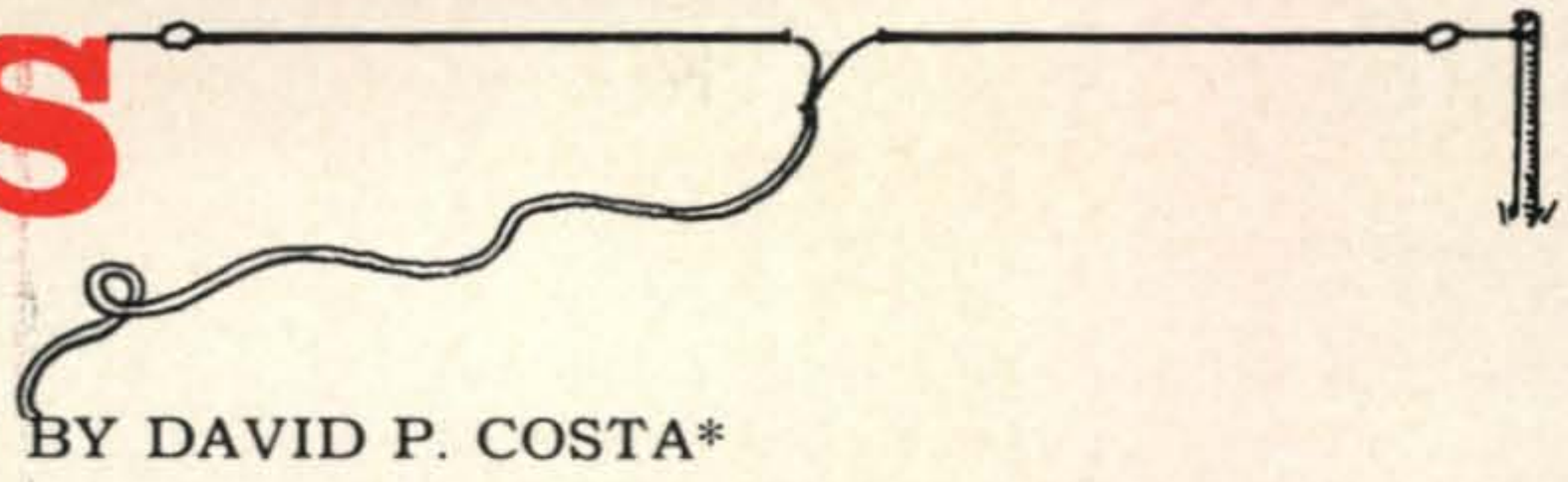
TRANSMISSION LINES



BY DAVID P. COSTA*

The author presents a review of the basic principles of transmission lines and then covers the characteristics, advantages and disadvantages of the various types.

A TRANSMISSION line is a device for guiding electrical energy from one point to another. How well this purpose is accomplished depends on the charactertistics of the transmission line used. The output end of an electrical circuit is coupled to the transmission line's input end, also called the generator end or source. The load is coupled to the output end, also called the load end or sink. The ratio of voltage to current at the input end is the input impedance. The ratio of voltage to current at the output end is the output impedance. If the line were of infinite length, the characteristic impedance would be the ratio of voltage to current on the infinite line. This value is constant for a given transmission line.

Distributed Constants

The transmission line is essentially a four terminal device. Two terminals are connected to the source and two terminals to the load. Between these terminals are distributed constants of inductance, capacitance, and resistance. Their values depend on the physical characteristics of the line such as the length, conductor sizes, spacing between conductors, and the dielectric (air or insulation) between the conductors.

If an infinitely long transmission line is assumed, then the characteristic impedance, Z_0, determines the current that flows when a given voltage is applied. The characteristic impedance is important in determining how well energy is transferred from the source to the load. For the infinitely long line, all of the energy is sent out on the line and none returns to the source. If a finite line is terminated with a resistive load equal to Z_0, the source appears to see an infinitely long line, and all the energy passes into the line. If the line is terminated in any other load, energy is reflected back to the source.

*Mechnical Engineer, Port of New York Authority, New York, N.Y.

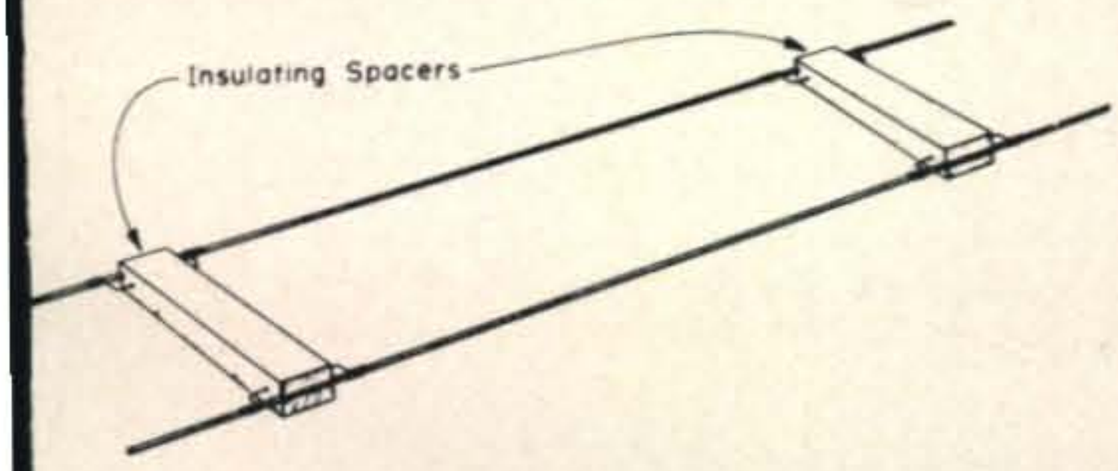


Fig. 1—Two wire open line, sometimes called the parallel wire transmission line, uses air as the dielectric. The characteristic impedance depends upon the wire diameter and spacing.

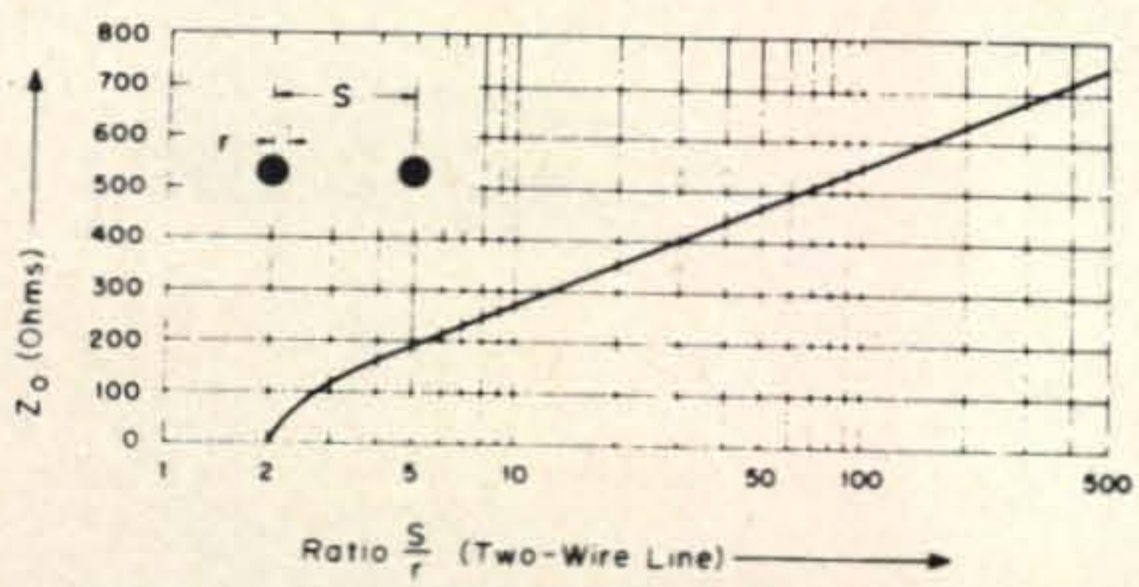


Fig. 2—A plot of the characteristic impedance, Z_0, versus the ratio s/r for a two wire open line.

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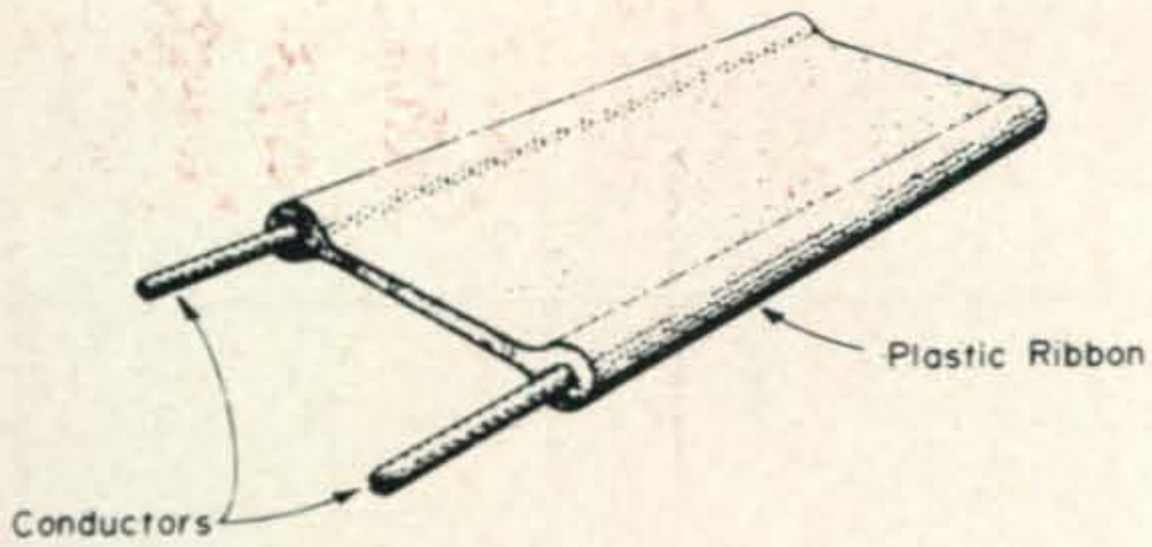

Fig. 3—Cross section view of an insulated two wire line. While more flexible and easier to run than the air dielectric type of fig. 1, insulated ribbon type shown has higher dielectric losses.

Attenuation and Losses

The ideal transmission line has no losses. It transfers all the energy available at the source to the load. Actual transmission lines, however, dissipate power in three ways; radiation, heating, and reflection.

Transmission lines of certain types tend to act like an antenna. Radiation losses of some of them can be considerable.

The resistance of the conductors dissipates a certain amount of power in the form of heat (I^2R loss). An I^2R loss also results from leakage between the conductors. Heat loss increases with lines having a lower characteristic impedance because of the higher currents that are permitted to flow.

A load with a value other than Z_0 reflects energy back along the line. This results in reflection loss. If energy is reflected, standing waves are formed, which means a changing ratio of voltage to current along the line, and therefore a changing line impedance.

If all energy is reflected from the output end and none is absorbed by the load, the impedance is purely reactive all along the line. If some energy is absorbed and some reflected, the impedance either can be resistive or can have both resistive and reactive components.

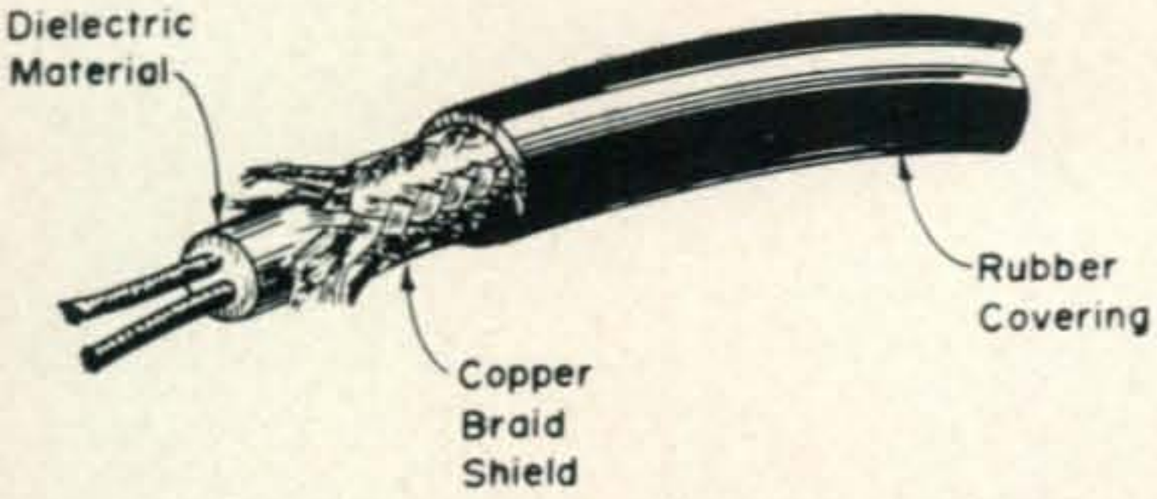

Fig. 4—The shielded pair shown above has the advantage of low radiation losses because the shield provides a uniform ground for both conductors.

When the source injects energy into a line impedance equal to the characteristic impedance, there are no standing waves and no reflections. Inductance, capacitance, and resistance found in a transmission line are distributed uniformly along its length. Therefore, no reflection of energy takes place unless the impedance at some point on the line is different from that caused by the distributed constants. The impedance seen by the source can be changed by changing the load. The travelling waves reaching the load suddenly encounter an impedance different from that along the line, resulting in the formation of standing waves and reflection of energy. Reflections occur as long as the load differs from Z_0.

Standing Wave Ratio (S.W.R.)

The actual loads connected to the transmission line usually have both resistive and reactive components. Considering the standing wave of voltage, the ratio of maximum to minimum voltage along the line is the standing wave ratio. The s.w.r. can be obtained by measuring the maximum and minimum current along the line. The standing wave ratio provides a measure of the energy reflected. When the line is terminated in a resistance equal to Z_0, the maximum and minimum values of current are the same. The s.w.r. is 1 to 1. In this condition, the load is said to be matched to the line. All of the energy is absorbed by the load (neglecting line losses), and there are no standing waves. Such a line is called flat, since the impedance, Z_0, is the same value all along the line.

If standing waves occur on the line with a given load, the s.w.r. is a measure of the degree of mismatch between load and line. For example, assume that a resistive load of 500 ohms is used to terminate a line with a characteristic impedance, Z_0, of 50 ohms. If the s.w.r. is measured, it is found to be 10:1. This is the same as dividing 500 by 50.

Impedance Matching

Assume that a transmission line has a characteristic impedance different than the load impedance. Since a mismatch occurs if the line is connected directly to the load, an intermediate element or impedance matching device must be used between the line and load

Types of Transmission Lines

Transmission lines differ considerably in their construction and specific characteristics

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Various types are the single wire line, open two-wire line, insulated two-wire line, shielded pair, twisted pair, and coaxial lines.

Single Wire Line—This is the simplest type of transmission line where a single wire conductor links the source to the load. The return path completing the circuit is ground. The line is unbalanced; this condition leads to large radiation losses, which is a definite disadvantage. Another disadvantage is the lack of a constant physical relationship between wire and ground, which leads to a varying characteristic impedance, making the line difficult to match to the load. Because of these two disadvantages, the single-wire line is used rarely. It is found where its advantage of easy installation outweighs its disadvantages.

Open Two-Wire Line—Because it uses two parallel conductors, this is called also the parallel conductor line, or the open two wire line because the dielectric medium is air. The construction and installation of the open two wire line is nearly as simple as for the single-wire line. Although the balanced conductors act to reduce radiation loss, the balance is critical, and nearby metallic objects tend to unbalance the line and cause large radiation losses. The two wires used in this line are kept at a constant distance from each other by means of insulating spacers, or spreaders, shown in fig. 1. The actual distance used between the conductors depends on the impedance required, the diameter of the conductors, and the frequency of operation. The characteristic impedance of a two-wire line is relatively constant. For a two wire line having air as a dielectric medium, Z_0, is given by the formula:

$$Z_0 = 276 \log_{10} s/r$$

where s = space between conductor centers
r = radius of the conductors.

This formula is sufficiently accurate provided that the ratio s/r is 4 or greater. The graph of fig. 2 shows the variation in Z_0 produced by changing the ratio s/r. Currents flow through the two parallel conductors in opposite directions. If the two currents are 180° out of phase, the fields nearly cancel and the radiation loss approaches zero. At relatively low frequencies, this condition can be approached. As the frequency of operation is raised, however, the two currents tend to be more and more out of phase, causing considerable radiation loss. The loss can be reduced by moving the conductors closer together. Moving the conductors closer together lowers the characteristic impedance of the line. This can be seen from the equation above. In order to have a relatively high impedance and close spacing, it is necessary to reduce the conductor size. Reduction in size though, decreases the power capacities of the conductors. The higher the frequency of operation, the more difficult these problems become.

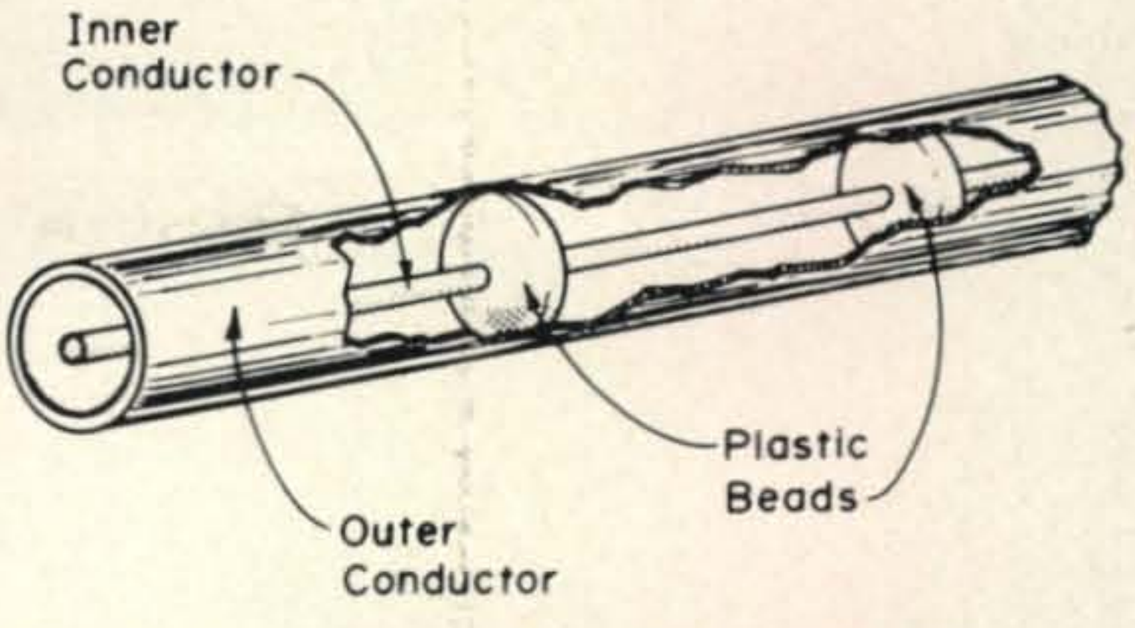

Fig. 5—A cut-away view of air dielectric coax using a flexible metal tube for the outside conductor. Coax is more often found in the form shown in fig. 4 but with a single inner conductor, a solid dielectric and braided copper outer conductor.

Insulated Two-Wire Line—Instead of having air as a dielectric medium, the two-wire line can be encased in a solid dielectric. This type of line has several advantages over the open line. Installation is simplified considerably because of its flexibility. For example, it is difficult to run the open wire line around a corner without changing the spacing be-

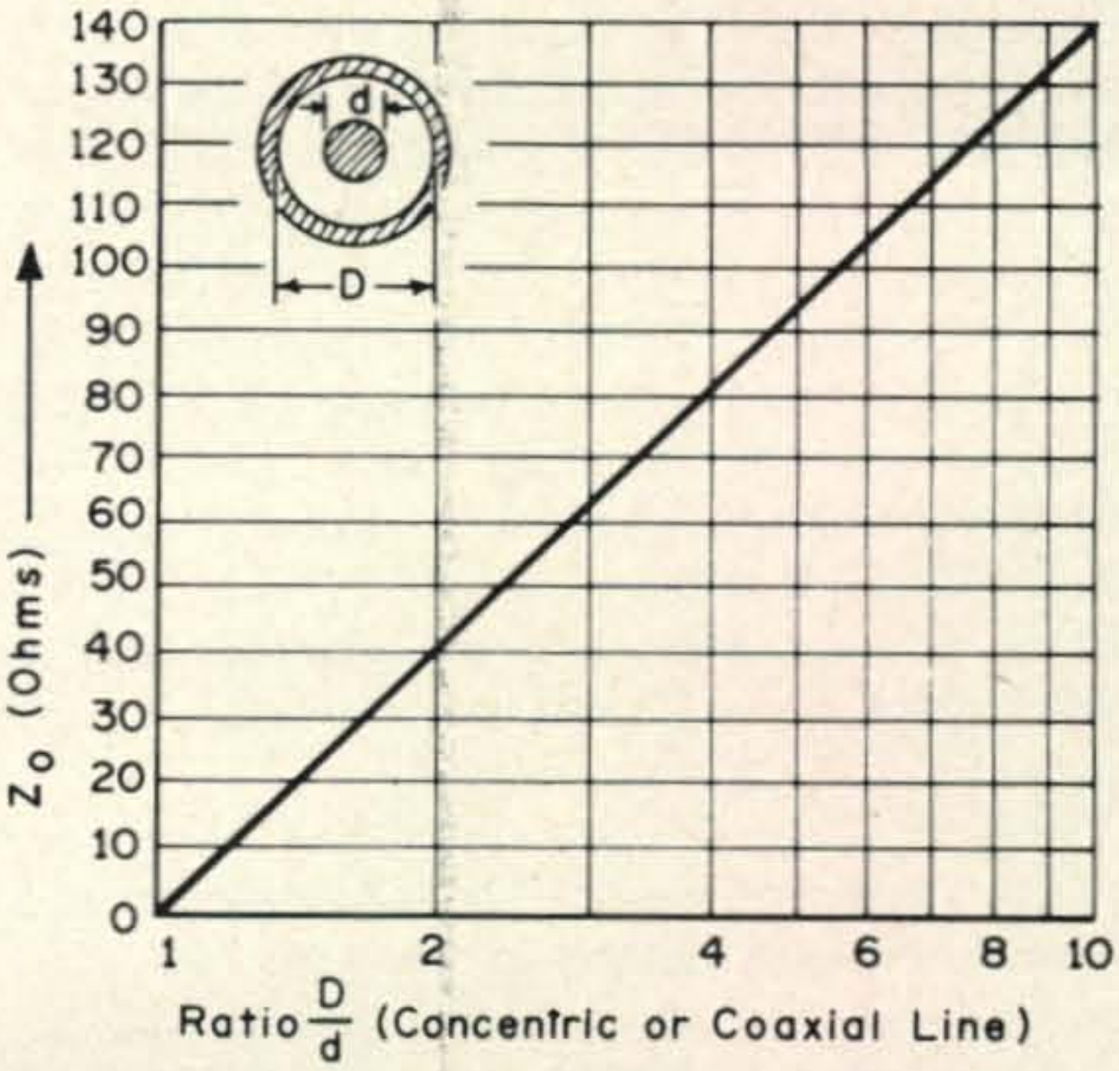

Fig. 6—Variations in Z_0 with changes in the ratio D/d for air coax.

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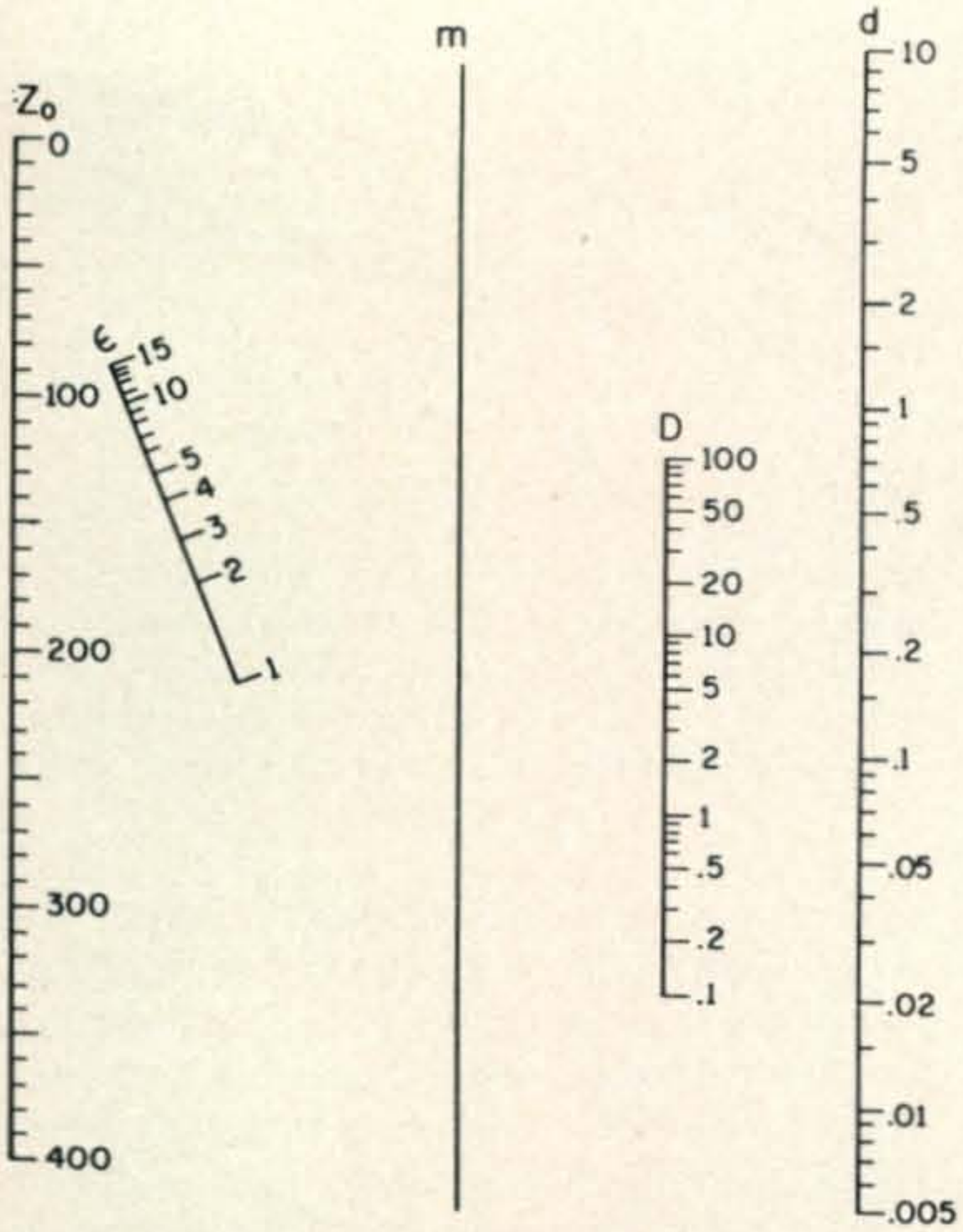

Fig. 7—Nomograph for determining the Z_0 of a solid dielectric coax. The two step procedure is explained in the text

tween the conductors. In the insulated type, the dielectric is solid enough to keep the conductors evenly spaced, but flexible enough to bend easily around corners. In one type of insulated line, the two conductors are molded into the edges of a plastic ribbon. See fig. 3. The dielectric losses are higher than in a comparable open wire line, and the higher dielectric constant lowers the characteristic impedance.

Shielded Pair—A further development of the insulated two-wire line is the shielded pair. See fig. 4. The two parallel conductors are imbedded in a solid dielectric. The insulated pair then is enclosed in a tube made of braided copper. The principal advantage of the shielded pair over other types of two-wire lines is its low radiation loss. This is true because the shield provides a uniform ground for both conductors, resulting in a well balanced line. Furthermore, the shield provides protection from stray pickup in the presence of external fields.

Twisted Pair—If two insulated wires are twisted together, a flexible transmission line results without the use of spacers. This type is limited to use as a short untuned line because of its high losses.

Coaxial Lines—It is possible to place one conductor inside the other to form a transmission line. Such a line is called coaxial, or concentric. The open line (air dielectric) is shown in fig. 5. Usuallly, it consists of a wire conductor placed inside a flexible metal tube or shield which serves as the second conductor. The inner wire is fixed along a central axis of the outer tube by spacers. The open coaxial line is used to provide efficient operation at relatively high frequencies. There is little radiation loss from this type of line because the outer conductor confines radiation to the space inside the line. External objects consequently have no effect on transmission, making this line definitely superior to the two wire type. Instead of air, the line can be filled with a flexible dielectric, forming a solid, coaxial line which has the advantage of greater flexibility compared with an open coaxial line. The use of a solid dielectric, however, increases the dielectric losses. The characteristic impedance of the open coaxial line can be calculated from the formula:

$$Z_0 = 138 \log_{10} D/d$$

where D = inner diameter of shield
d = wire diameter.

Variations in Z_0 with changes in the ratio D/d are given in fig. 6. The formula for Z_0 of a solid coaxial line is given by:

$$Z_0 = \frac{138}{\sqrt{\varepsilon}} \log_{10} D/d$$

where ε = dielectric constant of the materia between the conductors.

The other quantities are the same as for the open coaxial line. If ε is equal to 1 (the dielectric constant of air), the two formulas formulas become identical. From both for it can be seen that a high ratio of D/d means a high Z_0, and conversely, a low ratio means a low Z_0.

The designer of communications and elec tronics systems is often involved with deter mining characteristic impedances of concen tric lines so as to properly match them to im pedances of electronic instruments, meters *etc*. The nomogram of fig. 7 solves the abov equation for any scale of dimensions.

Example: What is the characteristic imped ance of a coaxial line if the wire diameter d, is (0.06) centimeters, the inner diameter o the shield, D, is (0.85) centimeters, and th dielectric constant of the material (ε) be tween conductors is (4.0)?

Solution: 1) Connect (d) with (D), intersec (m). 2) Connect (m) with (ε), find Z_0 equal 80 ohms.

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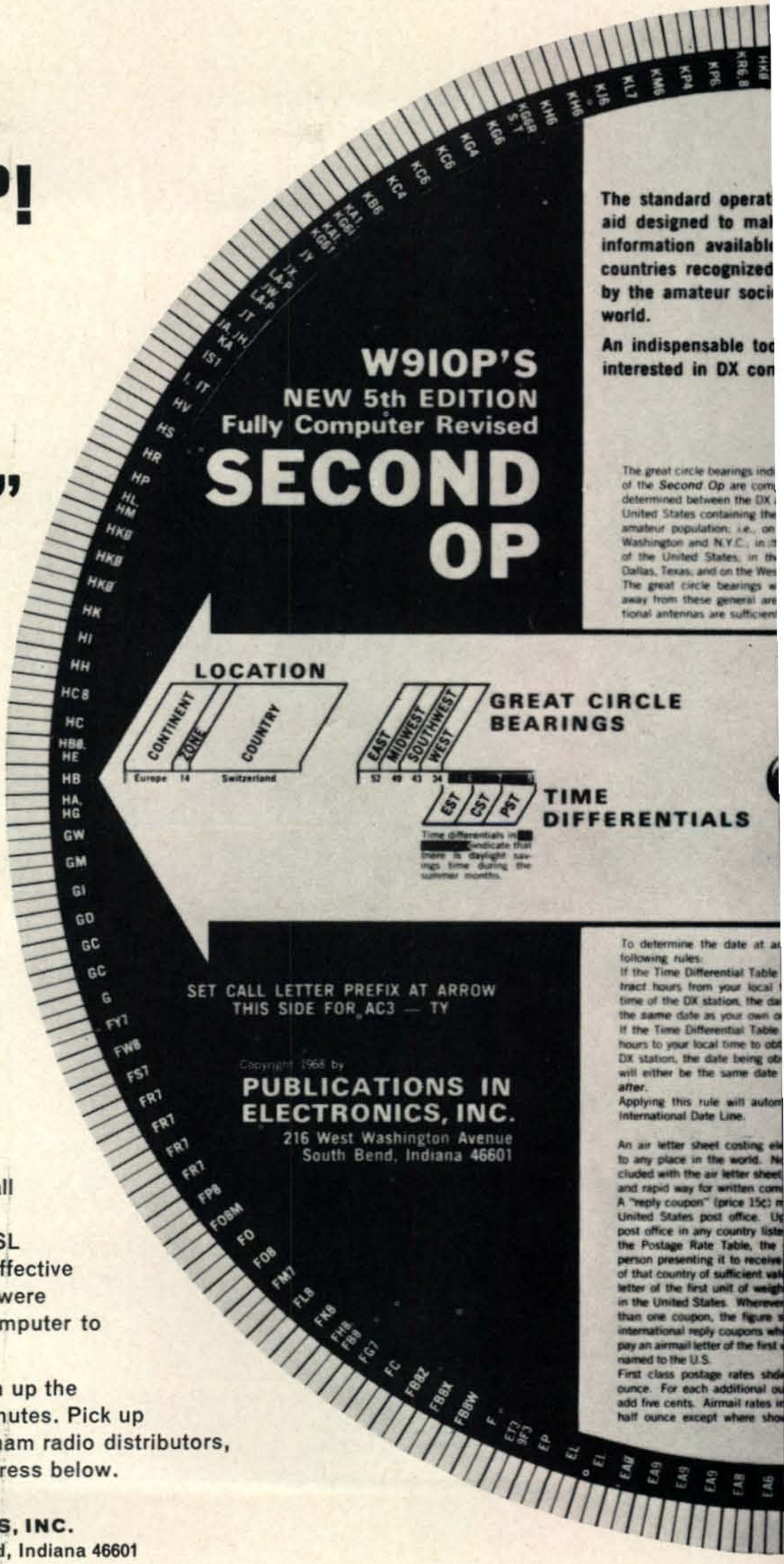

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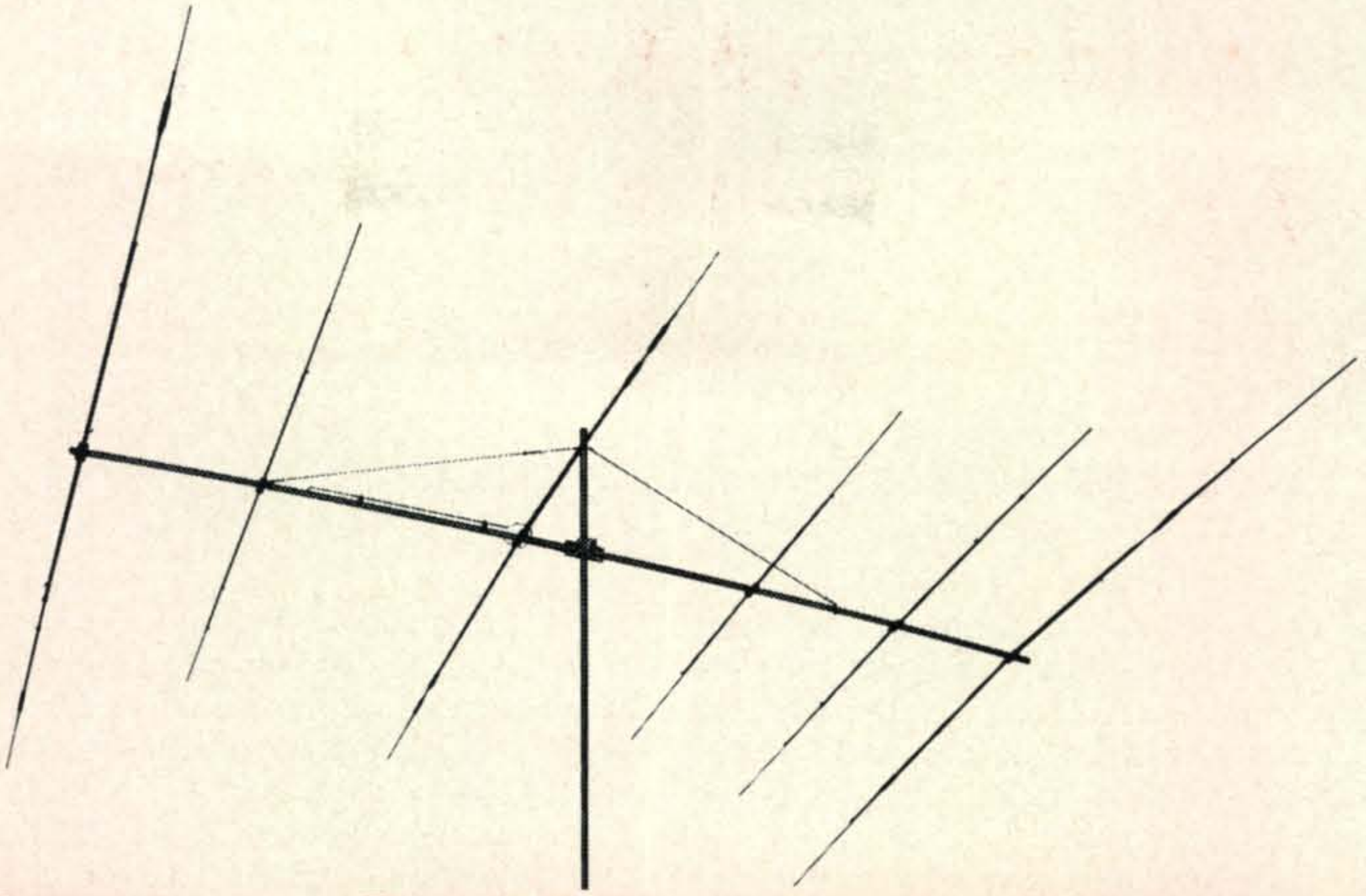

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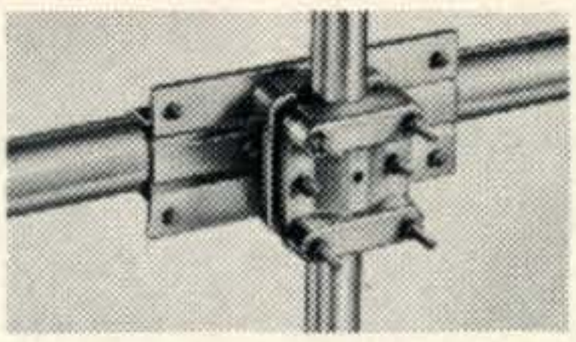

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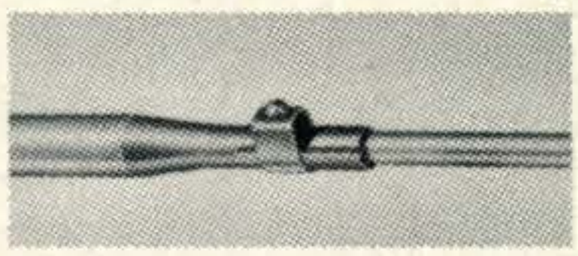

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SEPARATE KW AMPLIFIERS FOR THE CONTESTMAN

BY LARRY KLEBER,* K9LKA and WILLIAM I. ORR,† W6SAI

No doubt about it. Some of the most serious DX "contestmen" find that separate kilowatt amplifiers for each of the amateur h.f. bands are the ultimate answer to a flexible, reliable contest station. In addition to the versatility, moreover, a check of the cost of separation amplifiers leads to the conclusion that this solution to the ultimate contest station is not as expensive as it would seem at first glance. The station junk box, of course, can be heavily relied upon and the elimination of expensive, switchable pi-network configurations substantially reduces the overall cose of a multiplicity of amplifiers.

It must be admitted, however, that to a *real* contestman, cost is secondary. He can self-justify almost any expenditure, not to his XYL, prehaps, but at least to himself!

*922 Whitney Boulevard, Belvedere, Ill.
†Manager, Amateur Service, Eimac Division of Varian, San Carlos, Calif.

Using the 4-100A

This article describes a series of amplifiers covering the popular h.f. bands which make use of the 4-1000A tetrode strapped in grounded grid configuration. A tuned cathode circuit is employed, plus a simple pi-network output circuit. The amplifier is designed to work at a plate potential of 3000 to 3500 volts, at which it runs an average 1 kilowatt (2 kilowatts p.e.p.) input. Best of all, it is rated for continuous service so that it will not be "over cooked" by an eager contestman in the heat of battle. Five such amplifiers are in use at K9LKA and excursions from one high frequency band to another are accomplished with a minimum of fuss by means of a switch that changes antennas, drive and primary voltages to the amplifiers.

The 4-1000A is rated for grounded grid service and the various ratings are listed in Table I. Operation is possible at plate potentials as low as 2500 and as high as 5000 without damage to the tube, provided good sense is used during tune-up procedure. Power gain of the 4-1000A is quite high, and the amplifier may be driven by most of the popular s.s.b. exciters on the market.

While rather large in size, the amplifiers are very robust and hardly turn a hair at 24 hour a day operation. Quite a change from the "hot shot" sweep tube jobs that fold up when you look cross-eyed at them. Having 1000 watts

D.C. Plate Voltage	3000	4000	5000 V.
Zero Signal d.c. plate current	90	100	140 ma
Single Tone d.c. plate current	700	675	550 ma
Single Tone d.c. screen current	105	80	55 ma
Single Tone d.c. grid current	170	150	115 ma
Single Tone driving power	120	105	70 ma
Plate Load Impedance	2450	3450	5500 ohms
Plate Input Power (p.e.p.) max	2100	2700	2750 watts
Plate Output Power	1470	1870	1900 watts

Table 1—Grounded grid data for the 4-1000A.

See page 110 for New Reader Service

Front view of 15 meter amplifier. The 15 meter amplifier is typical of the various units The three meters are placed across the top of the panel, with plate tuning and loading controls directly below. A filament switch, pilot lamp and fuse are at the bottom left of the panel. Handles are included on the assembly to facilitate removal from a relay rack or cabinet. The 5 amplifiers are mounted one above the other and input and output circuits are relay controlled. When mounted, space is left between each amplifier to permit egress of the cooling air. For continuous operation, it is recommended that the amplifier cabinet be fan cooled.

of plate dissipation, the 4-1000A is quite capable of overcoming most of the "goofs" that happen during periods of high speed contest activity. Truly an admirable tube for such operation.

The Amplifier Circuit

The amplifier circuit is shown in fig. 1. The screen terminals of the 4-1000A are grounded and the control grid current is measured by monitoring the voltage drop across a low value of resistance placed in the grid return circuit (R_1). Since the ratio of control grid to screen grid current is fixed, only one need be monitored to make sure that the tube is driven properly.

A small, fixed-tuned cathode circuit is employed, isolated from the filiment circuit by a mica capacitor. A heavy-duty capacitor is used, as excitation and r.f. cathode current flow through the unit. It may be necessary with some exciters to place an additional mica capacitor in series with the input to prevent a d.c. short from being placed across the exciter r.f. terminals. Some exciters don't like this, while others are not aroused in the least. Check yours to see that the capacitor is not required. If in doubt, put it in the circuit between the tuned cathode tank and receptacle J_1.

The filiment choke, RFC_3, is a manufactured unit, as shown in the under-chassis may be substituted at a substantial savings in cost, and data for winding your own choke is given in the parts list.

Plate current is metered in the B-minus return lead, necessitating that the power supply float above ground, the ground point in the amplifier being the center-tap of the filiment transformer secondary winding. A protective resistor, R_3, is placed across the meter to prevent appreciable voltage from appearing between the chassis and the B-minus line should the meter winding open up.

The plate circuit of the amplifier is a conventional pi-network arrangement having a Q of about 10. Data for the cathode circuit and the plate circuit for the various amateur bands is given in the caption of fig. 1. While the amplifier requires no neutralization, a plate parasitic suppressor is used to prevent v.h.f. parasites which may take place under certain conditions of adjustment. As shown, the amplifier is stable as a rock under all conditions, either with or without drive or load.

A separate high voltage plate voltmeter is incorporated in each amplifier to comply with FCC regulations and also to remind the operator which amplifier of the set of five has *high* voltage applied to it. Even though the high voltage is completely enclosed and impossible to touch, it is a good idea to know where the "fire" is. The plate voltmeter helps keep track of this.

Amplifier Construction

Considerable leeway exists in the layout and construction of the amplifiers. It was desired that all amplifiers look alike and that the panel layout be somewhat symmetrical. The three meters are placed across the top of a 12¼" relay rack panel. The rear of each meter is enclosed in a small aluminum box to isolate the meter movement from the

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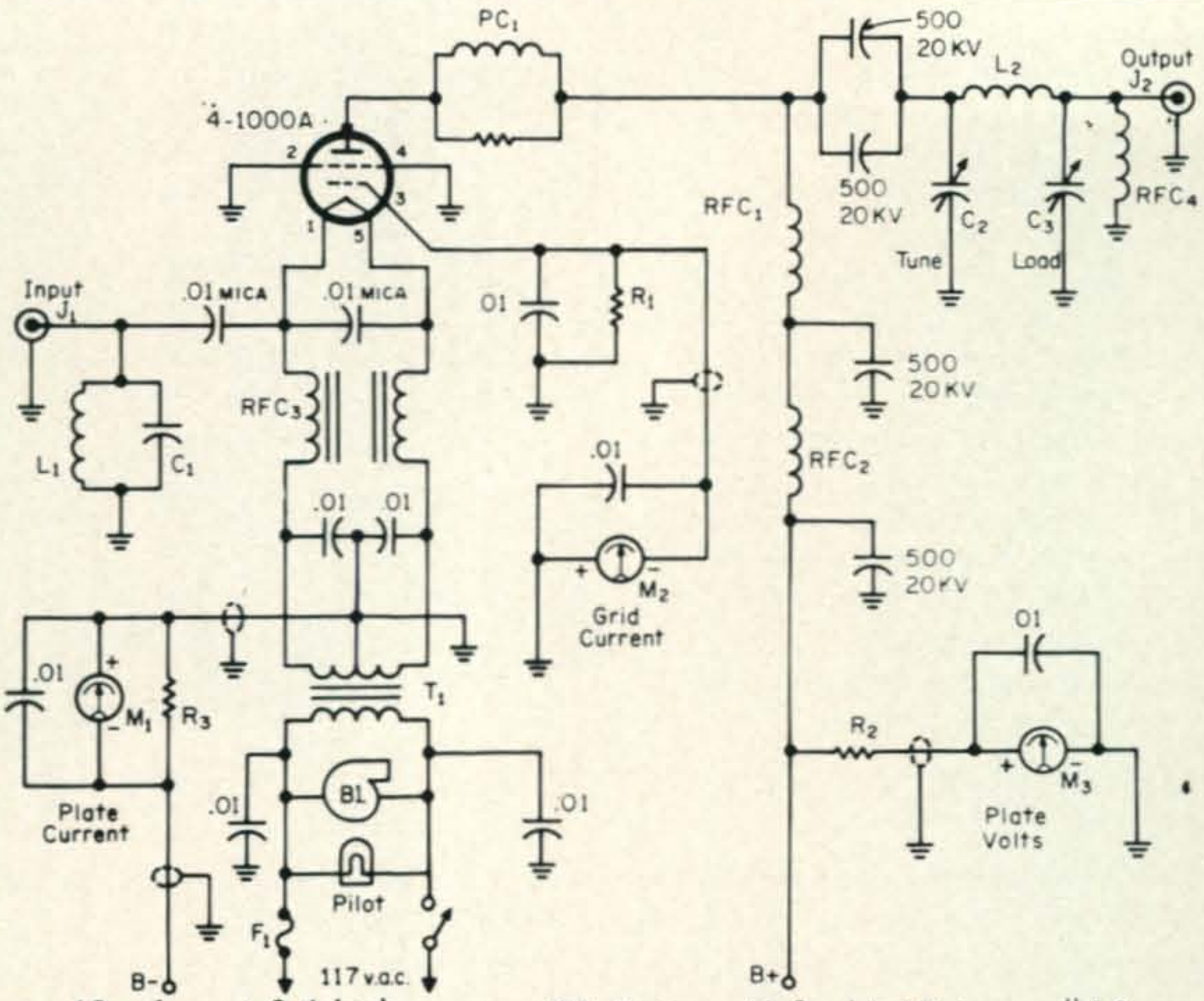

Fig. 1—Basic circuit of the grounded grid 4-1000A amplified. Capacitors marked MICA are micas of the heavy duty type. Bypass capacitors are 1.6 KV ceramics. Capacitors values greater than one are indicated in mmf and values less than one are in mf. The plate blocking capacitors are 20 KV TV doorknob types. The plate connectors used is the Eimac HR-8.

B_1—Centrifugal blower, 60 c.f.m. at 0.6 inch static pressure. Ripley #8472.

C_1—10 Meters: 200 mmf, 2500 volt mica, Sangamo H-5320 or equiv.
15 and 20 meters: 470 mmf, 2500 volt mica, Sangamo H-5347 or equiv.
40 and 80 meters: 1000 mmf, 1250 volt mica, Sangamo H-2210 or equiv.

C_2—10 Meters: 100 mmf, 7KV. Johnson 153-11. Rework to 3 stator and 2 rotor plates.
15-20 Meters: 100 mmf, 7 KV. Johnson 153-11. Rework to 3 stator and 4 rotor plates.
40 Meters: 150 mmf, 7 KV. Johnson 153-12.
80 Meters: 245 mmf, 7 KV. Johnson 153-13.

C_3—10 Meters: 250 mmf, .045" spacing. Johnson 154-1.
15 and 20 Meters: 350 mmf, .045" spacing. Johnson 154-2.
40 Meters: 500 mmf, .045" spacing. Johnson 154-3. Parallel 100 mmf, 5 KV ceramic, Centralab type 850.
80 Meters: 1140 mmf, .017" spacing. Jackson #LE3-4595-380. Available from M. Swedgal Co., 258 Broadway, N.Y., 10007. Parallel three 100 mmf, 5 KV ceramic capacitors, Centralab type 850.

J_1, J_2—Coaxial receptacle, chassis mount, SO-239.

L_1—10 and 15 Meters: (0.15 μh) 4 turns #16 e, on 1/2" diam. form, spaced 1/2" long. National XR-50 with slug removed.
20 and 40 Meters: (0.31 μh) 6 turns #14 e, on National XR-50. Slug removed from 20 meter coil only.
80 Meters: (1.3 μh) 13 turns #18 e, on National XR-50.

L_2—All coils made from 1/4" o.d. copper tubing.
10 Meters: 5 turns, 1½" diam., spaced ⅛" between turns.
15 Meters: 5 turns, 2½" diam., spaced ⅛" between turns.
20 Meters: 7 turns, 2⅝" diam., spaced ⅛" between turns.
40 Meters: 9 turns, 2⅝" diam., spaced ⅛" between turns.
80 Meters: 17 turns, 2½" diam., spaced ⅛" between turns.

R_1, R_3—200 ohm, 10 watt.

R_2—Meter multiplier for 0-5KV meter.

RFC_1—Solenoid r.f. chock (B&W #800).

RFC_3—30 ampere bifilar chock. (B&W FC-30A). Homemade equivalent: Two windings of #10 e. wire, 14 turns each, bifilar, on ferrite rod, 1/2" diameter, 5" long. (Indiana General CF-503. (Available at Newark Electronics Corp., Chicago, Ill. as catalog number 59F-1521.)

RFC_4—2.5 mh. National R-100 or equiv.

M_1—0.1 amp. d.c. meter.

M_2—0-250 ma d.c. meter.

M_3—0-5k.v. d.c. voltmeter.

F_1—5A, 3AG fuse.

Socket—EIMAC SK-510.

PC_1—3 turns # 10 e, about 5/8" diam. and 1" long, parallel connected with three 150 ohm, 2 watt composition resistors.

T_1—7.5 volts at 21 amps. Stancor P-6457 or Chicago F-725.

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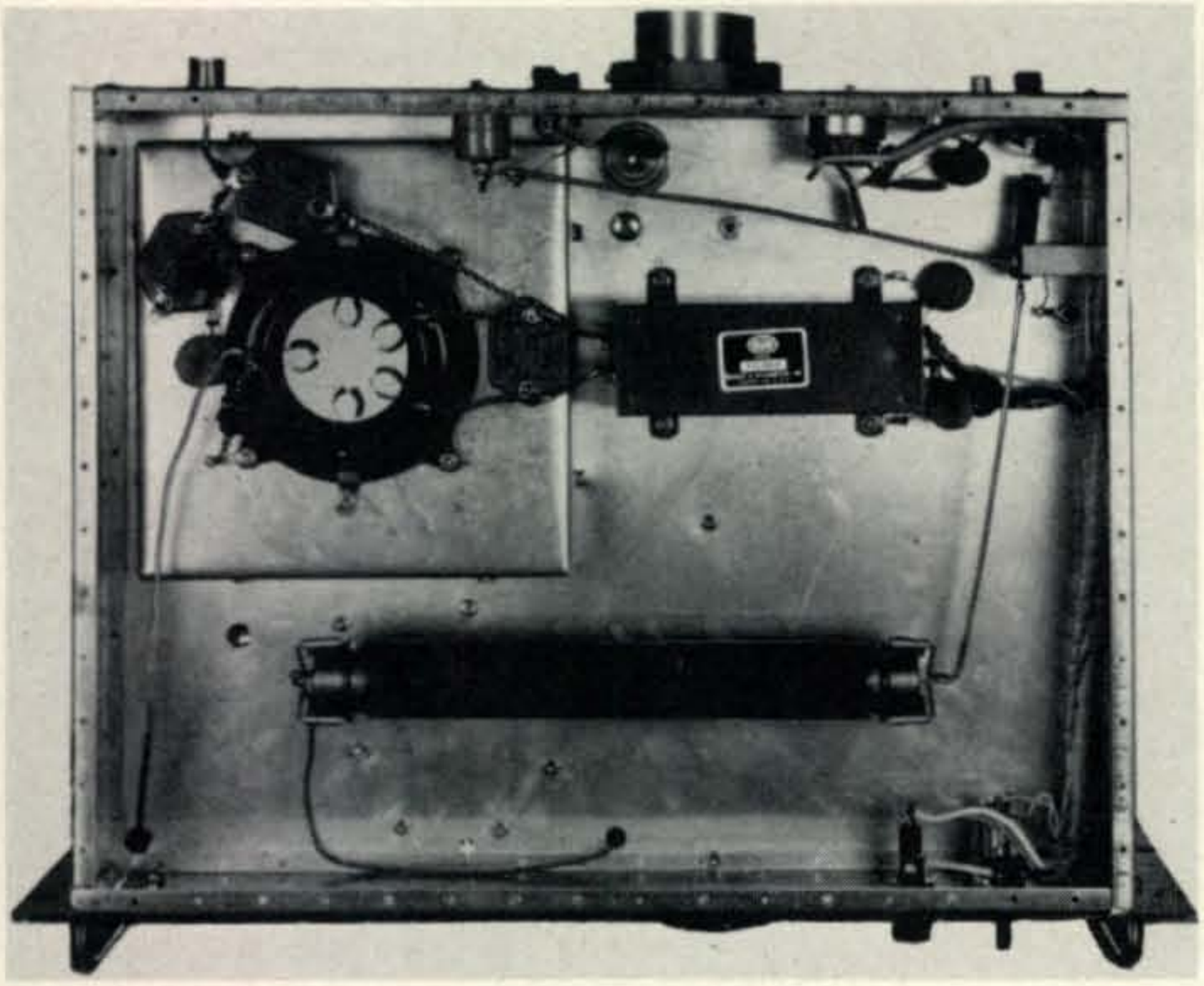

Under-chassis view of 15 meter amplifier showing the relatively few components. The 4-1000A socket is in the corner, with the mica filament capacitors arranged around it. The tuned cathode circuit is to the side of the socket, with the filament chock on the opposite side. The large resistor is the multiplier for the plate voltmeter, and is a surplus item. A substitute may be made up of a number of 2 watt composition resistors connected in series. The solid bottom plate was removed for this photograph.

strong r.f. field existing within the plate compartment.

The amplifier is built upon a 12" × 17" × 3" aluminum chassis. The particular chassis used were built of *See-Zak* chassis components in a do-it-yourself operation, but ordinary folded aluminum chassis may be used.

The blower is mounted on the rear of the chassis and the under-chassis area is pressurized, allowing the air to escape via the Air System socket used for the 4-1000A. A bottom plate is placed under the chassis and held in position with sheet metal screws placed about 1 inch apart around the perimeter of the plate.

To make full use of the excellent isolation of the 4-1000A tube, it is necessary to fully enclose the plate circuit above the chassis. If this is not done, r.f. energy from the plate circuit will "creep" into the input circuit via exposed power lines and the small "leaks" in the chassis seams. The plate area, therefore, is enclosed in a cage made of perforated aluminum, which may be partially seen in the front view photograph. The end pieces of the enclosure are made of solid aluminum sheet, whereas the top and back are made of the perforated stock. If desired, the whole enclosure may be perforated. The edges of the enclosure are bolted to a strip of 1/2-inch angle aluminum by means of sheet metal screws, and the whole enclosure, in turn, is affixed to the chassis edges in the same fashion. An r.f. tight box is thus created, which still allows good ventilation to be achieved.

In order to reduce the overall height of the amplifier, the 4-1000A socket is mounted in a recessed box below the chassis deck. The box is fully enclosed so that the pressurized air escapes only via the socket. The socket is depressed 7/8" below the chassis. Normally this would cause a misalignment with the Air System glass chimney. If this particular dimension is used to lower the socket, however, the Eimac SK-516 chimney (normally used with the 3-1000Z) may be used for the 4-1000A in place of the usual SK-506 chimney which is for use only when the 4-1000A is mounted at chassis level.

In the case of the amplifiers shown in the photographs, it was desired to use the SK-506 chimney, as two of them were at hand. This was done by enlarging the chassis hole so that the taller chimney dropped down to the level of the socket, mounted at the bottom of the recessed box. Either scheme works perfectly well, and it is a matter more of economic choice to the builder which system is used. If a chimney happens to be at hand, the wisest choice would be to use the construction technique that best fits the chimney.

Placement of parts above and below the chassis is relatively noncritical. The input circuit components are grouped about the tube and the leads from the grid circuit shunt and meter multiplier that pass through the chassis are run in shielded wire. The a.c. power receptacle and various coaxial fittings are mounted on the rear lip of the chassis, with the exception of the antenna connector (J_2) which is mounted on a small angle plate atop the chassis.

The plate circuit components may be viewed in the photographs of the 10 and 40

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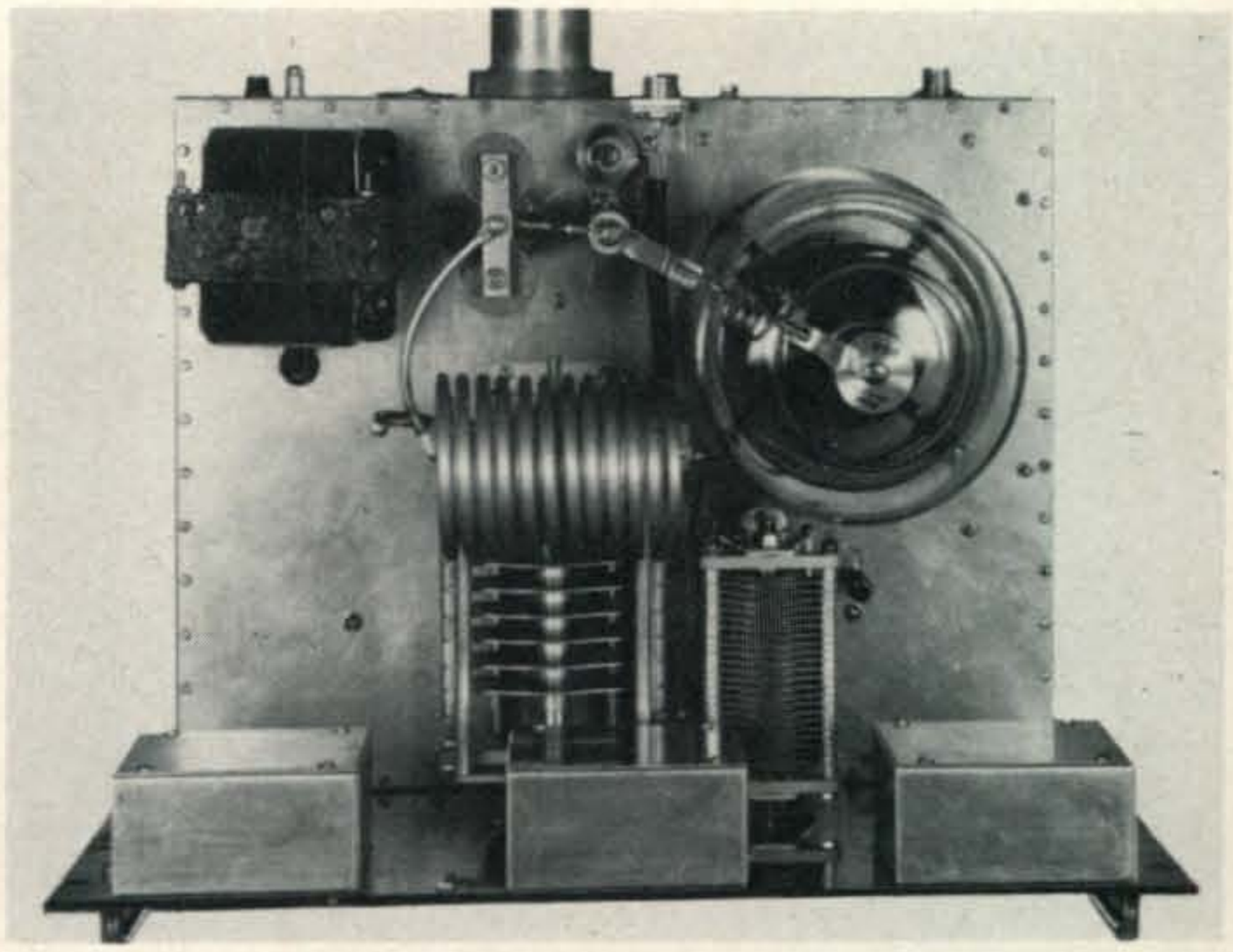

Top view of 40 meter amplifier. The filament transformer is mounted at the rear of the chassis, with the plate circuit bypass capacitors and plate r.f. choke to the right. Operating temperature of the transformer can be appreciably reduced by spraying the outside of the case and core with white paint to reflect the heat radiated by 4-1000A tube. Copper tubing tank coil is mounted to tuning and loading capacitors by its leads. The 4-1000A and air chimney are at right. Blower assembly is mounted to the flange at the rear edge of the chassis (blower has been removed for photograph).

meter amplifiers. The only word of warning is to point out that the plate circuit choke (RFC_1) is series resonant about 24 mc. Normally, this would cause little concern, except that capacitance to nearby objects may often lower the series resonant frequency into the 21 mc band. It is prudent, therefore, to remove about four turns from the bottom end of this choke *for the 15 meter amplifier only*. If the choke is operated near its series resonant frequency, it will run extremely warm and may shortly burst into flames. The problem may be eliminated by removal of a few turns, thus pushing the self resonant frequency well above the 15 meter band.

The specified plate parasitic suppressor works well on all bands, but a few words about this particular component may not be amiss. The suppressor consists of a resistive load made up of one or more composition resistors tapped across a sufficient portion of the plate lead so as to load the amplifier tube at the parasitic frequency. Most parasitic oscillations with tubes of this size occur between 70 mc and 120 mc, and sufficient coupling may be achieved if the load resistor is tapped across an inch or two of the plate lead. Normally, the tapped portion of the lead is wound into a small coil which is placed in series with the remainder of the lead. The resistive load is connected across the coil. In order to achieve greater coupling at the parasitic frequency, the portion of plate lead across the resistor is increased (that is to say, more turns are added to the parasitic inductance). If the coupling is carried to an extreme, a portion of the fundamental power will be coupled into the resistor and it will overheat and burn up. Rarely does the resistor overheat from harmonic parasitic oscillation. It is usually a result of too-great coupling of fundamental power into the resistor portion of the suppressor. The cure, obviously, is to remove a turn or two from the inductor of the suppressor, thus reducing the degree of primary power coupled into the resistor. Contraiwise, if the suppressor does not fully suppress a parasitic oscillation, it is a sign that the resistive load is not coupled closely enough to the plate circuit, and a turn or two should be added to the parasitic choke.

A commercial parasitic suppressor *(Ohmite)* is available, but it has far too many turns on the inductor for use above about 10 mc. It makes an ecellent suppressor up to 30 mc or so, however, if the number of turns on the shunt coil are reduced to about three or four.

Tuning the Amplifier

Once the amplifier is complete, the 4-1000A tube may be placed in the socket and the cathode circuit grid-dipped to the middle of the operating range. It need not be further adjusted. The plate circuit, too, may be adjusted to approximate resonance before power is applied. The pi-network output capacitor *(loading control)* is set to about 3/4 full capacitance, and the *tuning* capacitor adjusted for resonance with the aid of the grid dip oscillator. Filament power should be applied and the voltage at the socket terminals checked. It should be between 7.2 and 7.5 volts. It is not recommended that the tube be run over this maximum figure and, indeed, may be run closer to 7.2 volts for longest life.

As with all grounded grid amplifiers, exci-

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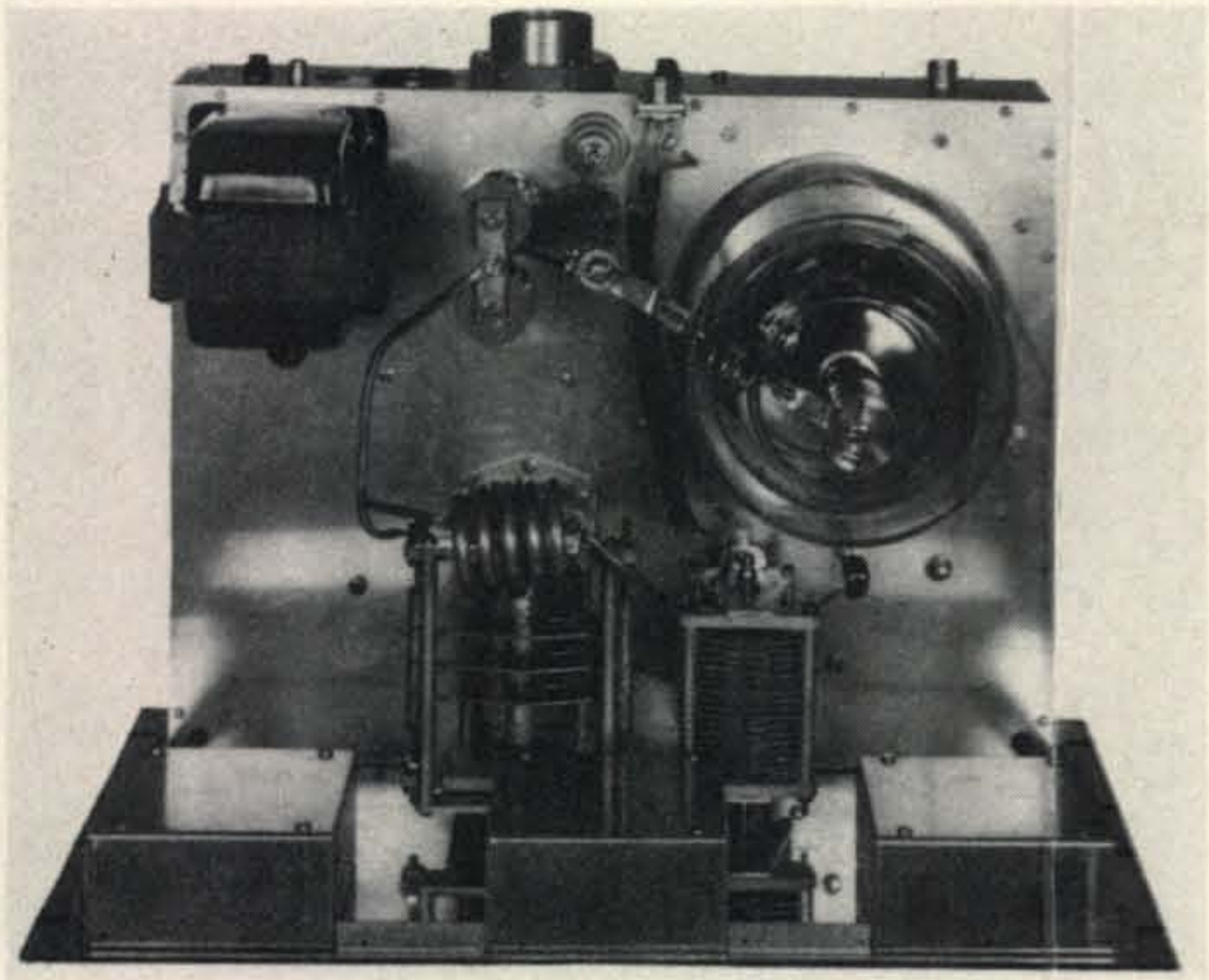


Top view of the 10 meter amplifier.

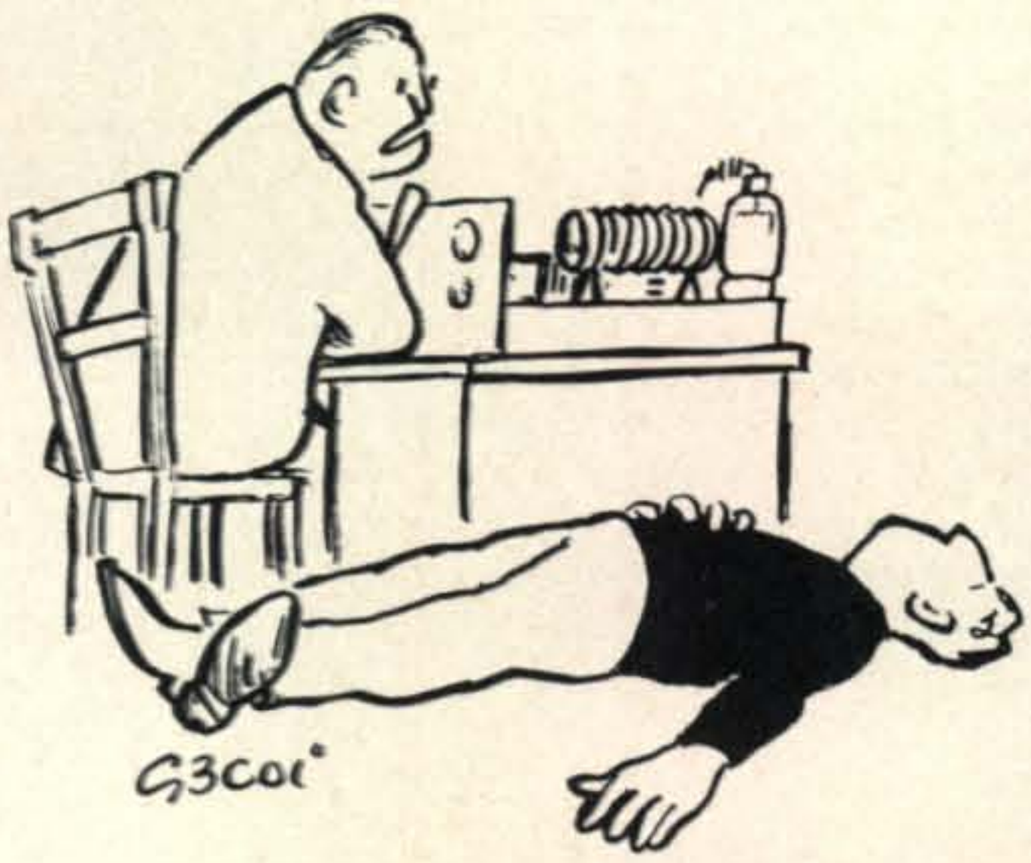
tation should never be applied until the plate circuit is loaded and plate voltage applied to the tube. The antenna or other dummy load, therefore, is connected and plate voltage applied. The quiescent (or zero-signal) plate current should be approximately the value shown in Table I, although this figure may vary as much as 20 percent from tube to tube. Tuning the plate capacitors through their range should show no variation in plate current, otherwise any fluctuation may indicate the presence of a parasitic oscillation.

If all goes well, a bit of drive may be applied to the amplifier. Power output is checked with the aid of an s.w.r. meter in the antenna circuit. Drive is slowly raised, re-resonating the plate tank circuit for optimum output. When plate current approaches 500 ma or so, with 75 to 100 ma of grid current, the "target" area is being approached, and loading should be readjusted. The name of the game is to approach the proper input level, say 2 kilowatts p.e.p. input with a dummy load, with coincident maximum power output and proper grid drive. You will note that power output will peak at a certain setting of the loading control with a given value of grid drive. With either too much or too little loading, efficiency will suffer.

The convenience of a power output monitor such as an s.w.r. meter cannot be overstressed, as it permits the operator to achieve maximum power output with a given power input, without over-driving the tube. When in doubt, hold the grid current on the low, rather than the high, side. With 2000 watts p.e.p. input (3000 volts at 660 ma) a power output of the order of 1300 watts or more should be expected on all bands. Plate dissipation (peak) will be about 700 watts, allowing a good margin for error.

As a final check on circuit isolation, it should be noted that maximum grid current and minimum plate current should occur at the same point on the dial of the plate tuning capacitor. If grid current increases as the plate circuit is detuned, it is a sure sign of regeneration at the operating frequency and indicates that plate circuit energy is entering the input circuit compartment. In some cases, using shielded wire for the power leads to the amplifier will aid in curing this regeneration.

Once properly adjusted, the setting of the various controls should be logged. Dial locks are recommended, too, to make sure that the various settings "stay put" over a period of time. The 20 and 15 meter amplifiers, when tuned up for the center of the band, require no retuning for moderate frequency changes. The 80 and 10 meter amplifiers, being required to cover a larger frequency change as expressed as a percentage of the operating frequency may perhaps be equipped with a tuning chart showing dial settings for the low, middle and high frequency portions of the bands. ■



"...Next job here is to build a cover for the final..."

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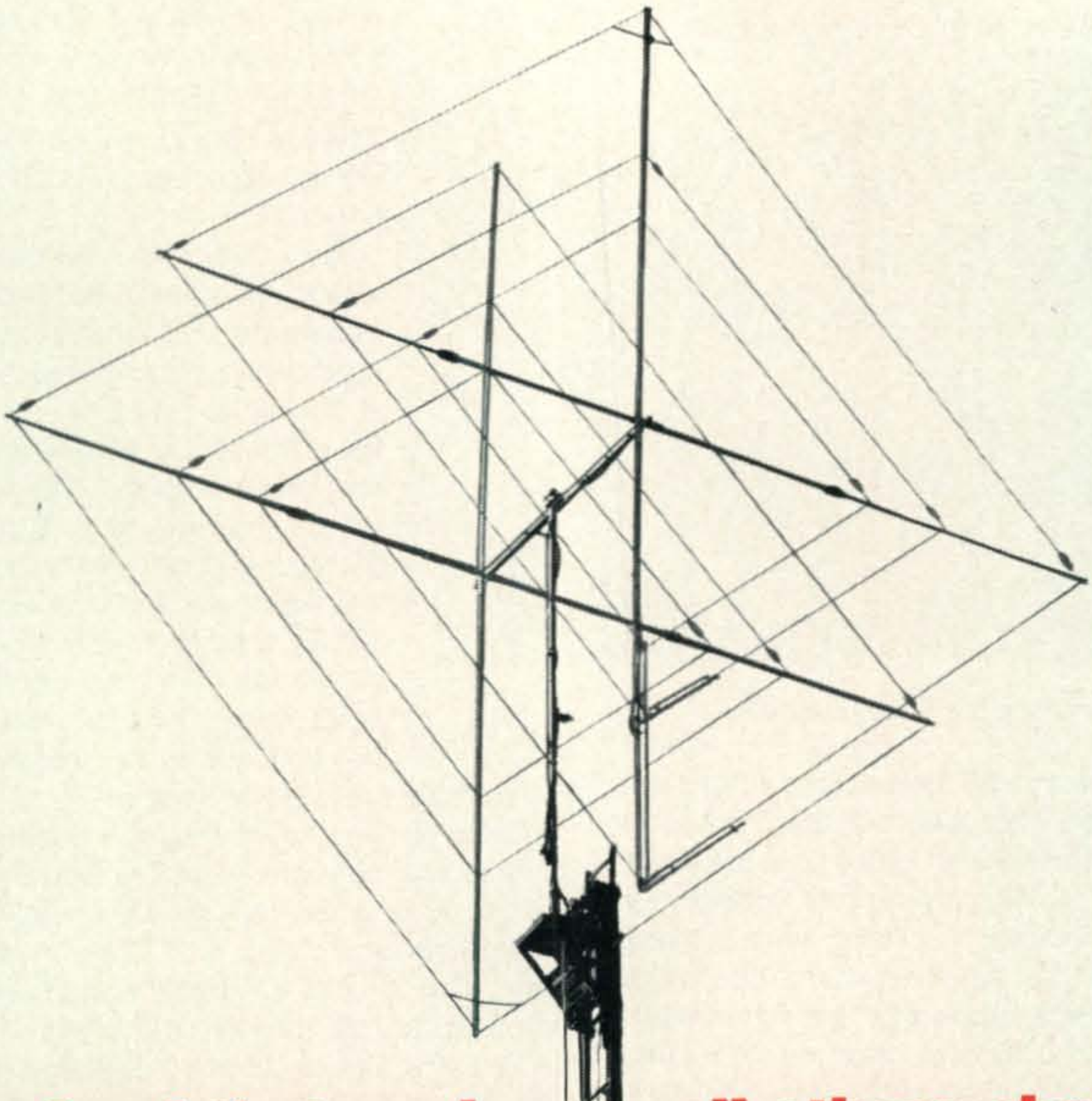

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INTEGRATED CIRCUIT R.F. PREAMPLIFIER

BY JOHN J. SCHULTZ,* W2EEY

A small IC unit is the heart of this cascode r.f. amplifier that may be used for single or multiband operation. Operation from a variety of power sources is possible.

MORE and more linear integrated circuits are becoming available at reasonable prices which are designed for r.f. or i.f. amplifier use. This article describes the construction of a preamplifier using a Philco PA-713 unit but much of the information is applicable to other linear IC's designed for r.f. amplifier use.

The cost of the IC unit itself (about $6 in the case of the Philco unit) may, at first, appear high when one considers that a few transistors will cost less. If one focuses only on the cost of the IC unit, however it clouds an evaluation of the overall advantages of the IC unit. The IC unit not only contains a few transistor functions but a number of resistors and diodes which make up the biasing networks and form a matched and temperature compensated structure. The IC unit, for instance, will operate from −55°C to +125°C. It is true that discrete individual transistors will also operate over such a range but the builder of a unit has to devote a great deal of care to forming the proper external bias networks and providing temperature components considerably reduces the overall complexity and cost of the complete r.f. amplifier. Also, because the IC is a matched and compensated unit, the power drain is very low.

The unit can be operated from batteries, if desired, for an extended period with a lantern type battery, for instance, having an operating life approaching its shelf life. This fact plus its wide temperature range makes it ideal for use in remote locations, such as a mast mounted preamplifier. Another bonus it that an a.g.c. control circuit is built-in. A discrete component amplifier might require another transistor and several passive components to achieve this function.

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

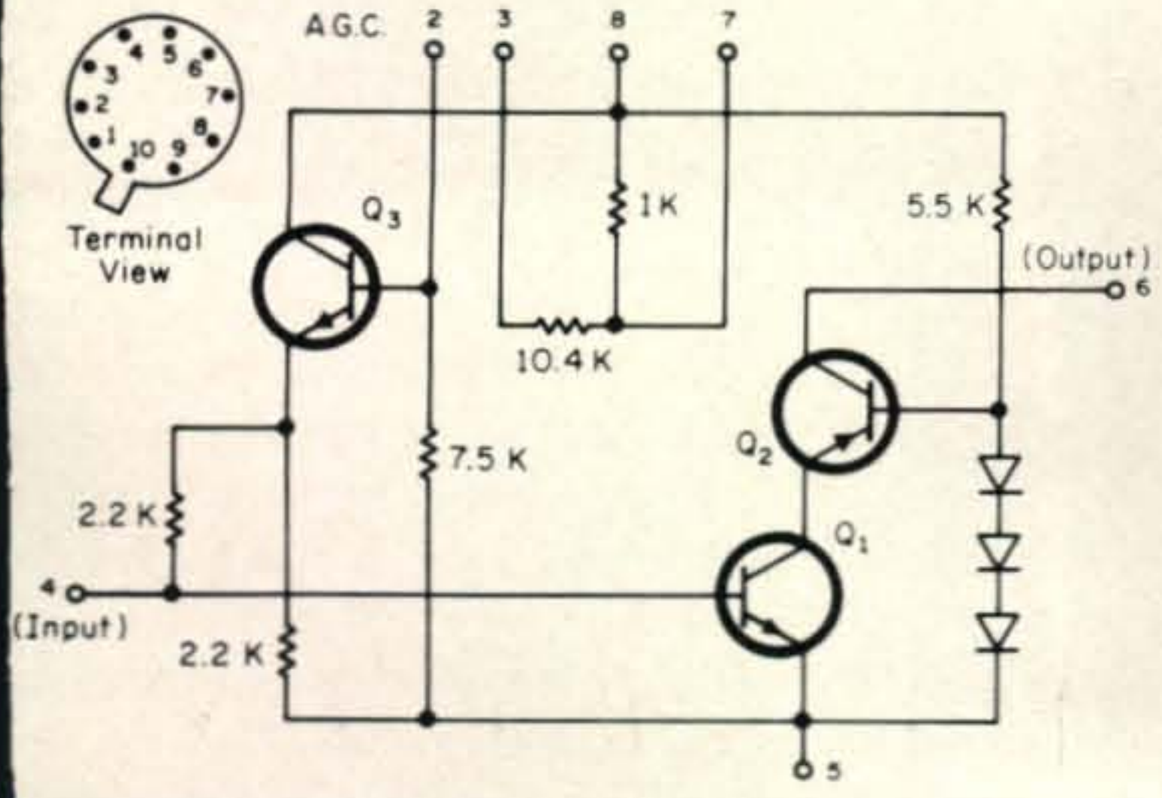
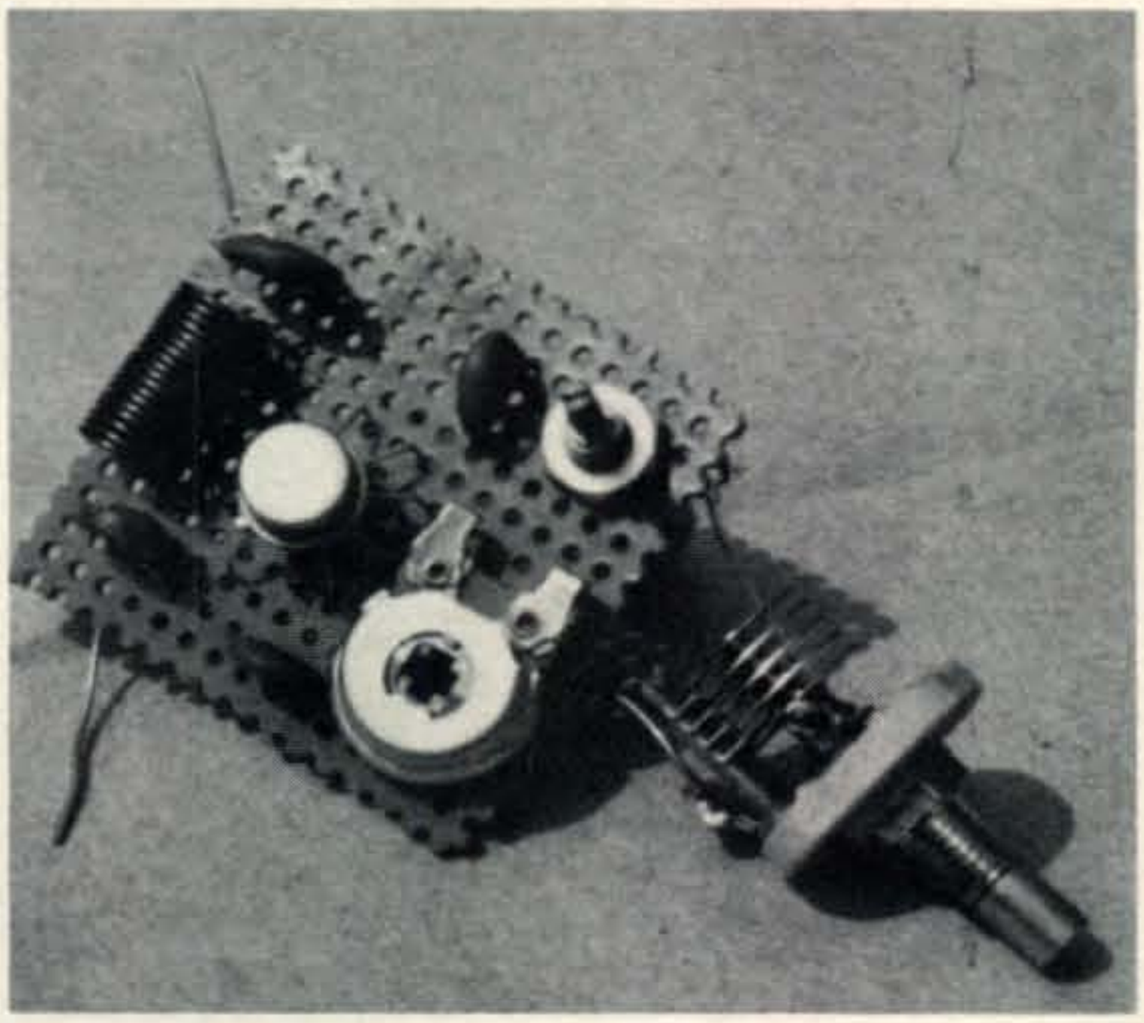


Fig. 1—Internal Circuit of the PA-713 r.f. amplifier IC.



The IC unit is in the middle of the board with its leads spread out spider-leg fashion. Below and to its right is the potentiometer used to set the amplifier gain. A slug-tuned input coil is mounted above the potentiometer. The output coil is directly left of the IC.

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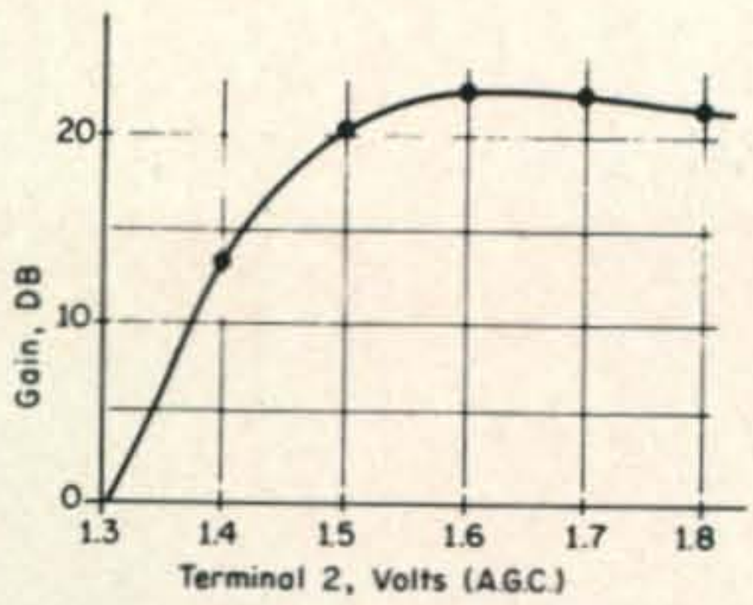

Fig. 2—AGC/Gain characteristic of the PA-713.

The PA-713 Circuit

Figure 1 shows the internal circuit of the PA-713 unit, all of which is contained in a 10 lead TO-5 transistor package. Transistors Q_1 and Q_2 are a direct coupled amplifier in a cascode configuration. Transistor Q_3 is an auxiliary emitter follower stage which provides bias stabilization and gain control. The unit can be operated either "wide open" without a.g.c. or with a.g.c., as desired. For the former type of operation, terminals 2 and 3 are tied together so a voltage divider network is formed by the 1K, 10.4K and 7.5K resistors. The drop across the 7.5K resistor provides a fixed forward bias on Q_3. If a.g.c. action is desired a positive a.g.c. voltage is applied to terminal 2. The range of a.g.c. voltage necessary and its effect upon the gain of the unit is shown in the graph of fig. 2. Note that only a small change in voltage is necessary to produce a large variation in gain. A manual gain control, if desired, can be provided very easily by placing a 10K potentiometer between terminal 8 and ground with the wiper arm going to terminal 2.

The PA-713 is usable at frequencies up to 200 mc, although its best gain and noise figure will be achieved when operated below 60 mc. At 200 mc it can provide about 11 db of gain with a noise figure of 10 db. Below 60 mc the gain increases to about 22 db and the noise figure drops to 7 db. The latter figure is not pushing the state-of-the-art by any means but it is much better than the noise figure of many receivers. So, the PA-713 does qualify as a very suitable choice for a preamplifier when used with any but the most expensive commercial receivers.

Since the unit is directly coupled, it can be used down to i.f. frequencies or even audio frequencies for that matter. The gain increases somewhat to 33 db but the drive/versus gain at the lower frequencies tend to make other IC's a better choice.

Figure 3 shows the variation of the supply current required with supply voltage. The maximum rated voltage is 12 volts but little additional gain is achieved when the unit is operated with more than 6 volts. Voltages below 5 volts should not be used or else the performance, especially noise figure, will start to deteriorate.

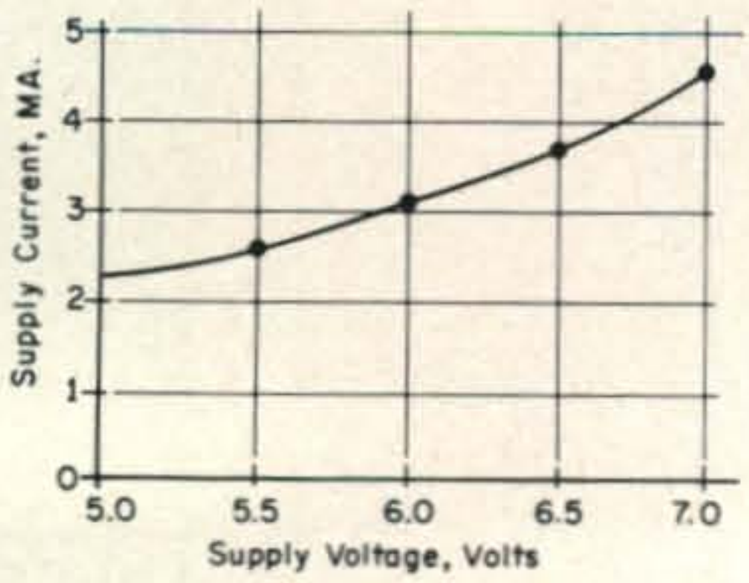

Fig. 3—PA-713 supply voltage/current curve. Optimum operating voltage is 6 volts; maximum voltage is 12 volts.

RF Amplifier Circuit

Figure 4 is the circuit of the PA-713 used as a single-band r.f. amplifier. There are so few components involved in the overall circuit that none should require any special explanation.

Figure 4(B) shows some input and output tuned circuit components that can be used if it is desired to make a multiband preselector. The input circuit is tuned while the output circuit is left broadbanded. Homebrew coils can be used just as well, if desired, and checked with a grid-dip meter for proper resonance on any desired band.

For protective purposes, particularly if the preamplifier is remotely installed or used close to a highpower transmitter, a pair of diodes connected from terminal 4 to ground is good insurance against damaging the IC unit. The diodes are connected with opposite polarity. Almost any small signal computer type diode will do, particularly of the high speed switching type. Types 1N456, 1N816 are typical examples.

Construction

The photograph shows the construction of a single band preamplifier using the PA-713 for eventual placement in a Minibox enclosure.

About the only precaution to observe in construction is adequate isolation of the input and output circuits. In this case, the coils are separated as far as possible and are also oriented at right angles to each other to pre

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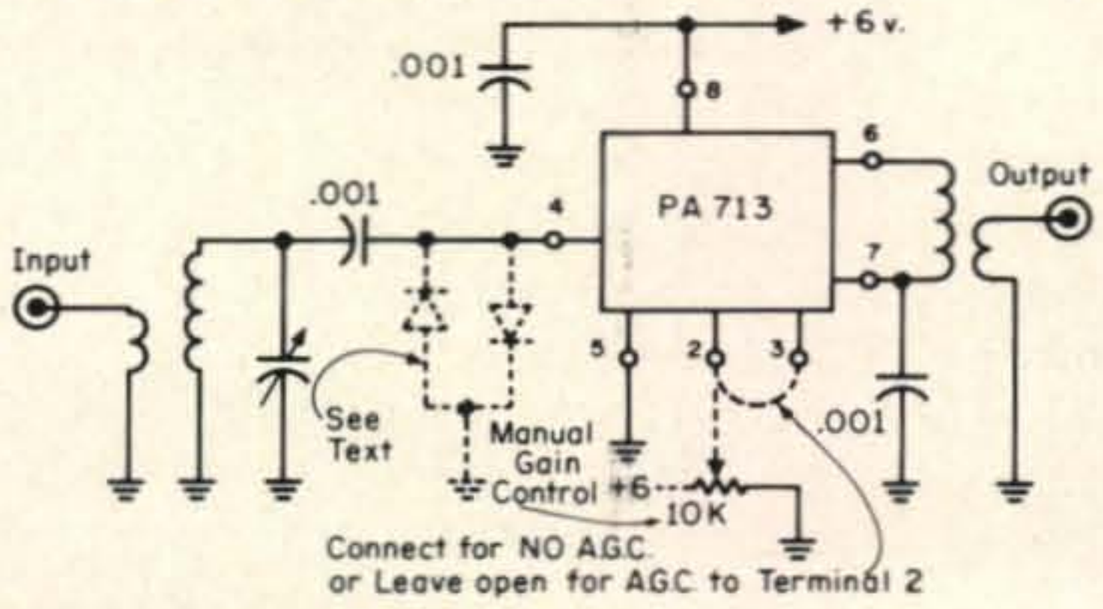
vent coupling.

The PA-713 itself is directly soldered into the circuit although a PC board type of socket could have been used. The latter are inexpensive and probably a good idea to use rather than risk heat from the soldering iron ruining the IC during construction. A PC board type of potentiometer is used as a manual gain control, although it is not brought out as a front panel control. It was incorporated so that a handy means of adjustment is possible to initially set the optimum value of gain for use of the preamplifier before a particular receiver.

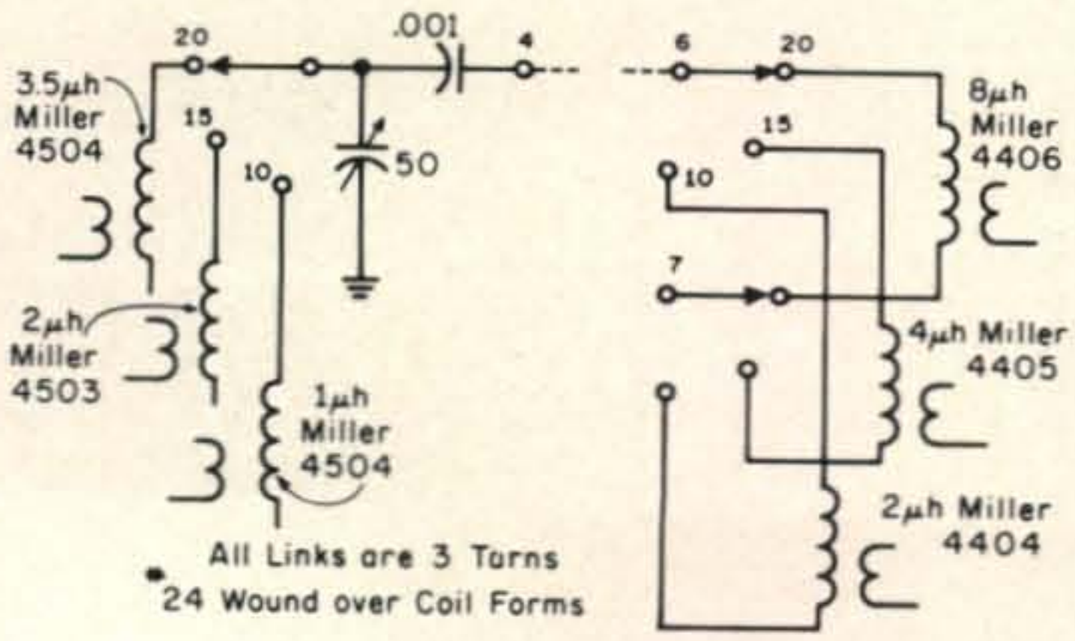
Summary

This article only illustrates one of the uses of the PA-713 and other similar linear integrated r.f. amplifier circuits. They would fit nicely into the construction of a number of receiver accessories and receiving units.

Essentially, they provide the same performance as a circuit using junction type bipolar transistors, not FET's, although IC's are being developed with FET functions incorporated. Adjustment is simply a matter of peaking the tuned circuits and there is no need to worry about the need to carefully select external bias networks, control networks or interstage coupling and loading elements. ■



(A)



(B)

Fig. 4(A)—Basic r.f. amplifier circuit and (B) coil values that can be used for 20-15-10 meter operation.

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RESISTANCE TUNING CRYSTAL B.F.O. OSCILLATORS

BY JOHN J. SCHULTZ,* W2EEY

This is not a varactor diode tuning scheme. It uses resistance variation directly to cause small changes in crystal oscillator frequency. The method may be used directly at the oscillator or remote control is possible using an FET as the resistance control element.

THERE are many instances when it would be desirable to have some means available to slightly vary the frequency of a crystal oscillator. One instance that is common, concerns the crystal oscillator used for b.f.o. action in most transceivers in the receive mode. Making the b.f.o. frequency variable over a few kc would provide a simple form of receiver incremental tuning for many transceivers that do not provide this feature. The tuning range cannot be made too great because of the bandpass shape of the usual crystal or mechanical filter used in a transceiver. However, it will be found a useful feature for s.s.b. operation, where many DX signals are still far from ultra-stable and even slight retuning of the transceiver main tuning often results in lost QSO's. Basically the same effect can be achieved by making one of the crystal oscillators used for a mixer stage in the receiver chain variable. Since such stages are generally common to both the receive and transmit functions, provisions must be made for switching the crystal frequency along with the receive/transmit changeover.

Other purposes for which it might be desirable to make a crystal oscillator slightly variable include f.s.k. units, for calibration purposes and test oscillators.

Various schemes have been developed to "rubber" the frequency of a crystal; some date back many years. Most methods involved some form of tuned circuit approach with an inductor and variable capacitor being required. Moreover, the tuning capacitor had to be located in close proximity to the crystal oscillator. The method described in this article is uniquely simple and does not require the use of any special circuit components, such as varactors. Only a potentiometer and ordinary capacitors are required.

The tuning element may be physically located by the crystal oscillator or remotely by the use of an FET in place of a potentiometer at the oscillator. The scheme is illustrated using transistor circuits but is equally applicable to tube-type crystal oscillators as well since it only modifies the crystal operating conditions.

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

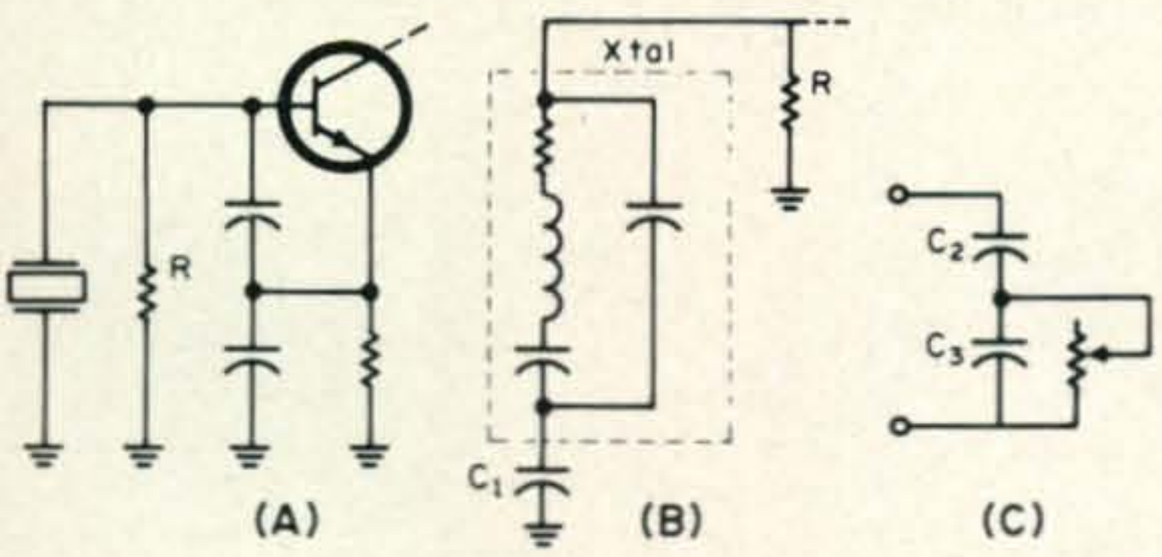

Fig. 1—Simple crystal oscillator circuit (A). Equivalent crystal circuit with added series capacitor(B) and replacement circuit for capacitor (C) in order achieve resistance tuning.

Basic Circuit

The circuit of a simple transistor crystal oscillator is shown in fig. 1 (A). The oscillator output frequency is determined by the basic crystal resonant frequency and the circuit conditions which interface the crystal and a transistor or vacuum tube. For those who don't mind a bit of math, the Appendix gives the formulas which can be used to determine the output frequency. Figure 1 (B) shows the equivalent electrical circuit of the crystal and also an external capacitor, C_1. The effect of C_1 on the output frequency can

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also be calculated. If now C_1 were replaced by the network shown in fig. 1 (C), the impedance of the network would vary with the setting of the variable resistor. When the resistance is zero, only C_2 is active and replaces C_1. Thus, varying the resistance will change the network impedance and hence the output frequency of the oscillator.

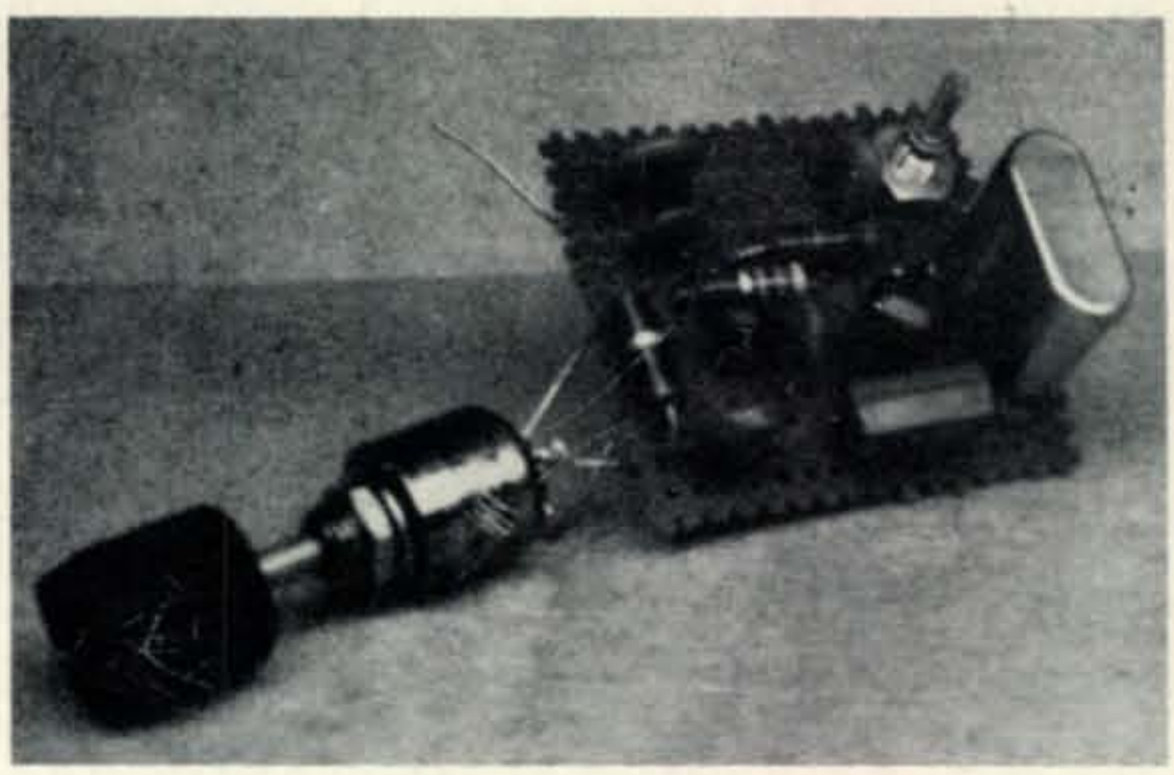
One can calculate the changes in frequency that take place, but generally one can form a good idea of the frequency variation possible from the circuit illustrations shown. For example, fig. 2 (A) is a simple oscillator circuit using the resistance tuning scheme. Figure 2 (B) is a graph of resistance change versus oscillator frequency with the oscillator center frequency set when the resistance value is 6K ohms. A variation of 2 kc total, 1 kc each side of the set frequency, is easily possible.

The frequency variation with resistance change is not exactly linear but close enough for smooth frequency variation. One problem is that the resistance range over which the most linear frequency variation takes place requires a resistance range of about 3K to 10K. So, in practice, to obtain an equal change in frequency with angular rotation of a potentiometer shaft, one would use a potentiometer of 7.5K with a linear taper and place a 3K resistor in series with it, in place of the variable resistor shown in fig. 2 (A).

Remote Operation

Remote operation of the tuning of the oscillator can be accomplished in several ways, but the easiest is by using the resistance properties of an inexpensive FET. Many FET's exhibit a wide range of variation in drain-source resistance as the gate-source bias voltage is varied. Figure 3 shows this variation for a specific FET. What makes the use of the 2N5163 particularly useful for resistance tuning of a crystal oscillator, however, is that the drain-source capacitance shows very little change over the gate-source voltage range.

It should be noted, that the drain-source resistance shows a wide and linear variation over a restricted gate voltage range, about 5.5 to 7.0 volts. Fortunately, the resistance change over this range almost exactly equals that required by the curve of fig. 2 (B). It is only necessary to have the gate voltage to the 2N5163 vary linearly from about 5.5 to 7.0 volts in order to remotely accomplish the same frequency change as takes place with a



View of the crystal oscillator built on a piece of Vector board.

variable resistor placed directly in the oscillator circuit as shown in fig. 2 (A). The gate of the 2N5163 is a.c. bypassed to ground and there is no particular restriction upon how far distant a potentiometer need be located which controls the 2N5163 gate voltage and hence the crystal oscillator frequency.

Practical Circuit Illustration

Figure 4 shows a circuit which is actually a combination of the oscillator circuit of fig. 2 (A) and the FET control circuit of fig. 3 (A). The circuit will operate with fundamental frequency crystals over the broad range of 3 to 15 mc. Such a unit designed to operate over a narrow frequency range can be used to simply directly replace the b.f.o. in a transceiver. Alteration of the transceiver circuits is thereby avoided and the unit can be removed as desired to return the transceiver to its normal b.f.o. operation. The same circuit can be used, of course, to modify an existing crystal-controlled b.f.o.

The gate voltage range of the 2N5163 is restricted by the 18K ohm resistor in series with the 5K tuning potentiometer from about 5.3 to 7.0 volts. The 5K linear taper potentio-

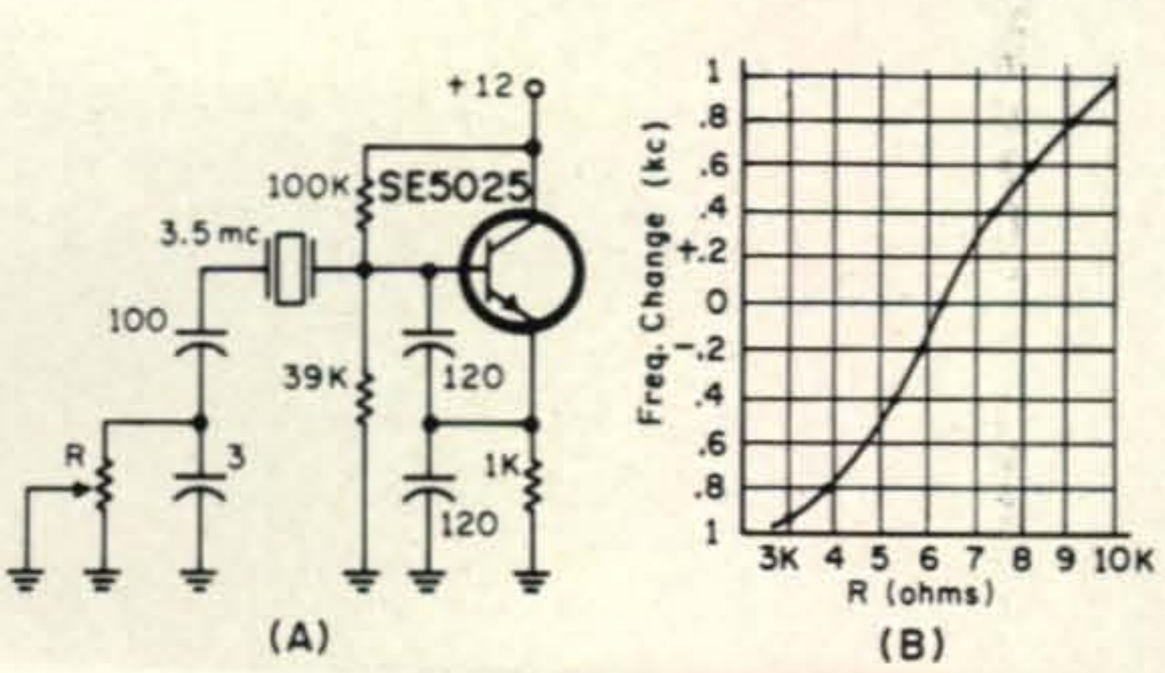


Fig. 2—Oscillator circuit with resistance tuning (A) and graph of tuning range (B).

meter is initially set about mid-range. The

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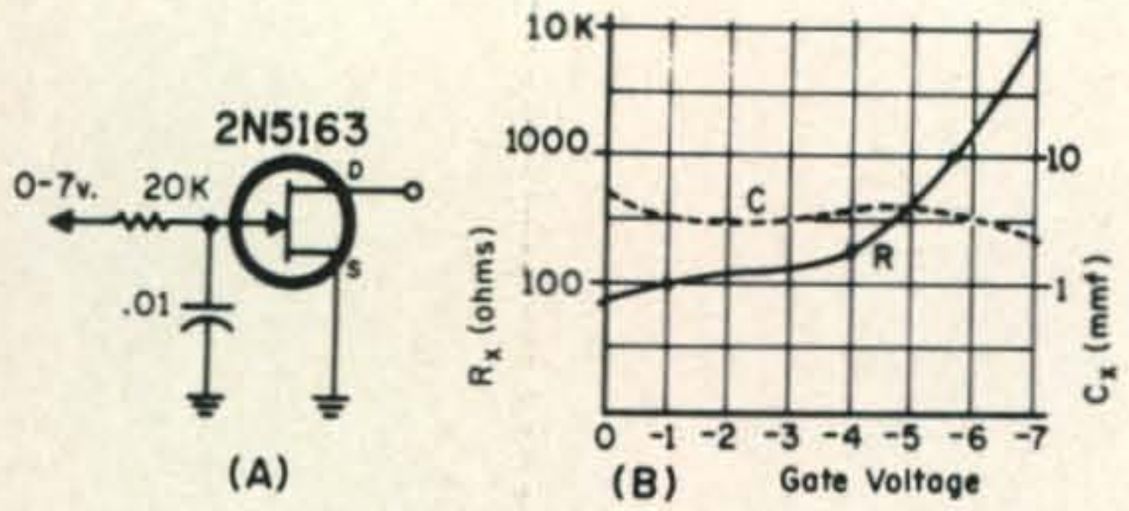

Fig. 3—Drain-source resistance and capacitance of circuit (A) vary as shown in graph of figure (B) with different gate voltages.

output frequency of thet crystal oscillator is then adjusted using an approximate 10 mmf variable capacitor across the drain-source terminals of the 2N5163 for the correct center frequency. The frequency range covered by variation of the 5K ohm depends upon the operating frequency of the oscillator and will range from about ±1 kc at 3 mc to about ±3 kc at 15 mc. The supply voltage to the 5K potentiometer should be regulated, preferably using a zener diode circuit. The tuning slug in the coil in the collector output circuit can be adjusted to provide the correct amount of output for use with a particular product detector.

Construction

There is nothing particularly critical about of the construction of a resistance tuned crystal oscillator. If an FET is not used for remote control, the potentiometer used as a tuning control should be located within a few inches of the oscillator. There is no particular restriction upon placement of a potentiometer if an FET is used to control the oscillator since only a d.c. control line is involved between the potentiometer and the FET gate terminal.

The photograph shows the construction of a b.f.o. crystal oscillator circuit which uses an FET to allow remote potentiometer frequency control. The potentiometer is only placed next to the oscillator in the photograph for illustrative purposes. On the Vector board used for construction, the 2N5163 is the small epoxy unit immediately to the right of the resistor mounted on the extreme left hand edge of the board. The transistor used for the oscillator is immediately to the left for the crystal can and the slug tuned output coil immediately above the crystal can. The other circuit components are placed around the oscillator circuit to provide the most direct terminal connections, although their placement is not critical.

In a transceiver, the circuit contained on the Vector board could be mounted on the chassis along side normal b.f.o. oscillator circuit with its output substituted for that of the normal b.f.o. The tuning potentiometer can be mounted in place of some infrequently used control on the front panel of the transceiver or even external to the transceiver. In any case, it should be possible with any transceiver to add such a unit without drilling any holes in the transceiver panel and in such a manner that the unit can be easily removed and the transceiver restored to its normal b.f.o. circuit function.

Summary

The resistance tuning method for a delta frequency variation of a crystal oscillator has been presented mainly as a means to permit simple b.f.o. frequency variation in the case of a crystal controlled transceiver or receiver b.f.o. The applications of the method are far wider and can be used for many construction or equipment modification projects. Also, the use of an FET as a remotely controlled, noiseless variable resistance element can be applied to a variety of other applications besides resistance tuning of a crystal oscillator.

The transistors used in the illustrative circuit presented are all Fairchild units and are all inexpensively priced epoxy case units. They are especially recommended for the applications shown. Most of them are available locally but in case of difficulty the nearest source of supply can be determined by writing Fairchild Semiconductor, 60 Connolly Parkway, Hamden, Conn. 06514.

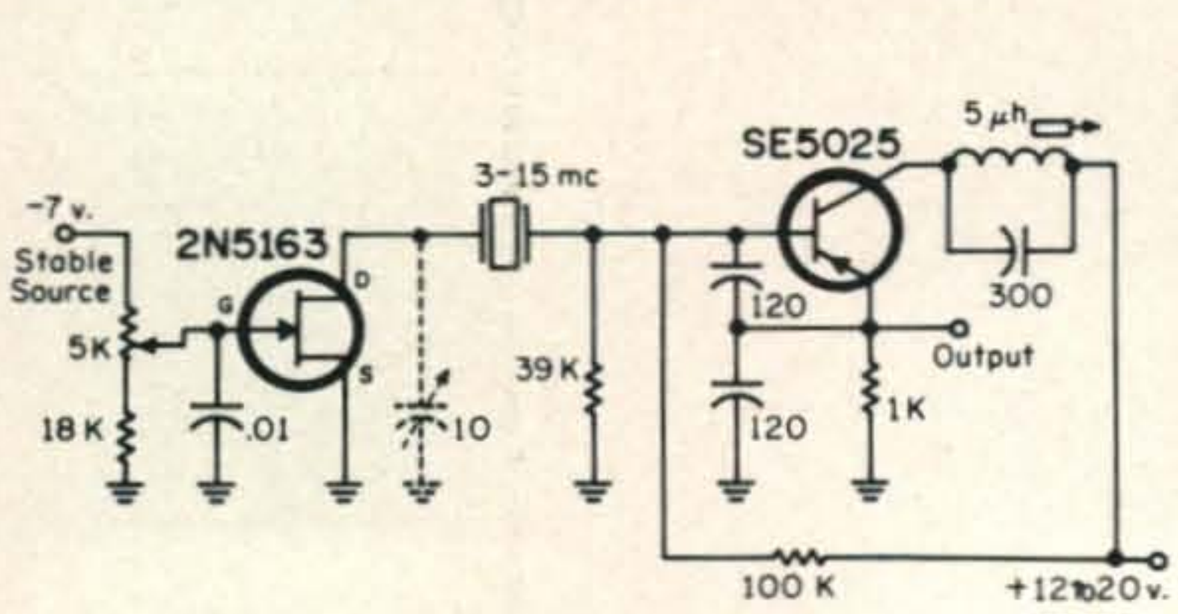

Fig. 4—Example of application or resistance tuning as used to provide incremental tuning for a simple crystal oscillator.

Appendix

The oscillating frequency of the oscillato circuit shown in fig. 1 (A) can be found from

[*Continued on page 96*]

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A MUST FOR EVERY DXER

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

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WEATHER WARNINGS WITH VHF RECEIVERS

BY IRWIN SCHROEDER,* W9VCL

THE radio amateurs have long been known for their service to their fellow man. We can assist in new ways in this ever increasing complex civilization. The way to be discussed involves watching for severe weather and notifying authorities when a storm may be coming toward you or has passed. The equipment is already in each two meter amateur station.

The basis of severe weather warning rests in the ability of the storm to have great electrical potential resulting in discharges that we understand as lightning and static crashes. These "floating capacitors" which is one way of looking at severe electrical storms, have a constant rate of discharge and static crashes per two minutes or thereabouts Because this is standard for this storm, at this time one can tell if the static crashes in one minute are more frequent indicating the storm is moving closer. If the number is less the storm is out of range or decreasing in intensity.

If one could follow these static crashes, the direction of the storm could be determined if it were not overhead. This is done by pointing the two meter beam first due north, second due east, third due south, and fourth due west. With a minute timer the number of static crashes are counted in one minute. The quadrants that have the greatest number of static crashes have the storms in that direction from the amateur station.

At two meters the storms are usually not detected until they are about seventy five miles away. If one will recheck the location of the static crashes at fifteen minute intervals, he will see the frequency at each compass heading change. By marking these down on a diagram, the direction of the storm can be noted and one will be able to tell if it's coming nearer or moving away.

As one becomes interested in storm tracking he will find a barometer to be helpful since most tornados occur with a barometric pressure of 29.75 mm of mercury or less especially around 29.50 mm of mercury. A warm and a cold weather front usually meet south of the area. The amateur does not have to monitor two meters day and night to check this, but can easily tune an a.m. radio to the 550 kc end of the dial. If there are more than 30 static crashes per minute, he should then begin seriously looking for an electrical storm.

The above procedures are important because tornados and hurricanes have their own electric generating system. One does not have to bounce a radar signal off them and then receive it on the bounce. The average tornado will have static crash counts of 80 or more per minute. Thunderstorms will be included in the same catagory, but the frequency will be less. A wind storm and a rain storm may not have this electrical potential and are not dangerous so they will not be confused in your severe weather watching. The above information is not new, but not generally published.

It is very possible that the six meter amateurs could use their rotating beams for the same public interest, and the detection of storms seems to be about a 20 mile greater distance at 50 mc.

Let's all hop on the bandwagon and give the public an added service in the name of amateur radio; and who knows, you may be able to warn your own neighbors of an existing catastrophy in time to help him avoid personal injury. See if you can also beat the weather bureau reports by one half hour.

The same, incidentally, can be done with a TV set if it is equipped with a rotator on the antenna. ■

*1815 North 4th Street, Sheboygan, Wisconsin.

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TWIN LEAD MULTIPLE DIPOLES AND VEES

BY WILLIAM M. TURNER,* W4MND

SEVERAL years ago this station was faced with the problem of erecting a 75 meter and a 40 meter antenna in a yard not particularly suited for low frequency antennas. After much thought and research this problem was solved by using open wire transmission line for the elements of a dual band inverted vee. The result was a vee antenna mounted on a single set of supports that:

(1) Performs similar to a monoband inverted vee on 75 and 40 meters respectivly.

(2) Has a low standing wave ratio on both bands.

(3) Is light weight.

(4) Is inexpensive.

(5) Uses a single 50 ohm coaxial feed line.

(6) Is easy to construct and adjust.

The antenna employed for 75 and 40 meters was so successful that the same idea was later used in constructing a dual 15 and 20 meter dipole. This antenna also gave excellent performance. While there is nothing unique about multiple dipoles,[1,2,3] the construction technique outlined here will permit an excellent performing antenna to be assembled and adjusted with minimum effort and expense. The purpose of this article, then is to outline in detail the construction technique, performance, and additional thoughts pertinent to the above type of multiple dipole.

Basically, the multiple dipole type antenna s as shown in fig. 1 and consist of two dipoles ed by a common 70 ohm coaxial transnission line.The elements are made of comnercially available 450 ohm open wire line.)ne wire of the open wire line is cut for dipole No. 1 (lowest frequency dipole) and the ther wire cut for dipole No. 2. The antenna supported by insulators and halyards emloyed at the ends of dipole No. 1. The open ire line insulating spreaders provide support r dipole No. 2. If either of the dipoles is t for 40 meter operation the antenna system will perform on three bands. Example:

(1) Dipole No. 1 is cut for 40 meters and dipole No. 2 is cut for 20 meters. The system will then operate on 40, 20, and 15 meters as the 40 meter dipole will operate at 1½ wavelengths at 15 meters.

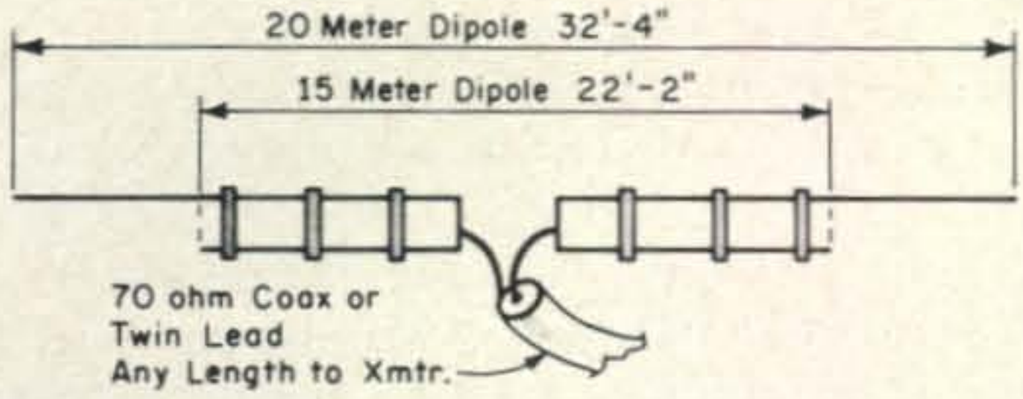
(2) Dipole No. 1 is cut for 75/80 meters and dipole No. 2 cut for 40 meters. The system will then operate on 75/80, 40, and 15 meters.

It appears that the antenna system may be used for any two bands by cutting each dipole as if it were suspended separately. There appears to be little interaction between the dipoles. The basic idea can be extended to inverted vees without much difficulty as shown in fig. 2. In this case the antenna is fed with 50 ohm coaxial line.

Other Ideas

Several other ideas were considered, however they have not been tried at this station. The ideas are outlined below in hopes that they may help solve someone's problem or provide a base for further experimentation.

(1) Construct elements of 300 ohm open wire line in place of the 450 ohm line described. Consideration was also given to construction of the elements from regular 300 ohm polyethylene line; however, it is suspec-



Antenna Type	Antenna Length	
	Lo Freq.	Hi Freq.
75/40 Meter Inverted Vee	122'-2"	66'-10"
20/15 Meter Dual Dipole	32'-4"	22'-2"

Table I

Fig. 1—Dual dipole constructed from commercially available 450 ohm open wire TV transmission line. Typical lengths are given in Table 1.

624 Squire Lane, Orlando, Florida 32806.

The Radio Amateurs Handbook," ARRL, 45th Edition, 1968, page 355.

ARRL Antenna Handbook," ARRL, 10th Edition, Multiple Dipole Antennas, page 192.

CQ Antenna Roundup, Vol. I," Cowan Publishing Corp., The All-Band Dipole, page 72.

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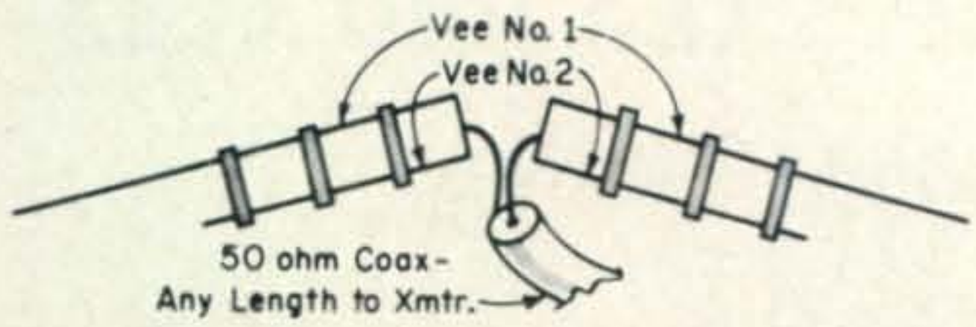

Fig. 2—Dual inverted vee constructed from 450 ohm open line. Vee no. 1 cut for 75 meters is 122′ 2″ long. Vee no. 2 cut for 40 meters is 66′ 10″ long. The antenna is fed with 50 ohm coaxial cable.

ted the lower velocity factor caused by the solid dielectric will not permit this without some form of compensation similar to that required for a folded dipole constructed from regular 300 ohm TV line.

(2) Construct longer elements of 450 ohm wire line and interlace 300 ohm open wire line between the spreaders of the 450 ohm line cut for the higher frequencies. Theoretically a five band antenna could be made using this concept. For example, cut the 450 ohm open wire line for the 75 and 40 meter bands thus permitting operation on 75, 40, and 15 meters. Interlace 300 ohm open wire line between 450 ohm line spreaders cut for the 20 and 10 meter bands. Therefore we have one antenna that operates on 75, 40, 20, 15 and 10 meters. The 20 meter antenna beyond the 10 meter antenna might be difficult to support in this configuration, however, if the 300 ohm spreaders were left on that portion of the 20 meter antenna they could be taped to the 75 and 40 meter elements without much difficulty.

Construction and Results

Two different antenna systems have been constructed using the technique outlined. The first system constructed was a dual band inverted vee similar to fig. 2 for 75 and 40 meter phone band operation. Both dipoles were initially cut about 10% longer than shown. Each dipole was then trimmed a few inches at a time until it was resonant at the desired frequency. Resonance was determined by observing the lowest s.w.r. reading obtained from a plot of frequency *vs* s.w.r. The 40 meter antenna was cut for optimum phone band performance. It will not, therefore, have a very low standing wave ratio inside the 15 meter band. Fifteen meter operation from the vee was not required at this station as a tri-band beam is used on this band. If 15 meter vee operation had been desired, the 40 meter antenna would have been cut to resonate at a lower frequency. The ratio of the 15 meter resonant frequency to the 40 meter frequency is 3 to 1.

The second system was recently constructed at WB4BKF and is a dual band dipole for 15 and 20 meter operation. This antenna was constructed similar to fig. 1 and mounted about 25 feet above ground. It was fed with 70 ohm coaxial cable.

If in trimming the antenna for exact reasonance the inner antenna must be cut between the spreaders, the end of the wire may be held firmly in place by using electrical tape made into spreader. The wire is so lightweight the tape spreader will support it for a considerable length of time.

Curves of s.w.r. versus frequency are shown in figs. 3 and 4. Figure 3 indicates the 15 meter antenna has an excessive standing wave ratio at the low frequency end of the band. In this case the antenna was cut for optimum performance in the phone band. If performance over the entire band had been desired the antenna would have been made longer so that its resonant frequency would have been about 100 kc lower than that shown. This would have shifted the entire curve to the left by 100 kc so that the standing wave ratio at 21.0 mc would have been approximately 1.4:1.

It was somewhat suprising to find the 20 meter antenna was essentially flat across the entire band (see fig. 3). The reason for the antenna being so broadband is not apparent at this time. ■

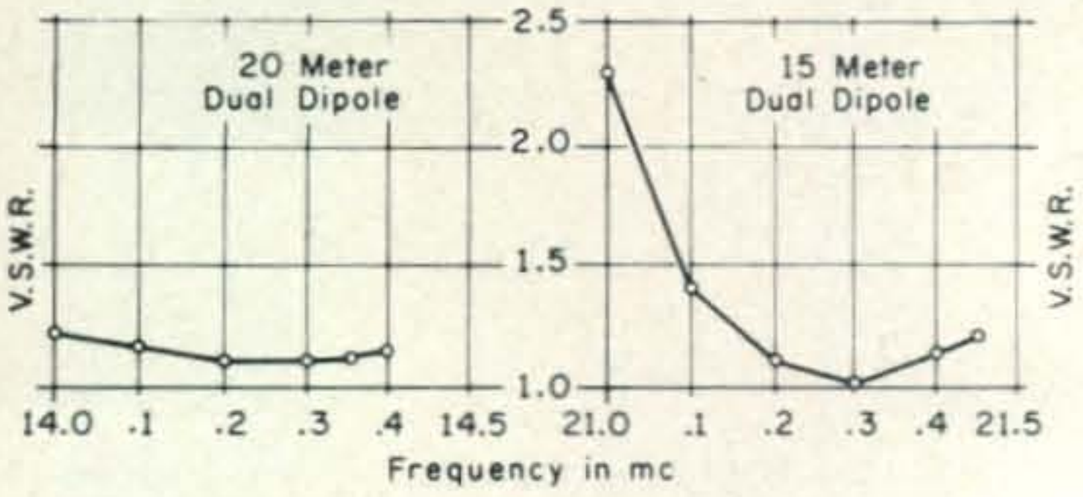

Fig. 3—Plot of s.w.r. versus frequency for the 15 and 20 meter dipole.

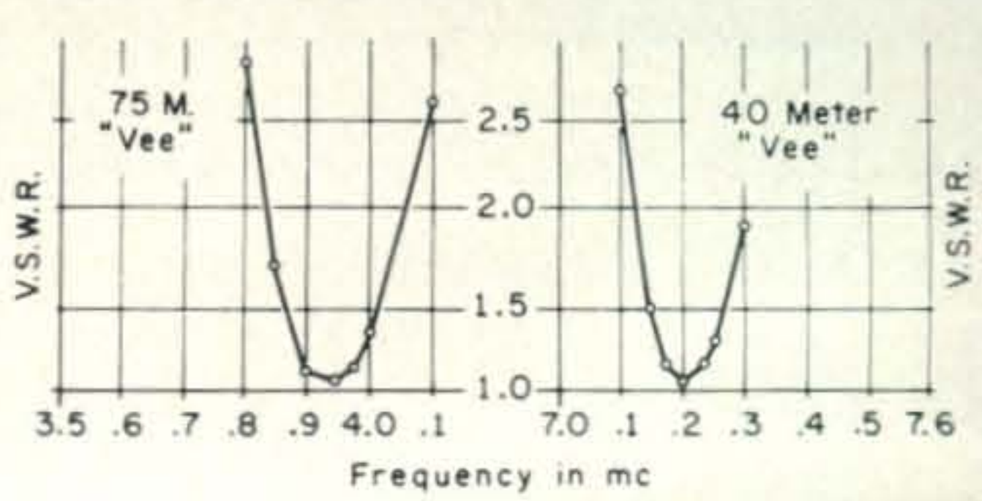

Fig. 4—Plot of s.w.r. versus frequency for the 75 and 40 meter dual vee.

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Results of the 1968 CQ World Wide DX (Phone) Contest

BY FRANK ANZALONE,* W1WY

THE October 1968 *CQ* WW Phone Contest will probably go down in the record books as the biggest one of them all. Not only in the number of entries but also in the number of participating countries and record breaking scores.

We received logs from 132 countries, a 20% increase over last year and a new all time record. A total of 1349 stations submitted logs, a modest 4% increase over last year. But our own W/K 503 logs indicated a 10% increase, for which we were very grateful.

Also pleasing were the returns from our VE neighbors, mostly due to some spirited club competition and the VE6TP Trophy.

The two top contenders for this Trophy, VE3LZ and VE3FHO, turned in the highest country total of the contest. Barry Garrett (VE3CDX) was the operator at the winning 3LZ and Garry Hammond (VE3GCO) was behind the mic. at runner-up 3FHO.

If you check the scores closely you will find that four single operators worked all 40 Zones on 14 mc. K2KUR, W2ONV, K8MMM andVE3LZ. Three of the multi-multi "big guns" also made it, OH2AM, W3MSK and W4ETO.

Application for the special WAZ contest certificate should be made through the usual

*Chairman, Contest Committee

Another contest expedition, this one out of Luxembourg. That's Walt Smith, W1DWQ at the mic. and Bernie Welch DL4FS the other half of the team. They also had problems, broken tower and what not.

PLAQUE & TROPHY WINNERS

Single Operator, Single Band

WORLD–North Jersey DX association, Dr. Harold Megibow Memorial Trophy. Won by Ricardo Sierra, Jr. CX2CO.

CANADA–Gene Krehibiel, VE6TP Trophy Won by VE3LZ, Barry Garrett operator.

CARIB./C.A.–Gus Kuether, HR2GK Trophy Won by Carmen Elena Nieto, YS2CEN.

Single Operator, All Band

WORLD–Bill Leonard, W2SKE Trophy Won by James B. Neiger, ZD8Z.

U.S.A.–Potomac Valley R.C. Trophy Won by Gordon S. Marshall, W6RR.

EUROPE–W4BVV Operator's Trophy Won by Robert M. Snyder, LAØAD.

OCEANIA–Jack Chalk, KW6EJ Trophy Won by DU1UP, Brian Ike operator.

CARIB./C.A.–Harold Fox, W3AA Plaque Won by Herb Schoenbohm, WØVXO/KV4.

AFRICA–Gordon Marshall, W6RR Plaque Won by Thomas W. Curry, ZS5XA.

Multi-operator, Single Transmitter

WORLD–John Knight, W6YY Trophy Won by station DLØWR.

Multi-operator, Multi Transmitter

WORLD–Radio Club Venezolano Trophy Won by station PJØMM.

Contest Expedition

WORLD–Stuart Meyer, W2GHK Trophy Won by station ZF1EP.

Special CQ Plaques

U.S.A. All Band Champion James L. Lawson, W2PV.

WORLD–Multi-Multi Champion Station OH2AM, OH DX Ring.

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TOP SCORES

SINGLE OPERATOR ALL BAND

ZD8Z **4,184,680**
WØVXO/KV4 .....**3,135,475**
DU1UP **2,068,843**
LAØAD **1,828,503**
OH7PI 1,813,700
DJ2YA 1,783,204
I1FLD 1,775,718
VE7SV 1,752,576
JA1AEA 1,714,195
I1BAF 1,684,475

MULTI-OPERATOR SINGLE TRANSMITTER

DLØWR **3,048,903**
I1LCK 3,046,160
SK6AB 2,831,328
UA9AN 2,692,440
DLØWW 2,635,133
UP2A 2,524,424

MULTI-OPERATOR MULTI-TRANSMITTER

OH2AM 10,074,120
OH5SM 9,510,588
PJØMM **7,037,658**
W3MSK 5,515,701
OH1AA 4,346,580
W4ETO 3,459,249

SINGLE OPERATOR SINGLE BAND

28 mc

YV1LA 664,560
DL4PM 614,544
DL6EN 430,330
W2SKE 429,976
SM7CCU 405,886
KH6GPQ 378,320

21 mc

CX2CO **805,090**
PAØFM 613,816
G3HCT 576,007
SM3CNN 525-150
YV1WX 520,030
DJ3JB 471,822

14 mc

YV5ANF 754,075
UR2AR 609,440
VE3LZ **601,620**
VE3FHO 561,960
PAØHBO 521,560
DL8NU 479,961

7 mc

YV4UA 97,605
JA2BTV 65,910
SM4CMG 61,473
SM5BLA 57,661
K2GXI 46,835
DJ6TK 40,918

3.8 mc

W1FZJ/KP4 50,410
OM1BY 19,778
YV5BPJ 19,485
W4AXE 18,224
G3IAR 15,714
G3RHM 14,723

1.8 mc

W8GDO 36

The DLØWW crew erecting their 20 meter beam. Looks like DL6FF is doing all the work. The rest of the gang, DL2UU, DL6NK, DJ6DU, DK1AN,DJ6NK and DL3ZA.

channels, via K4IIF.

Not so encouraging were the returns from the Caribbean/Central America and African areas. Makes us wonder if the special awards donated by HR2GK, W3AA and W6RR are all in vain. Maybe the news hasn't gotten around yet. More publicity in these areas certainly is in order. You can help by spreading the good word whenever you work a station in these areas.

Breaking a million by the all banders was commonplace, 33 single operators made it. Not much object in repeating the winners, the Top Scores listing shows that very clearly. However we would be derelict if we did not give special mention to the fantastic scores turned in by ZD8Z and WØVXO/KV4.

It might interest you to know that the four all band Trophy winners are Yankees operating from these overseas areas.

And just to keep the record straight, W2PV is none other than Jim Lawson, ex-W2SFP and W6RR is Gordon Marshall, ex-W6ITA.

The 28 mc band was real hot, probably its swan song for the present sun spot cycle. A new world record was set by YV1LA, and every continental record was broken by the other top leaders. Missing was the King of the 10 meter band, LU1DAB. Jaycee lost his tower in a tornado and could not get it back up in time.

DL4PM really planned for this one. Pete (WA2USX) constructed a 6 el. yagi especially for the contest. At least he has the satisfaction of breaking the European record.

It has been quite a few years since the Single Band Trophy has been won on any band other than 14 mc. And wouldn't you know that CX2CO would be the one to do it on 21 mc? Ricardo is back in competition after a lay-off of a few years and is again eligible for the Trophy.

Which probably doesn't make YV5ANF too happy, since it looked like he had it all sewed up on 14 mc. Oscar is a member of the famed YV9AA team that was the Champ of the "Big Guns," but did not enter competition this year.

I1FLD and I1BAF have a good one going down sunny Italy way, this year however Antonio turned the tables on Mino and took the top spot.

The two lower frequency bands were not too productive in single band scores although the Multi-operator stations used them to good advantage to fatten up their multipliers.

[*Continued on page 97*]

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U.S.A. TOP SCORES

Single Operator

All Band	**W2PV**	**1,314,403**
28 mc	W2SKE	429,976
21 mc	W6GHM/5	275,762
14 mc	W2ONV	407,660
7 mc	K2GXI	46,835
3.8 mc	W4AXE	18,224
1.8 mc	W8GDO	36

Multi Operator

Single Trans.	W2CP/2	1,082,496
Multi Trans.	W3MSK	5,515,701

mber groups after call ters denote the following: nd (A-all); Final Score: mber of QSOs; Zones and untries. Certificate win- rs are listed in **bold face.**

MII/1	A	317,420	466	68	168
DBT	A	269,222	430	72	155
DKG	"	212,352	342	72	152
DRV	"	198,432	333	61	151
BFA	"	178,760	321	63	155
AX	"	154,944	204	79	190
XL	"	154,198	328	52	111
KJL	"	122,616	273	51	105
BIH	"	95,000	204	59	131
SPW	"	49,020	147	39	75
PCD	"	44,109	131	32	85
KDV	"	37,907	251	49	99
X	"	28,168	106	39	70
VY	"	14,578	70	31	43
LJ	"	2,376	27	13	20
L	28	181,168	483	32	102
JQ	"	146,304	401	30	97
NQ	"	108,777	375	27	74
HFN	"	105,915	316	31	84
JL	"	96,030	303	28	82
VI	"	93,492	305	29	77
HXU	"	12,720	121	13	40
WE	"	2,548	33	9	17
VV	21	239,190	624	31	103
DO	21	206,554	510	32	107
TY	"	104,868	337	25	83
YU	"	53,489	210	25	64
OP	"	53,300	280	23	59
WD	"	35,334	158	21	57
HN	14	170,200	416	38	110
YR	"	18,648	104	21	42
MH	7	64	5	3	5
	A	1,314, 403	1107	114	305
D	A	595,455	658	94	227
LK	A	508,750	637	83	192
	"	380,912	519	78	188
L	"	352,440	477	87	180
UZU	"	336,519	434	80	189
V	"	300,594	434	71	167
ES	"	241,776	423	58	149
B	"	233,784	390	65	139
	"	210,542	374	59	140
M	"	188,496	287	84	154
ZG	"	159,011	268	72	135
FB	"	158,599	338	47	116
	"	124,640	238	57	133
B	"	60,388	172	39	85
/2	"	58,800	177	38	82
K	"	49,652	120	48	104
	"	48,954	139	41	82
IG	"	48,884	172	28	73
X	"	38,955	242	51	112
S	"	34,989	114	30	77
	"	28,704	109	29	63
	"	24,310	101	28	57
	"	23,088	115	29	49
	"	21,074	93	31	51
B	"	13,266	112	43	65
	"	11,760	64	26	54
N	"	11,753	64	30	43
R	"	9,720	66	21	33
W3CBF	"	9,114	73	11	31
W3DPJ	"	315	10	6	9
K3HPG	**28**	**147,069**	**443**	**30**	**87**
W3KDD	"	86,616	285	31	77
K3JVT	"	32,725	150	24	53
W3QQL	"	22,113	127	17	46
W3EGD	"	18,198	118	19	35
K3AWZ	"	13,145	83	17	38
W3CI	**21**	**44,919**	**162**	**28**	**65**
W3DHM	**14**	**58,400**	**200**	**31**	**69**
K4NTC/3	"	17,472	106	18	46
W3MQ	"	9,300	63	16	34
W3EAN	"	1,598	32	5	12
W4BVV	**A**	**1,011,940**	**931**	**118**	**262**
W4SYL	**A**	**541,650**	**562**	**100**	**245**
W4ZCY	**A**	**500,889**	**579**	**90**	**219**
W4AQW	"	425,855	549	78	187
W4NBV	"	344,144	441	90	184
W4KFC	"	310,134	454	79	175
W4YWV	"	290,928	442	75	157
W4AXL	"	282,663	396	90	171
W2GHK/4	"	232,564	390	69	143
W2UJ	"	7,749	50	24	39
K2OEA	"	7,100	63	23	41
W2ZV	"	5,891	48	14	29
W2JB	"	2,490	30	10	20
W2SKE	**28**	**429,976**	**1030**	**34**	**108**
WA2IFS	"	61,566	232	27	65
W2TD	"	61,056	220	29	67
WA2VWI	"	58,685	202	29	68
WB2VQG	"	48,048	221	23	55
W2AH	**21**	**207,690**	**595**	**29**	**109**
WB2NXL	"	190,080	499	31	101
W2JVU	"	132,973	440	29	74
WA2CYQ	"	115,260	352	30	83
WB2ZKJ	"	95,294	316	29	77
W2LA	"	86,982	277	31	78
W2CXM	"	74,496	274	27	69
DL7KX/W2	"	66,704	273	24	64
WB2ZGI	"	26,532	142	19	47
F3VN/W2	"	4,440	43	15	22
W2ONV	**14**	**407,660**	**820**	**40**	**130**
K2KUR	**14**	**353,742**	**733**	**40**	**134**
K2ISP	"	243,429	530	39	120
WA2WVL	"	60,027	190	30	77
W2IUV	"	43,830	170	29	61
W2RGV	"	26,883	111	26	61
K2GXI	**7**	**46,835**	**226**	**25**	**60**
W3WJD	**A**	**840,285**	**846**	**103**	**252**
K7ADD/3	**A**	**712,068**	**732**	**97**	**249**
W3JNN	**A**	**677,352**	**721**	**107**	**227**
W3MWC	"	493,115	639	77	188
W3OV	"	404,300	542	75	185
W3NZ	"	387,774	526	77	181
K3JLI/3	"	379,050	493	81	185
WA3KEG	"	370,080	457	89	199
K3BNS	"	349,875	509	74	151
K3TGM	"	331,574	442	77	187
W3BYX	"	330,750	470	70	180
W3WPG	"	302,720	481	62	158
W3KT	"	208,101	343	64	149
W3GRS	"	192,528	277	75	177
W3AXW	"	174,312	301	78	138
W3GRF	"	163,938	344	64	114
K3JLK	"	160,398	330	55	116
K3EUR	"	159,080	338	50	114
K3HHY	"	150,960	280	75	129
W3MVB	"	150,660	356	55	125
K3AIG	"	138,882	316	51	107
W3NMP	"	136,590	310	50	107
WA3FQJ	"	131,225	252	54	127
WA3EPB	"	125,328	269	59	109
W3YUW	"	84,588	226	45	88
W3DRD	"	77,404	191	49	99
W3ML	"	71,696	200	42	82
W3GN	"	52,393	158	42	79
W3NNK	"	51,030	145	50	85
WA3JDA	"	48,671	153	40	79
W3GHD	"	45,539	144	42	71
W3EVW	"	43,734	142	39	72
W3HVM	"	43,350	153	34	68
WA3HBT	"	31,255	113	31	64
K3CBW	"	27,615	101	37	68
K3GYS	"	23,604	103	27	57
WA3FFR	"	19,250	93	27	50
W3CGS	"	18,600	87	23	52
WA3IXF	"	13,400	74	27	40
W3EQA	"	10,065	63	19	36
WA4VIY	"	211,432	356	74	140
W4DRK	"	168,144	320	54	132
W4CRW	"	165,767	298	66	133
K4LPW	"	145,200	362	46	106
W4ZNI	"	137,313	278	60	111
W4EZ	"	131,760	251	60	123
WA4UFW/4	"	121,482	273	52	101
K4OSE	"	121,146	245	61	122
W4TMR	"	100,602	240	59	103
K4PCL	"	94,752	244	51	90
WB4AMT	"	92,713	234	43	96
WB4LEH	"	66,220	167	47	93
WB4JSV/4	"	62,487	181	46	85
W4FIG	"	45,952	132	51	77
WB4AIK	"	38,532	181	24	52
W4GZD	"	33,384	141	34	73
K4ZLE/4	"	26,602	106	34	60
WB4JCV	"	19,250	132	44	88
W4FCJ	"	14,592	68	28	48
W4KMS	"	9,996	52	28	40
WB4ENX	"	8,640	105	37	54
K5FSE/4	"	5,040	37	20	28
W4GF	"	4,312	35	15	29
K4VYN	**28**	**191,125**	**478**	**33**	**106**
W4QCW	**28**	**183,095**	**471**	**32**	**103**
K4II	"	165,564	459	31	95
WB4BDO	"	124,956	425	29	88
WB4FIN	"	102,724	296	29	93
W4VAN	"	97,438	328	29	74
K4QWX	"	88,181	280	31	78
W4WSF	"	56,488	213	23	69
W4DQD	"	38,080	165	22	58
K4HAV	"	9,408	67	18	31
WB4FJO	"	8,213	69	17	26
W4YDY	"	6,016	46	17	30
K4SKI	**21**	**140,270**	**476**	**30**	**72**
WB4FOS	**21**	**136,152**	**384**	**33**	**91**
K4YYL	"	119,223	351	31	86
WB4DJT	"	117,219	330	34	89
WA4LMD	"	105,336	324	31	83
W4NOM	"	102,752	347	29	75
WA4UXU	"	83,436	271	26	76
WA4MSU	"	77,724	265	27	75
K4CFB	"	76,558	266	25	76
W4DRW	"	69,161	259	28	69
WA4CCW	"	21,183	112	22	47
W4DS	"	12,993	75	20	41
WA4KYR	"	6,380	58	16	28
WB4GLO	"	2,060	23	15	20
W4WJJ	**14**	**30,030**	**151**	**21**	**49**
W4JAT	"	24,426	125	22	47
K4TWJ	"	12,920	80	24	44
WA7JAN/4	"	8,580	83	14	30
WB4EKY	"	6,045	61	11	28
W4BYB	**7**	**9,724**	**70**	**17**	**35**
W4AXE	**3.5**	**18,224**	**110**	**22**	**45**
W4NML	"	2,520	40	10	20
W5NMA	**A**	**490,439**	**617**	**93**	**190**
WA5ALB	"	465,227	593	100	187
K5BXG	"	430,514	554	100	182
W5EU	"	276,129	506	69	120
WA5RXT	"	44,408	161	31	73
W5EDX	"	11,545	79	36	64
K5EXW	"	9,918	63	21	36
W5EQT	**28**	**127,312**	**437**	**28**	**81**
W5JWM	"	60,895	227	26	69
WA5CBT	"	25,404	125	23	50
K5TGJ	"	16,252	87	26	42
W5QNY	"	12,801	99	18	33
W5QNQ	"	12,773	95	19	34
WA5VSL	"	4,136	33	17	30
WA5UOR	"	405	11	6	9
W6GHM/5	**21**	**275,762**	**731**	**32**	**97**
W5LLB	"	102,502	366	30	76
W5NXF	"	12,510	96	17	28
W5OBS	**14**	**63,525**	**224**	**33**	**72**
WA5PER	"	8,250	70	18	32
W5KTR	**7**	**18,414**	**106**	**20**	**46**
W6RR	**A**	**1,184,625**	**1237**	**119**	**256**
WA6IVN	**A**	**593,914**	**694**	**109**	**189**
WA6BOU	**A**	**549,400**	**597**	**112**	**216**
W6QJW	"	393,448	565	102	161
WB6UDC	"	337,441	472	94	163
W6DGH	"	292,392	446	90	158
WB6HGU	"	291,081	437	93	156
W6WX	"	278,712	402	96	156
W6NTQ	"	248,750	432	83	116
W6CY	"	232,893	360	85	144
WA6WXP	"	224,284	421	67	121
K6EV	"	214,034	413	75	131
WA6EPQ	"	185,878	347	72	115
K6SDR	"	177,898	331	72	122
W6EJJ	"	175,014	339	82	107
WA6ZCO	"	174,658	355	80	107
WA6TQK	"	149,468	336	61	97
K6PIH	"	132,125	302	61	90
K6ITL	"	132,030	280	69	94
WA6AHF	"	124,456	236	70	118
K6ZQP	"	116,350	263	60	90
W6VNH	"	103,342	228	66	97
W6CS	"	73,353	197	57	90
W6SR	"	69,120	197	55	73
W6VK	"	66,495	173	55	88
W6DZZ	"	63,812	145	70	102
WB6WIT	"	63,784	76	43	119
W6BIP	"	55,460	173	46	72
W6JKR	"	49,764	152	60	72
W6UQQ	"	49,200	150	47	73
W6KJS	"	46,564	123	55	84
WA6AUD	"	41,528	129	49	67
K6NA	"	34,176	122	38	58
WB6OYU	"	33,966	155	28	46
WA6IVM	"	31,875	134	41	44
WB6YHV	"	30,603	108	41	60
W6AOI	"	28,512	130	33	48
K6CCY	"	23,682	106	30	48
W6QFU	"	19,512	100	32	40
W6AM	"	16,875	79	33	42
K6AUC	"	14,820	71	34	44
K6TXR	"	14,616	64	34	50
W5CWQ/6	"	11,760	72	21	35
W6HS	"	10,920	73	20	32
W6EJ	"	6,298	47	20	27
K6KA	"	5,115	55	14	17
K6KQN	"	4,770	39	23	30
K6MG	"	4,329	40	14	23
W6GQK	"	3,913	33	17	26
W6BHH	"	3,192	29	17	21
W6NKR	"	3,150	30	21	21
K6MHD	"	3,045	31	16	19
W6RQZ	"	728	41	10	18
W6EJA	"	714	20	7	7
W6OL	"	525	13	6	9
W6KG	"	216	6	6	6
K6PUR	**28**	**126,144**	**404**	**31**	**77**
W6ED	**28**	**119,918**	**360**	**31**	**87**
K6SVL	"	105,156	408	27	65
W6ISQ	"	89,991	314	30	69
WB6FYW	"	71,456	292	28	60
WB6FRD	"	46,332	203	26	55
W6QY	"	38,610	175	26	52
K6YFZ	"	36,610	191	24	46
WA6CPY	"	20,844	138	19	35
W6DYC	"	20,463	134	20	37
K6VZA	"	18,414	109	22	40
WA6BWG	"	17,591	126	20	29
K6VOI	"	10,208	84	14	27
W6CLM	"	2,687	34	14	15
WA6JAN	"	1,320	24	11	13
WA6EKL	**21**	**249,984**	**710**	**33**	**91**
WB6NWW	"	101,050	391	27	67
WB6OLR	"	81,286	296	28	69
K6ERT	"	78,120	317	27	57
W6HJA	"	76,612	246	30	77
WB6LMN	"	19,952	132	21	37

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Impressive antenna farm at VE3FHO, runner-up to VE3LZ for the VE6TP Trophy. That's a six section Quad on 14 mc. If Doc came in second best with that lay-out, wonder what VE3LZ was using.

W6BH	"	15,741	102	19	34	
WB6ZSU	"	15,168	110	22	26	
W6RGG	"	4	1	1	1	
K6UJW	**14**	**150,258**	**339**	**39**	**119**	
K6EVR	"	124,320	326	38	102	
WB6MOS	"	74,704	244	36	76	
W6EUF	"	63,710	199	37	78	
K6ERV	"	59,405	200	36	73	
W6ANN	"	7,038	54	19	32	
W6ITY	**7**	**6,660**	**59**	**18**	**27**	
K6AO	"	5,617	59	17	24	
W6DQ	**3.5**	**2,910**	**43**	**13**	**17**	
W7AYY	**A**	**212,072**	**397**	**71**	**125**	
W7QQN	"	208,362	319	79	152	
W7SGN	"	151,368	230	83	155	
W7BJ	"	111,254	273	57	86	
W7TZL	"	88,296	222	67	89	
W7CNM	"	53,582	139	60	86	
W7AAI	"	17,480	84	30	46	
K7CVL	"	13,509	61	29	50	
W7FCD	"	360	8	7	8	
WA7GFL	**28**	**87,714**	**309**	**29**	**70**	
W7YEX	"	32,925	153	25	50	
WA7BAV	"	24,570	135	24	46	
W7JRG	"	11,128	75	20	32	
K7ALJ/7	"	6,954	74	16	22	
WA7JCB	"	5,084	56	13	18	
K7RLS	**21**	**124,722**	**518**	**25**	**57**	
W7LVI	"	117,515	422	27	68	
K7INE	"	71,199	304	30	51	
WA7ISQ	"	62,088	281	26	52	
W7MSI	"	43,890	220	24	46	
W7AQB	"	19,949	125	16	24	
W7HEU	**14**	**106,560**	**344**	**35**	**76**	
K7CHT	"	17,577	104	24	39	
W0SII/7	**7**	**6,732**	**60**	**19**	**25**	
K9LBQ/7	"	6,116	60	17	27	
WA8LYF	**A**	**791,046**	**811**	**101**	**241**	
K8HZU	**A**	**655,600**	**769**	**91**	**207**	
W8IPA	"	459,136	611	83	189	
W8HDR	"	404,880	514	98	182	
WA8NYB	"	365,967	499	82	177	
W8TWA	"	344,123	473	81	176	
W8WPC	"	334,264	465	82	172	
W8GEG	"	284,970	440	77	153	
WA8QIY	"	254,898	409	72	166	
WB8BXX	"	144,400	261	77	123	
W8NZD	"	117,704	321	39	89	
W8JGU	"	92,538	214	53	106	
WA8OSL	"	84,120	242	42	78	
W8FRJ	"	81,338	214	47	87	
W3TBF/8	"	80,041	179	44	87	
WA8MCR	"	72,884	186	52	85	
W8WUO	"	70,882	200	41	78	
K8GVK	"	62,823	167	45	84	
WA8GGN	"	51,952	159	55	81	
W8YGR	"	36,462	112	43	75	
W8AQZ	"	29,596	109	33	65	
WA8VVU	"	28,696	109	35	53	
W8KC	"	22,218	113	22	47	
K8MMH	"	21,237	132	45	72	
W8DQL	"	18,600	62	22	38	
W8TWJ	"	14,016	74	21	43	
WA8ZZZ	"	12,354	83	21	35	
W8SS	"	6,960	60	13	27	
W8IRG	"	3,444	31	19	22	
K8QYG	"	220	10	6	4	
WA8TFJ	**28**	**136,152**	**391**	**32**	**90**	
W8JAQ	"	68,034	234	29	73	
W8WEJ	"	66,348	243	28	69	
WA8PWZ	"	29,526	137	28	46	
W8AJW	"	23,026	140	16	42	
W8WNR	**21**	**46,155**	**191**	**24**	**61**	
W6IIM/8	"	26,061	129	21	52	
WA8TKM	"	11,130	79	16	37	
K8YBL	**14**	**398,160**	**833**	**39**	**129**	
K8MMM	"	218,790	510	40	113	
W8BVF	"	45,024	163	29	67	
W8JFD	"	35,814	140	31	63	
W8BDO	"	12,738	87	22	44	
K8HYC	**7**	**27,761**	**158**	**21**	**50**	
W8LXU	"	7,755	65	13	34	
W8GDQ	**1.8**	**36**	**10**	**3**	**3**	
K9ECO	**A**	**710,220**	**730**	**107**	**249**	
W9EXE	**A**	**615,825**	**738**	**98**	**217**	
W9EWC	"	520,520	651	92	194	
K9CUY	"	467,870	622	98	197	
WA9WBF	"	306,908	481	66	160	
W9IRH	"	291,816	569	91	193	
W9DWQ	"	252,642	379	81	156	
K9QFR	"	241,472	446	66	130	
WA9HJM	"	217,391	530	74	149	
K9ZJV	"	101,887	262	51	88	
WA9NJB	"	88,892	214	51	91	
WA9UGI	"	76,629	222	47	76	
W9BZW	"	67,635	175	51	84	
W9CRN	"	63,157	169	54	83	
WA9UMH	"	50,794	256	26	47	
K9HDZ	"	36,642	141	33	60	
K9VQK	"	33,712	122	35	63	
W9NZM	"	32,724	110	36	72	
W9EVX	"	31,621	112	44	59	
WA9QZE	"	17,680	82	34	46	
W9WYB	"	16,056	76	28	44	
WA9FCD	"	14,690	78	21	44	
K9PPX	**28**	**193,664**	**523**	**31**	**97**	
K9ECE	**28**	**190,212**	**501**	**31**	**101**	
W9LKI	"	159,500	493	30	86	
W9JT	"	133,497	399	28	89	
WA9LMY	"	130,065	405	29	86	
WA9NME	"	90,900	310	27	74	
W9RQM	"	66,616	261	25	63	
W9VBV	"	13,478	101	13	33	
K9UQN	"	9,963	85	14	27	
W9ISF	"	8,832	66	15	31	
W9GXH/9	"	5,000	36	23	27	
WA9OMN	"	1,682	23	10	19	
K9KDI	"	540	15	3	9	
W9GEG	"	270	8	8	7	
W9VNE	**21**	**222,300**	**596**	**34**	**96**	
W9OHH	**14**	**88,000**	**259**	**34**	**91**	
W9IZF	"	37,628	154	29	63	
W9YYG	"	1,350	25	12	13	
WAØKDI	**A**	**164,124**	**303**	**70**	**124**	
WØACT	"	107,280	283	55	89	
WØGE	"	62,020	163	60	80	
KØJPL	"	55,118	156	49	78	
WAØRUE	"	32,618	134	41	53	
KØSPH	"	28,906	116	38	59	
KØBE	"	27,936	113	37	59	
WØUCK	"	2,074	22	15	19	
W9ECV/Ø	**28**	**120,435**	**382**	**28**	**83**	
WØLBB	"	83,398	309	29	69	
WAØNHW	"	70,914	235	30	76	
KØRNZ	"	63,954	226	30	69	
WØKBG	"	7,754	64	19	27	
WAØCVS/Ø	**21**	**47,061**	**203**	**25**	**56**	
WØGHN	"	34,866	152	21	57	
WAØMOJ	"	9,786	86	16	26	
WØSEA	**14**	**51,701**	**203**	**28**	**69**	
KØTCF	"	47,250	166	31	74	
WAØTCO	"	25,146	142	23	43	
KØCVA	3.8	783	29	11	16	
Alaska						
KL7EGO	**A**	**356 922**	**1000**	**59**	**99**	
KL7GHF	"	127,571	756	32	51	
KL7GKA	"	98,610	321	54	60	
KL7EQG	"	80,993	562	34	33	
KL7EWA	**14**	**3,720**	**45**	**11**	**20**	
W7GHB/KL7	14	1,160	22	8	12	
Barbados						
8P6CV	**14**	**38,430**	**284**	**21**	**40**	
Bermuda						
VP9BY	**14**	**101,442**	**402**	**27**	**79**	
Canada						
VO1HI	**A**	**196,180**	**601**	**36**	**93**	
VO1AQ	**14**	**416,610**	**1322**	**32**	**103**	
VO1HH	"	151,575	456	30	99	
VE1SH	**A**	**108,712**	**366**	**36**	**91**	
VE1EK	"	18,176	101	22	49	
VE1ATC	**28**	**58,181**	**381**	**20**	**53**	
VE1TG	**14**	**372,155**	**931**	**36**	**119**	
VE1AJJ	"	29,568	153	23	54	
VE2NV	**A**	**378,040**	**585**	**76**	**184**	
VE2AYU	"	359,856	530	75	177	
VE2WA	"	351,654	486	78	180	
VE2YU	"	331,470	513	74	180	
VE2DCX	"	186,592	378	63	133	
VE2AJ	"	30,590	108	26	69	
VE2DCW	**28**	**50,616**	**271**	**20**	**52**	
VE2AFC	**21**	**138,805**	**422**	**29**	**86**	
VE2WY	**14**	**171,216**	**462**	**36**	**108**	
VE3KZ	**A**	**714,777**	**806**	**104**	**233**	
VE3HJ	"	284,834	463	61	153	
VE3CEZ	"	111,150	229	62	109	
VE3CYF	"	82,240	211	57	103	
VE3CWE	"	3,876	36	14	24	
VE3BS	**28**	**123,172**	**462**	**28**	**78**	
VE3ACD	**21**	**286,358**	**806**	**34**	**100**	
VE3BMB	"	55,675	244	26	59	
VE3LZ	**14**	**601,620**	**1274**	**40**	**145**	
VE3FHO	**14**	**561,960**	**1221**	**38**	**142**	
VE3CBG	"	273,716	640	39	125	
VE3DLC	"	242,005	722	37	118	
VE3BSJ	"	150,480	442	35	97	
VE3DWH	"	2,738	29	12	25	
VE4BF	**A**	**65,852**	**263**	**38**	**63**	
VE6TP	**A**	**417 238**	**734**	**77**	**152**	
VE6AGV	"	154,389	356	55	104	
VE6AJJ	"	116,889	353	48	93	
VE6AP	"	67,377	224	39	72	
VE6MC	"	55,770	208	47	63	
VE6XF	"	46,354	202	41	57	
VE6AJD	"	44,448	174	35	61	
W8ILH/VE6		39,000	187	44	56	
VE6ARD	"	37,240	217	35	41	
VE6UV	"	25,112	122	23	50	
VE6TK	"	23,868	111	33	45	
VE6AWF	"	3,401	82	9	10	
VE6NW	**21**	**74,115**	**367**	**29**	**52**	
VE6APO	**14**	**188,928**	**636**	**33**	**90**	
VE6AQL	"	141 312	481	36	92	
VE6AO	"	128,935	492	30	77	
VE6PL	"	85,680	308	32	80	
VE6GN	"	74,868	360	30	72	
VE6NX	"	53,669	161	35	84	
VE6FZ	"	43,680	162	28	68	
VE6ABR	"	29,716	183	24	44	
VE6IN	"	12,675	73	25	40	
VE6GQ	"	10,890	69	21	34	
VE6AUT	"	410	18	4	6	
VE7SV	**A**	**1,752,576**	**1956**	**124**	**260**	
VE7AHD	"	267,329	539	83	114	
VE7EH	"	192,556	436	65	117	
VE7AAF	"	57,486	163	52		
VE7IQ	"	10,200	94	28		
VE7IG	**28**	**318,752**	**1280**	**30**		
VE7BQF	**14**	**88,245**	**249**	**34**		
VE7NW	"	62,370	202	31		
VE7PY	"	28,416	95	33		
VE7BDJ	**3.8**	**8,250**	**138**	**13**		
VE8BB	**A**	**329,289**	**963**	**55**		
VE8RX	**14**	**318,524**	**798**	**35**		
VE8OK	"	140,864	517	38		
Cuba						
CO8RA	**A**	**59,976**	**396**	**30**		
CO2FA	**14**	**21,060**	**170**	**14**		
Dominican Rep.						
HI3ABB	**A**	**1,505,192**	**1900**	**109**		
(Opr. WB2VAE)						
HI8LC	**28**	**28,413**	**306**	**14**		
Greenland						
OX5AP	**A**	**123,600**	**422**	**45**		
OX5BA	**14**	**36,750**	**314**	**17**		
Guadeloupe						
FG7XL	**14**	**156,177**	**560**	**29**		
Honduras						
HQ2GK	**A**	**650,928**	**1,471**	**73**		
Jamaica						
6Y5CB	**14**	**74,336**	**359**	**26**		
Mexico						
XE1TU	**14**	**73,920**	**378**	**28**		
Nicaragua						
YN1GLB	**A**	**404,200**	**1022**	**46**		
Panama						
HP1JC	**A**	**401,098**	**686**	**79**		
HP1AC	**21**	**43,960**	**271**	**23**		
Puerto Rico						
KP4AAK	**28**	**67,608**	**383**	**26**		
W1FZJ/KP4	**3.8**	**50,410**	**297**	**18**		
San Salvador						
YS1XEE	**A**	**898,857**	**1738**	**76**		
YS2CEN	**14**	**208,065**	**568**	**35**		
Virgin Islands						
WØVXO/KV4	**A**	**3,135 475**	**3372**	**119**		
KV4AM	**28**	**37,924**	**481**	**15**		
AFRICA						
Angola						
CR6GA	**A**	**807,950**	**1273**	**66**		
Ascension Is.						
ZD8Z	**A**	**4,184,680**	**3210**	**122**		
Cameroun						
TJ1AQ	**A**	**440,607**	**693**	**66**		
Canary Is.						
EA8EC	**A**	**27.857**	**111**	**26**		
Cape Verde Is.						
CR4BI	A	3,604	38	13		
Liberia						
EL8J	**28**	**275,296**	**829**	**31**		
Malawi						
7Q7AH	**A**	**205,128**	**505**	**61**		
Mauritius						
VQ8CC	14	1,360	27			
Morocco						
CN8GE	**14**	**11,313**	**209**			
Mozambique						
CR7DS	**A**	**723,294**	**995**	**7**		
CR7IC	"	130,002	325	5		
CR7DD	**21**	**6.110**	**48**	**1**		
CR7FR	**14**	**80,801**	**303**	**3**		
Nigeria						
5N2AAF	**A**	**324.700**	**656**	**5**		
Rep. of Congo						
9Q5EP	**28**	**107.040**	**395**	**2**		
9Q5PT	**21**	**39,073**	**329**	**2**		
Rhodesia						
ZE1CU	**A**	**620.540**	**931**	**7**		
ZE1JE	"	455,382	669	8		
ZE2JE	**14**	**368,543**	**958**	**3**		
Sierra Leone						
9L1KZ	**A**	**228,201**	**597**	**4**		
South Africa						
ZS5XA	**A**	**1,257.408**	**1574**	**8**		
ZS2DC	"	73,472	230	4		
ZS6ACK	**28**	**47,460**	**273**	**2**		
Zambia						
9I4MG	**A**	**355,962**	**523**	**8**		
ASIA						
Afghanistan						
YA5RG	**A**	**256 608**	**607**	**6**		
Ceylon						
4S7PB	**A**	**108,832**	**243**	**6**		

See page 110 for New Reader Servi

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
ZD8Z		20	173	1016	1000	1001		9	16	36	33	28		10	34	106	90	87
WØVXO/KV4	32	141	313	1053	817	1016	3	13	20	26	31	26	5	30	45	74	75	57
DU1UP			61	473	938	635			17	34	33	30			18	78	64	63
LAØAD		76	74	251	381	1210		6	12	20	26	27		35	33	59	61	54
OH7PI		72	71	466	764	669		5	7	35	31	30		21	24	71	57	69
DJ2YA		50	68	360	683	649		6	15	25	27	26		32	36	78	54	57
I1FLD		51	69	481	759	557		5	10	36	25	28		23	31	94	55	50
VE7SV	3	75	117	411	841	509	2	12	17	34	32	27	2	15	26	90	64	63
JA1AEA		1	69	693	565	656		1	13	37	27	23		1	16	94	47	42
I1BAF		52	102	981	452	151		6	13	35	26	26		25	42	86	58	48
W2PV	4	23	78	341	283	378	3	8	14	30	30	29	3	16	39	85	75	87
W6RR		19	80	160	560	418		10	19	31	29	30		12	33	69	73	69

Multi-Operator — Single Transmitter

DLØWR		74	95	615	1015	757		9	12	30	31	33		41	42	93	67	71
I1LCK		56	106	636	810	1167		7	11	31	33	33		28	35	88	64	74
SK6AB		107	130	867	739	667		10	15	32	28	28		37	43	100	72	67
UA9AN		38	155	1137	384	309		8	20	38	32	28		28	50	115	81	86
DLØWW		75	104	652	543	758		8	16	31	32	33		37	45	102	81	76
UP2A		95	216	510	759	554		7	20	37	35	31		36	59	102	88	73

Multi-Operator — Multi-Transmitter

OH2AM	34	315	459	1806	1776	1492	2	13	28	40	38	38	4	50	73	144	121	119
OH5SM	19	244	433	1776	1938	1546	2	11	26	39	37	37	3	48	71	136	109	123
PJØMM	26	220	401	2130	1880	1759	3	13	17	39	33	29	3	28	53	100	86	73
W3MSK	7	110	231	849	861	1036	3	16	27	40	39	34	4	31	70	138	119	108
OH1AA		215	332	1067	1190	760		7	20	36	34	33		33	54	124	92	91
W4ETO	6	57	136	892	572	566	3	13	22	40	36	32	4	29	55	136	95	84

Top scores band-by-band breakdown

India

VU2DKZ	**A**	**1,372,788**	**1477**	**96**	**246**
VU2BX	**14**	**40,622**	**209**	**31**	**50**
VU2TP	"	6,916	60	16	36

Iran

EP2BQ	**A**	**1,131,420**	**1223**	**88**	**239**

Israel

4Z4HF	**A**	**968,190**	**1184**	**87**	**208**
4X4SO	**28**	**44,880**	**257**	**19**	**49**

Japan

JA1AEA	**A**	**1,714,195**	**1983**	**101**	**200**
JA3UI	**A**	**1,028,874**	**1490**	**90**	**148**
JA1NDO	"	727,762	1094	82	147
JA3GZN	"	319,448	742	50	96
JA7JM	"	288,351	506	73	126
JA3LGG	"	223,965	567	58	77
JA3GNQ	"	221,280	480	71	89
JA8EL	"	181,152	469	55	81
JA8BFI	"	162,864	493	51	65
JA2JKV	"	119,329	282	55	82
JA1HHM	"	68,311	215	42	51
JA7CDV	"	40,200	129	44	56
JA2BGV	"	30,652	143	34	45
JA6QZ	"	27,265	112	41	54
JAØAWF	"	25,830	123	35	47
JA4FM	"	24,929	99	39	58
JA4ERX	"	22,620	132	28	32
JA2LA	"	9,420	55	25	35
JA6CLO	"	4,480	33	26	30
JA7ARW	"	2,835	29	15	20
JH1AJT	**28**	**246,150**	**931**	**31**	**59**
JA8CKC	**28**	**217,120**	**803**	**29**	**63**
JA1WSK	"	185,892	748	29	55
JA2DDU	"	176,000	682	31	57
JA2JAA	"	171,398	679	28	58
JA6QT	"	122,232	480	29	59
JAØDAI	"	114,807	514	27	50
JA1WPX	"	113,334	532	27	51
JA6DHE	"	100,714	470	25	49
JA1WRP	"	64,030	350	25	45
JA1LZR	"	59,400	499	22	33
JA2AAQ	"	34,587	194	24	39
JA9CHH	"	33,916	203	21	40
JA2BVZ	"	33,432	199	20	36
JA2WZ	"	32,960	245	19	21
JA5PQ	"	31,460	206	21	31
JA2HUN	"	17,148	175	18	18
JA7UQ	"	17,028	137	20	22
JA8CIJ	"	13,845	123	17	22
JA8WY	"	13,524	95	20	29
JA6FFK	"	13,132	92	21	28
JAØENG	"	3,162	37	14	20
JH1CJU	"	3,000	51	10	10
JA4ABS	"	1,280	24	10	10
JH1CDN	"	748	21	6	6
JA7GDW	"	660	16	8	7
JA8BZ	"	559	17	4	9
JA1EEG	"	360	10	6	6
JA7FGH	"	80	6	4	4
JA3JGB	**21**	**330,228**	**1004**	**36**	**80**
JA3NLK	**21**	**251,472**	**826**	**33**	**71**
JA2CHJ	"	172,045	623	30	65
JA6EFR	"	156 876	531	33	69
JA1JXU	"	147,420	558	32	59
JA4FK	"	109,076	514	27	47
JA1RJW	"	85,470	402	25	49
JH1JOM	"	73,002	413	25	44
JA2IYJ	"	65,076	337	26	40
JA9UR/0	"	62,205	327	23	42
JA1PNA	"	56,615	286	25	42
JA3LDH	"	46,665	262	21	40
JA2HNP	"	29,202	164	25	37
JA7BZU	"	27,987	174	23	34
JH1JJC	"	27,136	149	25	39
JA6ECM/3	"	17,649	126	24	29
JA2EFV	"	15,884	125	21	23
JA3MGX	"	14,514	91	23	36
JA3IG	"	14,393	130	15	22
JA2ITH	"	9,786	84	17	25
JH1BHW	"	8,008	68	21	23
JA2KKX	"	7,995	74	17	22
JA9BKM	"	5,511	59	16	17
JA9NB	"	2,225	31	12	13
JH1GCS	"	1,500	21	14	16
JA8FBM	"	406	13	7	7
JA2HSG	"	45	3	2	3
JA8NU	**14**	**263,200**	**676**	**37**	**103**
JA3ERG	"	106,496	360	34	70
JA2ACC	"	68,020	265	33	62
JA1RJU	"	39,114	176	30	52
JA7MA	"	39,100	151	33	59
JA6PN	"	11,403	66	26	37
JA1AAT	"	10,304	76	24	32
JA1BNW	"	8,370	58	24	30
JA1ALX	"	7,301	57	22	27
JA1SJV	"	6,171	41	19	32
JA3CF	"	5,720	50	21	23
JA3IG	"	5,358	42	20	27
JA5IU	"	2,660	35	18	17
JA1VZM	"	2,280	24	18	20
JA4AQR/5	"	756	14	10	11
JA3ADW	"	168	6	6	6
JA2BTV	**7**	**65,910**	**272**	**29**	**53**
KA2RM	**A**	**1,336,320**	**1591**	**108**	**182**
KA2FL	**21**	**139,550**	**674**	**26**	**44**

Korea

HL9TF	**A**	**96,126**	**360**	**49**	**62**

Laos

XW8CS	**A**	**433,752**	**675**	**71**	**167**
XW8CN	**14**	**13,833**	**113**	**24**	**29**

Lebanon

OD5BZ	**A**	**1,407,456**	**1665**	**79**	**209**
OD5BA	"	271,078	567	43	123
OD5FA	**28**	**105,400**	**540**	**18**	**50**

Malaysia, West

9M2PO	**A**	**382,659**	**794**	**83**	**146**

Pakistan, West

AP2MR	**28**	**118,680**	**509**	**26**	**66**

Ryukyu Is.

KR6KN	**A**	**964.440**	**1353**	**99**	**183**
KR6TAB	**28**	**144,760**	**622**	**27**	**61**
KR6NR	**21**	**111,693**	**515**	**30**	**63**
KR6RL	"	17,612	106	24	44

Saudi Arabia

HZ1AB	**28**	**114,142**	**593**	**17**	**45**

Singapore

9V1OE	**14**	**34,000**	**216**	**29**	**56**

Thailand

HS3DR	**A**	**379,532**	**742**	**86**	**153**
HS1FB	"	11,025	80	33	42

U.S.S.R.

Asiatic

UA9MR	**A**	**240,264**	**520**	**60**	**128**
UA9UY	**28**	**14,288**	**168**	**13**	**34**
UA9MS	"	12,954	119	16	35
UA9WJ	**21**	**81,216**	**316**	**26**	**70**
UA9AB	"	26,474	160	17	44
UW9WR	**14**	**196,342**	**536**	**36**	**91**
UW9EX	"	32,928	210	15	41
UA9MT	"	23,392	136	31	55
UAØSK	**A**	**193,050**	**627**	**52**	**91**
UAØSU	"	39,675	262	30	45
UAØABV	28	1,615	51	4	13
UAØNL	**14**	**34,880**	**251**	**29**	**51**
UAØDG	"	18,256	169	26	30
UAØYE	"	15,028	106	14	24

Armenia

UG6JJ	**14**	**13,833**	**106**	**13**	**40**
UG6AU	"	5,249	71	9	20
UG6KAA	"	4,760	50	9	25

Azerbaijan

UD6BD	**A**	**159,936**	**340**	**50**	**118**
UD6BR	**28**	**37,088**	**204**	**21**	**55**
UD6BN	**14**	**19,292**	**137**	**14**	**38**

Georgia

UF6CW	**A**	**136,480**	**306**	**44**	**116**
UF6CR	**28**	**280,836**	**891**	**34**	**82**
UF6CA	**14**	**14,681**	**110**	**16**	**37**

Kazakh

UL7LA	**14**	**94,500**	**374**	**30**	**70**

Tadjik

UJ8KAJ	**28**	**90,480**	**404**	**24**	**63**

Turkoman

UH8BO	**14**	**4,255**	**50**	**13**	**24**

Uzbek

UI8CD	**A**	**47,142**	**194**	**33**	**64**

EUROPE

Aland Islands

OHØNI	**A**	**597,828**	**1020**	**83**	**225**
OHØNF	28	1,100	23	12	20

Austria

OE2EGL	**A**	**123,768**	**331**	**53**	**109**

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Jim McVay, KØBWN on left and John Hizer, WAØ-QLH at the PX1BW operating position. High in the mountains of Andorra with the temperature below freezing at night, the tent offered little protection.

OE6RP	"	102,245	366	45	98	
OE1ZQA	14	336	20	4	12	
Belgium						
ON5GA	**A**	**359,160**	**722**	**68**	**151**	
ON4XG	"	321,058	564	70	159	
ON5MG	"	140,184	350	58	119	
ON5DJ	**28**	**104,052**	**445**	**25**	**62**	
ON5KL	"	12,803	86	21	38	
ON8CG	**21**	**128,293**	**468**	**28**	**79**	
ON5EB	**14**	**54,782**	**328**	**22**	**64**	
Bulgaria						
LZ2SA	**14**	**32,186**	**301**	**19**	**58**	
LZ1KSA	**7**	**3,160**	**64**	**8**	**32**	
Corsica						
FOCH/FC	**14**	**454,896**	**1295**	**34**	**110**	
Czechoslavakia						
OM1ADM	**A**	**280,112**	**416**	**88**	**199**	
OM2BFT	"	7,889	116	14	35	
OK8AAE	"	6,477	68	19	32	
OM2DB	**28**	**128,152**	**548**	**27**	**56**	
OK2BEN	"	88,312	422	23	53	
OK1AHZ	"	19,398	120	20	41	
OM1AGQ	**21**	**61,920**	**535**	**14**	**29**	
OK1VB	"	59,943	271	29	58	
OM2ABU	"	11,220	113	14	30	
OM3BU	**14**	**281,550**	**1001**	**36**	**114**	
OM1ADP	"	241,684	746	36	106	
OM3DG	"	29,212	333	15	52	
OM1APJ	"	29,078	310	19	48	
OK20P	"	13,750	104	18	37	
OK1LM	"	13,680	155	16	44	
OK1NH	"	3,240	71	7	33	
OK1AKL	"	1,512	58	4	20	
OM1MP	**7**	**26,712**	**294**	**14**	**49**	
OM1BY	**3.8**	**19,778**	**331**	**11**	**47**	
OM1NR	"	12,972	308	8	38	
OM1XN	"	7,616	223	6	28	
Denmark						
OZ1LO	**A**	**1,170 000**	**1379**	**92**	**233**	
OZ3SK	**A**	**1,127.632**	**1443**	**87**	**211**	
OZ1RH	"	740,928	1042	84	188	
OZ7DX	"	68,400	201	46	104	
OZ3M	"	17,050	133	22	40	
OZ4EDR	"	16,281	131	26	55	
OZ4IA	"	16,119	114	28	53	
OZ3FU	"	11,418	113	17	49	
OZ6EI	"	8,064	110	16	40	
OZ5KF	"	2,496	53	13	26	
OZ4LX	"	1,271	39	7	24	
OZ9JX	"	480	12	9	11	
OZ4FA	**28**	**347,599**	**1026**	**32**	**87**	
OZ3Y	"	135,720	466	32	72	
OZ3KE	**21**	**88,976**	**374**	**28**	**55**	
OZ8BZ	**14**	**126,610**	**760**	**28**	**82**	
OZ5AR	"	3,300	86	7	26	
England						
G6PD	**A**	**219,240**	**394**	**67**	**165**	
G3XKV	"	130,530	387	42	128	
G2AJB	"	65,736	241	52	114	
G3MWZ	"	5,760	54	23	37	
G2BOZ	**28**	**241,998**	**862**	**29**	**77**	
G3LSF	"	239,058	725	33	81	
G3VZJ	"	234,255	786	31	74	
G3KMA	"	178,143	551	35	84	
G3WJN	"	126,730	477	30	65	
G3TXZ	"	50,876	247	24	55	
G2NH	"	36,608	169	26	62	
G3XFW	"	7,520	81	12	28	
G3HCT	**21**	**576,007**	**1684**	**33**	**98**	
G3VZD	"	158,159	558	30	79	
G3SHM	**14**	**43,296**	**346**	**24**	**58**	
G3OUQ	"	16,992	225	10	38	
G5HZ	**7**	**8,480**	**104**	**13**	**40**	
G3IAR	**3.8**	**15,714**	**264**	**10**	**44**	
G3RHM	"	14,723	188	13	48	
Faroe Islands						
OY40V	**A**	**19,952**	**182**	**22**	**64**	
Finland						
OH7PI	**A**	**1,813.700**	**2042**	**103**	**242**	
OH1OE	"	246,466	579	60	127	
OH6RH	"	32,011	137	33	86	
OH4RH	"	24,232	150	32	72	
OH2XK	"	18,260	71	44	66	
OH8OW	**28**	**26,460**	**139**	**24**	**60**	
OH2BHU	"	11,822	120	14	32	
OH2HC	**21**	**283,452**	**1174**	**29**	**63**	
OH2VB	"	120,645	455	79	26	
OH2TH	**14**	**309,175**	**911**	**38**	**111**	
OH5VT	14	119,997	551	32	74	
OH2CP	"	71,145	428	27	66	
OH2VZ	"	4,773	71	14	29	
OH2DW	"	2,652	64	7	27	
OH2DN	"	576	18	7	17	
France						
F9RM	**A**	**262,626**	**463**	**68**	**154**	
F2JE	"	69,738	304	36	82	
F2VX	"	66,768	280	36	68	
F3KT	"	51,512	205	35	59	
F8TQ	"	24,250	121	33	64	
Germany						
DJ2YA	**A**	**1,783,204**	**1810**	**99**	**257**	
DJ6QT	**A**	**1.517 731**	**1443**	**110**	**287**	
DJ2QZ	**A**	**1.516. 032**	**1585**	**106**	**278**	
DJ4PT	**A**	**1,239,850**	**1253**	**103**	**259**	
DJ6RX	**A**	**1,080,508**	**1427**	**80**	**206**	
DL7AAA	**1,036,350**	**1101**	**108**	**242**	
DJ1FC	A	967,703	1555	72	145	
DL8PC	"	660,296	745	104	260	
DL2NB	"	590,446	1073	75	127	
DJ6QP	"	370,048	732	60	136	
DJØRM	"	359,724	598	66	162	
DL8BS	"	291,635	493	75	160	
DL6WE	"	264,480	585	58	132	
DL1MD	"	235,616	481	64	135	
DL2JO	"	212,266	467	60	151	
DL9RE	"	159,408	386	58	104	
DJ5LU	"	150,982	371	55	123	
DK7HV	"	134,771	519	31	60	
DK1NF	"	121,146	342	63	120	
DJ9IA	"	115,430	347	53	141	
DJ8UV	"	100,674	308	48	105	
DL9HC	"	95,360	357	35	125	
DL8EJ	"	86,950	277	55	130	
DJ2UU	"	86,496	257	61	143	
DL8XA	"	81,627	235	52	109	
DJ1MC	"	69,580	487	22	27	
DJ1VP	"	69,448	337	45	118	
DL9PE	"	64,640	214	48	112	
DK1YK	"	64,260	327	39	114	
DL8FR	"	57,204	194	47	79	
DJ7PB	"	55,002	202	32	71	
DL8MY	"	37,629	179	36	77	
DL6QX	"	34,944	143	40	72	
DJ3YU	"	34,224	188	30	67	
DJ8FF	"	25,920	177	28	92	
DJ5IH	"	22,725	149	21	54	
DLØII	"	22,365	127	28	39	
DJ4JR	"	21,384	125	31	50	
DL1HH	"	20,532	90	33	54	
DJ5LA	"	15,089	126	39	76	
DL6VP	"	9,000	82	24	36	
DL6EN	**28**	**430,330**	**1235**	**35**	**80**	
DJ9LI	"	334,356	1124	31	71	
DL7BA	"	302,022	873	35	84	
DJ1LP	"	270,735	809	37	84	
DJ2QH	"	74,783	313	28	55	
DL9VS	"	57,760	274	28	48	
DLØHM	"	23,010	147	23	36	
DJ6WX	"	21,630	116	26	44	
DL7FP	"	15,125	107	20	35	
DL1TV	"	10,664	60	26	36	
DL1AM	"	2,542	62	18	23	
DJ3JB	**21**	**471,822**	**1196**	**37**	**101**	
DJ5GI	"	290,280	860	34	84	
DJ9TQ	"	234,260	686	32	96	
DL8RM	"	146 544	608	27	59	
DJ6AP	"	100,067	104	14	37	
DJ9ZB	"	22,126	171	21	53	
DL7IW	"	16,768	124	22	42	
DL8NU	**14**	**479.961**	**1206**	**36**	**117**	
DJ1RJ	"	89,748	402	28	80	
DK1QA	"	62,216	369	27	74	
DJ6SI	"	2,415	39	11	24	
DJ6TK	**7**	**40,918**	**282**	**21**	**67**	
DK2JX	**3.8**	**2,016**	**58**	**6**	**26**	
DL4PV	**A**	**592,669**	**797**	**83**	**223**	
DL4FU	"	145,800	416	47	103	
DL4PM	**28**	**614,544**	**1858**	**34**	**84**	
DL5LB	**21**	**270.810**	**1141**	**25**	**65**	
DL4CQ	**14**	**50,290**	**272**	**27**	**80**	
DL5AO	**7**	**17,472**	**161**	**12**	**40**	
DL5DZ	**3.8**	**5,980**	**125**	**9**	**26**	
DM3VGO	21	132	12	3	9	
Greece						
SVØWP	**14**	**56,214**	**650**	**14**	**40**	
Hungary						
HA5CQ	**A**	**184,184**	**405**	**57**	**125**	
HA5DU	"	128,329	373	53	128	
HA3MB	"	56,261	284	40	87	
HA5BY	**14**	**20 658**	**231**	**17**	**49**	
HA5FE	"	17,990	183	20	50	
HA5FQ	"	3,724	58	12	26	
HA5BI	"	1,575	63	4	21	
Iceland						
TF3SG	**A**	**24,071**	**208**	**22**	**69**	
TF3MA	**28**	**70,060**	**486**	**20**	**42**	
Isle of Man						
GD3AIM	**A**	**27,144**	**182**	**26**	**61**	
Italy						
I1FLD	**A**	**1,775.718**	**1917**	**104**	**253**	
I1BAF	**A**	**1,684.475**	**1738**	**106**	**259**	
I1SV	A	283,975	391	87	220	
I1AUM	**28**	**73,640**	**406**	**18**	**38**	
I1LAG	"	12,111	107	18	23	
I1SGZ	**21**	**27,378**	**202**	**21**	**57**	
I1NU	**14**	**317,580**	**995**	**32**	**102**	
I1MOL	"	250,100	844	34	88	
I1PRK	"	116,103	418	31	1	
I1KBT	"	100,793	374	29		
I1TUS	"	35,035	199	23		
I1SRO	"	26,740	270	16		
I1REK	"	10,948	114	16		
I1ZSQ	**7**	**30,178**	**254**	**20**		
I. T. U.						
4U1ITU	**28**	**89,895**	**493**	**21**		
Luxembourg						
LX1BW	**A**	**205,800**	**695**	**64**		
Netherlands						
PAØSNG	**A**	**81,346**	**252**	**48**	1	
PAØDEC	"	46,110	225	28		
PAØVB	"	41,022	193	41		
PAØMIR	"	15,960	162	18		
PAØXKB	**28**	**150,452**	**509**	**31**		
PAØLV	"	36,300	225	22		
PAØFM	**21**	**613,816**	**1564**	**34**	1	
PAØQT	"	108,665	358	30		
PAØHBO	**14**	**521,560**	**1237**	**37**	1	
PAØSSB	14	362,610	790	38		
PAØHSJ	"	75,200	330	24		
Norway						
LAØAD	**A**	**1,828.503**	**1992**	**91**	1	
LA8NH	**A**	**485,694**	**881**	**72**		
LA1SL	"	148,428	457	51		
LA9DL	"	138,768	499	48		
LA4R	"	33,756	236	25		
LA8RI	"	29,988	127	41		
LA1MG	"	22,227	156	26		
LA4SK	"	12,432	112	28		
LA7QI	**28**	**18,676**	**124**	**20**		
LA6U	"	7,600	102	7		
LA2AB	**14**	**61,852**	**446**	**24**		
LA8WF	"	40,188	184	30		
Poland						
SP8AJK	**A**	**1,012,928**	**1012**	**133**		
SP8AWP	"	37,120	285	24		
SP3PL	**28**	**17,596**	**122**	**20**		
SP5AKG	**14**	**149,760**	**411**	**39**		
SP9PT	"	11,115	122	16		
SP5BB	"	5,460	117	9		
SP5CJU	"	3,960	103	7		
Portugal						
CT1BH	**A**	**939,760**	**1302**	**83**		
CT1UA	"	211,724	534	45		
CT1WA	"	80,886	330	35		
CT1IQ	"	15,066	116	24		
CT1MZ	"	14,400	74	38		
CT1OF	**28**	**223,156**	**928**	**27**		
CT1BB	"	77,700	461	23		
Romania						
YO2BB	**A**	**301,930**	**794**	**59**		
YO9CN	"	119 525	396	51		
YO9VI	**14**	**115,540**	**628**	**28**		
Scotland						
GM5AHS	**A**	**344,832**	**822**	**67**		
GM3CFS	"	50,512	215	35		
GM3BCL	**28**	**30,521**	**187**	**19**		
GM3SSB	**14**	**19,198**	**218**	**15**		
GM3VTB	**3.8**	**8,360**	**216**	**7**		
Shetland Is.						
GM3RFR	**3.8**	**9,456**	**186**	**9**		
Spain						
EA1IY	**A**	**141,930**	**516**	**35**		
Sweden						
SM5CEU	**A**	**1,624,493**	**1609**	**107**		
SM3BIZ	**A**	**829,503**	**1071**	**84**		
SM5RK	"	477,420	872	62		
SM6DHU	"	387,276	736	69		
SM2ME	"	287,532	800	59		
SM3CWE	"	233,723	534	67		
SL7AC	"	136,136	409	56		
SM7ID	"	127,080	392	51		
SM3CXS	"	90,948	206	62		
SM6DSS	"	36,860	223	28		
SMØFT	"	28,880	194	29		
SMØBDS	"	28,665	162	3		
SM5CAK	"	20,735	230	1		
SM5CBN	"	20,384	86	4		
SM7DVF	"	19,838	116	3		
SMØKV	"	2,947	62	1		
SM4BTF	"	972	34			
SM7CCU	**28**	**405,886**	**1064**	**3**		
SM5CLU	"	275,889	802	3		
SM7BKH	"	272,610	829	3		
SM4ARQ	"	160,489	526	3		
SMØAJU	"	85,344	260	3		
SM6CQV	"	81,627	315	2		
SM5BOE	"	56,028	217	2		
SM7BEM	"	2,925	30	1		
SM4DPB/5	"	1,014	28			

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3CNN	21	525,150	1453	36	99
5API	"	418,140	1203	35	103
7DMN	"	97,300	459	27	73
7ACB	"	77,390	315	28	81
3DXC	"	29,610	248	21	42
5CMP	"	5,529	97	17	40
5AD	14	300,898	956	33	109
5EAC	"	196,224	523	36	110
7CSN	"	146,640	701	39	102
5GA	"	1,380	70	13	10
5BLT	"	1,742	61	5	21
4CMG	7	61,473	363	23	70
6BLA	7	57,661	352	28	81
Switzerland					
ADD	A	749,450	871	90	235
AKJ	"	541,450	864	76	169
AEB	"	140,890	394	49	97
UB	"	89,900	251	55	100
IX	28	3,565	48	13	18
ZY	21	306,432	1001	32	82
DX	"	18,165	82	28	77
Wales					
NWV	A	721,191	1203	65	172
SFC	28	94,527	406	26	55
Yugoslavia					
NPZ	A	65,340	360	33	99
NFJ	"	40,425	293	41	105
TXT	21	31,104	243	20	52
NAQ	"	1,625	31	9	16
U.S.S.R.					
Estonia					
C	A	5,005	72	14	41
Z	"	3,410	47	20	35
V	28	1,296	27	8	10
R	14	609,440	1447	39	121
W	3.8	600	28	4	16
European					
T	A	690,636	1020	85	183
H	"	215,220	587	59	145
G	"	168,950	487	48	107
O	"	147,552	403	51	108
F	"	132,460	337	57	133
V	"	95,304	378	40	92
	"	70,819	211	51	100
M	"	16,351	91	31	52
E	"	8,880	73	19	29
V	28	158,928	818	28	60
E	28	154,464	676	28	68
M	"	70,488	372	25	63
A	"	51,060	319	29	63
	"	41,480	257	26	59
	"	35,475	328	15	40
	"	23,104	202	18	46
R	"	14,718	215	12	21
T	"	912	22	9	15
	21	105,798	595	23	54
	"	65,324	387	27	60
	"	10,783	145	12	29
	14	163,047	555	39	100
	"	73,440	439	25	60
	"	58,312	410	22	52
	"	9,796	105	18	44
	"	3,913	59	9	34
A	"	1,488	54	6	18
Karelia					
	14	7,452	125	13	34
Latvia					
	A	583,786	1099	85	237
E	"	1,353	41	9	24
	"	360	20	5	13
	14	84,174	608	25	64
Lithuania					
	28	139,840	474	31	84
	"	944	21	8	8
	14	29,580	331	17	51
	3.8	7,600	190	7	31
Moldavia					
	28	34,587	191	23	59
	14	22,949	320	14	39
Ukraine					
	1,494	654	1487	118	281
	"	490,446	847	87	197
	"	98,745	386	42	103
	28	58,926	420	25	44
	"	18,370	220	17	38
	21	53,845	356	22	67
	"	4,664	58	13	31
	14	8,140	62	21	35
White Russia					
	A	14,013	111	24	57
	28	10,434	96	17	30
	14	7,744	156	8	36
	"	3,904	104	8	24

OCEANIA

Australia

VK2AND	28	42,435	329	21	24
VK2APK	14	320,069	753	37	112
VK3QV	28	27,554	205	20	26
VK3SM	21	864	25	6	6
VK3ARX	14	42,588	179	24	60
VK3KS	"	3,520	74	9	7
VK3XB	7	8,416	89	15	17
VK4FH	A	132,495	384	52	69
VK4CK	"	74,715	295	38	47
VK4SS	28	8,556	64	21	25
VK4SD	14	26,316	88	30	72
VK4UC	"	24,210	102	33	57
VK4DO	"	21,900	103	25	50
VK5LC	28	28,300	120	22	38
VK6RU	A	1,491,644	1543	113	221
VK6XX	28	311,163	1119	27	76

Christmas Is.

VK9XI	A	21,386	198	16	21
VK9DR	"	40	5	5	5

Guam

K1FNA/KG6	21	195,120	837	26	56

Hawaii

KH6GLU	A	1,409,921	2038	89	144
KH6GPM	"	611,100	1651	57	69
KH6GPQ	28	378,320	1695	30	50
KH6BZF	21	290,628	1382	27	42

New Guinea

VK9KS	14	36,432	155	31	61

New Zealand

ZL1HW	A	450	934	70	129
ZL3IS	28	188,175	833	28	47
ZL3AB	"	36,630	374	14	19
ZL4BO	14	303,548	741	36	112
ZL3RT	"	8,892	54	20	37
ZL3RJ	"	2,125	35	13	12
ZL1AGO	7	13,896	134	17	19

Philippines

DU1UP	A	2,068,843	2107	114	223
(operator WB6KRW)					
DU1FH	14	130,077	473	34	63

SOUTH AMERICA

Argentina

LU2FAO	A	247,010	520	62	108
LU8DKA	28	140,450	898	29	77
LU4DMG	14	3,160	32	17	23

Brazil

PY7ACQ	A	1,100,575	1270	94	237
PY1NBF	A	950,208	1140	94	200
PY2EAD	"	125,100	311	51	88
PY2GE	"	65,600	154	57	103
PY2AQQ	28	137,400	470	30	70
PY7VNY	"	1,656	26	10	13
PY5EG	21	313,208	890	33	86
PY2PC	"	273,429	764	34	89
PY2CYK	"	255,960	720	36	84
PY3APH	"	106,314	376	29	65
PY2YC	"	17,655	123	23	32
PY3BAD	14	148,350	417	33	96

Chile

CE30E	21	117,432			

Colombia

HK3CF	3.8	7,125	129	8	11

Ecuador

HC1EPN	21	51,911	293	18	43

Neth. Antilles

PJ2VD	14	23,240	118	19	51

Paraguay

ZP3AL	A	21,894	94	37	52

Peru

OA1A	21	6,260	108	10	10

Suriname

PZ1BI	A	256,880	686	50	80

Trinidad

9Y4KR	7	11,931	102	10	31

Uraguay

CX2CN	A	217,092	479	58	100
CX3GS	28	52,520	346	18	34
CX2CO	21	805,090	1912	37	106
CX1JM	"	94,835	490	24	41
CX8BE	14	159,695	600	30	65
CX9CO	"	84,782	241	35	94

Venezuela

4M7AV	A	234,243	528	56	97
YV5JH	"	66,120	288	50	95
YV1LA	28	664,560	1898	33	87
YV5BPG	"	1,357	21	10	13
YV1WX	21	520,030	1618	32	83
YV5ANF	14	754,075	1470	37	138
K4PHY/YV5	"	348,836	818	35	113
4M4AJ	"	333,750	755	35	115
YV1SA	"	226,088	680	29	89
YV4WT	"	17,111	105	23	48
YV4UA	7	97,605	414	20	61
YV5BBU	"	24,950	167	13	37
YV5BPJ	3.8	19,485	150	14	31

MULTI-OPERATOR

Single Transmitter

North America

U.S.A.

W2CP/2	1,082,496	986	105	279	
W2FZJ	532,480	595	98	222	
W3YLJ	431,766	550	86	203	
WA2FQG	305,760	502	55	155	
WA2IZS	304,236	442	73	170	
K3JYZ	18,018	86	27	50	
WA3JKO	6,678	45	20	33	
K4WJT	585,120	589	107	238	
WA4QPL	133,551	297	58	113	
WA5VPZ	406,809	575	79	168	
W5WMU	318,240	518	81	153	
K5FIQ	48,241	325	47	82	
W6NJU	824,895	861	111	234	
W6HVN	488,334	606	102	192	
K6AN	441,592	567	106	183	
K6CQF	432,432	531	111	186	
WB6RZH	419,862	577	92	162	
W6DOD	301,077	456	95	148	
K6SSJ	267,520	377	92	164	
K6AR	243,452	366	88	154	
WA6GLD	230,076	361	88	143	
W6HPG	195,930	348	82	128	
W6JKJ	158,015	271	89	132	
WA6ZZK	152,366	388	38	104	
W7CRT	380,475	502	97	170	
K8UDJ	667,260	707	107	230	
WA8GKW	206,652	363	57	147	
W9LKJ	963,549	883	117	264	
W9ARV	579,480	639	107	223	
WA9JYR	472,295	585	97	198	
K9PPJ	389,301	531	80	171	
WA9UMU	279,207	406	77	166	
WA9TMK	276,606	388	87	167	
K9NBH	57,236	255	26	56	
WØHP	602,718	675	102	221	
WAØCJU	370,080	529	87	170	
WAØNLP	200,431	347	70	139	
WØFLN	181,792	347	56	128	
WØASU	147,569	349	60	113	
KØBXI	128,803	307	55	96	
WØIV	108,711	270	51	90	
WAØSVS	36,005	146	39	56	
WAØUFS	35,741	136	42	61	

Alaska

KL7JDO	431,100	1323	65	85	

Bahamas

VP7NA	1,374,756	2206	88	188	

Canada

VE1DH/1	894,495	1658	71	174	
VE2BV	312,570	497	62	168	
VE4AA	302,446	663	57	137	
VE5AAA	335,350	772	69	121	
VE6ADX	970,240	1586	80	176	
VE6AAV	110,331	394	43	74	
VE6AOW	64,500	608	18	32	
VE6AKV/6	48,510	197	39	59	
VE7LB	391,310	1529	30	79	

Saint Martin

FG7TI/FS7	1,278,244	1970	84	194	

AFRICA

Angola

CR6CA	2,481,248	2371	99	272	

Ethiopia

ET3USA	1,719,669	1661	100	257	

Mauritius

VQ8CI	9,462	60	23	34	

South Africa

ZS5OA	420,522	668	74	144	

ASIA

Cyprus

ZC4MO	1,047,100	1264	80	203	

Hong Kong

VS6DR	1,055,996	1781	94	180	

Korea

HL9US	568,928	1254	68	116	

Japan

JA6YCU	809,862	1115	95	163	
JA1YFL	300,510	650	49	113	
JA1YNX	85,072	294	46	58	
JA3YBF	58,680	190	47	73	
JA1YJR	12,780	73	33	38	
JA7YFY	11,799	80	26	31	
KA9MF	881,925	1891	61	104	

U.S.S.R.

Asiatic SSR

UA9AN	2,692,440	2073	126	360	
UA9KFS	322,560	540	58	122	
UA9KQA	147,840	328	47	121	
UW9KDL	11,628	85	15	36	
UA9KPW	6,290	78	16	21	

EUROPE

Andorra

PX1BW	358,910	1018	54	136	

Czechoslavakia

OM5UKV	13,065	119	23	44	
OK3KGI	8,820	128	14	35	

Denmark

OZ8EV	116,667	348	50	99	

England

G3KDB	1,649,578	1733	97	257	
G5YC	1,255,419	1496	82	215	
G3WYX	919,240	1313	79	189	
G8FC	467,798	1146	38	113	
G3VUM	223,880	514	63	169	

The HS1MD multi-multi operating position. L. to R.—Bob HS1BD, Doug HS1MD, Frank HS1HI and Fred HS3AL. (Photo by SP/4 J. W. Hawkins, Jr.

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G3KMI	176,633	588	48	125
G3EBH	138,425	392	49	126
Finland				
OH1VR	**1,333,745**	**1530**	**94**	**277**
OH3AG	6,716	89	14	32
Germany				
DLØWR	**3,048,903**	**2556**	**115**	**314**
DLØWW	2,635,133	2132	120	341
DJ5BV	2,301,693	1952	121	332
DJØJX	989,820	1188	101	251
DL6UN	891,940	1143	80	197
DL3OJ	886,770	1111	88	207
DL4RW	444,693	795	63	164
DLØKL	409,590	738	75	147
DK2OG	333,450	663	71	154
DL8CM	256,300	507	69	151
DL2ZN	250,541	496	66	133
DL8AM	178,476	417	60	154
DLØAA	37,169	185	34	75
Hungary				
HA9KOL	**64.768**	**479**	**24**	**68**
Italy				
I1LCK	**3,046.160**	**2755**	**115**	**289**
I1DFE	108,692	376	37	79
Luxembourg				
DL8ML/LX	**1,426,083**	**1451**	**100**	**218**
K1DWQ/LX	636,104	1124	81	215
Netherlands				
PAØIRC	**217,689**	**559**	**55**	**94**
PI1PT	117,820	361	51	125
Norway				
LA1K	**2,484.550**	**2442**	**114**	**311**
LA1H	472,839	830	78	199
LA3T	110,262	434	45	93
Sweden				
SK6AB	**2,831,328**	**2510**	**113**	**319**
SL3ZV	1,228,444	1597	86	206
SK6AW	534,848	788	83	191
SM5AZU	394,112	671	69	198
SKØBW	27,066	251	19	20
Yugoslavia				
YU3TBM	**324 684**	**713**	**72**	**189**
YU1BCD	258,852	697	48	111
European SSR				
UA3KBO	**2,140.354**	**2056**	**121**	**325**
UA3KND	424,800	771	87	209
UA4KED	44,940	237	33	74
UA4KCE	1,890	56	6	24
Kaliningrad				
UA2KAW	**993,995**	**1460**	**93**	**212**
UA2KBD	449,696	1070	58	150
Latvia				
UQ2KAA	**662,220**	**1222**	**69**	**196**
UQ2KEM	15,730	257	15	40
Lithuania				
UP2A	**2,524.424**	**2134**	**130**	**358**
UP2KAB	194,944	717	45	131
Ukraine				
UT5KTH	**643.801**	**1409**	**69**	**154**
UB5KAW	473,888	958	75	176
UB5KAS	61,777	194	48	115
UT5KWB	56,860	331	25	51
UB5KKO	5,565	74	15	38

OCEANIA

Hawaii

KH6UL	**329,005**	**822**	**58**	**87**

M.O. S. T. Station Operators

CR6CA & CR6BX, CR6DB, CR6GO, CR6IK. **CX3BH** & CX1BBV, CX4CR. **ET3USA:** K7ZBN W4DIW, W4EJP, W4EJQ, W4SYX, W5QHD, WA0TIX. **G3EBH** & G3NIC, G3TGK. **G3KDB** & G3LNS, G3NLY. **DJ5BV** & DJ3KR. **DJØJX** & DJ7IK. **DK2OG** & DL1HC. **DL2ZN:** DL5XC, DL5XD, DL5ZB. **DL3OJ** & DJ5JK. **DL4RW** & DL4FB. **DL6UN** & DC4AD, DJ3OI, DJ8EQ, DJ9TJ, DK1LC, DK2PB. **DL8AM** & DJ2XP. **DL8CM** & DL8CH. DL8ML/LX & DJ2BW, DL1KS, DL9OH. **DLØAA:** DJ8UB, DK1UO, DK2GH, DL3BK. **DLØKL:** Club. **DLØWR:** DJ4AX, DJ8SW, DJ9YI. **DLØWW:** DL2LW, DL2UU, DL3ZA, DL6NK, DL8XI, DJ3GR, DJ3OS, DJ3YV, DJ4OO. **FG7TI/FS7:** PJ2CB, PJ2MI, VE3EUU, VE6MT. **G3KMI:** G3TSM, G3UPK, G3VRW, G3WHJ, G3WNU, G3WXC, G3WZH, G3XBX, G3XJM. **G3VUM:** G3UJI, G3VDB, G3VNR, G3WZM, G3XIR, G8AZP. **G3WYX** & G3HTA, G3RUV, G3RUX, G3TUW. **G5YC:** Club. **G8FC:** G3GNS, G3JUT, G3SVG, G3XIN. **HA9KOL:** Club. **HC1TH** & HC1MF. **HL9US:** K4BAI, WA3EHT, GA9ZMT, WB6POH. **I1DFE:** K7USC, K7YUC, WB6BUR. **I1LCK** & I1AUM, I1BER, I1GAD, I1TAE.

JA1YFL: JA2LHV, JA6CZF, JA0CAG, JH1CRF. **JA1YNX:** Club.

SOUTH AMERICA

Antarctica

KC4USM	**358,512**	**1067**	**47**	**65**
Brazil				
PY3BXW	**1,105,612**	**1442**	**85**	**174**
PY3OJ	52,100	201	44	56
Ecuador				
HC1TH	**2,324,432**	**2791**	**89**	**192**
Uraguay				
CX3BH	**1,673,612**	**2018**	**100**	**184**

MULTI-OPERATOR

Multi-Transmitter

North America

U.S.A.

W3MSK	**5,515,701**	**3094**	**159**	**470**
W4ETO	**3,459,249**	**2229**	**146**	**403**
W3GM	2,137,135	1678	124	331
W7SFA	**1,460,256**	**1396**	**113**	**258**
K4CG	1,205,964	1030	116	301
W3BWZ	723,765	783	100	239
K3HTZ	711,205	721	102	233
W8NGO	**605,220**	**642**	**98**	**232**
WB6GFJ	**535,788**	**667**	**102**	**195**
W3NX	400,096	509	84	193
WB6YPX	247,544	451	75	119
K9YHB	**229,840**	**379**	**73**	**148**
K9KYF	215,907	336	79	158
W2UW	**107,310**	**255**	**46**	**96**
Cayman Is.				
ZF1EP	**3,152,214**	**4309**	**103**	**229**
Puerto Rico				
WA4MMO/KP4	**467,704**	**1318**	**55**	**108**
Sint Maarten Is.				
PJØMM	**7,037,658**	**6406**	**134**	**343**

AFRICA

ZS5JY	**3,458,007**	**2886**	**123**	**296**

ASIA

HS1MD	**851,480**	**1298**	**110**	**210**
KA2NY	**620,268**	**972**	**78**	**144**

EUROPE

OH2AM	**10.074,120**	**5882**	**159**	**511**
OH5SM	9,510,588	5956	152	490
OH1AA	4,346,580	3564	130	394
UIA	**3,312,965**	**3770**	**106**	**291**
UR2A	**3,041,100**	**3167**	**112**	**324**
UV4H	**859,144**	**1318**	**76**	**210**
DLØEL	**831,760**	**1183**	**82**	**214**
OH6AA	397,000	997	72	178
DJ10J	266,000	559	75	191
G3CXX	**259,808**	**756**	**51**	**138**
OH5AA	118,728	422	54	140

Our thanks to the following stations who submitted their logs for checking purposes: CX8AAL, DL1RO, EI8BB, F5RV/FC, G3MWZ, HA5FA, HR2AFK, IS1PZR, I1-12843, KG4DH, LA6XI/m, PA0SCH, SM2COR, SM5UH, SM7TQ, SP8-1079, TF3EA, UA3ARG, UW3IN, UA3KOB, VK9TB, VP1TC, VP2AW, VP2KF, VP5-AB, W5MSG, ZS2DC, ZS5D, ZS6BFC, 5W1AS, 9Y4KK, 9Y4LO.

JA3YBF: JA3EBT, JA3KGF, JA3OLO. **JA6YCU:** JA6 JA6ECF, JA6ENR, JA6GLN. **J97YFY:** Club. **K3JYZ** & K3 W3KMV. **K4WJT** & K6QPH. **K5FIQ:** K4FTY, WA5QZG. & K6AUC, W6BH, WA6UFW. **K6AR** & K6CU. **K6C** VE3DXV, W6CUF. **K6SSJ** & W6VUN. **K8UDJ** & K1 WA8LWK. **K9NBH:** K1PLA, K1SMT, WA4SVO. **K9P** WA9UFV. **KØBXI** & KØHGW, KØWAO, KØAGM, KØ WNØTSI. **KA9MF:** K1DGR, K9PVD, WA4FLR, WA WA7KPN, WB4KWB, WB8AZF. **KC4USM:** WA2GHN, SZH. **KH6UL:** K7GZT, WA7KVX, WB4JYO. **K1DWQ/** W8IMZ. **KL7JDO** & KL7GRI. **LA1H:** LA8UL, LA9OI. LA1EE, LA1HL, LA2QK, LA3JJ, LA3LJ, LA7XK. **LA3T:** L LA5II. **OH1VR** & OH3SM, OH3YI. **OH3AG:** Club. **OK** Club. **OM5UKV:** OK1AMC, OK1YD, OK8AAE. **OZ8** OZ9JX.

PAØIRC: Club. **PI1PT:** Club. **PX1BW:** KØBWN, WA **PY3BXW** & PY3AHJ. **PY3OJ** & PY3AGT, PY3BAR. **S** SM2BJI, SM6CAS, SM6DXK, SM6VR. **SK6AW:** SM SM6CRC, SM6CVE, SM6DTG, SM6ESH, SM6EJI, SM **SKØBW:** JA1KFQ, SM5FC, SMØCXQ, SMØDZL, SM **SL3ZV:** SM3DGU, SM3DYU. **SM5AZU** & SMØATN, SM **UA2KAW:** Club. **UA2KBD:** UA2WJ, UA-212513, UA2- UA2WO. **UA3KBO:** Walt, Yuri. **UA3KND:** Rimas, Slav **UA4KCE:** Club. **UA4KED:** Slav, Alex, Walt. **UA9** UA6ACA, UA9AAA, UA9BE, UV9AB, UW9AF, U **UA9KDL:** Club. **UA9KFS:** UA9FU, Yuri. **UA9KPW:** **UA9KQA:** UA9QD, UA9QAH, UA9RQ, UA9RR. **UB** Club. **UB5KAW:** Club. **UB5KKO:** Club. **UP2A:** UP2CY KNP, UP2NK, UP2NV, UP2ON, UP200. **UP2KAB:** **UQ2KAA:** UQ2AO, UQ2AQ, UQ2PN, UQ2-0371, UQ **UQ2KEM:** Club. **UT5KTH:** Alex, Stan, Vlad, Yuri. **UT** Club.

VE1DH/1 & VE1ASJ. **VE2BV** & VE3BEJ. **VE4AA:** VE4AS, VE4BJ, VE4CJ, VE4FU, VE4IM, VE4MP, VE4SA, VE4SD, VE4SK, VE4TJ, VE4ZX. **VE5AAA:** VE5UU, VE5XJ. **VE6AAV** & VE6ABP. **VE6ADX** & V VE6HN, VE6SB, VE6SB, VE6VD, VE6XJ. **VE6ARK/6** AUT, VE6AWF, VE6QK. **VE6AOW** & VE6AED. **VE** VE7BDJ. **VP7NA:** K4IIF, K4SHB. **VQ8CI** & VQ8BZ, VQ8CJ. **VS6DR** & JA3AER, VS6AA, VS6AL, VS6DO,

W2CP/2 & W2PCJ, WB2CKS. **W2FZJ** & G3NKR, W2CCL, WA2ODQ, WB2PNN. **W3YLJ** & WA3GJU. **W** & K5ARH, W5NQR, WA5NDW, WA5OIH, WA5QQB. & W6KG. **W6HPG** & K6EBB, WB6UOM. **W6HVN** & W6GFS, WB6KBK. **W6JKJ** & K6YGS. **W6NPU** & **W7CRT** & K7PZC. **W9ARV** & K9VLE, W9GFF, W9JUV. & K9KDI, K9LTN. **WØASU** & WØKHZ. **WØFLN:** WØFB AML, WAØFVR, WAØKXZ. **WØHP** & WØBE, WØPAN. WAØRCH. **WA2FQG** & WA2HSX. **WA2IZS** & W2UI. **W** & WA3HGX. **WA4QPL:** K4PIA, WB4EOQ, WB4EQR. **W** **WA5VPZ** & W5CCP, WA5TSJ. **WA6GLD** & WB6FC **ZZK** & K6SEN, WB6NRO. **WA8GKW** & WA8OSE. **W** G3PAC, K9HMY. **WA9TMK** & WA9UVE. **WA9UMU** TBA. **WAØCJU:** KØUYN, WØBMT, WØISJ, WAØMV PMM. **WAØNLP:** K7BOY, KØVLC, WØGYH, WØOSB, WAØBHD, WAØPRP, WAØRFR, WAØRZD, WAØTSW. & WAØSSO. **WAØUFS** & WAØCPX. **WB6RZH** & W WB6VFJ. **YU1BCD:** YU1NOW, YU1QBC. **YU3TBM** & **ZC4MO:** Club. **ZS5OA** & ZS5OB.

M.O. M.T. Station Operators

DJ1OJ & DJ7RU, DJ901. **DLØEL:** DJ2EH, DK2EH, DL2ZX, DL8UI, DL9BL. **G3CXX:** G3XIK, G3XLX, GW3XST. **HS1MD** & HS1AF, HS1BD, HS1CB, HS1HI, HS1NE, HS3AC. **K3HTZ** & W3AZR. WØLZ K3WUW, K4POL, K4ZA, K9OPF, KL7EGA, W3JPT, WB4KYS. **K9YHB:** K9RHY, WA9EJD. **KA2NY:** K6 OCX. **OH1AA:** OH1NK, OH1NM, OH1SS, OH1SY, OH1YW, OH2KZ, OH3NB, OH8OA. **OH2AM:** OH2BBR, OH2BC, OH2BCZ, OH2BH, OH2BO, OH2KH, OH2QV, OH2SB. **OH5AA:** OH5QX, OH5UY OH5WA. **OH5SM** & OH2BCP, OH2BO, OH2MK, OH3PC, OH3QA, OH5NQ, OH5NW, OH5SE, OH5TM OH5UQ, OH5VY. **OH6AA:** OH6OP, OH6WG, OH6WI OH6YA, OH6YB, OH6YD, OH6ZH. **PJØMM:** K4MZU K9RHN, PJ2HI, W9POK, W9ZRX, W9ZTD. **U1A:** UA0CK, UW1BG, Alex, Val. **UR2A:** UR2AO, UR2AT, UR2CW, UR2DW, UR2DZ, UR2EK, UR2LO, UR2OP Jerry, Mati, Pater, Sarge. **UV4H:** UA4IJ, UA4IQ UA4KMW, UA4MBC, UA4MP, UW4IB, UA4-13321 WA2ADU, WA2DPC, WB2NJN, WB2RHJ. **W3BWZ** W4RHS. **W3GM** & K3GYS, W3ISE, W3KV, W3MQ, **W3MSK** & K1ANV, K3EST, K3NPV, W3AZD, W4MYA, WA3FUM, WA0GOI, WB2WMT. **W3NX** & **W4ETO** & W4FWG, W4LCP, W4OBK, W4TLN, W4YK W0AIH, WA4LUG, WA4PXP. **W7SFA** & W7LAV, W7PHO. **W8NGO** & K8LSG, K8YEI, W8CLR, W80 ODZ. **WA4MMO/KP4** & K5FKT. **WB6GFJ** & K4BVD W6PNV, W6WLO, W6ZKM. **WB6YPX:** W6DLE, W6D WRX, WB6YWT. **ZF1EP** & K4CAH, K4IA, WA4W & ZS5DC, ZS5IW, ZS5JM, ZS5QU, ZS5RS.

See page 110 for New Reader Ser

A PORTABLE DIPOLE

BY CORTLAND E. RICHMOND, SSg,* W1CEJ

HERE is a portable dipole that will operate on 40 through 10 meters. The entire antenna is shown in fig. 1A. It can be cut from 300 ohm line or 450 ohm open wire line. The overall length is cut for the 40 meter band and the starting length was 67 feet. As shown in fig. 1(B) the 40 meter length also functions for 15 meters as a 1½ wavelength antenna.

The 40 meter length also acts as a 20 meter antenna as well as a 15 meter antenna. This is accomplished by the sections marked 20 meter stubs in fig. 1(C). The stub length for 20 meters should be a quarter wavelength so the high impedance at the open end will effectively isolate the stub from the rest of the antenna. Each section of the 20 meter antenna is then made a quarter wavelength and we have a half wave 20 meter dipole.

The 10 meter antenna is straight forward. It is a half wavelength cut to the portion of 10 meters you prefer. If cut to 29.5 mc, from the formula L in feet $= 468/f$ mc, we get a total of 15.8 feet or 7.9 feet for each side.

Since the antenna is made of 300 ohm line its velocity factor must be taken into account. The effect of the velocity factor is to require the length of the stub to be shortened from the calculated length in order to resonate at the frequency desired. I allowed a 0.95 velocity factor for the material used. Check the velocity factor of the material you use.

Construction and Tuning

The construction of this antenna couldn't be simpler. Cut the full length of 67′ (or shorter if you wish to work up the band). Cut the forty meter section to exact length using either a grid dip oscillator or your transmitter and an s.w.r. bridge. Cut for the lowest s.w.r. at the desired frequency.

The 15 meter operating frequency is, of course, dependent upon the 40 meter length. If the 40 meter length is cut for 7.1, then 15 meter resonance will fall in around 21.3 which is good for s.s.b. and passable for c.w.

For 20 meters we simply calculate the length of the stub using the same formula, $468/f$ mc, but multiplying the result by 0.95, the velocity factor (or the velocity factor correct for your material). Do not completely cut away the material between the stub and the feed point as this will be the 10 meter dipole.

Calculate the length of the 10 meter dipole, measure it off and remove the wire between it and the stub so that the antenna appears as shown in fig. 1(A).

Feeding

Since the antenna is a balanced type and coax is unbalanced, a balun should be used. It will have to be an all band type if you can find one. If not, you can feed the antenna with coax as it works all right that way.

While this antenna is no replacement for a carefully tuned beam, it is certainly equal to any commercial trap dipole. Can any one modify it for 80 meter operation? Or 160? ■

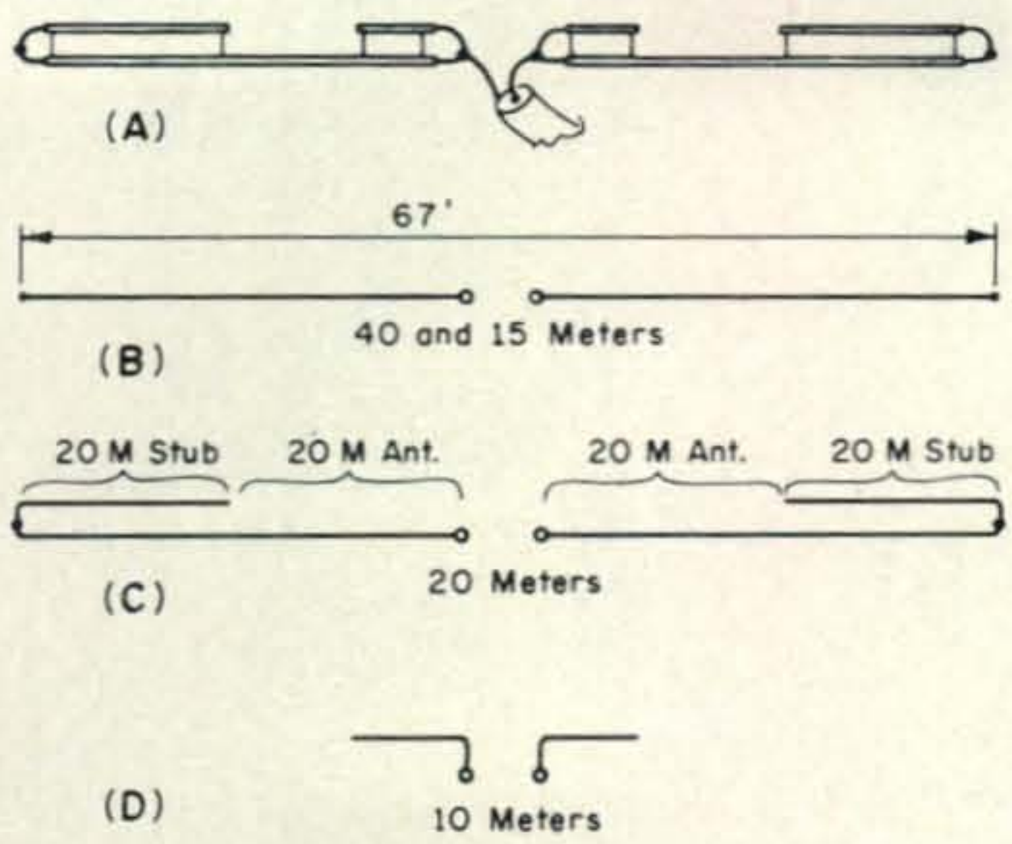

Fig. 1(A)—Portable dipole, made from 300 ohm line, operates on 40, 20, 15 and 10 meters. (B) Antenna section that resonates on 40 and 15 meters. (C) The 20 meter section uses the 40 meter length but it is effectively shortened by the $\lambda/4$ stubs on the ends. (D) The 10 meter section is conventional.

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Product Detector and A.G.C. for the Knight Kit R-100A Receiver

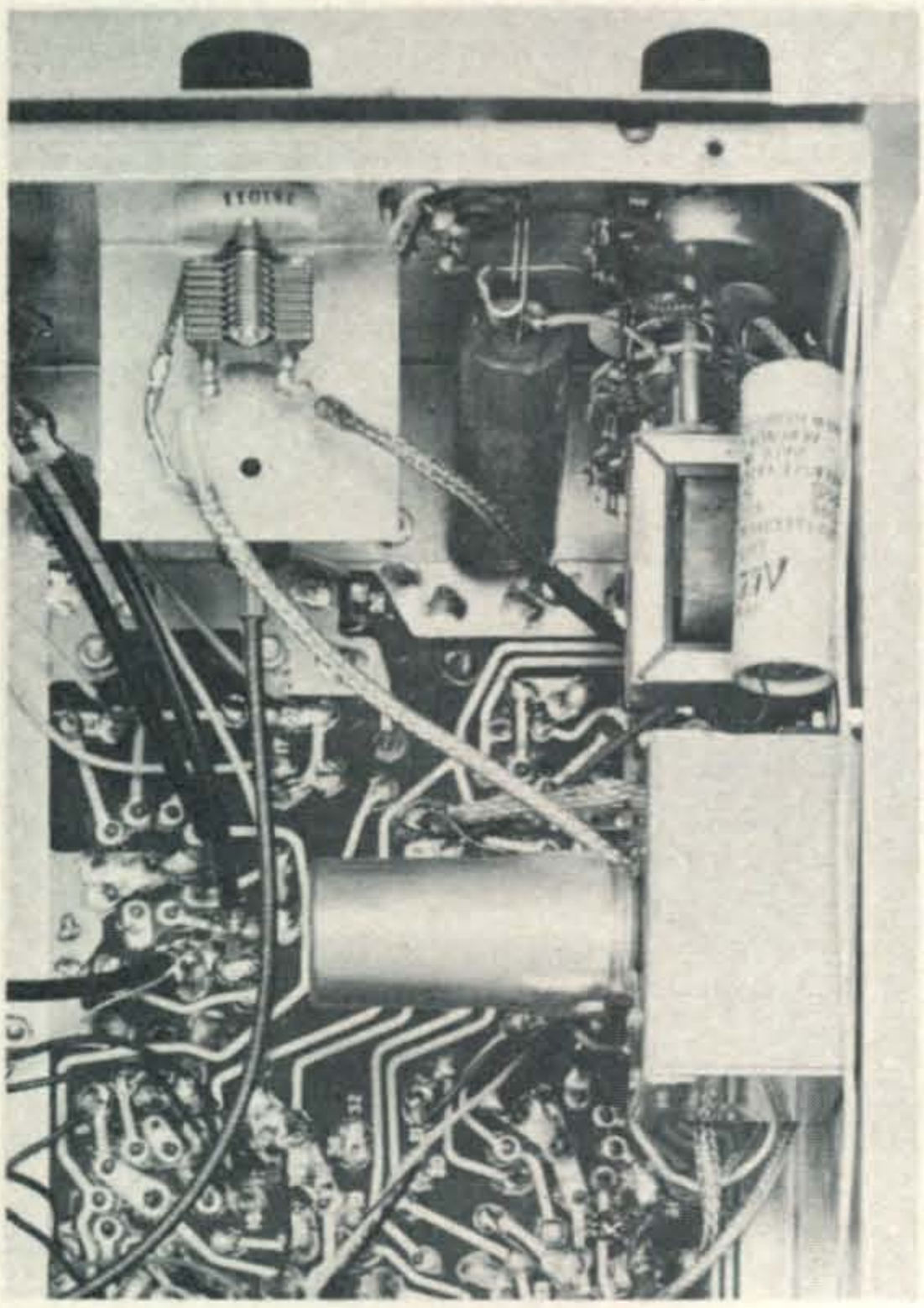
BY WILFRED M. SCHERER,* W2AEF

OPERATION of the Knight R-100A Amateur Communications Receiver with the b.f.o. turned on for c.w. or s.s.b. leaves much to be desired. During this mode of operation, the a.v.c. is automatically switched off, making it necessary to reduce the r.f. gain to prevent receiver overload and to obtain a high b.f.o.-to-signal ratio for handling strong c.w. signals or for properly demodulating s.s.b. signals.

Also, since a.v.c. is lost, you're either missing weak signals when the r.f. gain is down for strong signals, or your ears are blasted when a strong signal pops up at the time the r.f. gain is raised for weaker signals.

The modifications described herein allow full use of the a.v.c. with a slow release when the b.f.o. is on and also include a product detector for clean reception of both c.w. and s.s.b. signals.

*Technical Director, *CQ*.



View of the modification installation. The detector box is on the side of the chassis at the right.

Circuitry

The modified circuitry is shown at fig. 1. The r.f. signal from the i.f. amplifier is applied to the grid of the product detector V_{1B}. The b.f.o. signal is injected at the detector cathode through V_{1A} which functions as a cathode follower to provide a match between the b.f.o. and the detector cathode. The cathodes are d.c. coupled and have a common resistor. Components C_6 and R_6 make up a voltage dividing network to attenuate the input signal for the proper i.f. signal to b.f.o. signal ratio. Components C_4, C_5 and R filter out the 455 kc signal components from the a.f. output line. Components C_1 and R provide decoupling for preventing a.f. motor boating.

Selector S_1 switches the a.f.-amplifier input between the a.m. envelope detector and the product detector. It also provides the original function of cutting the a.m. a.n.l. in or out and retains the choice of a.v.c. or m.v.c. for a.m. In addition, it allows the a.v.c. to function in the b.f.o. position where C_7 is added to provide a slow release-time constant to minimize pumping effects and eliminate dynamic a.v.c. distortion.

Installation

The components within the dashed line are installed in a small aluminum box that is secured with two self-tapping screws on the inner side of one end of the chassis, near T_1 as shown in the photo.

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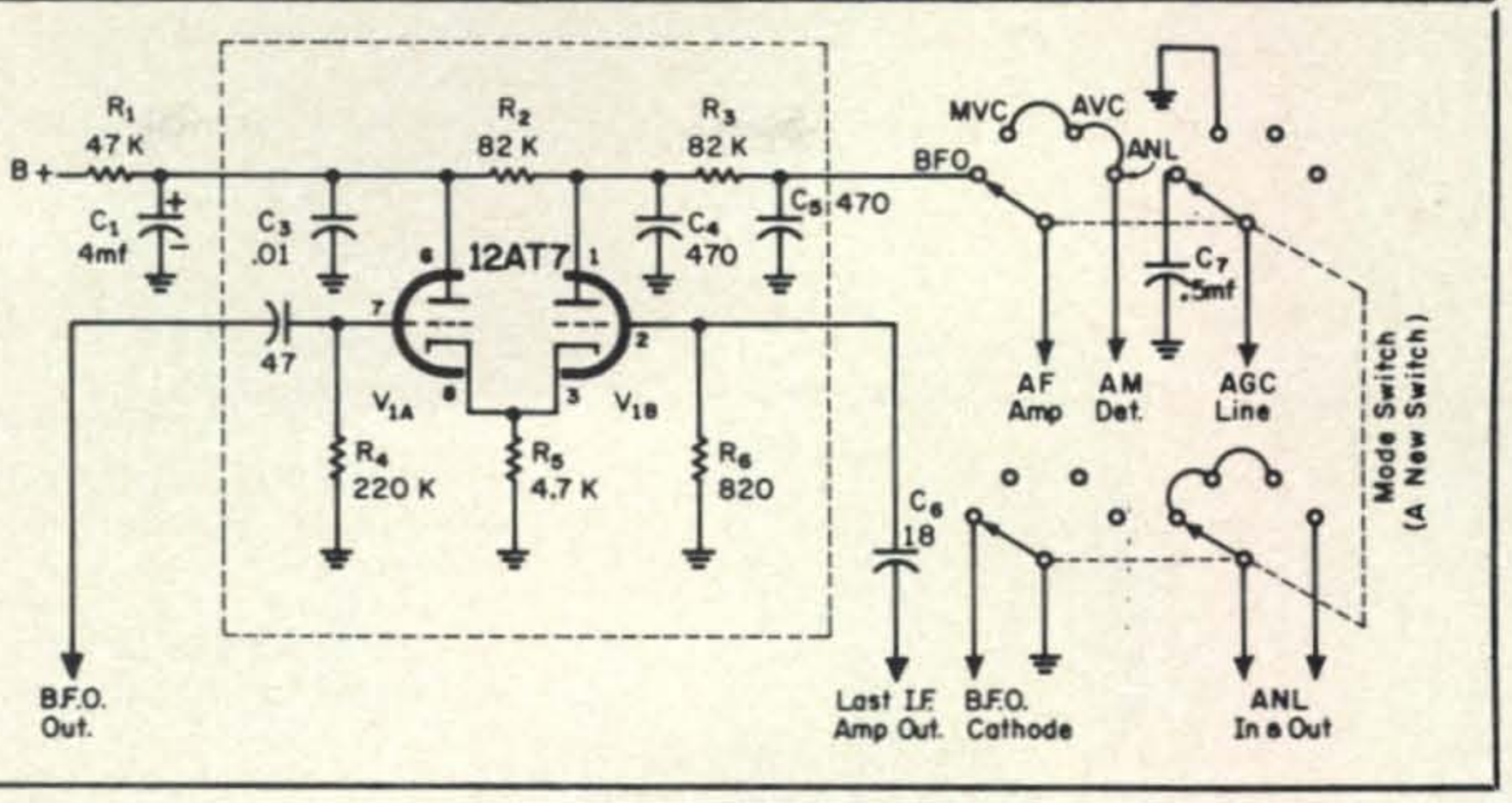

Fig. 1—Schematic diagram for product detector and revised a.v.c. setup used in the Knight Kit R-100A general coverage receiver. Dotted enclosure is a minibox.

The size of the illustrated box is 2¼" × 1½ × 1⅜" (LMB type M00), but there is adequate space for the next larger size box (LMB type 00Z or Bud type CU-3000A) which will provide a little more "elbow room" for installing the parts within it. A physical wiring diagram is shown in fig. 2.

The external connecting leads should temporarily be made about 8 inches long. They may be trimmed to correct length and connected to the outside points after the box is permanently mounted, but before doing so, proceed as follows:

1—Disconnect both ends of the shielded lead (including the shield) that runs between the b.f.o. tuning capacitor, C_{40}, and point 36 on the i.f.-circuit board.

2—Remove R_{32} from points 19 and 36 on the bottom of the i.f. board.

3—Disconnect all the leads from the mode switch, S_3 (BFO, MVC, *etc.*).

4—Take off the front panel of the set. This will require prior removal of the knobs and the S-meter.

5—Remove the mode switch, S_3.

6—The mode switch is to be replaced by a 4 pole, 5 position type (Centralab #1013) which should be wired as shown in fig. 3. Before installing this switch, go to the next steps.

7—Set up the switch stops so that they provide 5 positions when the switch is rotated clockwise.

8—Solder the indicated jumpers on the switch terminals 6-7, 16-17-18 and 13-21-22-23.

9—Disconnect the old-switch leads from points 12 and 29 on the i.f. board and solder the ends, that were formerly connected to the old switch, to terminals 12 and 1, respectively, on the new switch. This procedure is used to allow the soldering at these two switch terminals to be done before the switch is mounted, otherwise they would be difficult to reach.

10—In order to provide easy access for the under wiring to the new switch, set the receiver right-side-down on the bench with the bottom of the chassis facing upward. Disconnect the black lead of the output transformer, T_1, from the phone jack. Remove the mounting screws from the transformer and let it rest on the i.f. board.

11—Mount the switch oriented in relation to the A.F. GAIN, R_{44}, as indicated in fig. 3B.

12—Solder the leads from switch terminals 1 and 12 to points 29 and 27, respectively, as indicated.

13—Connect and solder switch terminal 7 to the ground connection on R_{44} as indicated in fig. 3A.

14—Solder C_{47} to switch terminal 19.

15—Mount the product detector box.

16—Trim to length as needed and solder the product-detector a.f. output lead to switch terminal 24. The shield of this lead should be connected and soldered to the ground foil at the edge of the i.f. board.

17—The old shielded leads from i.f. board points 30 & 31 should now be soldered to switch terminals 13 & 16 respectively.

18—Trim as needed and solder the 6.3 v. and ground leads from the detector box to the points on the i.f. board as indicated in fig. 4.

19—Cut each lead of an 18 mmf disc or ceramic capacitor (C_6) to 3/8" in length.

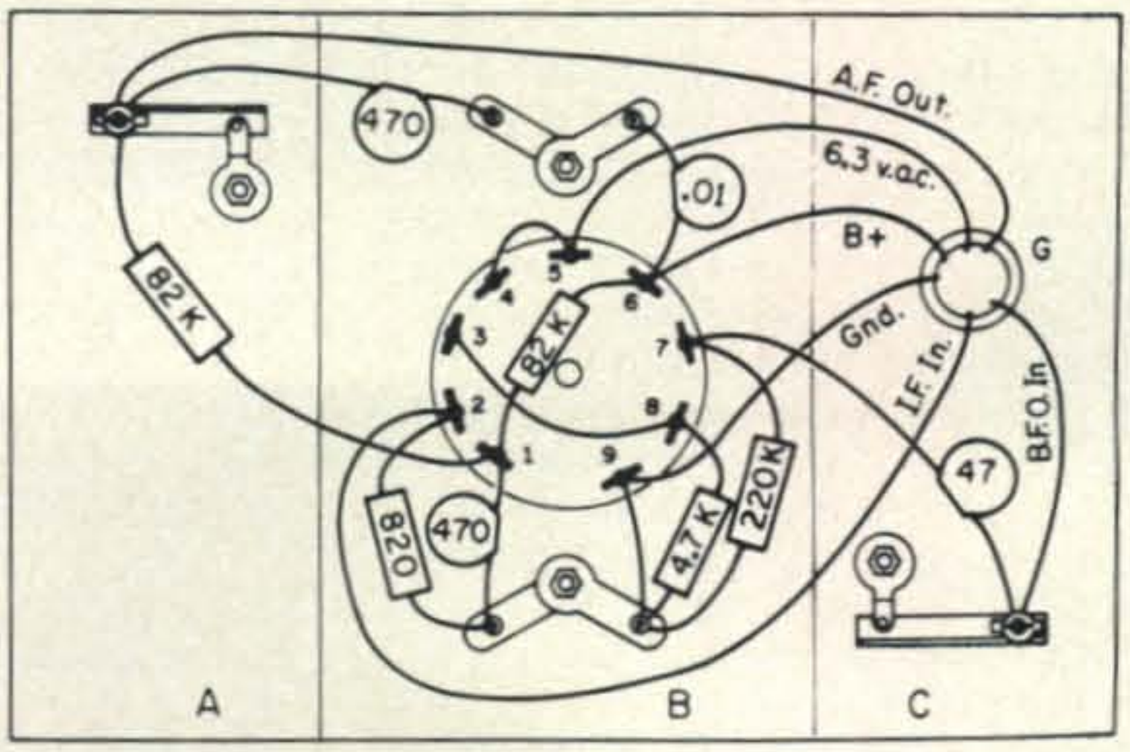

Fig. 2—Wiring layout within the product-detector box. Section B is the top of the box; sections A and C are the sides. The external leads pass through a 1/2" diameter hole with a grommet at G on section C which faces the chassis deck or i.f. board of the receiver. Shielded leads are used for the a.f. out, b.f.o. in and i.f. in. The shields are connected to ground externally.

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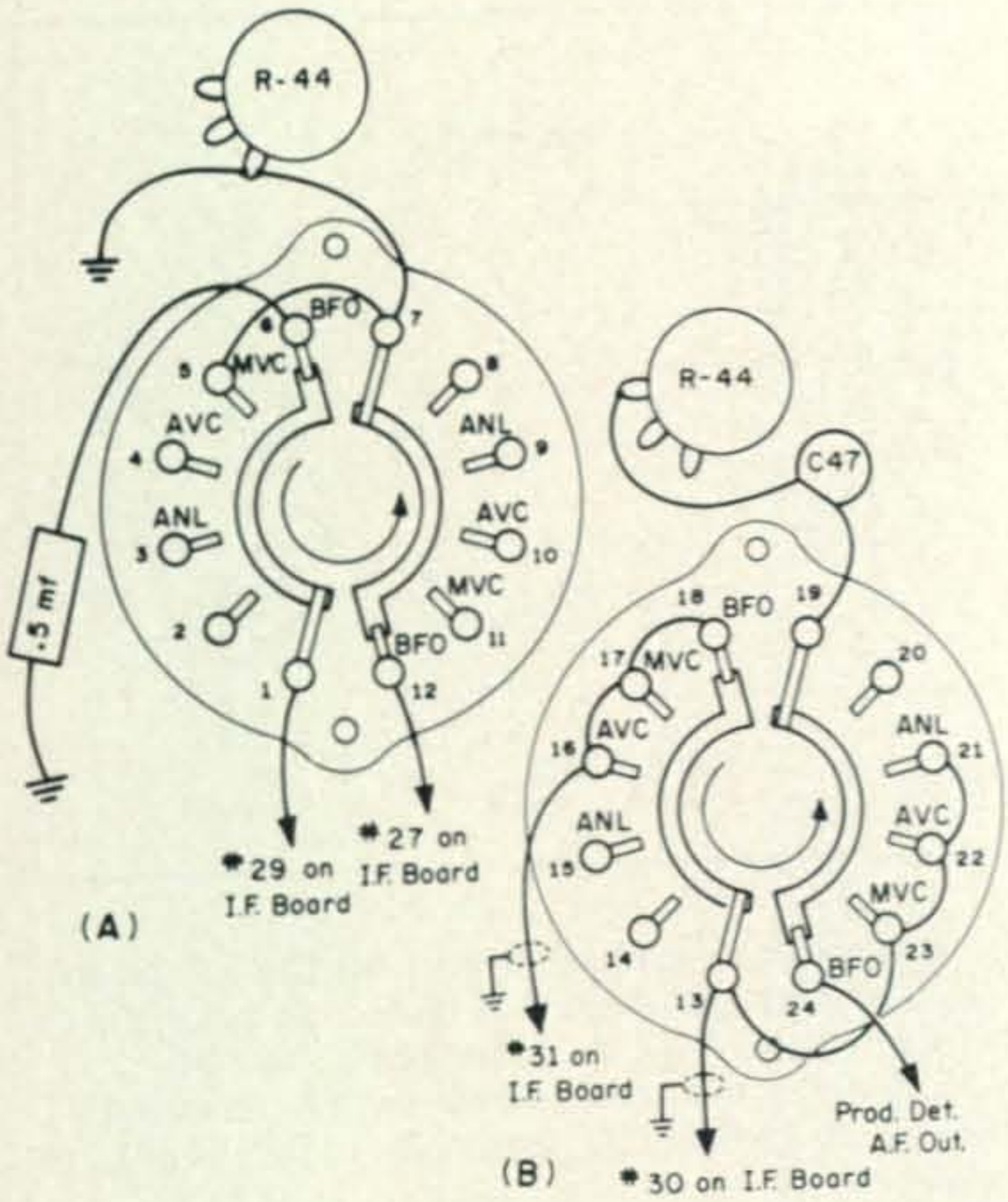

Fig. 3—Wiring arrangement at the new mode switch. Deck 1(A) is that nearer the receiver panel and at the front of the switch. Deck 2(B) is at the rear of the switch. The decks are viewed from the rear. See the text for the wiring procedure.

20—Solder one end of this capacitor to the circuit-board point as indicated in fig. 4.

21—Trim as needed and solder the i.f.-input lead, from the detector box, to the other end of the 18 mmf capacitor. Connect and solder the shield of this i.f. lead to the ground connection for the existing shielded lead connected to point 23.

22—Connect R_1 (47K-1/2 watt) between the terminals of a two-point tie strip.

23—Remount the a.f. transformer, T_1, with the above tie strip held by the transformer-mounting screw nearer the rear of the chassis. Be sure to reinstall the former ground lug and wire at this point. Also resolder the black lead of the transformer to the phone jack.

24—At the transformer screw nearer the front panel, install a ground lug.

25—Solder the negative end of C_1 (4 mf, 400 v.) to this ground lug. Solder the positive end of C_1 and the B-plus lead, from the detector box, to one end of R_1 on the tie strip.

26—Connect and solder a lead between the other end of R_1 and the i.f. board at the point shown at fig. 4.

27—Trim as needed and solder the inner conductor of the b.f.o. lead, from the detector box, to the stator terminal of the b.f.o. tuning capacitor, C_{40}. Connect and solder the shield of this lead to the rotor-or ground-tab on this capacitor.

28—Solder banded end of a 0.5 mf-200 v. (C_7) paper or molded capacitor to ground foil at edge of i.f. board. Solder other end of this capacitor to switch terminal 6.

29—Reinstall the front panel, the S-meter and the knobs.

30—Adjust the knob of the b.f.o.-tuning capacitor so that the indicating dot is at 9 o'clock when the capacitor plates are fully meshed.

31—Make sure there are no shorts between the circuit-board foils as a result of soldering or splattered solder. Loose pieces of solder may be shaken out with the set right-side-up.

Adjustment

32—Set the bandswitch to Band B and the main-tuning dial to 4 mc.

33—Set the mode switch at BFO.

34—Rotate the b.f.o.-tuning capacitor to where the indicator dot on the knob is at 12 o'clock or the center position.

35—Set the Q MULTIPLIER at OFF, the R.F. GAIN maximum clockwise and the A.F. GAIN about half-way on.

36—Turn on the receiver and adjust the core of L_{15} (b.f.o. inductor) for the lowest-pitch background noise. If the noise is insufficient, connect the antenna and tune the receiver to where there is no signal.

37—Peak the noise level by adjusting the *bottom* core of Z_3 (secondary of last i.f. transformer).

38—An inherent characteristic of this receiver is a certain amount of b.f.o.-signal leakage into the first i.f. amplifier, in which case it produces some a.v.c. voltage and causes the S-meter to read. To counteract this, the following step is necessary.

39—Disconnect the antenna. If the receiver is equipped with the S-meter, adjust the *bottom* core of Z_3 in either direction, until the meter reads S-1. If there is no meter, make this adjust-

[*Continued on page 99*]

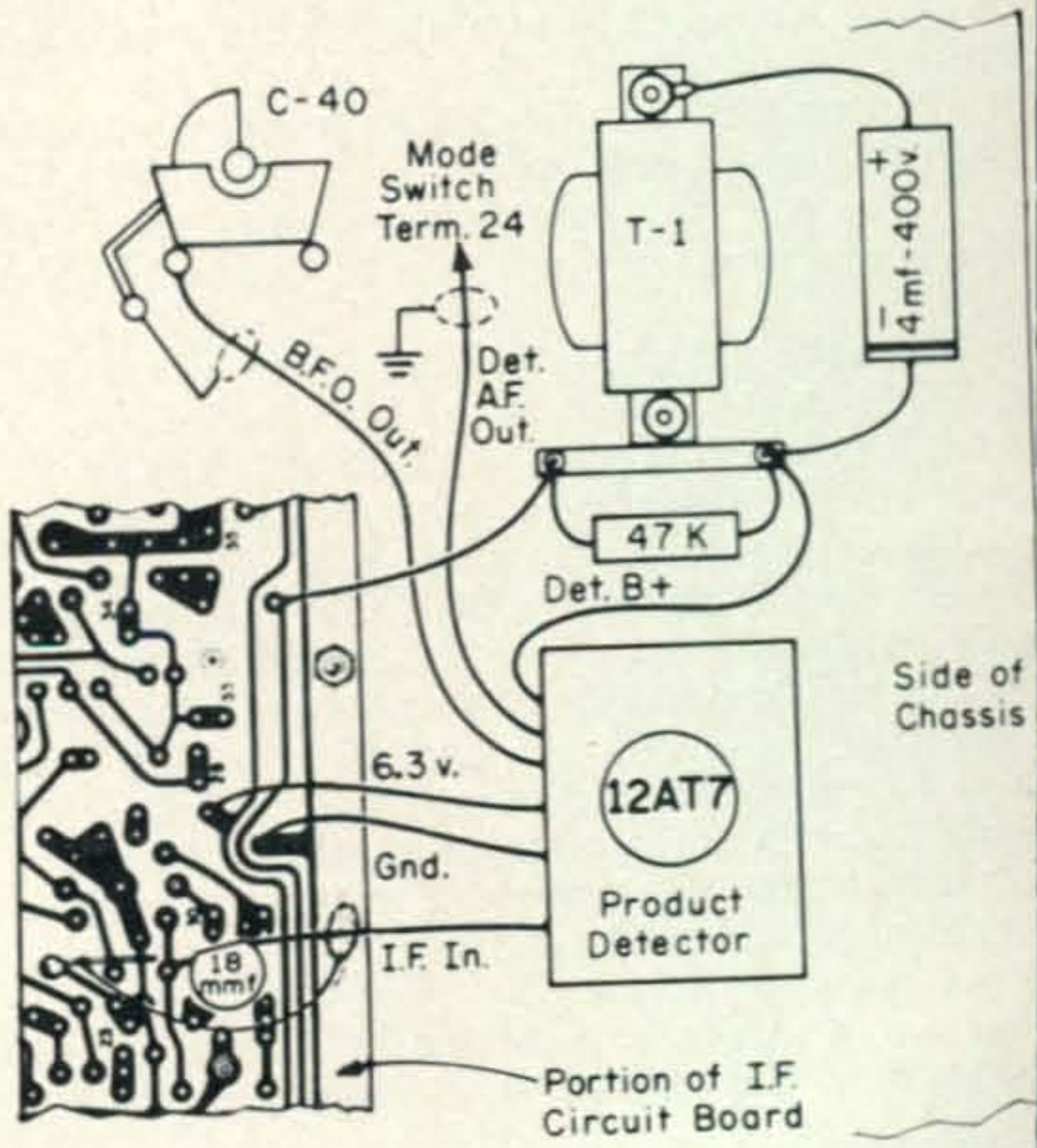

Fig. 4—Wiring diagram showing points for exte nal connections of leads from detector box. portion of the i.f. board is at the left. The dete tor box, T_1, etc., are on the side of the chas See text for details.

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CQ Reviews: The Allied Model A-2515 Receiver

BY WILFRED M. SCHERER,* W2AEF

THE Allied Model A-2515 Communications Receiver is an inexpensive solid-state job (made in Japan) that provides continuous coverage from 550 kc to 30 mc, plus 150-400 kc, with calibrated bandspread tuning for the 3.5-30 mc amateur bands for operation with a.m., c.w. or s.s.b.

As such, the A-2515 may serve not only for amateur-band use, particularly for the newcomer, but also for other purposes for which a general-coverage receiver may be desired, such as for reception of WWV signals, short-wave broadcasts, the 160-meter amateur band, press and weather reports for code practice, marine communications, aircraft beacons and weather reports, etc. In addition, the receiver operates from either a 117 v.a.c. or a 12 v.d.c. source, the latter permitting battery operation for field use and also making the set a suitable companion unit as a variable i.f. system for operation with solid-state v.h.f. converters.

*Technical Director, *CQ*.

Technical Details

The A-2515 is a single-conversion job with a 455 kc i.f. as indicated at the block diagram at fig. 1.

The basic lineup is similar to that of the usual receivers of this type, but instead of vacuum tubes, transistors are used, of which there are two f.e.t.'s, nine bipolar transistors, plus 14 diodes including one zener.

The two f.e.t.'s are used in the r.f. stage and the mixer where they provide excellent front-end characteristics. Although f.e.t.'s have been publicized as possessing superior signal-handling capabilities, this is the first piece of gear we've found where measure-

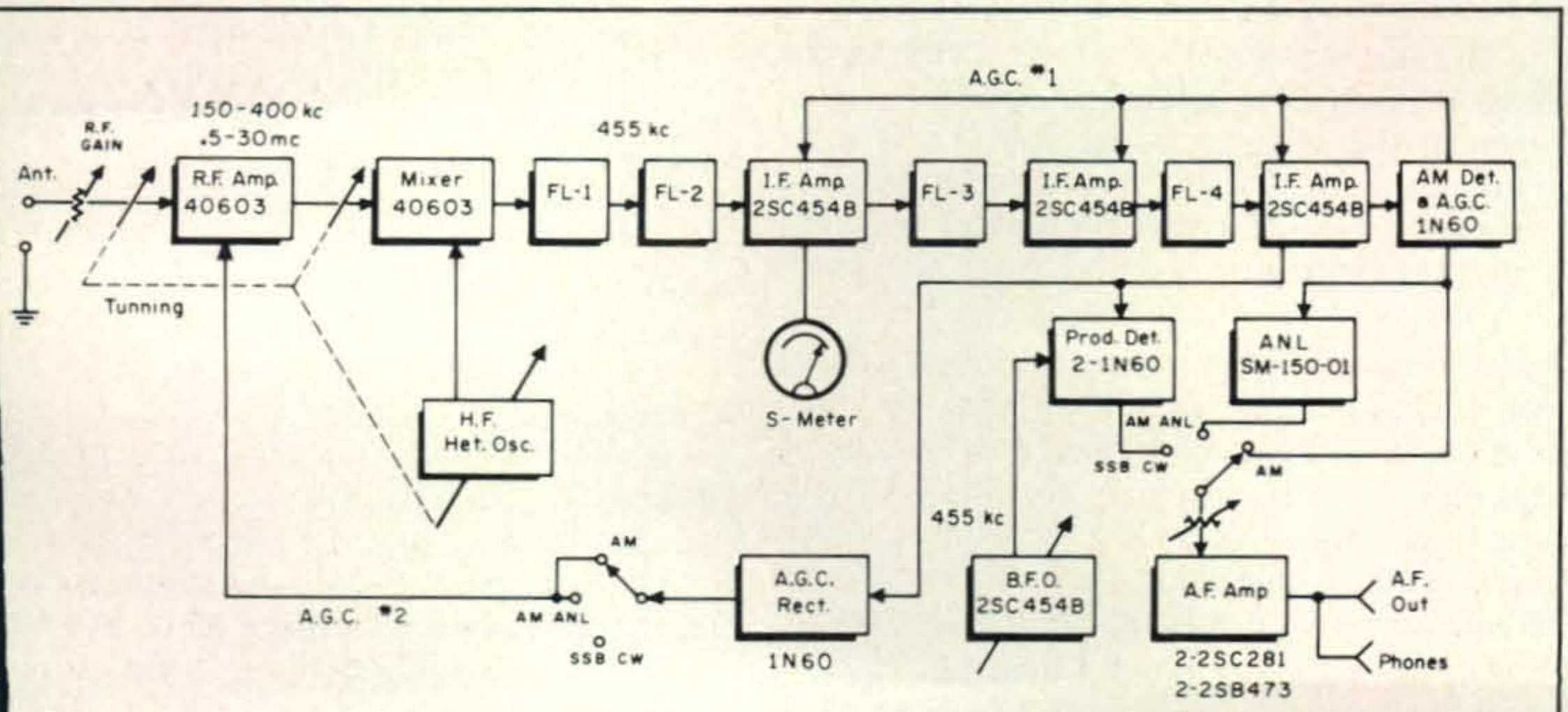

Fig. 1—Block diagram for the A-2515 Receiver. The 2S-type transistors are Japanese. The 40603's are RCA MOSFET's (Dev. No TA-7150).

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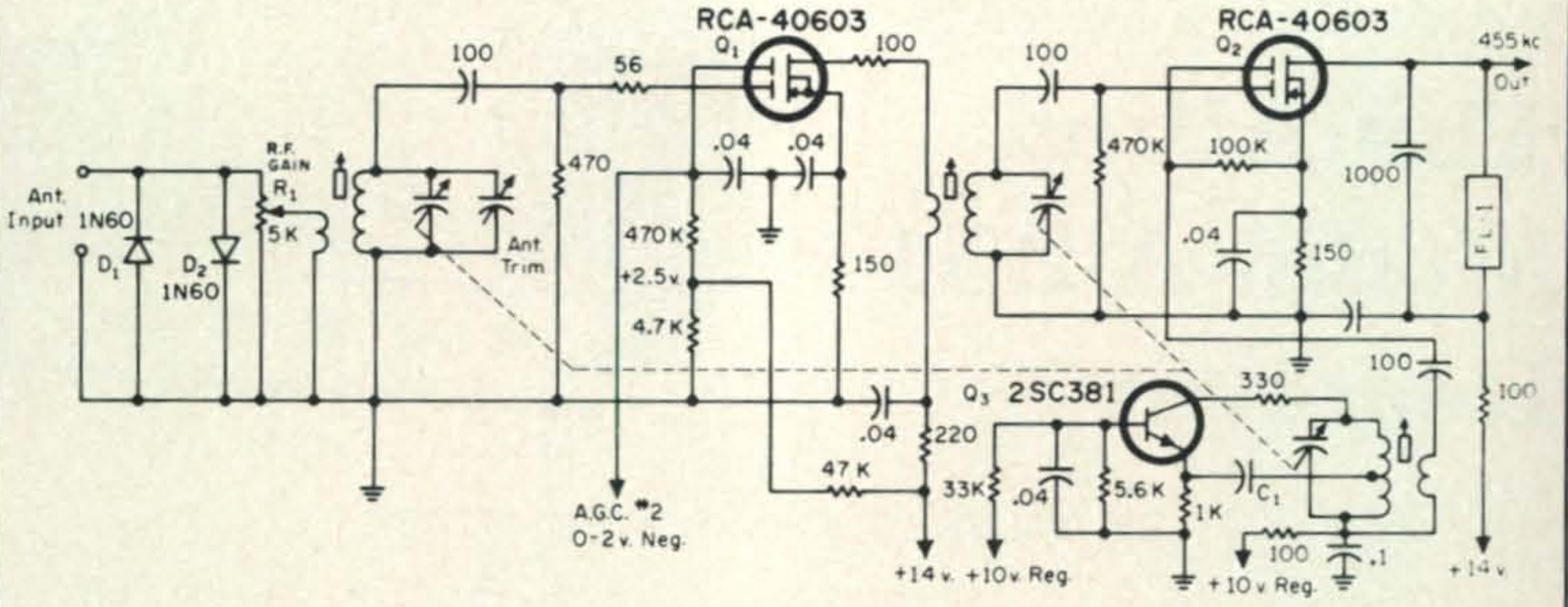

Fig. 2—Basic front-end circuitry for the A-2515. Not shown is that the r.f. and oscillator inductors are bandswitched. The a.g.c. voltage for Q_1 varies from zero with no signal to 2v. negative with maximum signal.

ments indicated the use of the f.e.t.'s in the front end to actually result in significantly better r.f.-intermodulation, cross modulation and overload characteristics than equipment using bipolar transistors. As a matter of fact, the performance in this respect was better than that of a number of vacuum-tube receivers.

The front-end circuitry is shown at fig. 2. The f.e.t.'s are dual gate types. Both the control gate and the drain for the r.f.-stage f.e.t. have circuits capacitively gang-tuned along with the h.f. heterodyning oscillator. An antenna trimmer is included for optimizing the input tuning by compensating for the various antenna reactances that may be encountered at the input.

The output of the r.f. stage is fed to one gate of the mixer, while the oscillator signal goes to the other gate. A bipolar transistor is used for the oscillator and functions in a grounded-base Hartley-type circuit with the output inductively coupled from the oscillator tank to the mixer gate.

The oscillator frequency was found to have surprisingly good stability (more so than with many single conversion receivers using vacuum tubes), considering that it works near the signal frequency (455 kc higher) which thus requires operation at a relatively high frequency over much of the receiver range.

On the 10-meter band a drift of 1 kc per each 15-minute period during the first hour of operation from a cold start was experienced. During the next hour the drift diminished somewhat, tapering off to 1 kc per hour thereafter. Less drift occurred on the lower-frequency bands. Banging the cabinet produced microphonics; while dropping one corner of the set an inch or so to the bench caused the frequency to slightly jump mainly due to the mechanics of the drive system.

The mixer is followed by three i.f. stages coupled with a total of four "mechanical filters". These filters each consist of a single ceramic element suspended by small wire leads in a tiny metal can which also contains a tunable matching transformer. The overall selectivity, rated at ±1.5 kc at the 6-db points, measured 2450 c.p.s. at 6 db and 10,200 c.p.s. at 60 db.

A diode is used as an envelope detector for a.m. and another one functions as a series gate noise limiter for a.m. only. Two additional diodes are used in a balanced product detector circuit as shown at fig. 3.

The b.f.o. is self-excited and also functions in a grounded-base Hartley circuit with inductive coupling to the product detector. A b.f.o.-tuning control is located on the panel with points indicated on either side of the control center position for l.s.b. and u.s.b. reception. With this control correctly set, the USB or LSB indication good s.s.b. quality was experienced and the selectivity provided adequate unwanted-sideband suppression for most applications measuring 35 db at 1 kc.

The a.f. section has three stages: an amplifier, a driver and a class-B push-pull power output stage with negative feedback to the driver and bias-stabilized with a thermis-

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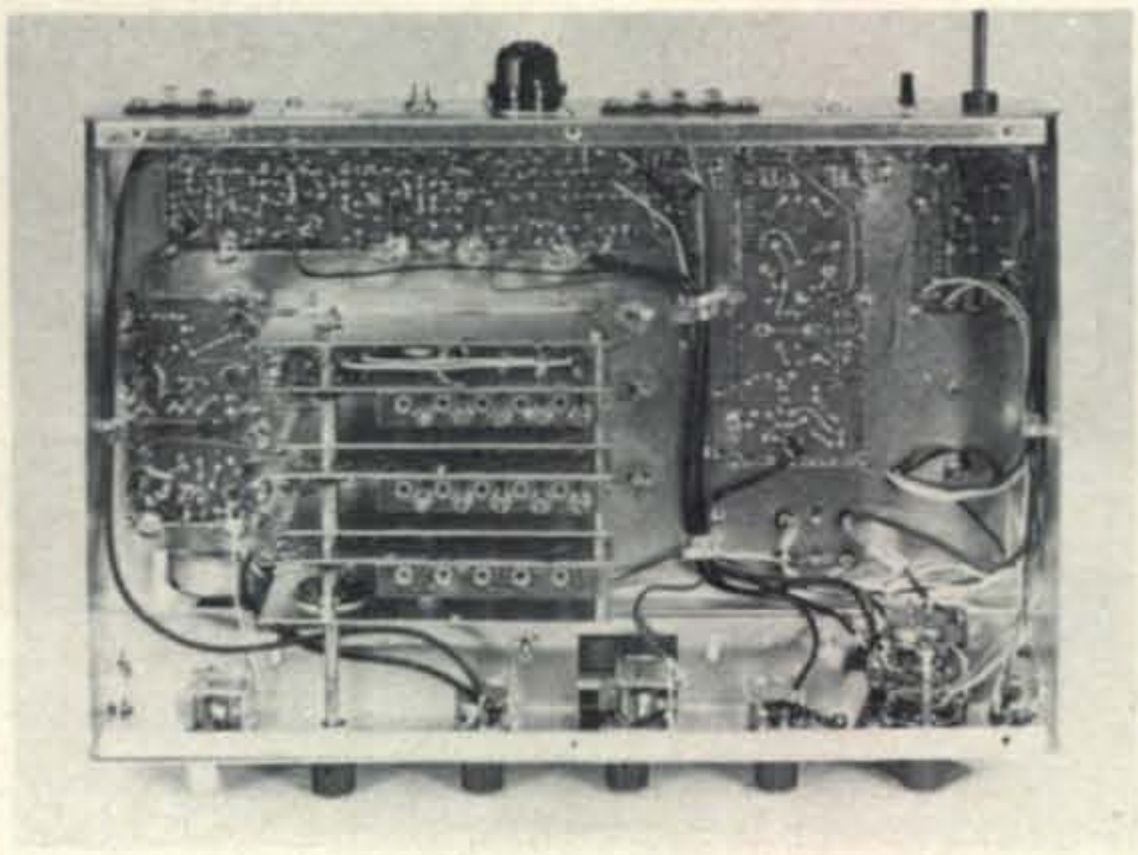
The output is rated at 1.3 watts.

The a.f.-output transformer has 4- and 8-ohm taps which are connected to rear-apron screw-type terminals for loudspeaker use. The terminal screws are knurled for easy hand manipulation without the need for a screw driver. The headphone jack is wired to the 8-ohm speaker tap in such a way that when the phones are used, the speaker is cut off. The 4-ohm tap goes directly to the terminals, so that when a 4-ohm speaker is connected there it still functions when phones are used.

Similar type terminals are used for the antenna input, but by removing a small plate on the rear apron, an SO-239 u.h.f. connector may be installed in holes already provided. On the other hand, a 1/4"-diameter hole may be drilled in the plate for mounting a phono-type jack. The antenna input is unbalanced with an input impedance of 50-400 ohms.



Bottom view of the A-2515. The bandswitch and the inductors are on the assembly at left center. The inductor cores and tiny ceramic trimmers are accessible for adjustment through holes in the bottom of the receiver cabinet.

R.F. Gain

Referring to fig. 1, the r.f. gain control serves as an r.f.-input attenuator. Back-to-back diodes across the antenna terminals limit the r.f. input voltage to prevent damage to the front-end f.e.t.'s by strong signals; however, in the presence of local broadcast-station or other very-strong signals and when the r.f. gain is reduced below the maximum point, effects similar to cross modulation were experienced on all bands. This occurred because when the arm of the control is moved toward ground the resistance between the arm and the top end of the potentiometer increases, raising the impedance across the input circuit. The attendant rise in the r.f. voltage easily reaches the diode-clipping level, producing strong harmonics that introduce r.f. intermodulation and spurious responses.

This was cured by moving the diodes over to the arm of the control where the impedance remains at a low value, regardless of the r.f.-gain setting. Germanium diodes are used, so they clip at about 0.3 volts. On the 150-400 kc and broadcast bands, there is a very high voltage stepup between the antenna and the input gate of the first f.e.t. This still could cause possible damage in spite of the diode limiting setup.

A.G.C.

Two a.g.c. systems are used. One supplies a negative control voltage for the bases of the i.f. amplifiers, the other furnishes a negative control voltage for gate #2 of the r.f. stage. On c.w. and s.s.b. the mode switch automatically removes a.g.c from the r.f. stage. The logic behind this at first was not apparent, but subsequent investigation revealed that when a.g.c. voltage on the f.e.t. is varied, the h.f.-oscillator frequency is pulled (this also happens when the antenna trimmer is tuned). Therefore, if a.g.c. were used here with s.s.b. reception, the effect would be frequency-modulation of the signal as the a.g.c. voltage varies with the s.s.b. speech levels.

Power Supply

A power supply for 117 v.a.c. operation has a tap on the primary of the power transformer to also allow 100 v.a.c. use. There are three secondary windings on the transformer. One delivers 14 v.a.c. for two dial lamps. The other two are used to separately power two individual full-wave silicon-diode rectifiers with *R/C* filtering. One supply delivers +12 v.d.c. for the a.f. amplifiers and

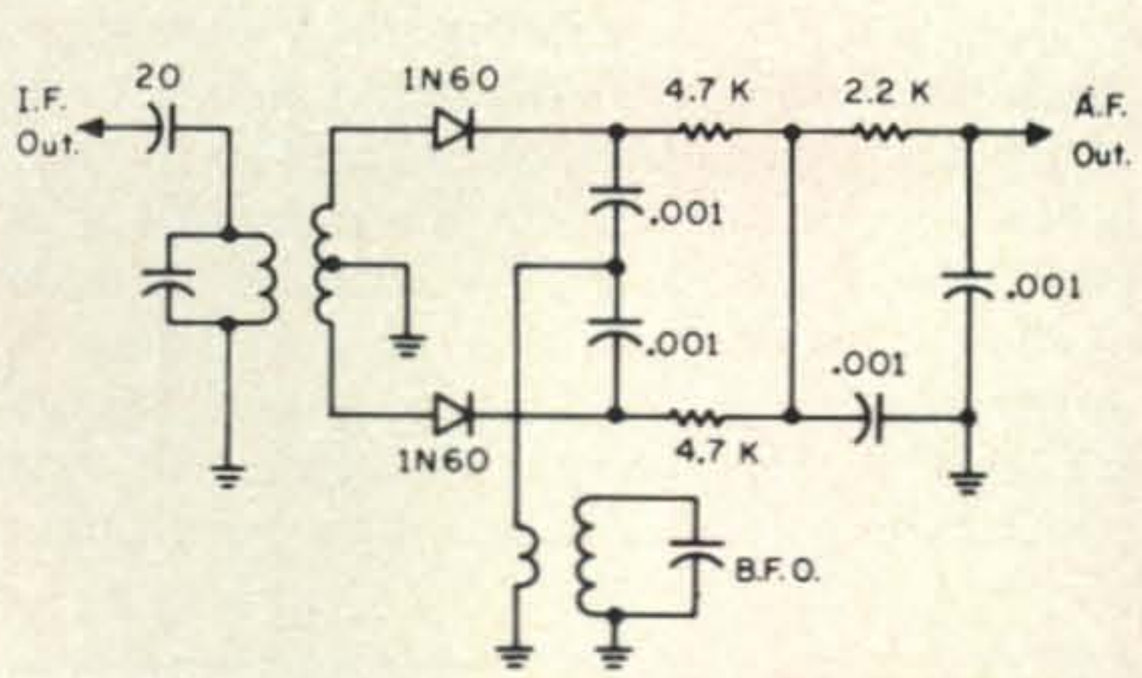


Fig. 3—The simple balanced-diode product detector used in the A-2515.

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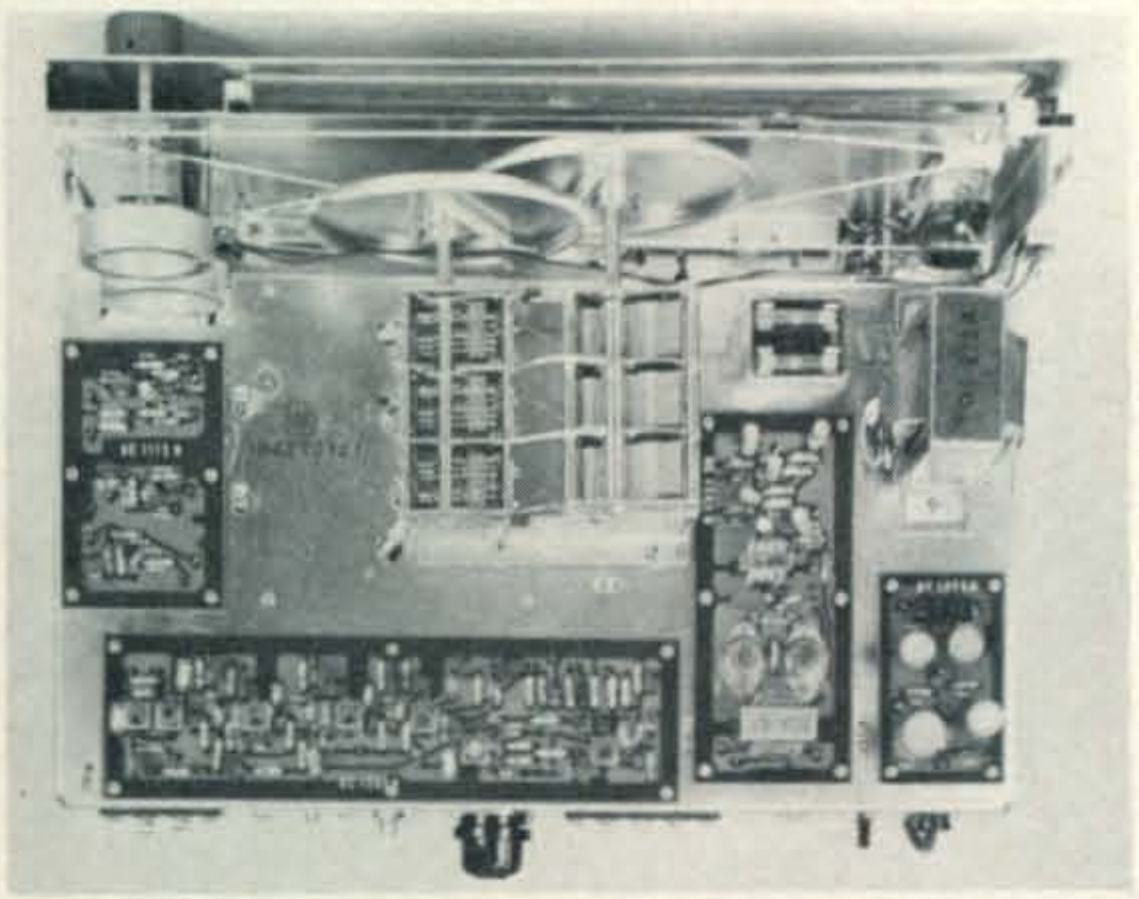

Top view of the A-2515. It is neatly arranged with four circuit boards. The tuning capacitors at the center are string-driven by the weighted-flywheel controls at the left.

+ 16 v.d.c. for the class-B output stage. The other provides +14 v.d.c. for the r.f. and i.f. stages along with a 10-volt zener-regulated potential for the h.f.o. and b.f.o.

For operation from an external 12 v.d.c. source, such as batteries, a cable connector is supplied for plugging in the external supply at the rear of the set. An "a.c.-d.c." slide-type switch must then be set for d.c. It has a locking tab that must be unscrewed, before the switch can be set for either d.c. or a.c. operation.

The current drain with d.c. operation is 300-550 ma, depending on the a.f.-output level. This can be reduced by 265 ma either by removing the two dial lamps or by re-wiring the lamp circuit so that they work only when a.c. is used.[1]

Separate 1-ampere fuses are used in the a.c.-and d.c.-supply lines. These are located on top of the chassis, necessitating removal of the top half of the cabinet when a fuse needs replacement.

There is no reverse-polarity protection in conjunction with external-d.c. operation. Since the wrong polarity could damage some of the transistors, it might be well to provide protection by connecting the anode of a 2-ampere silcon diode to ground and its cathode to the receiver-side of the d.c. fuse which is in the positive leg of the supply line. Should the polarity be reversed, the diode will then conduct heavily and blow out the fuse, opening the supply line.

[1]To do this, at the a.c.-d.c. switch remove the blue wire that goes to the dial lamps and connect it to the switch terminal where the blue lead to the power transformer is attached.

A standby position at the mode switch, for use during transmitter operation, breaks the voltage feed to the r.f. stage and mixer. An auxiliary socket is provided to enable this also to be accomplished by a transmitter relay where normally-closed ungrounded contacts are available.

Tuning Setup

There are two large slide-rule dials. One is for the main-frequency tuning and it has five ranges coinciding with the bandswitch positions. The other dial is for band-spreading the amateur bands (except 160 meters) for which it is accordingly calibrated. The 40-meter band is split into two sections. A 0-100 logging scale is also included for use on other portions of the range. Bandsetting points are indicated on the main dial to correlate with the bandspreading calibrations for the amateur bands.

The dials and tuning capacitors are string driven by control shafts with weighted flywheels. The drive ratio is high enough to allow easy tuning for s.s.b. signals with the bandspread control, but a difficulty experienced on two of these sets, is that the bandspread-tuning is somewhat "rubbery." This was due to the fact that the bandspread capacitor itself does not rotate too freely and that the large drive wheel for this capacitor is installed on the shaft quite a distance from the front bearing, the end result being that the shaft bends slightly before the capacitor rotates when pull is exerted by the string drive. Then was partially alleviated by loosening the rear-bearing adjustment on the capacitor. A further improvement might be made by installing a bracket with a panel bearing right next to the drive wheel.

The S-meter is an edgewise-mounted type and is positioned vertically.

Construction

The A-2515 is assembled on four individual printed-circuit boards; one for the r.f. front end and h.f.o.; one for the i.f. strip, detectors, a.g.c. and b.f.o.; one for the a.f. amplifiers, and one for the power supply. The r.f. and h.f.o. inductors are on a separate assembly along with the bandswitch on edge-wise-mounted boards with interstage shielding.

Circuit tracing on the p.c. boards is easily done from either side since the top-side of

[*Continued on page 97*]

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DX

BY JOHN A. ATTAWAY,* K4IIF

"Great is the art of beginning, but greater the art is of ending."

—HENRY WADSWORTH LONGFELLOW

The time has come to write *finis* to a completed chapter in the continuing story of amateur radio progress, the *CQ* S.S.B. DX Awards. It has been a successful undertaking with many highpoints, and *CQ* is proud of the role it has played in popularizing this mode.

Page 1 of the chapter was written in the June, 1956 issue of *CQ* by Bob Adams, K2-DW, as he kicked off the world's first sideband column with these words: "There are now 50 countries with s.s.b. operation and it warrents recognition." On Jan. 12, 1957 the first *CQ* S.S.B. DX Contest was held with an enthusiastic group of participants, and by April, 1957 W2KR and W3ZP were topping the S.S.B. DX list with 68 countries each.

By January, 1958 W2JXH was first in the race at 95 countries, and *CQ* had instituted the S.S.B. DX Award certificates for working 50 countries on s.s.b. General Curt LeMay, K4RFA, was one of the leading sidebanders of the day. Hard to believe isn't it, that little more than 10 years ago it was an achievement to work 50 countries on sideband.

In January, 1959, Bob, now W3SW, reported that 36 stations had qualified for 100 countries on s.s.b. The first to hit the century mark were W6UOU and W2JXH. In March, 1960 Bob wrote his last column and the driver's seat was occupied by Irv and Dot Strauber (K2HEA and K2MGE) who instituted the first formal S.S.B. DX Honor Roll topped by, guess who, TI2HP. From 1960 to 1963 the list of "countries" on s.s.b. rose rapidly to near 300, and in late 1963 the s.s.b. column was discontinued. The mode had become as commonplace as orange juice for breakfast and no longer warranted the separate status of a special column.

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

S.S.B. DX Honor Roll

W2TP	318	K6CYG	305	K8RTW	286	G2BVN	264
WA2RAU	317	W6YMV	303	W9EXY	284	W2FXE	264
W9ILW	316	WØQVZ	303	F2MO	283	W2MJ	261
VK3AHO	315	XE1AE	302	W3KT	281	W9QLD	261
TI2HP	314	G3AWZ	301	W1LLF	280	DL3RK	259
W2RGV	314	G6TA	301	W6UOU	280	G3DO	259
W3NKM	314	W3DJZ	301	WA2EOQ	279	W6WNE	259
DL9OH	313	G3HDA	300	W3FWD	279	PJ2AA	258
WA2IZS	312	W9JT	300	W4RLS	279	K1SHN	257
W8DE	312	5Z4ERR	298	K4OEI	279	PAØEEM	256
K6LGF	311	VE3ACD	297	DL1IN	276	SM6CAS	254
G3FKM	310	K2DX	297	K4HYL	276	W6BAF	254
KP4CL	310	W4SSU	297	W7DLR	276	K6CAZ	254
W4NJF	310	W4QCW	297	PZ1AX	274	PAØSNG	252
WA8AJI	310	W4PAA	294	K9EAB	273	K4GXO	252
W4OPM	309	W8EVZ	293	K9LUI	273	WA6GLD	252
I1AMU	308	K8ONV	293	W6RKP	272	VE6TP	251
G8KS	307	W2FXN	292	G3NUG	270	W1AOL	250
W5KUC	307	K1IXG	288	G3WW	269		
K6YRA	306	W2LV	286	MP4BBW	267		
W2ZX	305	W6EUF	286	G2PL	265		

The S.S.B. DX Awards and Honor Roll were continued under the auspices of Urb Le Jeune's DX column as they had a wide following. However, interest subsequently dropped, and now we are only receiving 5-10 new applications per month despite the diligent efforts of Award's Manager, Louise Rippe, W8HBD. Consequently we are phasing out the program on the grounds that it has served it's purpose. Anyone who doubts it should tune above 14200 for a.m. signals.

As it would be unfair to abruptly drop these awards, a two step procedure will be followed. New certificate applications will be processed up to Oct. 1, 1969 so that anyone who still wishes to qualify may do so. After that, the Honor Roll will be maintained through the December, 1969 issue. At that time specially endorsed certificates will be issued to everyone on the Honor Roll showing their final standing.

De Extra

Over two years have gone by since becoming your DX Editor. They've been interesting, fast-moving years and I would like to share some of the highlights, particularly as they have affected this, the editorial portion of the column. Becoming DX Editor fulfilled an ambition of mine. Even though I had no journalistic experience I wanted the chance to prove that a DX column could be varied and interesting. *CQ* continues to put up with me so I assume that I have at least partially succeeded.

We knew from the beginning that a monthly column written 2 months prior to publication was not the proper vehicle to carry current DX news. That is the province of the weekly bulletins. Consequently, we resolved to build the column around features of long

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WPX HONOR ROLL

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

Mixed

W4OPM	Joe Hiller	825/950
W8LY	Michael Bakos	733/733
K1SHN	Chuck Banta	685/702
WA6GLD	Jerry Hagen	561/561

SSB

W4OPM	Joe Hiller	746/810
W4NJF	Gay Milius	712/712
DL9OH	Karl Muller	611/611
K1SHN	Chuck Banta	586/601

CW

W4OPM	Joe Hiller	751/850
W8KPL	William Simpson	725/800
DL1QT	Helmut Baumert	672/672
K1SHN	Chuck Banta	572/671

Application forms for the *CQ* WPX Honor Roll may be obtained by sending a self-addressed, stamped envelope to WPX Manager, Howard Kelley, K4DSN, 6563 Sapphire Drive, Jacksonville, Florida 32208.

CW—Phone WAZ

2635.....WA9TFM	2647.....W3MDO
2636.....VE2BGJ	2648.....K8AEX
2637.....W1EDA	2649.....W7CNL
2638.....W6AYQ	2650.....W1APU
2639.....SP9AI	2651.....W5AKI
2640.....K2DDK	2652.....W2LWI
2641.....K1NOL	2653.....VE3BMB
2642.....WA9UES	2654.....I1ARS
2643.....W1JNV	2655.....UD6BD
2644.....K4TSU	2656.....UJ8AB
2645.....JA1NLX	2657.....UA3KBO
2646.....SP6AEG	2658.....W9AE

Two-Way SSB WAZ

666.....K8EHD	672.....WØYDB
667.....W4UAF	673.....JA6AFZ
668.....LA1ZI	674.....UC2BF
669.....I1LLZ	675.....VK2WD
670.....W7LFA	676.....UA1CK/JT1
671.....YV4UA	

All-Phone WAZ

410.....I1WT	412.....YV4UA
411.....VK3SX	

time value such as stories of DXpeditions large and small, in depth presentations on outstanding DX clubs and QSL managers, news of unusual DX such as on 160 meters, and a factual, unbiased editorial presentation of issues involving the DX world. The latter was christened 'De Extra.'

Our 'De Extra' concept got its supreme test almost the day it was born when the confrontation between Don Miller and the ARRL DXCC Committee burst on the scene. In April and May, 1967 we handled the issue cleanly, presenting points and opinions in favor of both sides. Later, although *CQ*, out of sympathy for the underdog, elected to defend Mr. Miller, 'De Extra' recognized the damage that both sides were doing to the worldwide image of amateur radio and declared a plague on both their houses.

The second controversy which 'De Extra' encountered forced us to temporarily abandon our unbiased position, as it involved the rejection of our own QSL cards (K4IIF/-KV4) by the DXCC Committee. This was done because we refused, after much soul searching, to humiliate ourselves before their DXpedition proof ruling. In my opinion this is a very hypocritical rule. When W9WNV decided to impose his own ideas of good operating ethics on everybody, and rearranged the DXCC Honor Roll in the process, he offended the DXCC Committee deeply, and they decided he had to go. However, refusing to work someone wasn't sufficient grounds so they had to find something they could make stick. His failure to land on certain islands was just what they needed, but in using it they abandoned an established tradition of looking the other way. In my opinion they came up with this new rule in an effort to prove how impartial they were. However, its made a bad situation worse by offending many amateurs, and 'De Extra's' position has been more than vindicated by the flow of favorable mail from overseas. In addition, G3FKM's column in the April, 1969 issue of *Radio Communication stated* "it seems a sad state of affairs when all members of the world's amateur population are assumed to be dishonest, and guilty of deceit unless they prove themselves otherwise!" and "It should be noted that our society (RSGB) continues to assume that expeditioners are honest until proven otherwise."

This controversy was particularly disturbing to me as an individual because I believe in a strong Amateur organization and had subscribed to a Life Membership in ARRL on the quarterly payment plan only about three months before my cards were turned down. As the cliche goes, I backed up my faith by putting my money where my *mouth was, but* I got nothing but a slap in the mouth for my trouble.

We sort of wandered into the third con-

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troversy mostly by accident, but finally had to take a stand. That was "Incentive Licensing," and the mail over it dwarfed that we received during the Miller-Awards Committee battle, and was much more extreme. This was a great surprise. This issue is divided between those who think "Incentive Licensing" is necessary to save the human race from extinction, and those who believe the road to Hades is paved with Amateur Extra licenses.

We first mentioned this subject in the November, 1967 issue where we encouraged everyone to live with the rules and stick with amateur radio. A year later in the November, 1968 issue we got off a couple of pretty good shots against it. This really stirred up the troops. The language in the letters you hear on occasion but you never dream people would sign such. Maybe these are the ones who lose their licenses for using profanity over the air. They weren't DXers thank goodness. None of them ever applied for a *CQ* DX award. Apparently non-DXers occasionally brouse through the DX column.

It had been our intention to drop the subject of "Incentive Licensing" as we aren't really rabid about it despite one letter which suggested we grow a beard, dirty up our hair, and picket the FCC. However, the mail stirred up our fighting blood. A professional columnist might have avoided this trap, but being a true amateur we decided to go a couple more rounds. Perhaps some good will come of it as our petition to FCC, RM-1393, has been well received and may help to eliminate some of the inequities in band assignment. Most of the gentlemen (DXers) who favored the new rules have agreed with us that too great a range of c.w. frequencies were allotted to the extra class, and that RM-1393 should have included the 80 and 15 meter bands as well.

This brings us up to date. We hope that conditions will remain calm for a while, but if controversy arises 'De Extra' will do its best to see that all sides are heard.

The Award's Program

Good conditions continue to produce great interest in DX and DX Awards. In April we authorized 38 new WAZ certificates, 35 new WPX certificates, and 11 new S.S.B. DX certificates for a total of 84, the highest monthly total in the history of the *CQ* DX Awards program. The WPX total was also a record for this award.

Many DXers have requested that we return to our old system of listing the winners in a separate table so we are trying it this issue. Hope you like it.

RM-1393

De Extra's petition, published in the March, 1969 DX column, requesting that the frequencies 14025-14050 and 7025-7050 remain open to General and Advanced Class amateurs after Nov. 22, 1969, received file number RM-1393. Comments could be filed with the FCC up through April 7. Exerpts from some letters commenting on the petition are as follows: "In my case your petition hit it right on the nose. I've had my ham license since 1922 and have my First Class Phone and First Class Telegraph licenses. I operate a 50 kilowatt commercial transmitter, but since I am too busy to take any more tests I can't go in certain spots on the ham bands. Does this make sense?"

"I've been a ham since 1927 and have always been strictly a c.w. man. I'm bedridden and my doctor says that I'll never get out of bed again. 20 meter c.w. is the only pleasure I have left and now half of that is gone. Am I supposed to take a test from my bed?"

QSL Manager of the Month

At the top of the list this month is Berlin's Franz Turek, DL7FT, who is an outstanding DXpeditioner as well as being a superb QSL Manager. Franz's list of clients includes EA6AR, EA6BG, EA6BH, HBØLL, HS3RB, KL7EBK, KR6JT, TU2AY, TU2AZ, W4-UAF/KH6, XE2YP, 3A2CN, 3A2CU, and 3V8BZ, and he is still looking for new sta-

SMSGT Ward B. Baker, Custodian of 11DFE. Ward's home call is K7YUC and he also holds the calls FØLD, DL4JP and OE5ZTM. He is ex-YU7LBC and WA6WAV. This trailer is spoken of many times over the air and houses one of the biggest signals from northern Italy.

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tions who want a QSL Manager in Europe.

Franz says that his motivation is his 13 year old daughter who is crazy about her stamp collection. He likes to keep her happy with lots of nice, colorful commemorative stamps. Sounds like a top father as well as a top amateur.

For those who want extra fast service, Franz holds a "Manager Net" every Sunday from 0630–0900 GMT on 14310-15 kc with EA6AR, HBØLL, TU2AY, and 3A2CN. It might be hard to find the band open from stateside at those times, but make a contact and you are sure to be in the log.

Franz was first licensed in 1959 as DL7FT and has since worked his 300 countries. His DXpeditions include 3A2CU in 1963, M1FT in 1964, 4U1ITU in 1965, 2nd operator at EA6AR in 1966, '67, and'68, 2nd operator at 3V8BZ in 1968, and 3AØCU in 1969. He is still working on ZA, but says it is too expensive.

From the Mailbag

de W5LEF: "I personally would prefer the following approach: Count the operation for DXCC unless one of the following is true:

1. Government authorities declared it illegal.
2. The radio society of the appropriate country says it was illegal, unauthorized, or not performed.
3. Two or more licensed operators swear out depositions that the operation claimed was not done and the guy did not do what he said he did.

"Heck, it's only a hobby and let's assume people are honest. Most of us are. People shouldn't have to prove that they're honest.

From left to right: Gerd (DJ1QP), GC5AET; Sam (W6ZJA), GC5ALN; and Horst (DJ6OZ), GC5-ALO drinking Bavarian beer on Jersey Island.

CW WPX

925.....K4MPE
926.....DL1MD
927.....KØQYD
928.....DJ6TU
929.....WA9UES
930.....DJ4VP
931.....W9OYZ
932.....WA3HRV
933.....W9JCK
934.....OK1XM
935.....PAØJR
936.....W6AKM
937.....SP5NE
938.....W1MM
939.....UA3UJ
940.....UA1KCU

Phone WPX

170.....W8NNR
171.....OK3BU
172.....W4WSF
173.....EA4GR

SSB WPX

406.....K4AJR
407.....W2LEJ
408.....HC1TH
409.....K8MMH
410.....OK3BU
411.....DL1MD
412.....W6CYO
413.....KL7EQG
414.....W8GKM
415.....EA4GR
416.....XE1HS
417.....K2JFE
418.....W6ZC
419.....UA2KBD

Mixed WPX

197.....OK3BU

WPX Endorsements

SSB: I1AMU-550, CN8AW-500, DL1MD-350, EA4GR-350, OK3BU-300, W6CYO-300, W6ZC-300, W8GKM-300, K2JFE-250, and W2LEJ-250.

CW: UA3UJ-550, W1MM-550, SP3AIJ-500, K2DDK-450, UB5WK-450, DJ4VP-400, UA1KCU-400, UD6BW-400, UA6KAE-350, UB5LS-350, and W9OYZ-350.

Phone: EA4GR-450.

80 Meters: OK3BU.

20 Meters: OK2PU, OK3BU, UA2KBD, and UT5CC.

15 Meters: UT5CC.

10 Meters: W8NNR.

Europe: DL1MD, OK3BU, UA1KCU, UA3UJ, UB5LS, and UT5CC.

VPX—Verified Prefixes

Nathan Rosen, SWL/CHC #1..... 9 (SSB)
Nathan Rosen, SWL/CHC #1.....10 (Phone)
Nathan Rosen, SWL/CHC #1.....11 (CW)
Lars-Ake Holst, SM-3274.....12
Yutaka Tanaka, JA3-2520.....13 (SSB)
Yutaka Tanaka, JA3-2520.....14 (Mixed)

Two-Way SSB DX Award

200 Countries

167.....WA9KQS
168.....DL1MD
169.....YV4UA
170.....VE3ACD
171.....HP1JC
172.....W8ILC

100 Countries

561.....WA3IKK
562.....HC1TH
563.....W2HSM
564.....EA4GR
565.....W3CDL

Complete rules for the CQ DX awards can be found in the DX column of the January, 1969 *CQ*.

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Somebody should have to prove that they aren't. At least that's the old fashioned way." *de W9JT:* "As a continuation of the logical *CQ* sponsorship of modern amateur communication with s.s.b., lets have a 5-band S.S.B. DX Award."

(This suggestion seems quite logical. However, the *CQ* DX Award's Advisory Committee considered the subject of new awards over a year ago, and almost unanimously concluded that it would put too great a burden on the rare stations who would have to QSL everybody all over again. To require that they QSL again not once, but five times, would be even worse, so we abstain.)

de W3DJZ: "Andy, VP8FL, and I have a sked each evening on 14220 kc at 2300 GMT. Most evenings VP8KO on the South Orkney's joins in and if there are any breakers we are only too glad to let them work a new one. No activity is planned for South Sandwich for at least a year. We will keep in touch on this one as it is badly needed by many. The following is up-to-date list of active hams in VP8-land:

Station	*QSL to:*
VP8FL, Andy	Eric Chilvers, 1 Grove Rd., Lydney, Glos., England
VP8KL, Margaret	WA3IKK
VP8KD, Frank	K3JXY
VP8KE, Brian	W4NJF
VP8KF, John	G3LDA
VP8HJ, Dave	W2CTN
VP8KI, DILYS	Direct to Port Stanley
VP8KM,Gladys	Direct to Port Stanley
VP8DQ, Miriam	Direct to Port Stanley
VP8JH, Buck	Eric Chilvers, see VP8FL
VP8JC, Mike	G contacts to G3NMH, others direct
VP8HZ, Tony	same as VP8JC
VP8IA, Jessie	same as VP8JC
VP8JB, Bill	same as VP8JC
VP8KO, Les	Eric Chilvers, see VP8FL
VP8JQ, Jake	Direct
VP8HO, Richard	Direct
VP8JT, Dick	VE1AST

QSL Information

BV2A–Via WB2UKP.
CEØAE–To Det 517, APO, New York, New York, N. Y. 09877.
CR3KD–c/o WA4PXP for s.s.b. QSO's, W2-CTN for c.w. QSO's.
DJ7RU/YBØ–Via DJ1OJ.
EP3AM–Via W3GJY, 1400 Chaplin St., Conway, Pa. 15027.
ET3REL–To W5LEF, 3107 Morningside Dr., N.E., Albuquerque, N. Mex. 87110.
FB8XX–For QSO's After Jan. 6, 1969 send to F2MO. Earlier QSO's to FR7ZD (Patience, only I ship from island each year).
FK8AC–c/o WA6MWG.
F08AU–To W3GJY.
F08BV–c/o VE2DCY.
FY7YG–To WA4GQM.
GD6UW–c/o W2GHK.
HL9KQ–Via W4YWX.
HL9UD–To WA8HBL.
JT1AG–c/o P.O. Box 639, Ulan Batro, Mongolia.
KC6BY–Via WB9ABL, 302 E. Baker St., Plymouth, Ind. 46563.
KG4DO–To VE1ASJ.
KG6AQI–For contacts after April 17 c/o WAØKDI, contacts prior to April 17 send to WAØPQF.
KZ5TC–Via W1EII.
LG5LG–To LA4YF, Hans E. Kinck, 3800 Bøi, Telemark, Norway.
MP4BHK–c/o P.O. Box 14, Manama, Bahrain.
OESHGL–To K9UTI, Box 567, Metropolis, Ill.
PJ8NN–Via K9GCE.
PJ9AK–c/o W5PDW.
SVØWMM–To K6JAJ.
SVØWN–c/o K3EUR.
TA2E–To VE3ABG, Box 35, Station S, Toronto 382, Ontario, Canada.
UP2NX–Rimas Zakarevicius, Box 289, Kaunas, Lithuania, USSR.
VK9KY–Via VK2SG.
VK9WD–To W2CTN.
VK9XI–c/o W2GHK.
VK9MI–Via VK7KJ.
VP2MQ–To KV4AM.
VP7NA–c/o K9GZK.
VR2DI–Via VE6TK.
VR4EZ–To W2CTN.
VS5TJ–c/o 9V1 Bureau, Box 777, Singapore.
VU2BX–To WAØLGR, 5114 Locust St., Lincoln, Nebraska 68516.
XEØFCR–Via WB6FCR.
YBØAC–To P.O. Box 1056, Djakarta, Indonesia.
ZD8AR–c/o W2GHK.
ZEF1AA–Via K2OLS.
ZF1CW–To WB8ABN, Box 62, Rochester, Michigan.
3AØCU–c/o F9RM.
3V8AD–Via DL1DA.
5H3LV–To VE3ODX.
5R8AN–c/o K4IE.
5W1AD–Via ZL1AAP, Box 1877, Auckland, New Zealand. (WØBN only handles cards for W9WNV's August, 1969, effort.)
5W1AZ–To George Ashton, 6 Roys Road, Plimmerton, Wellington, New Zealand.
5Z4KL/A–c/o VE3DLC.
5Z4LX–Tom Boardman, P.O. Box 17, Embu, Kenya.
6W8DY–Via VE4SK.
9H1BN–To W2CTN.
9JZXZ–c/o WA9PRE, 5 Pennypacker Drive, Willingboro, N.J. 08046.
9QSWS–Via W1BPM.

73, John, K4IIF

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CQ ANNOUNCES

SPECIAL REDUCED SUBSCRIPTION RATES FOR STUDENTS

One of the major concerns throughout hamdom these days is the lack of new blood coming into our hobby. Everyone seems to agree that we need thousands of new youngsters in the amateur ranks, but the question is how to get them started. One fact is obvious; students at the high school and college level are generally less able financially to afford many of the products they'd like to have to increase their hamming activity.

We at CQ feel that maybe we can help to ease the burden somewhat by lowering our subscription rates so that students can better afford our magazine. So we're going to slash the rates rather drastically for student readers to help bring them into the fold.

Effective immediately, subscription rates for students only are lowered to:

1 year —$4.00 (student saves $ 5.00 on newsstand price)

2 years— 7.50 (student saves $10.50 on newsstand price)

3 years—11.00 (student saves $16.00 on newsstand price)

We ask student subscribers to fill in the coupon below in its entirety in order that we may verify student status. This offer is extended to all persons under the age of 22 who regularly attend grade school, high school, or college at the undergraduate level.

☐ NEW SUBSCRIPTION
☐ RENEWAL

☐ 1 YEAR —$ 4.00
☐ 2 YEARS—$ 7.50
☐ 3 YEARS—$11.00

(Name) (Age) (Call Letters)

(Street Address) (City) (State) (Zip Code)

(School or college attended) (Number of years licensed)

See page 110 for New Reader Service

a complete amateur radio station

in one portable package

SWAN *Cygnet*

A 5 BAND 260 WATT SSB TRANSCEIVER WITH BUILT-IN AC AND DC SUPPLY AND LOUDSPEAKER

$435

The new Swan Cygnet is a complete SSB transceiver, with self contained AC and DC power supply, microphone and loudspeaker in one portable package. The Cygnet features full frequency coverage of the 10, 15, 20, 40 and 80 meter bands with a power input rating of 260 watts P.E.P. in single sideband mode, and 180 watts CW input. A crystal lattice filter at 5500 Kc is used in both transmit and receive mode, and provides excellent selectivity with a 2.7 Kc bandwidth at 6 db down. Superior receiver sensitivity of better than ½ microvolt makes it easy to pull in those DX signals, and with the Cygnet, if you can hear them, you can work them. Audio fidelity is in the well known Swan tradition of being second to none; providing smooth, natural sounding voice quality. The Cygnet is temperature compensated on all bands, featuring solid state oscillator circuitry with zener regulation which permits wide variation in supply line voltage without frequency shift.

Unwanted sideband suppression is 45 db, carrier suppression 60 db, and distortion products are down approximately 30 db.

The new Cygnet is designed to provide efficient, high quality communications in the 5 most commonly used amateur bands. Its low cost is a tribute to Swan's well known techniques in value analysis, and simple, direct circuit design. Above all, these techniques lead to a high degree of reliability and foolproof performance. Dimensions are: 13" wide, 5½" high, and 11" deep. Weight is 24 lbs.

The transceiver comes complete with AC and DC input cords, and carrying handle; thus making it the most versatile and portable set on the market, and certainly the best possible value.

Amateur net **$435**

P.S. Yes, for our customers who require some of the extra features, there will be a deluxe version of the Cygnet coming soon, which will sell for approximately **$495**

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SWAN
ELECTRONICS
OCEANSIDE, CALIFORNIA
A Subsidiary of Cubic Corporation

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

June 28-July 7		Wichita City QSO Party
July	5-6	Venezuela DX Contest
July	19-20	Columbia DX Contest
July	19-20	Minnesota QSO Party
July	19-20	Ontario QSO Party
July	20-21	Bermuda C.W. Contest
July	26-27	New Hampshire Party
August	2-3	Illinois QSO Party
August	2-3	Maryland/DC QSO Party
August	2-4	Missouri QSO Party
August	9-10	DARC WAE C.W. Contest
August	16-17	New Jersey QSO Party
August	16-17	QRP QSO Party
August	16-17	Indiana QSO Party
August	30-31	All Asian DX Contest
Sept.	6-8	Washington St. Party
Sept.	13-14	DARC WAE Phone Contest
Oct.	4-6	California QSO Party
Oct.	4-5	VK/ZL/Oceania Phone
Oct.	11-12	VK/ZL/Oceania C.W.
Oct.	11-12	RSGB 28 mc Phone
Oct.	15-16	YLAP C.W. Party
Oct.	18-19	Boy Scouts Jamboree
Oct.	18-19	KR6 DX Contest
Oct.	18-19	WADM C.W. Contest
Oct.	**25-26**	**CQ WW DX Phone Contest**
Oct.	25-26	RSGB 7 mc C.W.
Nov.	5-6	YLAP Phone Party
Nov.	8-9	RSGB 7 mc Phone
Nov.	8-9	ARRL SS Phone Contest
Nov.	15-16	ARRL SS C.W. Contest
Nov.	**29-30**	**CQ WW DX C.W. Contest**

Columbia Contest

Starts: 0001 GMT Saturday, July 19
Ends: 2359 GMT Sunday, July 20

Deadline Sept. 30th to: Independence of Columbia Contest, Ap. 584, Bogota, Columbia.

Minnesota QSO Party

July 20th—4 Periods
Phone: 0000-0400 & 1600-2000 GMT
C.W.: 1200-1600 & 2000-2400 GMT

Deadline Aug. 11th to: Viking Amateur Radio Society, Box 3, Waseca, Minn. 56093.

*14 Sherwood Road, Stamford, Conn. 06905.

Ontario QSO Party

Starts: 1700 GMT Saturday, July 19
Ends: 2400 GMT Sunday, July 20

Deadline Aug. 31st to: Radio Society o Ontario, Box 334, Toronto 18, Ont. Canad

Bermuda Contest

Phone: June 22-23 C.W.: July 20-21
Starts: 0001 GMT Sunday
Ends: 0200 GMT Monday

Logs must be received by Aug. 15th by t Radio Society of Bermuda, P.O. Box 27 Hamilton, Bermuda.

New Hampshire QSO Party

Starts: 1700 GMT Saturday, July 26
Ends: 2300 GMT Sunday, July 27

Deadline Aug. 6th to: Sam Colby, WA CBP, RFD #3, South Bow Road, Concor N.H. 03301.

Complete rules for the preceeding 5 eve were given in last month's CALENDAR.

Illinois QSO Party

Starts: 1600 GMT Saturday, August 2
Ends: 2200 GMT Sunday, August 3

The 7th annual Illinois QSO party is spo sored by the Radio Amateur Megacycle So ety. The same station can be worked a counted for a QSO point on each band a each mode.

Exchange: QSO nr., RS/RST and QT county for Ill., state, province or country others.

Scoring: Each QSO 1 point, Ill. stati multiply total by number of states, VE pr inces and countries worked. All others Illinois counties as their multiplier. (Max 102) Note: USA, Canada, Hawaii and Ala count as separate countries. Hawaii and A ka also count as states.

Frequencies: 1815, 3560, 3735, 39 7060, 7175, 7260, 14060, 14275, 210 21110, 21360, 28060, 28700 and 145.2

Awards: Certificates to the top statio each state, VE call area and each coun In Illinois, single and multi-operator stati

See page 110 for New Reader Ser

many have tried

but SWAN SUCCEEDED

a complete station

for only

$435.00

Just hook the Model 260 to an antenna and you're on the air.

's that simple! There is nothing else on the market comparable to the 260.
ook what you get for $435.00.

Complete frequency coverage on all five bands ☆ 10 meters ☆ 260 watts PEP Built-in power supply . . . AC and DC ☆ Portable . . . only 26 pounds, mplete with handle, built-in speaker and mike ☆ Designed and built with the me ruggedness, reliability and craftsmanship that has made Swan a household name e world over.

nd coming very soon will be another star in the Swan line, the 270 deluxe. verything that the 260 has, plus many additional features for those who can pay a tle more. The 270 will sell for about $495.00, still a low price for a complete station.

nd if you need an antenna, Henry Radio can make that a simple matter with its st saving Antenna Package Program.

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compete in separate catagories with 1st, 2nd and 3rd place winners in each catagory.

A summary sheet showing scoring and other pertinent information is also requested.

Mailing deadline is Sept. 1st and logs go to: Radio Amateur Megacycle Society, K9-CJU, 3620 N. Oleander Ave., Chicago, Ill. 60634. Include a s.a.s.e. if results desired.

Missouri QSO Party

Starts: 2200 GMT Saturday, August 2
Ends: 0200 GMT Monday, August 4

This is the 6th QSO party sponsored by the Northwest St. Louis A.R.C. The same station may be worked on each band and mode for QSO credits. Mobiles may be worked from more than one county.

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

Scoring: *For Missouri*—1 point per QSO, multiplied by number of states, VE provinces and countries worked. *Out-of-state*—2 points for each Mo. contact multiplied by number of Mo. counties worked. (max. of 115)

Frequencies: c.w.—3540, 7040, 14040, 21040, Phone—3940, 7240, 14240, 21340. On Aug. 3rd look for Mo. phone activity on 3940 at 0300Z, 7240 at 1600 Z and 14240 at 2000 Z.

Awards: Certificates to the highest scorer in each state, VE province and DX country. (min. of 5 contacts) Also to the top 5 single operator stations in Missouri and the 3 top club stations in the world.

Logs go to: Paul Haefner, KØJPL, 1269 Forest Home Drive, St. Louis, Missouri 63-137, and must be received by Aug. 30th. Include a s.a.s.e. for copy of results

Maryland/D.C. QSO Party

Starts: 2200 GMT Saturday, August 2
Ends: 2200 GMT Sunday, August 3

The 4th Maryland/D.C. QSO Party is again sponsored by the Maydale A.R.C. A station may be worked once on each band and each mode. Separate logs are requested for each mode.

Exchange: QSO nr., RS/RST and QTH. County for Md./D.C. stations; ARRL section or country for others. (Baltimore and Wash. D.C. count as separate counties)

Scoring: Two points for each completed QSO. Md./D.C. use ARRL section and countries for their multiplier. Out-of-state stations use Maryland counties. (max. of 25)

Frequencies: c.w.—3575, 7075, 14075, 21075. Phone—3850, 7275, 14275, 21325. Novice—3735, 7175, 21110.

Awards: Certificates to top stations in each ARRL section and country, phone and c.w. Additional awards where returns warrent.

Logs: Should show date/time in GMT, QSO nr., station worked, RS/RST sent and received and QTH. A summary sheet with the scoring, name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed is also requested.

Mailing deadline is September 1st and logs go to: Carl E. Andersen, K3JYZ, 14601 Claude Lane, Silver Spring, Md. 20904. Include a s.a.s.e. for copy of results.

DARC WAE Contest

C.W.—August 9-10. **Phone**—Sept. 13-14
Starts: 0000 GMT Saturday.
Ends: 2400 GMT Sunday in each instance.

This is the 15th "Worked All Europe" DX Contest sponsored by the DARC. Some minor modifications have been made to the rules of previous years, the most notable being the addition of a rest period.

All bands, 3.5 thru 28 mc, may be used, the same station may be worked once on each band for QSO and multiplier credits.

Classifications: Single operator and Multi operator, both single and multi transmitter.

Rest Period: Only 36 hours out of the 48 hour contest period allowed for single operator stations. The 12 hours of non operation may be taken in one to three periods any time during the contest. The periods need not be equal but must total at least 12 hours and clearly show on the log.

Exchange: The usual five or six digit serial numbers, RS/RST plus a progressive QSO number starting with 001. (Multi transmitter stations should use separate series of numbers for each band)

Points: Each QSO counts 1 point, except on 3.5 mc where it counts 2 points.

Multiplier: The multiplier for non-European is determined by the number of European countries worked on each band. (See WAE list)

Europeans use the ARRL country list for the multiplier. In addition each call area in JA, PY, VE/VO, VK, W/K, ZL, ZS, UA9 & UAØ are multipliers.

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

QTC-Traffic: Additional points may be realized by use of the QTC feature. A QTC is a report of a confirmed QSO that has taken pla

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earlier and later sent back to a European station. It can only be sent from a non-European to a European. The general idea being that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 points credit can be claimed for each station reported.

a. A QTC contains the time, call and QSO number of the station being reported. ie: 1300/DJ3KR/134. This means that at 1300 GMT you worked DJ3KR ad received number 134.

b. A QSO can be reported only once and not back to the originating station.

c. A maximum of 10 QTCs to a station per band is permitted. The same station may be worked several times to complete this quota. Only the original contact however has QSO point value.

d. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are being reported.

Awards: There will be three power divisions for award purposes: (a) up to 200 watts input, (b) more than 200 watts, (c) newcomers licensed less than one year.

Certificates to the highest scorers in each classification in each country and country/district listed. 2nd and 3rd place awards will be given in areas of sufficient participation, and continental leaders will also be honored.

There are Trophies for both Europe and non-Europeans that are the leaders in each of the three operating categories.

WAE Endorsements: Contest contacts can be used for WAE certificate endorsements providing the log of the requested station is also received.

Disqualification: Violation of the rules of the contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification.

Logs: It is suggested you use the log sheets of the DARC or equivalent, 40 QSOs or QTCs per sheet. Use a separate sheet for each band, and a summary sheet showing the scoring and your name and address in BLOCK LETTERS. Include a s.a.e. and IRCs with your request for official log forms.

Mailing deadline is Sept. 15th for C.W. and Oct. 15th for phone. Mail logs and requests to: Walter Skudlarek, DJ6QT, An der Klostermauer D-6471, Hirzenhain, West Germany.

WAE Country List

CT1, CT2, DL/DJ/DK/DM, EA, EA6, EI, F, FC, G, GC, GD, GI, GM, GM Shetland Is., GW, HA, HB, 4U1ITU, HBØ, HV, I, IS, IT, LA, Bear Is., JX, JW, LX, LZ, M1/9A, OE, OH, OHØ, OK, ON, OY, OZ, PA/PI, PX, SM/SL, SP, SV, SV Crete, SV Rodes, TA Europe, TF, UA/UV/UW 1-6, UB/UT/UY, UC, UN, UO, UP, UQ, UR, UA Franz Josef Land, YO, YU, ZA, ZB2, 3A, 9H.

New Jersey QSO Party

Two Periods:
1900-0600 GMT Sat./Sun. Aug. 16-17
1200-2300 GMT Sunday, August 17

This is the 10th QSO party sponsored by the Englewood A.R.A. Phone and c.w. are part of same contest and the same station may be worked on each band and mode.

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

Scoring: *For N.J.*–W/VE QSOs count 1 point, DX QSOs 3 points, multiply total by ARRL sections worked. (max. of 74) N.J. may work in state stations for QSO and multiplier credit. *Out-of-state*–Multiply number of completed contacts by the N.J. counties worked. (max. of 21)

Frequencies: 1810, 3555, 3740, 3930, 7060, 7275, 14075, 14285, 21100, 21375, 28800 and 50.1-50.5, 144-146. Phone activity suggested on even hours.

Awards: Certificates to the 1st place winners in each N.J. county, ARRL section and country. Second place awards if four or more logs received from that section. There are also Novice and Technician awards.

Indicate the multiplier *only* the first time it is worked. Also include a summary sheet with all pertinent information.

Stations planning active participation in New Jersey are requested to advise EARA as soon as possible so that plans may be made for full coverage of all counties.

Logs must be in the hands of the Englewood A.R.A., 303 Tenafly Road, Englewood, N.J. 07631 no later than September 13th. Include a s.a.s.e if results desired.

QRP QSO Party

Starts: 2000 GMT Saturday, August 16
Ends: 2400 GMT Sunday, August 17

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

Exchange: RS/RST; state, province or country, and QRP number for members, power input for non-members.

Scoring: Each contact counts 2 points. Multiply total QSO points by the sum of states, provinces and non-W/VE countries worked. And multiply again by following power factor. By 1 if power 100 watts or more, 1.5 if 25 to 100 watts; 2 if 5 to 25 watts; 3 if 1 to 5 watts; 4 if below 1 watt. (double above power figures for PEP ratings) The same station may be worked once on each band for QSO points.

[*Continued on page 99*]

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Propagation

BY GEORGE JACOBS,* W3ASK

THERE are now some positive indications that the peak of the present sunspot cycle may have occurred this past October.

The Swiss Federal Solar Observatory, the world's official keeper of sunspot records, reports a monthly mean sunspot number of 105 for April, 1969. This results in a *running smoothed sunspot number* of 110 centered on October, 1968. The sunspot cycle is based upon the value of smoothed sunspot number, and 110 is the highest recorded in the present cycle.

Solar observations during the next three months are likely to confirm the exact date on which maximum intensity of the present cycle took place.

A smoothed sunspot number of 97 is forecast for July, 1969.

July Propagation

Both the 15 and 20 meter bands are expected to share honors for optimum DX propagation conditions during July.

Excellent world-wide openings are forecast for 15 meters throughout the daylight hours, and on many circuits throughout the evening hours as well. Peak DX propagation conditions are expected during the late afternoon and early evening hours, with excellent openings forecast in almost all directions.

Twenty meters is expected to remain open to one area of the world or another, around-the-clock. Although DX openings should be possible at almost any hour, optimum conditions are forecast during the early evening, the hours of darkness and the sunrise period.

Some fairly good 10 meter DX openings are expected during July, mainly on north-south paths and to tropical regions, during the afternoon hours.

Despite seasonally high static levels some fairly good 40 meter DX openings are forecast to many areas of the world during the hours of darkness and the sunrise perio High static levels are expected to result in seasonal decline in DX propagation conc tions on 80 meters, although some openin are forecast during the hours of darkne Not many DX openings are expected on 1 meters during July, because of seasonal high levels of static and solar absorption.

Check last month's column for a co prehensive band-by-band DX propagati forecast for July.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for July 1, through August 15, 1969

	Days	Forecast Rating & Quality (4)	(3)	(2)	(1)
Above Normal:	2, 15, 21, 25, 30. Aug. 8, 14.	A	A-B	B	B-C
Normal:	1, 3-4, 6-7, 12-14, 16-17, 20, 22-24, 27-29, 31. Aug. 3-4, 7, 9-13, 15.	A-B	B	C	D
Below Normal:	5, 8, 11, 18-19, 26. Aug. 1-2, 6.	B-C	C-D	D	E
Disturbed:	9-10. Aug. 5.	C-D	D-E	E	E

HOW TO USE THESE CHARTS

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—These Propagation Charts are valid through Sept. 15, 1969. These Charts are prepared from basic propogation, data published monthly by the Institute for Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

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Short-Skip

This month's column contains Short-Skip Charts for the period July 15-September 15, 969. Optimum short-skip conditions on most ands are expected during July, mainly as result of a seasonal peak expected in spor-dic-E propagation.

During the daylight hours considerable hort-skip openings are forecast for 10 and 5 meters over distances ranging between pproximately 500 and 1300 miles, with some ouble-hop openings out to 2300 miles. Fre-uent short-skip openings on 20 meters, anging between 250 and 2300 miles, are xpected almost around-the-clock, with con-itions peaking during the late morning hours nd again during the late afternoon and early vening periods.

Good daytime short-skip openings are ex-ected on 40 meters between distances of pproximately 100 and 600 miles, with ex-llent nighttime openings between 250 and 800 miles. Good 80 meter short-skip open-gs are forecast for the daylight hours up to stances of approximately 300 miles, with e range extending up to 2300 miles during e hours of darkness. While no 160 meter ort-skip openings are expected during the ylight hours, some openings are forecast ring the hours of darkness for distances to 1300 miles. When static levels are low, 0 meter nighttime openings may extend t to approximately 2300 miles.

V.h.f. Ionospheric Openings

With a seasonal peak expected in sporadic-propagation, frequent 6 meter short-skip enings are likely to take place during July. ost of these openings will probably fall hin the 900 to 1300 mile range, but some y be as great as 2300 miles. Optimum es for such 6 meter openings are a few urs before noon and again during the early ning hours, although openings can take ce at any time of the day or night. During ny of the 6 meter sporadic-E type open-s signal levels are likely to be exception-strong.

Be sure to check the 2 meter band during nse 6 meter short-skip openings, since 2 ers may occasionally open as well. Gene-y, 2 meter short-skip openings take place ween distances of approximately 1000 and 0 miles.

There is a fairly good possibility for some eor-type v.h.f. ionspheric openings during the last week of July, when the *Aquarids* shower is expected to take place. Maximum meteor penetration of the earth's atmosphere should occur on July 29, with an hourly count of approximately 20.

Some v.h.f. short-skip openings resulting from auroral ionization are also expected during the month. Check the "Last Minute Forecast" appearing at the beginning of this column for periods that are predicted to be disturbed or below normal; since these are the dates that auroral v.h.f. openings are most likely to occur during July. ■

CQ Short-Skip Propagation Chart
July 15-September 15, 1969

LOCAL STANDARD TIME AT PATH MIDPOINT
(24-HOUR TIME SYSTEM)

Distance From Transmitter (Miles)

Band (Meters)	*50-250*	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	07-09 (0-1)* 09-13 (0-2)* 13-17 (0-1)* 17-21 (0-2)* 21-23 (0-1)*	07-09 (1)* 09-13 (2-3)* 13-17 (1-2)* 17-21 (2-3)* 21-07 (1)*	07-09 (1-0)* 09-13 (3-1)* 13-17 (2-1)* 17-21 (3-1)* 21-07 (1-0)*
15	*Nil*	07-09 (0-2)* 09-13 (0-3)* 13-17 (0-2)* 17-19 (0-3)* 19-21 (0-2)* 21-07 (0-1)*	07-09 (2)* 09-13 (3)* 13-17 (2)* 17-19 (3)* 19-21 (2)* 21-23 (1-2)* 23-07 (1)*	07-09 (2) 09-13 (3) 13-17 (2-3) 17-19 (3-4) 19-21 (2-3) 21-23 (2) 23-07 (1)*
20	09-00 (0-1)*	06-09 (0-2)* 09-15 (1-4)* 15-20 (1-3)* 20-00 (1-2)* 00-06 (0-1)*	06-09 (2-4) 09-15 (4) 15-20 (3-4) 20-00 (2-4)* 00-02 (1-3)* 02-06 (1-2)*	06-09 (4) 09-16 (4-3) 16-00 (4) 00-02 (3) 02-06 (2)
40	07-11 (2-4) 11-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (0-2)* 06-07 (1-2)	07-09 (2-4)* 09-11 (4-3) 11-16 (4-2) 16-18 (4-3) 18-20 (4) 20-22 (3-4) 22-04 (2-4) 04-07 (2-3)	07-09 (4-2) 09-11 (3-1) 11-16 (2-1) 16-17 (3-1) 17-18 (3-2) 18-20 (4-3) 20-04 (4) 04-05 (3-4) 05-07 (3)	07-17 (1-0) 17-18 (2-1) 18-20 (3-2) 20-05 (4) 05-06 (3-2) 06-07 (3-1)
80	06-10 (4) 10-18 (4-3) 18-00 (4) 00-06 (3-4)	07-09 (4-1) 09-10 (4-0) 10-16 (3-0) 16-18 (3-1) 18-19 (4-2) 19-21 (4-3) 21-06 (4) 06-07 (4-2)	06-07 (2-1) 07-09 (1-0) 09-16 (0) 16-18 (1-0) 18-19 (2-1) 19-20 (3-1) 20-21 (3-2) 21-04 (4) 04-06 (4-3)	07-18 (0) 18-19 (1-0) 19-20 (1) 20-21 (2) 21-03 (4-3) 03-04 (4-2) 04-05 (3-2) 05-06 (3-1) 06-07 (1)
160	17-18 (1-0) 18-19 (1) 19-21 (3-2) 21-23 (4-3) 23-05 (4) 05-07 (3-2) 07-08 (1) 08-09 (1-0)	18-19 (1-0) 19-20 (2-0) 20-21 (2-1) 21-23 (3-2) 23-03 (4-2) 03-05 (4-3) 05-07 (2-1) 07-08 (0-1)	20-21 (1) 21-00 (2-1) 00-03 (2) 03-05 (3-2) 05-06 (1) 06-07 (1-0)	20-22 (1-0) 22-00 (1) 00-05 (2-1) 05-06 (1-0)

*Predominantly sporadic—E openings.

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HAWAII

OPENINGS GIVEN IN HAWAIIAN STANDARD TIME†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	13-16 (1)	06-09 (1) 09-12 (2) 12-16 (3) 16-18 (2) 18-20 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-22 (4) 22-00 (3) 00-02 (2) 02-04 (3) 04-06 (2) 06-08 (1)	18-20 (1) 20-00 (2) 00-02 (1) 21-00 (1)**
Central USA	12-14 (1) 14-16 (2) 16-17 (1)	05-06 (1) 06-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-21 (1)	06-08 (2) 08-14 (1) 14-16 (2) 16-18 (3) 18-00 (4) 00-02 (3) 02-04 (4) 04-06 (3)	20-21 (1) 21-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 20-22 (1)** 22-00 (2)** 00-02 (1)**
Western USA	10-12 (1) 12-14 (2) 14-18 (3) 18-20 (2) 20-21 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-18 (4) 18-20 (3) 20-22 (2) 22-00 (1)	05-08 (4) 08-10 (3) 10-13 (2) 13-15 (3) 15-22 (4) 22-00 (3) 00-05 (2)	18-19 (1) 19-20 (2) 20-02 (4) 02-04 (3) 04-05 (2) 05-06 (1) 19-20 (1)** 20-22 (2)** 22-02 (3)** 02-03 (2)** 03-04 (1)**

†Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT or Z Time. For example, when it is Noon in Honolulu, it is 17 or 5 P.M. in NYC, EST.

ALASKA

OPENINGS GIVEN IN GMT‡

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	21-00 (1) 00-02 (2) 02-03 (1)	12-15 (1) 22-00 (1) 00-02 (2) 02-04 (3) 04-05 (2) 05-06 (1)	07-10 (1)
Central USA	*Nil*	20-00 (1) 00-03 (2) 03-05 (1)	13-16 (1) 22-00 (1) 00-03 (2) 03-06 (3) 06-07 (2) 07-09 (1)	08-12 (1)
Western USA	01-04 (1)	17-22 (1) 22-00 (2) 00-02 (3) 02-04 (4) 04-05 (2) 05-06 (1)	13-14 (1) 14-15 (2) 15-19 (3) 19-01 (2) 01-03 (3) 03-06 (4) 06-08 (3) 08-09 (2) 09-11 (1)	07-09 (1) 09-12 (2) 12-13 (1) 09-12 (1)

‡To convert to Local Standard Time in Alaska, *subtr* 8 hours in the Pacific Standard Time Zone; 9 hours the Yukon Zone and 10 hours in the Alaskan Standa Time Zone, from the GMT times shown in the Cha GMT is 5 hours ahead of EST; 6 hours *ahead* of CST hours ahead of MST and 8 hours ahead of PST. F example, when it is 18 GMT it is 13 or 1 P.M. EST N.Y.C.

**Indicates predicted 80 Meter openings. Openings 160 Meters are also likely to occur during those tim when 80 Meter openings are shown with a forec rating of (2) or higher.

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109	Ham's Interpreter	1.50		120	Shop & Shack Shortcuts	3.95	
112-A	Reg. Ham Log Sheets, per C	1.00		121-1	Electronic Circuits Handbook vol. 1	3.00	
112-B	SSB Ham Log Sheets, per C	1.00		121-2	Electronic Circuits Handbook vol. 2	3.00	
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THE awards PROGRAM

BY ED HOPPER,* W2GT

THE July, "Story of The Month" is about Bob Gensler, W8UPH.

Robert J. Gensler, W8UPH

Bob was first licensed in December 1954 as a Novice. Next came a Technician license in August 1955, followed by a General Class ticket in February 1956.

Although efforts were made to qualify for some of the county awards offered by the various states, the County Hunting bug bit in earnest when CQ announced the USA-CA Award. At that time, about 350 were confirmed.

Shortly after receiving the USA-CA-500 Award, Harry, K8KOM passed along the information about the 40 meter County Hunter Net, so much time was spent there and the county total climbed fast.

Bob has been mobile in many of the counties in Ohio, Michigan, Indiana and West Virginia, helping out both the 40 meter and 20 meter Nets. The thrill of mobiling is at its' best when you can supply the final county in a particular state for someone.

At 33, Bob is single and lives with his parents and works as an inspector for the Interchemical Corp, where he has been employed for the past 14 years, yes, amateur radio is strictly a hobby.

Present equipment includes a Drake TR-4, a National NCL-2000 linear and an all band trap antenna.

Our records show that Bob received USA-CA-500 Award #28 in October 1962; 1000 #26 in March 1964; 1500 #16 in August 1964. USA-CA-2000 #13 was issued in January 1965 and USA-CA-2500 Award #20 in November 1967. The present confirmed total is about 2790.

FLASH!

Louis Van Duyn, K8IWI
Has qualified for #8
USA-CA-3079 All Counties Plaque
SEE K8IWI "STORY" JUNE 1967 CQ

Letters

Lou Van Duyn, K8IWI, writes: "On April 3, 1964 I hardly thought that I would ever write this letter, but thanks to a lot of swell fellows and 5 years of hard work. I have come to the end of one of the most rewarding and fascinating periods of my lift. *3079 HAS BECOME A REALITY!*

Who can I begin to thank for ail this? Just a swell bunch of fellows, past and present, and a lot of real good operators. I can think back to W4BPC, K9CSL, K8CIR, WØMCX and many many others on the original 40 meter County Hunters Net. Today, most of the old timers have either reached 3079 or are not active for the time being. I want to give a special word of thanks to Abe, WA7-EGL for getting me the last 2 counties which were in Idaho. Conditions were not good on 20 meters when the time drew near for Abe

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

Robert J. Gensler, W8UPH

See page 110 for New Reader Service

to reach these counties, and we were "sweating it out", but when his beautiful 5-8 signal came on, we knew we had it made.

Thanks to you Ed for all your encouragement. I don't know what I'll work for now as I think this is the greatest award program in amateur radio. I'd do it all over again if I could afford the postage. *"(We will miss you Lou, but hope you mobile often, Ed.)*

Ed Goss, WA3GVP, writes: "Thought your readers might like to know of my planned operation in the Md/DC QSO party. I will be operating from Dorchester county the first weekend in August. The day following the QSO party, we might set up portable and move from county to county. There are several other rare ones around Dorchester".

Myron Craddock, K4RON, writes: "Although I am not a County Hunter, I enjoy working the fellows on 14336, (also the Gals!) and I did get a few needed states for my WAS.

I am glad to give out Talladega county, Alabama, I get on usually Tuesdays and Sundays. I'm a postman and it really keeps me busy.

As far as I can determine, there are no hams in three counties close to me. Clay, Coosa and Tallapossa. I plan to operate portable from these three counties this summer and I'll try to keep you posted". (QTH, P.O. Box 363, Sylacauga, Alabama 35150).

Dave Klimaj, W4JVN, writes: "Many thanks for explaining the USA-CA Program to me. I have my *Record Bootk* and have begun the large task of going through all my QSL cards.

I have a TR-3 which I put in the car to go mobile here in the Virginia area, and I enjoy it. If you or anyone else would care to suggest what counties are most needed within a 100 mile radius of Northern Virginia, I'll try to make plans to give them out.

Here is something of interest for you and all County Hunters. The U.S. Government sells a 26 inch by 41 inch USA County Map with the states in black and counties named and outlined in blue, for only 50¢. It is mailed postpaid but takes about 6 weeks for delivery. Order item C 3.62/2; UN3/8/960 COMM. U.S. COUNTY OUTLINE MAP BLUE & BLACK CO. BOUNDRIES as of April 1, 1960 A67-B SD-1209." *(Note—although this map is as of April 1, 1960 the only changes I know of since that time are: The county of Princess Anne was taken into the city of Virginia Beach on January 1, 1963 and the city of South Norfolk and the county of Norfolk merged to comprise the city of Chesapeake: so Virginia lost two counties. Ed).*

Worked All Maryland Counties

Awards

New Custodian for **The Garden State County Award** (N.J.) is: Clarence Tinsman, WA2QPC, 12 Dekalb Ave., Plainfield, N.J. This beautiful award was fotoed and explained in January 1969 *CQ*.

New Custodian and **Sponsor** for **The Oregon County Award:** New sponsor, Portland Amateur Radio Club (PARC), new custodian: Floyd Markham, K7WQJ, 4644 N.E. 38th, Portland, Oregon 97211. Although the award and rules were in August 1967 *CQ*, a new Award will be issued but the same numbering system will continue so holders of the award will not lose out but the cost will now be $1.00, other rules the same.

Worked All Maryland Counties Award: Sponsored by the Maydale Amateur Radio Club who also sponsor the yearly Md/DC QSO Party. Issued to those having confirmations from each of the 23 Maryland counties *and* the Independent City of Baltimore for a total of 24 confirmations (Washington, D.C. does not count toward any county). Prepare a GCR List: Give station call, city, county, date, time and mode of operation—have QSLs reviewed by 2 amateurs of General Class or higher and have them sign a declaration that these cards are available and have been checked by them and have them give their full name, call and QTH. Stations must have been worked under the same call. Send this GCR List, certified by the two hams and $1.00 to: Carl E.

Worked Almost All Gowanda Award.

See page 110 for New Reader Service

Fort Sill Centennial Certificate

Andersen, K3JYZ, 14601 Claude Lane, Silver Spring, Maryland 20904.

Tuscaloosa Sesquicentennial Award: Issued for working 3 Tuscaloosa stations. Send log data and 50¢ to the University of Alabama, Box 5001, Birmingham, Alabama 35486.

Lawton-Fort Sill Centennial Certificate: Issued by the Lawton-Fort Sill Amateur Radio Club under the following rules: 1. Continential U.S. amateur radio stations must contact 4 or more (excluding Oklahoma stations which must contact 8 or more) Lawton-Fort Sill Amateur Radio Club members between the Centennial period of January 8, 1969 through December 31, 1969. All amateur bands and modes may be used. 2. Applicants applying must submit a list of stations worked with all pertinent log data and 50¢ in coin to cover cost of handling. No GCR (General Certification Rule) list is required. 3. Stations outside the Continential U.S., including KH6 & KL7, need contact only two members to qualify. Award will be mailed free of charge to all amateurs who qualify as medically handicapped. Fort Sill Centennial Commemorative Medal: 1 Three Bronze Medallions will be awarded at the end of the Fort Sill Centennial Period. One Medallion will go to the Continential U.S. Amateur (excluding Oklahoma) who contacts the most Lawton-Fort Sill ARC members. One Medallion will go to the Oklahoma station who contacts the most Lawton-Fort Sill ARC members. The third Medallion will be awarded to the DX station, Hawaii and Alaska included, who contacts the most club members. Applicants for the Medallions must submit a GCR list with all pertinent log data to be received not later than February 28, 1970–there is no charge for the Medallions. 3. Contacts with K5USA, the club station, can be counted (only once!) as a contact with a member. 4. In case of a tie, the Medallion will be awarded to the applicant with the earliest log entry. For any additional data, send s.a.s.e. to the Lawton-Fort Sill Amateur Radio Club, P.O. Box 892, Lawton, Oklahoma 73501. QSLs for club members may also be mailed to this address. *(Note–All this data came courtesy of Doc, W4NXD/5 who had an interesting article in last August "Ham Radio" re the County Hunters. I mentioned this in October "CQ" but listed Doc as W4NDX, Ed.). (NOTE #2 –I forgot to mention that special QSLs have been printed for members for these QSOs, Ed.).*

Fort Sill ARC Centennial QSL

Gowanda Communications Center Award: Also known as Worked Almost All Gowanda (N.Y.) Award. This award will be sent to all amateurs working K2ISN, WB2-STM, the three active amateurs in Gowanda, N.Y. Contacts must be after February 1, 1969 and they are active nightly on 3855-3900. This is an easy way to catch Cattaraugus County. Write Evan R. Evans, WB2STM, 118 Torrance Place, Gowanda, N.Y. 14070.

Notes

I had hoped to list some QTHs of interest to County Hunters–especially those who have made recent changes but have found that, at least at the present time, space is not available for these.

QUAX, the only Radio Amatetur Newsletter devoted entirely to the 28 mc band–edited and published by SM4DXL, Uliman Qvick, Djurgardsvagen 35C, S-68100 Kristinehamn, Sweden is available for 1 year for 10 IRCs or air mail to USA for $3.00.

Sorry to hear about our loss of another County Hunter, WAØLPJ. I want to commend his widow who is kindly checking QSLs against his logs and answering them!

Rich Mahler, WB6YUI, 3111 Brian, Arcata, California 95521, printed a small booklet which consists of a numerical breakdown of just how many hams are in each QTH, *county*, section and so on, in the state of California. Hams of all kinds might find it of interest and the cost is only 25¢ in cash or stamps. I checked through it and found how lucky I am to have a QSL from a certain

[*Continued on page 99*]

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Q AND A

BY WILFRED M. SCHERER,* W2AEF

Product Detector, A.G.C. and Preamp for R-100A Receiver

QUESTION: Is it possible to either modify existing circuitry or to install new circuitry for providing a.v.c. in a Knight R-100A receiver when the b.f.o. is used? Lack of a.v.c. when a local station comes on while listening for weak signals is pretty hard on the ears. I expect to add an outboard r.f. preamp, in which case the problem will be greatly multiplied.

ANSWER: If the a.v.c. in the R-100A were allowed to operate when the b.f.o. is turned on, the b.f.o. signal injected at the last i.f. stage would capture the a.v.c. system and hold the gain down to a consistently low level. A modification which allows use of the a.v.c. through the installation of a product detector for clean c.w. and s.s.b. reception, as described elsewhere in this issue.

As for a preamp, the R-100A has relatively poor image rejection, so the amplifier should be one that provides added selectivity using at least two turned circuits. Such a device is referred to as a "pre-selector". Suggested circuitry as shown at fig. 1.

NKA Schedules

The following information, concerning the weather schedules of the U.S. Navy station NKA in Asmara, Ethiopia listed in the April Q & A Column, has been received from R. E. Lambert, ET3REL, Navy Operations Officer at Asmara: "Please be advised that the weather schedules of the U.S. Navy station in Asmara have been placed on an "on-call" status and are no longer available on a continuous basis. The broadcast can be activated by any U.S. Naval Ship on a three-hour notice". Thanks OM.

*Technical Director, *CQ*.

Increasing Power with SR-150 Transceiver

QUESTION: I have a Hallicrafters SR-150 and matching power supply PS-150-120 which puts out about 575 v.d.c. at 200 ma. This is a very popular transceiver and I know a lot of guys would like to know how to get more power output from it, which is now around 75 watts. Have you any suggesions for tube changes toward accomplishing this?

ANSWER: In respect to changing tubes in the SR-150 to obtain greater power output, the primary limiting factor is the PS-150-120 power supply which is rated to deliver 115 watts output (575 v. × 200 ma). Nevertheless Hallicrafters specifies this power supply for use with the HT-44 which is rated at 200 watts p.e.p. input.

This is about the maximum power you could expect by changing tubes while using the same power supply. This will give you a p.e.p. output of 100-120 watts or only a 1.25-1.8 db improvement over the 75-80 watts now obtained from the SR-150. The HT-44 uses a pair of 6DQ5's, but they are about 1/2" taller than the 12DQ6B's used in the SR-150, and thus would require recessing the p.a. sockets.

To obtain any significant increase in power, the plate voltage would have to be upped to 700-800 volts, in which case a good tube substitution might be the 6LQ6 with which 300-400 watts p.e.p. input could be obtained. This tube requires a 9-pin ("octal"-type) socket.

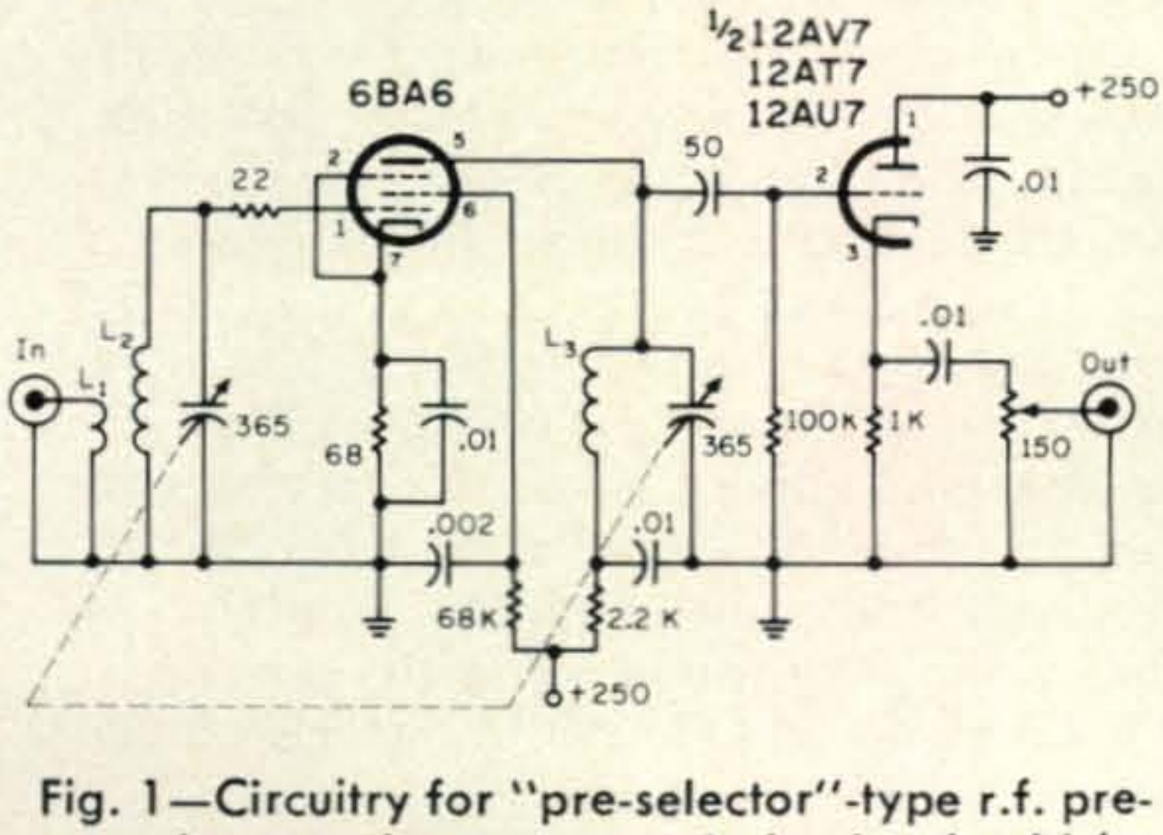

Fig. 1—Circuitry for "pre-selector"-type r.f. preamp. Input-and output tuned circuits should be shielded. Inductors may be bandswitched using the following:
L_1, L_2—1.7-5.5 mc, Miller #B-5495-A. 5.5.-15 mc, Miller #C-5495-A. 12-30 mc, Miller #D-5495-A.
L_3—1.7-5.5 mc, Miller #B-5495-RF. 5.5-15 mc, Miller #C-5495-RF. 12-30 mc, Miller #D-5495-RF.

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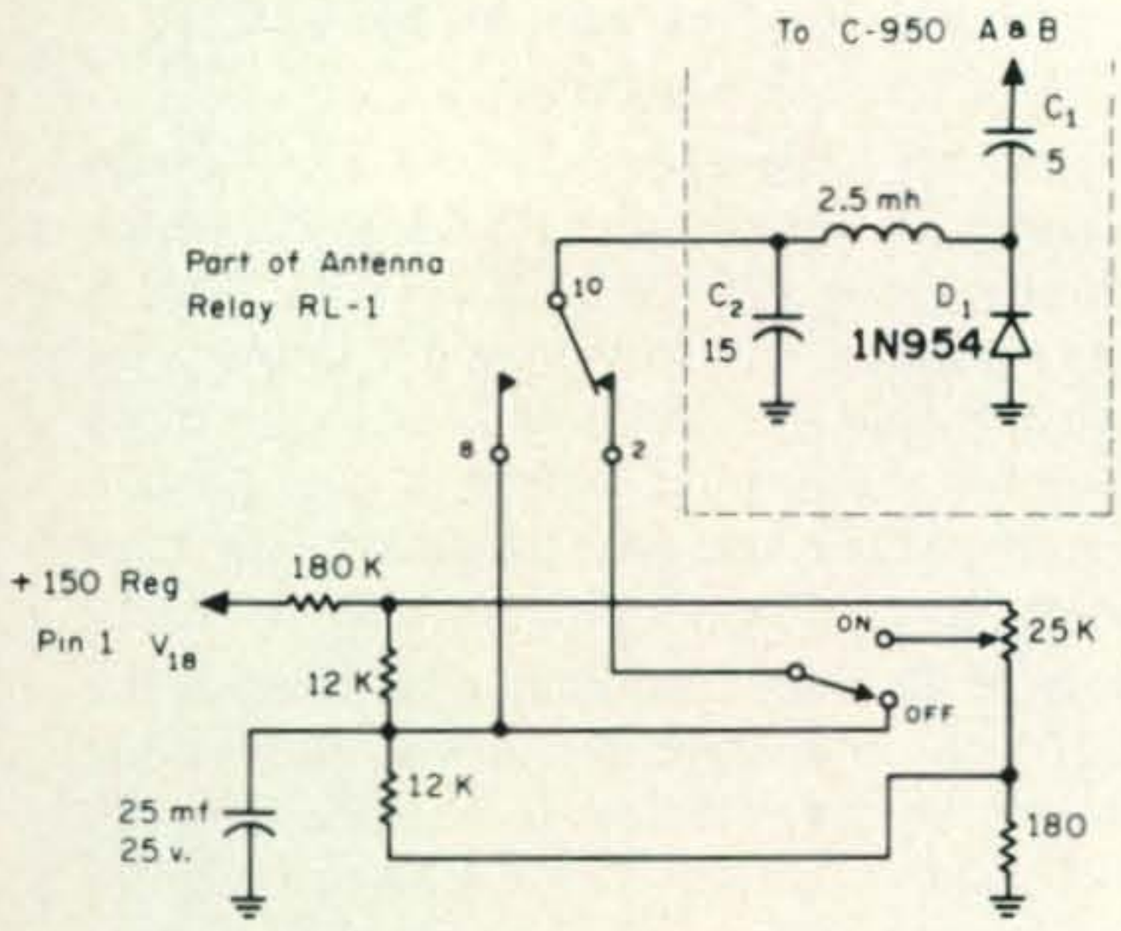

Fig. 2—Incremental-tuning modification for the HW-100 transceiver. $C_{1\text{-}2}$ are silver mica. D_1 is a Hughes Varicap. Components within the dashed lines should be installed in the v.f.o. using short leads.

Incremental Tuning For HW-100 Tranceiver

QUESTION: I should like to know how to add receiver off-set tuning to the Heathkit HW-100 Transceiver. There are many conversions published for other equipment, but I have been unsuccessful in adapting them to this rig. Can you tell me how this can be done?

ANSWER: We have received quite a few requests for such a modification to the HW-100, but before time permitted looking into the matter, the following data was received from Ambrose Barry, W4GHV, to whom we are gratefully indebted for such.

"An excellent incremental-tuning circuit can easily be added to a Heath HW-100, allowing a ±3 kc frequency swing on receive. The circuit used is identical to the one described for a Swan 240 in October 1967 *CQ*. Total cost of parts—about $6.00.

It is connected to C_{950} A & C_{950} B inside the v.f.o. and either C_{947} or C_{948} is changed from 56 mmf NPO to 47 mmf NPO, so the v.f.o. will track and calibrate properly. A small switch was mounted on the panel left of the S-meter and the pot to the right of it. It's worth a million to me!"

The circuit modification is shown at fig. 2. For more data on this type setup, refer to the *CQ* article mentioned above.

Heath SB-10 on 4467.5 Kc

QUESTION: I am using a Viking II with a.m. on the CAP frequency of 4467.5 kc. I should now like to use the Heath SB-10 s.s.b. adapter with it. Is it possible to tune or modify the SB-10 to work at this frequency?

ANSWER: The SB-10 may be modified for operation on 4467.5 kc as follows (the general procedure may be used for other frequencies):

1—Use the 80-meter band position, since this is the one that falls nearest to 4467.5 kc.

2—The fixed capacitors for the r.f. phase-shift network must be changed to a value that has a capacitive reactance of 50 ohms at the desired operating frequency. For 4467.5 kc this value is 715 mmf. Therefore, at the band-switch deck for the r.f. phase-shift network, change the present 80-meter-band 817 mmf capacitors to 715 mmf, 1%, silver mica (680 + 33 mmf in parallel = 713 mmf).

3—The plate circuit of the balanced modulator must be tuned to 4467.5 kc. This can be checked with a g.d.o. or under actual operating conditions. If it will not tune to the higher frequency, remove a few turns from *both* ends of the modulator-plate inductor (the same number of turns from each end, since this is a balanced push-pull type affair) or you can parallel some inductance equally between the 80- and 40-meter taps and both ends of the inductor to reduce the total inductance. The added inductance will have to be 3-5 times greater than now exists between the specified taps and will be subject to some experimentation. Note that the trimming must be done at both *ends* of the main inductor. If it were done at the 10- or 15-meter taps which are located at the mid-portion of the inductor, the required inductance might virtually be a short circuit and sufficient coupling between the link winding at the center then might not be obtainable.

4—The plate circuit for the 6CL6 driver also will have to be tuned to 4467.5 kc. If this cannot be accomplished by backing out the core on L_1, a few turns will have to be removed from the inductor.

5—The plate circuit for the 6BQ5 output stage also may have to be trimmed or adjusted as per step three, but since this is a single-ended circuit, the trimming will be needed only at one end. This probably may be done by shorting out the 10 meter section or both the 10- and 15-meter sections of the inductor. On the other hand, the circuit might tune as is, if as short a coax line as possible is used between the SB-10 and the Viking II.

[*continued on page 99*]

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VHF TODAY

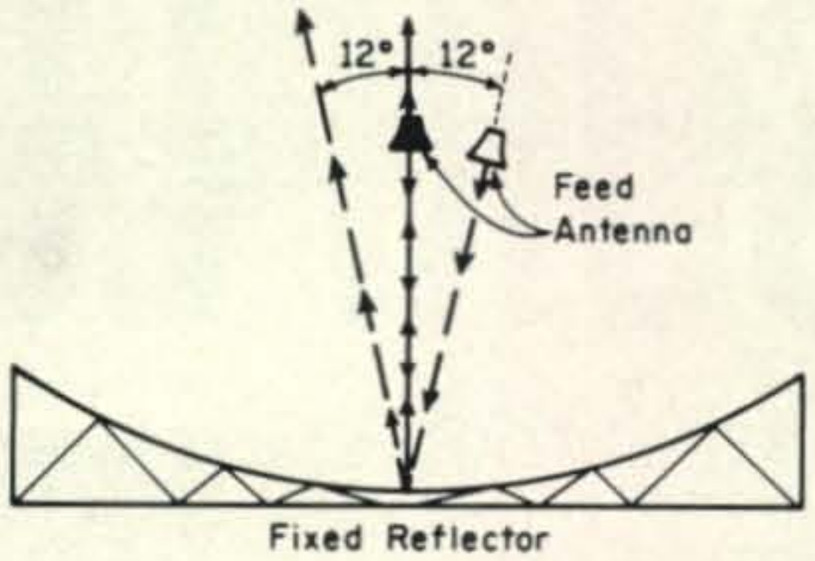

Fig. 1—How W1FZJ/KP4 tracks the moon with his 100′ diameter fixed dish.

BY ALLEN KATZ,* K2UYH

For several years now, there have been rumors that Sam Harris, W1FZJ/KP4 was working on a mammoth dish for v.h.f. moon bounce experiments. A few pictures of this antenna under construction have appeared in the amateur radio journals. Many amateurs have been skeptical that a project of the size proposed could be carried out. But those who knew Sam were confident that he would succeed and make possible the v.h.f. amateur dream of communicating by means of the moon with backyard-sized antennas.

It appears that this summer that dream will become a reality for many amateurs. Sam has already copied several 432 mc stations (K2TKN, W1BU, VE3NA, K2SS and K2UYH). Some of these stations were using medium power (less than 200 watts out) and antennas with apertures of less than 10 feet on a side. The antenna Sam is using is a 100′ diameter homebuilt circular dish. The dish is fixed in position and pointing straight up as shown in fig. 1. By moving the feed antenna which illuminates the circular reflector, the directional pattern of the antenna can be varied 12 degrees (from the zenith) in any direction. This means that from his Puerto Rican QTH (latitude 18.34617°, longitude 66.75304°), Sam can track the moon for more than one hour during 14 days out of each month.

The question now I suspect on most minds is just how "big" a "small" antenna one needs to hear Sam. Sam's antenna has a measured gain of 43 db. The path loss to the moon and back on 432 mc is approximately 262 db. This means that if Sam has at least 500 watts into his antenna (and he will probably have more), a station with a 4 db noise figure receiver (easily obtainable with inexpensive transistors on 432 mc) should be able to copy him with an antenna of 22 db of gain (Isotropic). This much gain can be obtained from only 4-6′ yagis if they are working properly.

The above calculation does not consider transmission line loss. Ideally, the first preamp should be mounted at the antenna. The calculation, however, was based on the reception of a non-marginal signal—a signal your wife could even tell was present. Hence it is conceivable that the presence of Sam's signal might be detected by someone with an antenna gain as little as 10 db.

There is still one other problem. To avoid the Faraday rotation effect (which is still present on 432 mc), Sam is using circular polarization. He is transmitting right circular and receiving left circular. Since circular polarization is flipped from right to left or *vice versa* when it is reflected off the moon, a station using circular polarization to communicate with Sam should follow the same sequence Sam is using, *i.e.*, transmit right circular and receive left circular. For those of us using linear polarization there will be a 3 db loss which must be made up some place in the system: better NF, larger antenna, etc.

According to present information, Sam will be transmitting on 432.000 mc and listening plus or minus 10 kc from 432.000 mc. During his schedule periods, Sam will be listening the first and third 15 minute periods of each hour and transmitting the second and fourth 15 minute periods of each hour.

The dates Sam will be on during the sum-

(continued on page 93)

May 13-24
June 9-21
July 6-18
August 2-4

Fig. 2—W1FZJ/KP4 Moonbounce test dates;

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

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

AFTER describing something as exotic—and rare—as the Fredericks 670B Morse to Baudot computer last month, I can come back to reality with a surplus find that ought to hold interest for a rather wider number of readers, and in addition, is reasonably widely available. My subject this month is telemetry receivers, now coming on the market in respectable numbers.

The first generation of telemetry gear was designed to work with transmitters being put into rockets, balloons, and satellites by space scientists in the mid 1950's. Much of it was specially-made and highly specialized; usually one-of-a-kind, and usable in surplus only as a junkbox source of parts. Later, after space became a more organized industry, telemetry became more standardized, and a family of commercial equipment was produced to monitor spacecraft transmitters sending back information on temperature, radiation, micrometeorite impacts, and other extraterrestrial parameters. Designed to handle weak signals, with cost no object, these telemetry receivers were beautifully designed and built, using such costly, low-noise tubes as the Western Electric gold-grid 417A miniature triode, a famous design for v.h.f. radio-frequency amplifiers

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

Fig. 1—The Nems-Clarke 1432 Phase-Lock Receiver.

Now that the transistor—and the integrated circuit—have taken over the state-of-the-art, tubes are *passe'*, and space scientists are no longer satisfied with the tube receivers, so, presto, into the surplus market!

Space's loss is the amateur's gain, and quite possibly the amateur who can get a telemetry receiver will get the better of the deal. One senior engineer of a Washington-area electronics manufacturer observed to me that the solid-state receivers now being produced suffer from cross-modulation and phase-modulation detector problems and transistor burnout in high-intensity radar fields, none of which affected the tube type receivers. "They just may have been the finest receivers ever built," he suggested.

There are, of course, several manufacturers in the telemetry business, but, according to my friends at the National Aeronautics and Space Administration's Goddard Space Flight Center here, Defense Electronics Inc., of Rockville, Maryland, is the chief manufacturer of standard telemetry receivers. D.E.I. is the successor to Vitro and Nems-Clark, and there are excellent units now available bearing all three of those corporate names, now consolidated under D.E.I.

Most commonly seen in surplus so far is the Nems-Clarke 1412/1432 receiver, which covers either the civilian 128-142 megacycle telemetry band, or the Air Force band lying between 215 and 260 mc. (fig. 1).

This receiver is a crystal-controlled, double conversion design for f.m. reception. (Amplitude-modulation could be provided by wiring in a simple diode detector) Phase-lock detection is provided in the 1432. The rated noise figure is less than 8 db and signal-to-noise ratio is 40 db for 1.5 microvolt input, using the receiver's 100 kc bandpass. (A 500 kc bandwidth position is selectable as well) Intermediate frequencies are 30 mc and 5 mc. The first crystal oscillator may be replaced with an optional Variable Frequency Control, (but these are notably rare in surplus.) The second oscillator is non-crystal, but is temperature-compensated to .005% stability. It may be varied by a front panel control over a range 300 kilocycles wide. First v.f.o. operation could rather easily be added by plugging an L/C circuit into the crystal socket.

Figure 2 is a block diagram of the 1432 receiver. Virtually the only difference between the 1412 and 1432 units is the phase-lock circuitry added to the 1432. I have seen these receivers bearing 128-142 mc dials, bu

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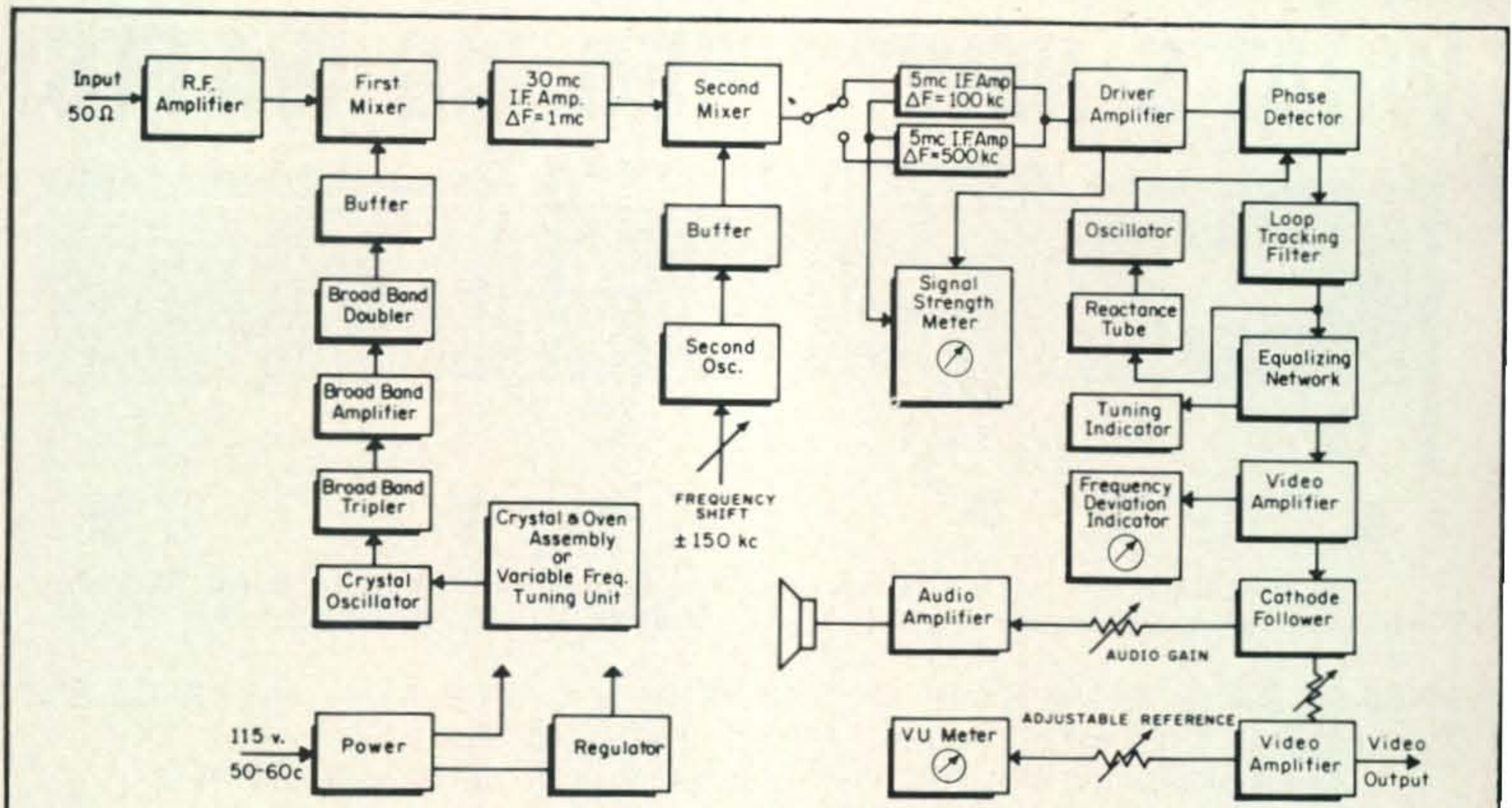

Fig. 2—The block diagram for the 1432 receiver.

according to Nems-Clarke almost all of the production units were for the 215-260 mc band. These should be ideal for the 220 mc amateur band, with the chief modification being, possibly, a narrower i.f. bandpass, nearer to 3 kc than the 100 kc video i.f. provided in the receiver originally.

For two-meter work, the low-band telemetry receivers should be easy to convert: altering the second local oscillator to produce a 37 mc rather than 25 mc signal might be one way, without tinkering with the front end. (As designed the 30 mc first i.f. is converted to the 5 mc second i.f. by hetrodyning with the 25 mc second oscillator signal)

As a receiver to copy the 136 mc weather

Fig. 3—The Defense Electronics, Inc., (D.E.I.), GPR-20 general purpose receiver.

facsimile satellite signals, the Nems-Clarke units should be near-perfect, with only the super-broad i.f. requiring any conversion at all.

The 1412/32, and the other telemetry re ceivers I have seen, operate on standard 11 volt alternating current. They are built for 1 inch rack mounting and weigh in the vicinity of 40 pounds, net. Outputs include an audio monitor and video rear-panel jacks.

For tuneup purposes, there are aircraf bands in the 128-135 mc area, with both traffic control and intra-company communi cations to be heard. Virtually anywhere tha the air lines fly, particularly near terminals these signals may be heard. Even out of nor mal v.h.f. range of an airport tower, it i common to hear the aircraft side of suc transmissions, since the planes have suc superb antenna elevation! In the 216-268 m military band, there are scores of aircraf channels for tuneup, including White Hous frequencies used by Air Force One.

The standard telemetry receiver for th 128-142 mc band was the Nems-Clark 1456A (the 1455 covered 216-260 mc). Thi fine unit featured a plug-in intermediate fre quency amplifier offering bandwidths fro 10 kc to 1500 kc.

The 1455/56 receivers are basically sim ilar to the 1412/32. The appearance is muc the same aside from the porvision for th plug-in i.f. module on the left side. Thes receivers also used the 417A r.f. amplifie

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They had selectable a.m.-f.m.-Phase Modulation detectors, and, most interesting to the amateur, they have *built-in variable first oscillators* and need not be bound to a single crystal channel. To activate the v.f.o. it is necessary only to remove the front panel crystal holder. A spring-loaded switch located behind the crystal socket automatically switches B+ voltage from the crystal oscillator to the v.f.o. circuit.

In some models of the 1455/56 sets there is, in addition, a red can inside the unit marked "VFO-CRYSTAL" Oscillator kit "OSC-100" This is an optional crystal oscillator for the *second l*ocal oscillator, which in the VFO position may be varied plus or minus 150 kc from a front panel control. The crystal position is used when the optional Phase-lock detector module is inserted in the i.f. module rack.

That phase-lock module, PDT-100 is an ingenious little device which will automatically (or manually) lock on to a carrier with a signal level as low as −140 dbm. The device will sweep a 10 kc band (30 kc in the manual position) and "acquire" a very faint signal. "Lock" is indicated by an alarm light on the front of the module. A synchronous detector for a.m. and a coherent liner phase demodulator for Phase of Frequency modulation are provided. This might be a very nice thing for the v.h.f. crowd working on satellite or moon-bounce projects.

The overall rated noise figure of the 1456 receiver is less than 6 db. Ifs are 30 mc and mc as in the 1412/32. The 1456 receiver use 17 tubes, including two nuvistors in the v.f.o. circuit.

A third Nems-Clarke f.m. telemetry set is the 1401, which covers 216-245 mc. It looks much like the 1432 set, and has specs that are close to the 1432. I have also seen receivers with nomenclature 1074, TR-102, 1037A and 1037F, for telemetry work in the high frequency bands.

Currently D.E.I. makes a wide range of commercial electronics equipment in addition to telemetry gear. One item which might be of interest is their GPR-20 general-purpose receiver (fig. 3) which covers 55-260 mc. This solid-state surveillance receiver is designed for portable operation and will handle a.m.-f.m.-c.w. and pulse signals. It costs "Low" $1,250.

Telemetry sets have been showing up in a number of places, but I would suggest three dealers who seem to have found a supply of

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hem: Sasco Electronics, 1009 King St., Alexndria, Virginia; Slep Electronics, Box 178, Ellenton, Florida; Columbia Electronics in Los Angeles. It is always hazardous to mention prices, but I have seen these $3,500 sets old for well under $100 in the east. Some ave recently been offered for sale by the General Services Administration in the Washington area.

Editors Notes

To refer back to something I covered last pring, I am informed that C.B. Goodman, 826 South Western Avenue, Chicago 60636, as a quantity of Western Union TELFAX ecorders and paper. These are miniature Vestern Union FAX units. ■

HF [*from page 87*]

er are listed in fig. 2 Actual times and more tailed schedule information can be obtained writing to Sam. Be sure to include a self-dressed, stamped envelope, since Sam is re to be inundated with mail. Schedule nes may also be calculated approximately determining when the moon is higher an 7 degrees North latitude at Sam's locan. For determining the moon's location for e above purpose, and for your own tracking formation, see the excellent article "How gh the Moon" in July 1965 *QST* and the *utical Almanic*.

It is our hope, as well as that of many other .f. amateurs, that the presence of a big nal (such as that of Sam's) pointed at a ed area of the sky will encourage the conuction of other large antennas pointed at same area, thus establishing a common on window towards which everyone will nt their antennas.

73, Allen Katz, K2UYH

Back Issues

Back issues of *CQ* are available from our Circulation Department. Issues in the current year sell for face value (.75) and all others in stock are one dollar each, postpaid. If the issue is no longer in stock, photo copies of specific articles are available at one dollar each. Preferably, the entire issue will be sent.

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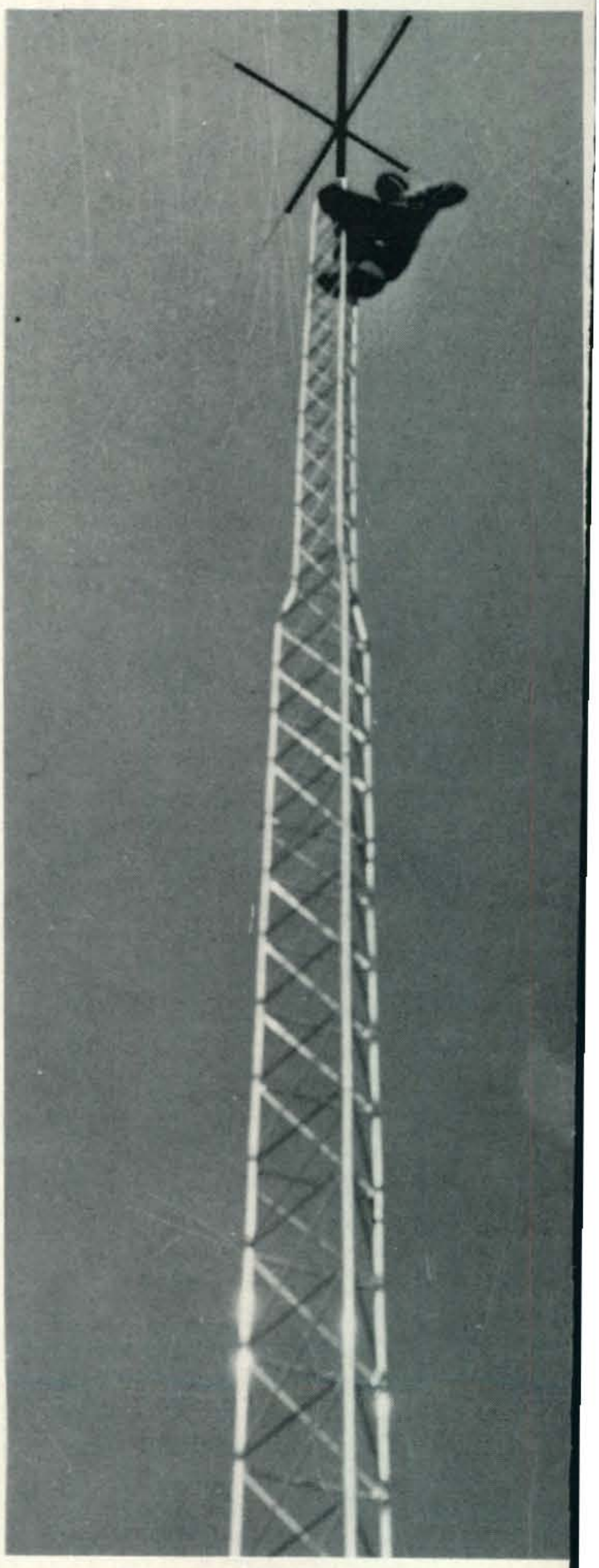

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CQ ANNOUNCES

SPECIAL REDUCED SUBSCRIPTION RATES FOR STUDENTS

One of the major concerns throughout hamdom these days is the lack of new blood coming into our hobby. Everyone seems to agree that we need thousands of new youngsters in the amateur ranks, but the question is how to get them started. One fact is obvious; students at the high school and college level are generally less able financially to afford many of the products they'd like to have to increase their hamming activity.

We at CQ feel that maybe we can help to ease the burden somewhat by lowering our subscription rates so that students can better afford our magazine. So we're going to slash the rates rather drastically for student readers to help bring them into the fold.

Effective immediately, subscription rates for students only are lowered to:

1 year —$4.00 (student saves $ 5.00 on newsstand price)

2 years— 7.50 (student saves $10.50 on newsstand price)

3 years—11.00 (student saves $16.00 on newsstand price)

We ask student subscribers to fill in the coupon below in its entirety in order that we may verify student status. This offer is extended to all persons under the age of 22 who regularly attend grade school, high school, or college at the undergraduate level.

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Resistance Tuned Osc. [*from page 46*]

the relationship

$$f_0 = f_r + f_r \left[\frac{1}{\frac{2C_o}{C_s} \cdot 1 + \frac{C_m}{C_s}} \right]$$

where:

Fo = operating frequency (cycles/second).
F_R = series resonant crystal frequency.
Co = crystal equivalent shunt capacitance (farad).
Cs = crystal equivalent series capacitance.
Cm = circuit capacitance seen by the crystal.

Capacitor C_1 can be chosen in fig. 1 (A) to change the oscillator frequency a definite amount by using the relationship:

$$c_1 = \frac{c_s f_r}{2f_\Delta}$$

Now looking at fig. 1 (C), it is seen that the total capacitance of the circuit goes from an extreme value equal to C_2 or to $C_2 C_3/C_2+C_3$ as the resistor goes from a short circuit to an open circuit. By substituting this total capacitance back in the formula for C_1 one can determine the variation $F\Delta$ for various combinations of C_2 and C_3.

Slow-Scan TV [*from page 20*]

from all parts of the world. Alaska and Sweden are just a few of the places that are transmitting TV pictures. It is now FCC approved and other countries around the world are busy granting permission for this new exciting form of amateur radio.[9, 10, 11]

[9] "Slow Scan FCC Proposal," *QST*, Nov. 1967, p. 78.
[10] "ARRL Comments on Slow Scan FCC Proposal," *QST*, Feb. 1968, p. 72.
[11] "FCC Approval of Slow Scan," *QST*, Sept. 1968, p. 80.

Back Issues

Back issues of *CQ* are available from our Circulation Department. Issues in the current year sell for face value (.75) and all others in stock are one dollar each, postpaid. If the issue is no longer in stock, photo copies of specific articles are available at one dollar each. Preferably, the entire issue will be sent.

SUBSCRIBE TODAY

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DX Contest Results [*from page 58*]

The multi-operator section, especially the single transmitter division, is becoming more and more popular each year. A 33% increase over last year's returns proves our point.

The OH DX Ring station OH2AM still retained its championship among the "Big Guns" with last year's Trophy winner OH5-SM as the runner-up. That makes the PJ$\emptyset$MM operation from Sint Maarten the Trophy winner. The crew composed of W/K9's put on quite a show, with the highest QSO total of the contest but short on their multiplier.

Missing this year was the big signal from K2GL. Heavy business commitments prevented Buz Reeves from participating. Most of the crew activitated their own home stations and gave a good account of themselves.

Several Contest Expeditions added excitement to the contest and put many rare areas in the country column. We did not specify the catagory in which the "Expedition Trophy" would be awarded, leaving the decision up to the Committee and the donor, Stuart Meyer, W2GHK. We are pleased to announce this year's award goes to ZF1EP, a dedicated group who have also put this relatively rare spot on the air in past contests. This year's crew was composed of K4IA, K4CAH, W4-PJG and WA4WIP.

The YL's were in there pitching, to mention a few, Carola at OH5SM, Lida UV3XZ, Molly Ze1JE and the Trophy winner Carmen YS2CEN. Missing by doctor's orders was KP4CL. Hope you will make the next one Alicia.

To see what it sounds like on the other side of the world, JA1KFQ multi-oped with the gang at SK$\emptyset$BW, and G3NKR joined the boys at W2FZJ. K4BAI who was at TG$\emptyset$AA last year showed up half-way around the world at HL9US.

We are always reluctant to disqualify a station, especially one that has put in so much effort in the contest. However we found it necessary to disqualify K8UQA this year. Perhaps he put in too great an effort in his zeal to win.

Some of the overseas club contest managers were very helpful in sending their member's logs all corrected and properly scored. Two of these did an outstanding job, and we are eternally grateful to Milos Prostecky, OK1MP and Gerhard Schnautz, DJ1-QP. And also to Bernie Welch, DL4FS.

The Committee was a bit short-handed for this one, only four of us were able to put in any time. The whole work load was on the shoulders of Fred Capossela W2IWC, Bob Entwistle W1MDO, Andy Malashuk W1-GYE and yours truly, not to forget Joan Weilbacher of the *CQ* Editorial Staff. So forgive us if a few errors are found in this report. See you next month.

73 for now, Frank W1WY

CQ Reviews: [*from page 66*]

each board bears a painted replica of the foil side, as well as component identification. Interconnecting points are numbered on the foil sides to coincide with the related points similarly numbered on the schematic.

Besides including the part numbers for the components, except resistors and fixed capacitors, the manual gives the part number for each circuit board with components installed, thus providing a complete module replacement in each case.

The size of the set is 7⅝" × 15" × 10" (H.W.D.) and it weighs 7¾ pounds.

Performance

Other performance data is as follows: Sensitivity —0.5 μv on a.m. and 0.25 μv or less on s.s.b./c.w. for 10 db S+N/N on all amateur bands and over the major portion of other ranges. Image Rejection—10, 16, 25, 45, 38 db on the 28, 21, 14, 7, and 3.5 mc amateur bands respectively. Internal Spurious Responses—1.5 μv or less at all 455 kc intervals throughout the receiver range only when the b.f.o. is turned on, due to b.f.o. harmonics. These were not bothersome during operation with normal background-noise pickup. Input-Signal Spurious Response Rejection—64 db. A.G.C.—15 and 20 db a.f. output change with r.f. input changes of 20 db (1-10 μv) and 60 db (10-10,000 μv) respectively.

As usually is the case with most receivers used for l.f. reception, a 500 kc low-pass filter[2] at the antenna input is desirable to eliminate inter-station l.f. beats, from standard-broadcast stations in the vicinity, when the 150-400 kc range is used.

The performance of the Allied Model A-2515 Communications Receiver is excellent for the price. You'd have to pay much more for anything better in up-to-date solid-state design. It is sold for $99.95 by Allied Radio Corporation, 100 N. Western Ave., Chicago, Ill. 60680. —*W2AEF*

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[2]"Low-Pass Filters for 5-500 kc Receivers", *CQ*, January 1966, p. 46.

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Our Readers Say [*from page 8*]

tained their extra, it is certainly in the bounds of reason that there will be at the end of the year. After all, this is only a small fraction of the people who were qualified for amateur extra initially with little or no study. When we do have 13,000 extras they will constitute just 4.6% of the U.S. amateur population. The number of amateurs in Canada is irrelevant. We will have more extras certainly than the total amount in 99% of the 300+ countries on the DXCC list for what that proves. We repeat what we said in May, namely that when we have 50,000 extras (20% of the U.S. hams) we can start debating whether or not the program has succeeded in its objective of increasing the technical ability of U.S. amateurs. As of now it is a *total failure*, and no amount of letters to the editor will change it.

Our overseas observers have expressed concern over the great influx of intruders into the extra class portion of the bands. Perhaps Mr. Lloyd prefers the presence of other services to that of U.S. amateurs whom he considers less skilled in their operating ability than himself.

Immigrant Operators

Editor, *CQ:*

I am one of those people who has left his country to realize his dreams and is at the point of touching his life ideals. I am soon going to arrive in the USA as an immigrant with permanent residence and I hope to get US citizenship as soon as possible.

I am convinced that my dreams will soon become reality for in the USA–in the middle of American society where I shall live and work–it is easier than in any other country to bring those dreams into being.

Only one of those dreams, one to which I have devoted all my time, seems to be more difficult to touch.

I have been an active radio amateur in my former country (Romania) from 1954 to March 1969, and had a first class license to operate all categories of radio amateur stations, being one of the operators of Central Radio Club station, YO3RCC. My call was YO3LM. I am also a graduate electronics and telecommunication engineer.

I know that at this time in the USA it isn't possible, if you are an immigrant, to obtain a license for amateur radio; it's possible oly after you get US citizenship. Amateur radio was all my life and it's very hard for me to be kept away from it. Dozens of American radio amateurs may remember our first contacts in two way single sideband and other contacts during ARRL or *CQ* World-Wide DX contests. I was always pleased to establish contacts with American stations.

Many immigrant ex-amateur radio operators with licenses are looking forward to becoming owners of a U.S. License.

I am one of them.

I ask that all United States radio amateurs help to support Senator Barry Goldwater's bill S.J. Res. 27 concerning the amendment to the Communications Act so as to provide aliens with permanent residence in the USA permission to operate amateur radio stations in the U.S. and to hold licenses for their stations.

Please write as soon as possible to the appropriate persons: Congressmen, Senators and let them know your feelings. It will make it easier for the amendment to become law.

Serge Costin, ex-YO3LM
Bad Dreuzen, Austria

Announcements [*from page 10*]

Bangor, Mich.

The annual Southwestern Michigan VHF Picnic will be held at Allegan County Park on August 3rd. It is sponsored by Van Buren County Radio Club Inc. W8JUU.

Carterville, Ill.

The SARA Hamfest will be held on the first Sunday in August, at the Herrin City Park in Herrin, Ill. There will be a trading line and prizes.

For tickets and info contact Bill Johnson W9ERI, 502 Kennicott, Carbondale, Ill. 62901.

Chicago, Ill.

The Six Meter Club of Chicago, Inc. will hold its 12th Annual Hamfest in Frankfort, Ill. on Route 45, one mile north of Route 30, on August 3. About 1500 amateurs and their families are expected to attend.

Pittsburgh, Pa.

The 32nd Annual Hamfest of the South Hills Brass Pounders & Modulators Amateur Radio Club will be held in Pittsburgh on August 3rd, in the pavilion at St. Clair Beach, Pittsburgh, Pa.

Washington MO.

The Zero Beaters ARC will hold their annual Hamfest on August 3rd at the City Park in Washington, Mo. There will be prizes, a swap shop and other activities.

Correction

On page 8 of January *CQ*, a letter from K7-MZC contained a typographical error which has caused no little embarrassment to one of the better-known Australian DXers T. F. (Fred) Evans, VK2NS. Fred has been the sole holder of '2NS since 1924, and how we came to credit his call to K7MZC is a mystery. Our apologies to VK2NS and K7MZC for the confusion.

PLEASE include your ★ ZIP code number on all correspondence ★

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Contest Calendar [*from page 77*]

Frequencies: c.w.–3575, 7075, 14075, 210-75, 28075. Phone–3980, 7280, 14330, 21430, 28600. Novice–3720, 7170, 21120. Check 7030 for DX stations.

Awards: Certificates to top scorers in each state, VE province and DX country. Also certificates to the three top places in W/VE and worldwide. The top scorer in each power catagory will also receive a certificate, as will the lowest power station in the contest submitting a log showing at least 3 genuine skip contacts.

Include a summary sheet with your log with all information, including equipment and power used, and the usual signed declaration that rules have been observed.

Mailing deadline is Sept. 15th to: Mike Czuha-Jewski, WA8MCQ, Route 3, Paw Paw, Michigan 49079.

Indiana QSO Party

Starts: 2300 GMT Saturday, August 16
Ends: 2300 GMT Sunday, August 17

This year's party is sponsored by the Lake County A.R.C. The same station may be worked on each band and mode for QSO points. Novice and Technicians are encouraged.

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

Scoring: One point per QSO. Indiana use states, VE provinces and non-W/VE countries as their multiplier. Others use Indiana countries. (max. of 92) Stations in Ind. may contact other Ind. stations for QSO points and one state multiplier.

Frequencies: c.w.–3535, 3745, 7040, 7155, 14085, 21120, 28070, Phone–3912, 7260, 14285, 21320, 28820. v.h.f.–50.1-50.5, 145-147.

Awards: Certificates to top stations in each state, province and country, and in each Indiana county. Separate awards for Novice and Technician entries. Plaques to the overall winner in Indiana and outside station.

Mailing deadline is September 15th and logs go to: Olen O. Coulter, K9KFM, 319 N. Colorado, Hobart, Indiana 46342. Include a s.a.s.e. if results are desired.

Editor's Notes

Just before going to press I received information from an authoritive source, but not official, that JARL had moved its All Asian contest to a week later than its previously announced time. You will note the change from last month's CALENDAR. Remember this is *not* official, and no rules have been received as yet but hope to have them for next issue.

This change sort of fouled up some of the other activities since the 3rd week-end was avoided on the strength of the previous announced date by the JARL.

However I still believe that the many state organizations should try to coordinate their activities by having a closer communication link. Some of these duplicate dates are repeated year after year. Two state parties on one week-end can be tolorated providing there is a separation in the suggested operating frequencies, but three at the same time becomes a bit sticky.

73 for now, Frank, W1WY

Q & A [*from page 86*]

The shunting inductors or shorts may be conveniently installed in each case at the related bandswitch terminals.

The most critical change is the r.f. phase-shift capacitors which should be held as close as possible to the target value of 715 mmf. Also, keep the capacitor leads short. The other circuits are simply a matter of obtaining resonance at the operating frequency. ■

R-100A Prod. Detector [*from page 62*]

ment for an a.v.c. potential no higher than 0.1 volts, as indicated by a v.t.v.m. at point 10 on the r.f. circuit board

40–Tuning in the crystal calibrator or other signals should now produce a beat note at the receiver output and the beat note should be able to be varied by rotating the B.F.O. TUNE control. Also, the meter should indicate signal strength.

41–Check the operation of the receiver with the other positions of the mode switch to make sure the performance is normal in each case. If the desired operation cannot be had in a particular mode, re-check the wiring and the component values. If needed, also check the continuity of the wiring using an ohmmeter.

When the b.f.o. is to be used for s.s.b. reception on bands A, B or C, set the B.F.O. TUNE at about 11 o'clock for lower-sideband use and near 1 o'clock for upper-sideband operation. On band D the sideband positions will be reversed. ■

USA-CA [*from page 84*]

county which has but one ham–and can you guess which one has the most?

Each month I see a list of amateurs who have had their licenses suspended for offenses like wilfull interference and I am happy to publicize such things, hoping that others will take note and STOP! I had hoped to reprint a letter from ARNS Bulletin that was issued by Ben F. Waple, Secretary, F.C.C. regarding wilfull interference, but space, or rather lack of it does not permit it at this time.

Hope to have space for YOU next month, so write and tell me–How was your month?

73, Ed., W2GT.

See page 110 for New Reader Service

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HT-46 Xmtr 225
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HX-20 Xmtr 129
HX-30 6m Xmtr 175
HA-20 6m Linear 95
HW-10 6m Xcvr 139
HW-12 75m Xcvr 89
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SB-110A Xcvr 295
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6N2 VHF Xmtr 85
6N2 VFO 34
6N2 Conv. (28-30) 39
Phone Patch 15
KW Amp w/desk (store pick-up) 575

KNIGHT
V-44 VFO $ 17
TR-106 6m Xcvr 89
V-107 VHF VFO 19
T-175 6/10m Lin 75

LAKESHORE
P-400GG Linear $ 89

LINEAR SYSTEMS
LSA-3 Linear $ 39
500-12 DC Sup 89
250 AC Supply 39
350-12 DC Sup 69
400 Century DC 75

NATIONAL
NC-300 Receiver $149
NC-303 Receiver 239
NC-300-C6 conv. 29
VFO-62 34
NTS-2 Speaker 12
XCU-303 Calib. 19
NCX-3 Xcvr 169
NCX-5 Xcvr 339
NCX-5 Mk II 389
NCXA AC Supply 75
VX-501 Rem. VFO 125
200 Xcvr 239
AC-200 AC Sup 59

P&H
LA-400C Linear $ 99

POLYTRONICS
PC-2 2m Xcvr $189

RCA
WR-49B RF Gen. $ 29

RME
6900 Receiver $149

SBE
SB-33 Xcvr $189
SBI-VOX 15
SBI-XC Calib. 12
SB-34 Xcvr 289

SWAN
SW-140 Xcvr $ 79
SW-240 Xcvr 169
117AC AC Sup 59
400 Xcvr 199
410C VFO 95
350 Xcvr (early) 249
350 Xcvr (late) 289
350C Xcvr 325
SW-117C AC Sup 79
500 Xcvr 349
500C Xcvr 389
117XC AC Sup 80
14-117 DC Sup 100
22 VFO Adaptor 15
VOX-1 15
250 6m Xcvr 225
TV-2 2m Xverter 225

TMC
GPR-90 Receiver $23

TAPETONE
XC-50N (30-34) $ 2

TEKTRONIX
545 Scope $125

TRANSCOM
SBT-3 Xcvr $18
SBA-3 AC/Spkr. 3

UTICA
650 Xcvr/VFO $ 6
650A Xcvr/VFO 6

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Ship me the following Reconditioned Equipment:

FIRST CHOICE _____

SECOND CHOICE (IF ANY) _____

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I enclose $_____; I will pay balance (if any)

☐ C O D (20% deposit) ☐ REVOLVING CHARGE ($100 Minimum)

Name _____

Address _____

City _____

State _____ Zip _____

☐ **Send Latest Ham Catalog.**

The items listed below are brand-new and carry the full manufacturers New Equipment Warranty. Some items have been on display, but most are Factory Sealed. NOTE: No trade-ins can be accepted on the close-out items shown below.

BTI	Reg.	NOW
LK-2000 Linear (ND)	$795	$635
EICO	**Reg.**	**NOW**
753 Transceiver - kit	$190	$139
751 AC Supply - kit	80	54
752 DC Supply - kit	80	54
752 DC Supply - wired	110	79
720 Transmitter - kit	90	59
722 VFO - kit	45	34
HFT-90 FM Tuner - kit		29
E-3A Metal cover for above		2
ST-97 FM Stereo Tuner - w - wired	139	89
1050 Battery Eliminator & Charger - kit	42	29
525 VOM - kit	16	12
526 VOM - wired	20	16
GALAXY	**Reg.**	**NOW**
DAC-35 Deluxe Console	$100	$ 79
SC-35 Speaker	20	18
2000 Linear with Supply - (Factory Sealed)	495	375
MOSLEY	**Reg.**	**NOW**
V-5 80-10m Vertical	$143	$ 89
V-3 20-10m Vertical	28	19
RV-4RK Roof Mtg. kit	35	17

MOSLEY		Reg.	NO
TA-32 2 el., Tri-Band	CR	$ 84	$
TA-32 Jr. (300 watt)	CR	60	
TA-40K 40m Conv. kit			
TW-3X 20,40,80m Ant.	CR	23	
TD-2 40&80m Dipole	CR	50	
NATIONAL		**Reg.**	**NO**
NCX-200 80-10m Xcvr	ND	$359	$2
AC-200 AC Supply	ND	75	
NCXA AC Supply	ND	110	
NCX-500 80-10m Xcvr	ND	399	
AC-500 AC Supply	ND	95	
HRO-500 Receiver	ND	1675	1
SWAN		**Reg.**	**N**
45 Swantenna	CR	$ 65	$
TV-2 Transverter (14Mc)		295	
TV-2 Transverter (50Mc)		295	
TELREX BEAMS		**Reg.**	**N**
10M-309 3 el, 10m Beam		$ 49	$
6M-624 6 el. 6m (24' boom)		69	
2M-3846 38 el. 2m (43' boom)			
2M-1528 15 el. 2m (28' boom)		65	

ND = New Display
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AMATEUR ELECTRONIC SUPPL

4828 W. Fond du Lac Ave.; Milwaukee, Wis. 53216 - phone (414) 442-47

See page 110 for New Reader Service

Large SWAN Stock = Fast Delivery

RAY SEZ: "Why so much new SWAN in stock?" Simple! SWAN makes GREAT transceivers and AMATEUR ELECTRONIC SUPPLY is a GOOD place to do business with. The demand created by the SWAN and AES Combination requires a huge inventory of Factory-Fresh equipment to insure prompt delivery.

GOOD REASONS for buying your new SWAN from AES

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Top Notch Service Department

Cygnet 260 – **$435.00**

SAVE $50

Purchase any new Swan transceiver or linear at the regular price with no trade-in and you may take a $50.00 Credit toward the purchase of any other merchandise.

LOOK at your low Monthly Payment AFTER JUST $5.00 DOWN

Now!...You can purchase the new 110vac/12vdc Cygnet Transceiver (shown above) or any new SWAN equipment on our convenient Revolving Charge Plan. For example: after a $5.00 down payment, you can own a Cygnet for only **$14.00** a month.

With our NEW plan, there are no more bulky payment books! Once a month you receive an itemized statement showing your exact account balance after the small 1½% monthly service charge has been added. Add-on Purchases (of $50.00 or more) are easy. The minimum Initial Revolving Charge Plan order is $100.00 – and, of course, subject to credit approval.

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Up to $300.		$10
$300.01 to	340.	11
340.01 to	370.	12
370.01 to	400.	13
400.01 to	430.	14
430.01 to	460.	15
460.01 to	490.	16
490.01 to	520.	17
520.01 to	550.	18
550.01 to	580.	19
580.01 to	610.	20
610.01 to	640.	21
640.01 to	670.	22
670.01 to	700.	23
700.01 to	730.	24
730.01 to	760.	25
760.01 to	790.	26
790.01 to	850.	28
850.01 to	910	30
910.01 to	970.	32

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Phone (414) 442-4200

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Ship me the following New Equipment.

_____

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☐ C O D (20% deposit) ☐ Revolving Charge Plan

Name _____

Address _____

City _____

State _____ Zip _____

☐ **Send Reconditioned Equipment Bulletin**

See page 110 for New Reader Service

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $2.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

Subscribers to **CQ** are entitled to one free 3-line ad per month. Ad copy must be accompanied by mailing label from subscription copy of **CQ.**

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

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

10 METER amateur band linear R.F. amplifiers for base or mobile use. Base units: "Hornet"—200 watts PEP ouput—$104.95; "Raider"—400 watts PEP output—$149.95; "Maverick"—2,000 watts PEP input—$244.95. Mobile: "Scorpion"—200 watts PEP output—$169.95. Electronic relay switching. All units designed for transceiver operation. State drive power when ordering. Dealer inquires invited. D & A Manufacturing Co., 1217 Avenue C, Scottsbluff, Nebraska 69361.

HAMFESTERS Radio Club, Chicago, Illinois, proudly announces its 35th Annual Midwestern Hamfest, Sunday, August 10th at Santa Fe Park, 91st & Wolf Road SW of Chicago. The Hamfest features manufacturer and distributor exhibits, swappers row, awards, clowns and games for children, and activities for the XYL. Featuring the Swan 500C with AC PS, the Hamfest climaxes "Illinois Amateur Radio Week August 3 thru 10th." For information and tickets write Tom Ondriska, WN9YZW, 6609 South Kedvale, Chicago, Illinois 60629.

NOMINATIONS are due for 1969 Illinois Amateur of the Year award to be presented at the 35th Anniversary Hamfest. Hamfesters, 6000 South Tripp, Chicago, Illinois 60629.

CRYSTAL LATTICE FILTERS: Ideal for FM & SSB rcvrs. 10.7 mhz IF freq. Singly—$9.00 ea. Two or more—$7.00 ea. Check with order. Singer Products Company, Inc., 95 Broad Street, N.Y., N.Y. 10004.

WRL's used gear has trial-terms-guarantee! Galaxy V—$229.95; TR3-$399.95; Swan 250—$249.95; SR150—$299.95; KWM1—$299.95; 516F1, ACPS—$69.95; HX10—$199.95; T4X—$319.95; AF68—$49.95; SX146—$189.95; HQ170AC—$209.05; HQ180AC—$349.95; R4A—$319.95. Hundreds more. Free "blue-book" list. Write WRL, Box 919, Council Bluffs, Iowa. 51501.

WANTED: Collins 2-1 KC mech. filter for 75A-4. Write or call E. C. Schmults, 361 Old Roaring Brook Road, Mt. Kisco, N.Y. 10549; Tel: 914 MO 6-7378.

2-WAY MOBILE TECHNICIAN WANTED: by S. Florida 2-way service corporation established 25 years. No beginners please! Minimum 5 years experience required on Motorola and GE. Send full resume including salary requirements and snapshot to Spencer Communications, 440 25th Street, West Palm Beach, Florida 33407.

SB-301 Receiver perfect, factory tuned and aligned, with SB & DM filters. $250.00. P. Margulies, K2GYY, 25 Fern Way, Berkeley Heights, N.J.

CAPACITORS—Just inherited 52 brand new 140 ufd. @ 450 vdc. caps. Will sell for 95 cents each in lots of ten or more. K4IHP, 6835 Sunnybrook Lane, Atlanta, Georgia 30328.

REPAIRS—Modifications on all types of equipment. For details write; Interstae Electronic Service, P.O. Box 71, Park Ridge, New Jersey 07656.

SELL: Mosley Triband Beam, Cushcraft 2 meter beam, Ham-m rotator, 100 feet control cable ten foot triangular tower, five invh oscilloscope, model 15 teletypwriter 813 Pushpull Kilowatt, W2RUZ, Leskinen, 3345 172 Street, Flushing, N.Y. 11358.

3 PLASTIC HOLDERS wil frame and protect 60 cards, $1.00—or ten holders $3.00. Prepaid and guaranteed. Patent 3309805. Tepabco, Box 198Q, Gallatin, Tennessee 37066.

ELECTRONIC PARTS and equipment to swap for U.S. and U.N. First Day Covers and stamps. George Beyers, 3208 N.W. 36th Street, Oklahoma City, Oklahoma 73112. Telephone: 405-942-5686.

HEAR POLICE & FIRE radio dispatchers. Exclusive directories of dispatcher call signs and frequencies, a must for all VHF buffs, RACES, CD, AREC, SWL's, Vamps. Catalog for stamp. Communications Research Bureau, Box 56-F, Commack, N.Y. 11725.

MECHANICAL FILTER: Lafayette 455. $10. Dan, 1105 Grammer Street, Vicksburg, Miss. 39180.

FOR SALE: UTC, LS-185 Plate transformer. Multitapped 110-220 primary. Tapped secondary for DC voltages 3.5 to 1 KU from filter at 1.2 amps., CCS. Weight 230 pounds. Price $350.00. UTC, LS-691, modulation transformer for C1. "B" 250th's 833A's etc. Tapped output range 4.5K to 2K ohms load. Oil filled. Weight 350 pounds. Delivers 1,000 watts distortionless audio under CCS rating. Price $300.00. UTC, LS-103 Modulation Reactor, Companion unit for LS-691. Price $50.00. UTC, LS-49 Driver transformer. Various tubes to 838, 805, etc., grids, Matches 805's to C1. "B" 250 th or 833A grids. Weight 15 pounds. Price $30.00. UTC, LS-6 Driver transformer. Various tubes to 805, 845, etc., grids. Weight 7.5 pounds. Price $25.00. UTC, LS-10 Line to grid transformer. Weight 3 pounds. Price $17.50. UTC, CG-512 Line to C1. "B" 250th, 450th, etc. Grids. Price $15.00. All units perfect. Will be boxed and shipped with freight and insurance paid by buyer. Geo. W. Smith, Jr., W5HTP, W5DPS, Route 1, Box 137, Pottsboro, Texas 75076.

FREE: To novices generals, all hams. Immediate information including photo, showing mst equisite way yet to display and protect your QSL collection. Contains free offer. You'll be impressed. Practical Products, Box 1365, Pittsfield, Mass. 01201.

FOR SALE: Swan 500 transceiver and matching A.C. supply/speaker. $450.00. Dr. David A. Usdan, 115 Miss. Ave., Columbus AFB, Miss. 39701.

FOR SALE: Seven only compact 29 foot pound output, 1.6 RPM, 117 volt 60 cycle, 4 wires brought out torque converters. 2/4" x 2½" long, top output shaft-4 hole mounting base, original cost $115, made by Bodine Gearbox, oilfilled. $39.00 each. and you pay freight. Details. J. C. Pehoushek, W0EFK, 10812 Thomas Avenue South, Minneapolis, Minn. 55431.

FILTER—Condensers: Aerovox Oil Filled 100 mfd. @ 3000 vdc. Condensers. $30.00 each. Basil J. Weaver, 1821-C-Ave. M, Lubbock, Texas 79401.

QSLS: Second to none. Same day service. Samples airmailed. 25¢. Ray, K7HRL, 25 South Terrace Drive, Clearfield, Utah 84015.

FOR SALE: Sencore FE-14 FET-VM $35, Data Instruments 536A oscilloscope $70, Mini-AF generator 6803 $30, Kay RF attenuator 432D $30. All like new. Herbst, 39 Lucille, Dumont, N.J. 17628

WANTED: SR150 transceiver QST magazine 1922 & some prior issues. State complete details, lowest cash price. W2CE, Beck, 8604 55th Road, Elmhurst, L.I., N.Y. 11373.

WSA CERTIFICATE (Worked South America), send verifications (any mode) and $1 for postage and handling to Tom, HC1TH, Box 583, Quito, Ecuador.

See page 110 for New Reader Service

DRAKE TR4 with AC and DC supplies and cables Turner J454X desk mic and mobileers cm boom mic $500.00. Prepaid U.S.A. W2TJW, P.O. Box K, Falmouth, Mass. 02541.

SWAN 500, 117XC supply, 410 VFO, Mars OSC, $495.00. Rohn tower 48' $60.00, R44 rotator $45.00, Classic 33 $95.00. You ship. Dave Gould, Rt. 1, Box 37. Woodburn, Oregon 97071.

SELL: Printed circuit boards with 10 or more transistors, 35 or more diodes, 15 or more resistors, and 5 or more capacitors 75¢. K8VEX, 124 E. Sycamore Street, Wayland, Michigan 49348.

CAMERADIO "HAM SHOPPE"—All the finest amateur equipment: Collins, Drake, Swan, National, Hallicrafter, Hammarund. Pus all accessories. 30 day guarantee on all used reconditioned equipment. Write for current list. Cameradio Company, 2801 Liberty Avenue, Pittsburgh, Penna. 15222.

SELL: SX-117 rcvr $229; Heath 2er w/mod $29; Heath MT-1 xmtr $39; Heath QF-1 Q-mult $9; Have 4 each, 7034/4X150A, 8245/4CX250K & 8167/4CX300A; Heath HW-20 2 meter xcvr, 117AC/12DC, vfo (9/68 WRL Blue Book $189.) rcvr rf amp/mixer doesn't work, make offer. USA postpaid. Bill Bode, 13241 Eton Place, Santa Ana, Calif. 92705.

WANTED: Simonia digital relay — type computer; secondhand, good condition. Howard J. Eich, 5950 Kedron Stret, Springfield, Va. 22150.

COLLINS R-390A, $650., KWS-1, $500. Plus wattmeter, mike, and assorted accessories. Clean equipment. $1100 takes all. W6YJG, H. C. O'Brien, 12054 Hammack, Culver City, Calif. 90230. 213-398-5380.

MANUALS: TS-323/UR, TS-173/UR, LM-18, BC-638A, SSB-100, $5.00 each. Many others. SASE brings reply. S. Consalvo, W3IHD, 4905 Roanne Drive, Washington, D.C. 20021.

FOR SALE: Complete station including all spare parts. Top highest offer. Meet college expenses. Write V. J. Taylor, Philco/Ford Corp., ETSP. APO 96346 S. F. Calif. For complete list.

RTTY gear for sale. List issued monthly, 88 or 44 toroids, uncased, five for $2.50 postpaid. Elliot Buchanan and Associates, Inc., 1067 Mandan Blvd., Oakland, Calif. 94610.

39th—ARRL WEST GULF Division Convention August 15 16 & 17, Amarillo, Texas. For an ideal summertime weekend of ideas, fellowship, entertainment, fun (and maybe good luck) you can't miss at $10.50 for registration. W5WX Panhandle Amateur Radio Club, Box 5453, Amarillo, Texas 79107.

POLICE - FIRE - AIRCRAFT - MARINE - AMATEUR - CB CALLS on your Broadcast radio with TUNAVERTER! Tunable-Crystal controlled. Guaranteed! Free catalog. Salch Company, Woodsboro 9, Texas. 78393

SIX METER CLUB OF CHICAGO, INC., 12th Annual Hamfest Sunday, August 3, 1969—"Picnic Grove" on U.S. 45 in Frankfort, Ill. $1.50 Advance $2.00 at Gate. Val Hellwig, K9ZWV, 3420 S. 60th Street, Cicero, Ill. 60650.

FOR SALE: Heath HW100 with HP23. $275. Galaxy III AC & AC & DC supplies $275. Duane Van Winkle, K0FJR, Washington, Iowa 52353.

NEED: Editors & Engineers Handbook—13th and 14th edition. Please write & give price. Bill Clearfield, WA0IMY, 2594 So. Colorado Blvd., Denver, Colo. 80222.

WANTED: Used ham antenna ROTOR and cable in working order. Will consider $15-25. Eric Smith, Box 675, Alamosa, Colo. 81101.

FOR SALE: RME DB-23 $20; 70E23 PTO for KWS-1 $30; Robert Ireland, Pleasant Valley, N.Y. 12569.

SAROC International fun convention January 7-11, 1970. For details, QSP, QSL, SAROC, Box 73, Boulder City, Nevada. 89005 de W7PBV.

4D32 TUBES—One pair . . . 1st check for $20.00 brings postpaid. Never used. Money back gty. W1YRC, 30 Rocky Crest Road, Cumberland, R.I. 02864.

FOR SALE: QST 1925 to 1965—CQ 1947-1965 S.A.E. for list. R. E. Snow, W1AFD, 14 Windemere Rd., Wellesley Hills, Mass. 02181.

MAGAZINE BINDERS, wanted for QST, CQ, 73. VHFer magazines wanted, all 1963 & Jul, Oct, Dec '64 VHF Amateur Dec 1960 & May '62 needed. 73 Oct '60, & Jan '61. Also desire all issues of 'The Technician' early 1960's. Your comments on how to equalize the VHF contests nationwide are requested by the ARRL advisory committee. Don Etheredge, 12040 Redbank St., Sun Valley, Calif. 91352.

INSTRUCTOR for Ham Camp, Free. Retired Air Force Officer, Advanced Amateur CB, First Class Radiotelephone, Commercial Pilot Licenses will instruct at Ham Summer Camp. W7BIF, 107 Wyoming St., Boulder City, NV. 89005.

AMATEUR RADIO CERTIFICATE: Display impressive 8½" x 11" personally endorsed certificate in your shack. Send $1 to Amateur Certificate, Box 244, Miami Fla. 33156.

WANT: Heath SB-610 Monitor; have Northern VMO type 115 to trade. Smith; 915 Lovera, San Antonio, Texas. 78201.

WANTED: Gud Collins 62-S1, manual, cables. Sell: MP-1 pwr Supply; 2 spare pwr Xstrs-$75.00 K2HNB, 57 Meeting Lane, Hicksville, N.Y. 11801.

FOR SALE: 420 Sams Photo-Facts covering Nos. 1-620; $225.00, Riders TV service manual 1-13, $150.00, All FOB. R. Wendel, WB2YVX, 160-20 Grand Central Pkwy, Jamaica, L.I., N.Y. 11432.

TRADE OR SELL: Heath IMW-25, factory wired TVM in excellent condition. Want SB-620 or $80.00 (kit price). Cal Enix, W8EN, Box 474, White Pigeon, Mich. 49099.

FOR SALE: New, regulated power supply 110 volt 60 C in. 250 to 300 regulated out at 200 MA. 6.3 at 10 A — —105 bias. $20.00. prepaid. W5HBG/W5HW 226 Blake Midwest City, Oaklahoma. 73130.

HW-16, $100; 300 Wt. Xmtr and P.S., surplus Xcur switch, $110; Will not ship Xcur and Xmtr. Scott Rowley, P.O. Box 293, Athol, Mass. 01027.

S.A.S.E. for list of surplus, commercial gear. W6KEC, 20707 Anza, Apt. 294, Torrance, Calif. 90503.

TRADE: My Viking Valiant 1 for anything of equal value W7MKB, 802 N. Rodney, Helena, Mont. 59601.

FOR SALE: EICO 753 Xcur & 751 Power supply, both $130; DX-20; C. C. Newberg, Rt. 2, Box 231, Kinston, N.C. 28501.

FOR SALE: Heath DX-60B. Near perfect condx. Assembled mid Nov. '68. with manual. B.O. over $80. Richard Kramer, 32 Walpole St., Sharon, Mass. 02067.

FOR SALE: HW-16 Excellent condition, never used. Only needs final alignment. $120. You pay shipping. D. Franklin, 2211 Cheryl Dr., Jax., Fla. 32217.

TRADE: New Collins F455 N 20 for McCoy 9mc filter with Xtals. Conley, 4304 Willow Woods Dr., Annandale, Va. 22003.

FOR SALE: Master Mobile K-73 Linear Amplifier w/ extra 811A's, $125 W1KWP, M. Sanborn, 128 Davis Ave., Brookline, Mass. 02146.

FOR SALE: D-104 Crystal Mike, Brand new unused, $14.00 postpaid. R. Scott, 371 Claymore Blvd., Cleveland, Ohio 44143.

FOR SALE: Hammarlund transmitter HX-50 $225.00. also Hickok VTVM model 209A $75., both in original cartons, D. Mullins, 901 E. Van Allen, Tuscola, Ill. 61953.

WANTED: Heathkit Q-mult that will work on a SX71. Jeff Dumbowski, 7023 Magoun, Hammond, Ind.

See page 110 for New Reader Service

WANTED: Old Hallicrafters receiver, made in 1936 model SX-9 (not SX-99). Jy Wilfong, Rt. 1, Box 334, Newton, N.C. 28658.

FOR SALE OR TRADE: Knight TR-106, 6m XCVR; V-107VFO; B&W 423 filter, excellent condition. Best offer or will trade for HW-12A. WA3KLK, 22 Enchanted Hills Rd., Apt. 202, Owings Mills, Md. 21117.

FOR SALE: Drake 2NT excellent condition, $80 NC121 $25. R. Bacher, 209 Mendell Place, New Castle, Del. 19720. Tel.: 302-328-5085.

COAX RELAYS, 115 VAC similar Dow-Key (two) each $4. K8DTS, 25884 Highland Rd., Richmond Hts., Ohio 44143.

304th, (five) each $20; 416B (three) each $4; unused surplus. Also have 832,332A,2J49, 845 write. K8DTS, 25884 Highland Rd., Richmond Hts., Ohio 44143.

COLLEGE EXPENSE: Must sell, complete station. HT-37, A-1 shape $200; SBE-34, Like new, $285 P.P. Many other items; cheap. L. Kirschemann, Box 633, Regent, N. Dak. 58650.

LINEAR AMP—Shrew-100, 110 VAC P/S. Like new $80. postpaid. Mike Gauthier, K6ICS, 10425 San Jose Ave., South Gate, Ca. 90280.

FOR SALE: Clegg 99'er $85.00; National 6N2 VFO $35.00. Sgt. A. R. Northam, WA6TKB, 347th T.F.W. Box 3331, APO San Francisco 96328.

TRIANGULAR TOWER 20' — $20, 500W-813-V.F.O. Xmtr—7' relay rack. P.P. 811 MOD. Hi & Lo voltage P.S. complete unit, or separate Lin. Ampl. G.G. 813's. $35.00. Mis. Tubes-Xfrs. Parts. Sets. Magazines. W4Z0 Phone (N.Y.) (212) NE 9-3982 or SASE only.

FOR SALE: Hallicrafters SR-42A Xcvr: $110.00 w/mike looking for SB-110, Swan 250, sidewinder or other 6 mtr SSB gear. All inquiries answered. WA9QZE, Al Ward, 402 Red Wing Ln., Barrington, Illinois 60010.

6N2 XMTR & AC pwr, $75. Eico 730 modulator $30. BC-221 & AC pwr $50. DX-100 with Rtty FSK $75. W9TKR, 505 So. Elmwood, Waukegan, Illinois 60085.

WANTED: Johnson Viking KW matchbox with SWR meter in excellent condition. W5CJ, 1911 Bermuda Street, Shreveport, La. 71105.

FOR SALE OR CHEAP: Excess ham gear of all kinds. Towers, xmtrs, rcvrs, transformers, power supplies, magazines. W2DE. Tel. 212 NE 9-3982.

NCX-200 Transceiver, 110/220N power supply, manuals. $325. Bill, WA2FFZ, 186 West Ave., Pitman, N.J.

FOR SALE: CE-100V, 75A4 (#4566), GSB-101, 4 el quad, 88 Fr c.u. tower, J. Walker, 328 Carpio Dr., Diamond Bar, Calif. 91766.

SELL: SX-99 $60; QF-1 Q-mltplr & Preslctr $10; Viking II & VFO $60; DSB 100 & VFO $55; Sixer $40; K0WTS, J. Schrimsher, 7004 N.W. Hwy, K.C. Mo. 64152.

AM/CW Xmtr: Globe Champ 350. 250a-Am, 275w-cw. Good condition. $75. Can ship. Going mobile. Rosecrans, WIEAD, 8 Windsor, Arlington, Mass. 02174.

COLLINS 75S3 Rcvr., $425. Collins 32S3 xmtr with 516 F-2 supply, $575. WA80NP, Al Schnorreberg, 612 Jenning Ave., Salem, Ohio 44460. Phone: (216) 377-7518.

CLEGG ZEUS—GN2 Xmtr. Interceptor—Rec. Mint condition—$475. 1103 W. Glenoaks Blvd., Glenoaks, Calif. 91202.

HY-GAIN DB-24A and DB-10-15A antennas, 6 mos. old, xlnt cond, in operation, will not ship. Make a reasonable offer. A. Emerald, K6EIV, Ph.: 714-962-5940.

FOR SALE CHEAP: A few brand new Hallicrafters CB20 and CB21 transistorized CB transceivers. Wanted SB200, SB620. Also inexpensive 2 meter station and KW antenna tuner. W5QNQ, 2025 O'Donnell, Las Cruces, N.M. 88001.

OLD OLD TIMERS CLUB welcomes any amateur who has been on the air for 40 years. Send your QSL card to W0CVU, Chas. W. Boegel, Jr., 1500 Center Point Road, N.E., Cedar Rapids, Iowa.

WANTED: Gud Collins 62-S1, manual, cables. Sell: MP-1 Pwr Supply; 2 spare pwr Xstrs—$75.00. K2HNB, 57 Meeting Lane, Hicksville, N.Y. 11801.

MINT CONDX: All with manuals—DX-60 $55; HG10 VFO $25; HQ-110 with 100kc calib. $100; all for $165; want GE FM gear, WA4ZYU, R. Beatie, 1904 114th Ave,. Tampa, Fla. 33612.

FOR SALE OR TRADE: 500c Globe King Xmtr $250.00. 1 complete multi Elmac AF68 Rig $200.00. K4JBP, R. E. Ture, Madison, Ala. 35758.

FOR SALE OR TRADE: SX-122 for SX-146. Also GR-64 rcvr, GD-125 Q mult. and T-60. John Rogus, WA1JKR, 58 Fremont Street, Meriden, Conn. 06450.

FOR SALE: KWM-2 with AC power supply, & 3 extra 10 meter crystals, almost like new—$750.00. Collins PM-2 portable power supply for KWM-2—$110.00. Collins 30L-I linear amplifier, absolutely like new, no more than 20 hours use—$395.00. Hallicrafters TO keyer without paddle, very good condition—$45.00. CDR-TR-44 Rotor with Control box and Cable, good condition and boxed for shipping $45.00. 66 ft. (7 section) Rohn #25 tower which must be taken down and moved away so I can sell the house—make an offer for tower, house, or combination. House will be vacated about July 1. K4IIF, P.O. Box 205, Winter Haven, Florida 33880.

NC300 w/cal, spkr., 6 & 2 Convtr. $250.00. Viking II w/VFO $100.00. HE45A $80.00. ART 13 make offer. K5ZUV, 911 S. Liberty, Okmulgee, Okla. 74447.

ZENITH Transoceanic portable recvr., model H-500. 117N AC-DC and portable 5XC exl. cond. Best offer, all replies answered. W2ASI, 15 Kensington Oval, Isle of Sans Souci, Danenport Neck, New Rochelle, N.Y. 10805.

DX60/HG-10; Johnson 6n2 $79.00.; Amplidyne 6N2 $125.00.; PMR6A Rx 160-10 $35.00.; 75A4 w/noise blanker $395.00.; HA-6 $95.00.; list stamp. Spitz, 1420 S. Randolph, Arlington, Va. 22204.

FOR SALE: Plate transformer 4000/5000 v. sec. 1 amp. for bridge rectifier—W4GD, 3087 Carnes Ave., Memphis, Tenn. 38111.

VARIACS FOR SALE: 2, 9A @ 220 V. Use on 115V, $15 each. Hallicrafters SP44 Panoramic Recvr, excellent, $35.00., Heath 0-7 scope, $15, CMI capacitor testor $15. W2FZE, 1269 Chestnut Street, Roselle, N.J. 07203.

SELL: Apache $90; Mohawk $105, Hallicrafters SX-42 with R-42 spkr. $125.; D-104 Mike and stand $12.; all good condition. K0DTD, 2507 Mad. Ave., Norfolk, Nebraska 68701.

NCX-5 Mk-II w/H.B. AC PS, IOM Xtals $375, pacemaker $95. SP-600 JX-21 $150. WA50NR, 125 Hillview, San Antonio, Texas 78209.

WANTED: Teletype Model 28KSR. State price and condition. Have for sale: RO-172/UX 2 speed facsimile recorder and CV-172A/U fax converter. H. V. Smith, W2LFL, 1757 Seaman Drive, Merrick, L.I., N.Y. 11566.

WANTED: B & W 51SB series SSB gen for spare parts; especially need audio strip xformers. LCDR S.R. Peake. W5PEO, VA-196, FPO San Fran., 96601.

SALE OF TRADE: Make a reasonable offer. 2 each NEW 4X150G tubes. 5 each NEW 100th tubes. 1 each NEW 250th tube. A. Emerald, 8956 Swallow Ave., Fountain Valley, Calif. 92708.

FOR SALE: Viking Navigator, Lysco 600S Xmtr., Hallicrafters HT-18, Swan 175 Xcvr, BC-348-J W/AC. All mint condition. Make offers. WANT 75A4 Vernier Knob. P. Ballinger, 1331 Concord Ave., N.E., Massillon, Ohio 44646.

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SELL: Assorted 4" panel meters as Hickok, Simpson etc. Volt, Milliamps., $5.00 each. Several Bliley 10 Mc. xtals FT243 cases, unused $1.50. Samkosky, 201 Eastern Parkway, Brooklyn, N.Y. 11238.

WANTED: Old battery radios, books, magazines, call, handbooks, catalogs, etc. for amateur museum. Erv Rasmussen, 164 Lowell, Redwood City, Cal. 94062.

FOR SALE: Wheatstone 15/32" oiled perforator tape. P .L. Lemon, W6DOU, 3154 Stony Point Rd., Santa Rosa, Calif. 95401.

WANTED: Used or Inoperative Galaxy, Swan, or Heath SSB equipment. Will consider others. Sell TR4 $450. K5TGH, 2817 Lakewood Dr., Garland, Texas. 75040.

COLLECTOR of obsolete radio & wireless tubes, needs all kinds recng & trans made prior to 1923 need not be working. W9LGH, 610 Monroe Ave., River Forest, Ill. 60305.

LINEAR AMP—Shrew—100, 120 VAC P/S. Like new—$80. postpaid. Mike Gauthier, 10425 San Jose Ave., South Gate, Calif. 90280.

SELL: Heath Apache with SB-10 SSB adapter $150. SX-101A $150. Over 250 countries worked with this FB gear. K9WEH, 312-256-2685.

SELL: Turner 454C microphone $13. Drake TV-1000LP ilter $11. Brand new, instructions, cartons. WB2ZQE, 1 Eaton, Syosset, N.Y. 11791 (516-931-2966).

SWAN-500C (late), 117XC, VX2, all exclnt condx—545. Heath patch, $15., Waters Compreamp—$15, Hygain 18AVQ—$35. K4TRJ, 2500 Hammonds Drive, pelika, Ala.

5A4 w/$175. Collins Noise Blanker, $395; Heath X-60 w/HG-10 VFO (80-2) $55; list; W4API, 1420 S. andolph Street, Arlington, Virginia 22204.

AMERA: Kodak Retina 3C w/exp. meter lens f2 Sell 75 or swap with S.W. Ham rcvr. M. Bae, Box 9, ingston, N.J. 08528.

NTIQUE SPEAKER to go with RCA Radiola 17. Must e working. R. Mendelson, W20K0, 27 Somerset Pl., urray Hill, N.J. 07971.

ONSTANT VOLTAGE TRANSFORMERS, Variacs, ate transformers, write your needs. S.A.S.E. Dale Lee, W3JRM, 1228 Shelbourne Drive, Bethelem, Pa. 3018.

OR SALE: 500 watt Thorarson transformers, chokes, 6s 813s meters reasonable W211R, 33 Grove Ave., oodbridge, N.J. 07095.

OR SALE: Collins 75-A1 with Crystal calibrator and anual mint condition. $130. C.O.D. or write to A4ZZG, Rafael M. Estevez, P.O. Box 2442, Hialeah, a. 33012.

LLOW GALAXY OWNERS—Modify your Galaxy 3, 5, Mark 2 to the 500 watt level of the Mark 3 and the W GT-550. SASE for details. Len Malone, 4305 ndsor Drive, Garland, Texas 75040.

ANTED: Drake T4X/R4A, 75S3, 220 volt 3KVA riac. Sell new 813's $8 each, with sockets. Rev. ttner, 814 4th St. South, Virginia, Minn. 55792.

LL: W7HFF estate, 1031 Logan, Helena, Mont. -221—$45; BC 312M Rec.—$30; Lafayette Rec. 350—$6; WRL SB175 xmitter & PSA63 Power sup-—$60. L. McKindree, 1029 Choteau Street, Helena, nt. 59601.

W 5100-B transmitter for sale—Best offer, excel-t condition. Paul Loegel, 265 Essex Rd., No. gstown, R.I. 02852.

R SALE: NCX-3 with NCX-A, keyer, and extras. 0. Mike Carrol, 1836 S. Woodhaven Dr., Baton uge, La. 70815.

R SALE: BC 453 "Q-5er", mtd on 5¼ x 19 RR panel h AC PS, $20. 522 Xmitter & Recvr, modified, with supplies, $25. Heath AA1 distortion Anal. $20. FZE, 1269 Chestnut Street, Roselle, N.J. 07203.

75A-4, SN4654, 3 and 1.5 filters, unaltered, $375. W0RQY, 4000 West 28, Topeka, Kan. 66614.

WANTED TO BUY: Two WD-11 tubes with good filaments. George D. Snell, 1289 Glen Eyrie Ave., San Jose, Calif. 95125.

CANADIANS: For sale Heathkit SB 400—$350.00; NC 303 with matched speaker and 2 meter converter—$350.00. All in excellent condition. Clayton Dean, VE3AUC, R.R. #1, Niagara-on-the-lake.

LET'S TRADE: I have one A.C. power transformer rated at 2,500V CT and 9000 with PRI. voltage ranging from 220 to 198 volts will trade for either the Johnson Ranger I or Ranger II transmitter. Contact Everett Bollin, WA3DVO, 2029 East Lanvale Street, Baltimore, Maryland.

LET'S TRADE: I have one 4-1000A tube to trade for a Heathkit HO-13 Hamscaner or one 4-400A for the RME DB-23 Preselector. Contact Everett Bollin, WA3DVO, 2029 E. Lanvale Street, Baltimore 13, Maryland 21213.

FOR SALE: Entire Six meter Rig. Complete package only. Send SASE for information. K2LAY, Jim O'Sullivan, 30 Doubleday Street, Binghamton, N.Y. 13901. 607-772-0574.

OLD OLD TIMERS CLUB extend membership application to any amateur licensed for 40 years. Send your QSL card to Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, N.E., Cedar Rapids, Iowa.

MAGAZINES FOR SALE: QST, CQ, Poptronics from 1954. Misc. before 1954. 73 also. Fred Hopengarten, W1NJL, 68 Avalon Rd., Newton, Mass. 244-3969.

WANTED: Used Lampkin 205A modulation meter. Cletus G. Reinsel, W3WUA, Box 25, Bigler, Pa. 16825.

FOR SALE: 19" Relay Racks and cabinets various sizes, pick-up, only, contact: R. Moore, P.O. Box 3178, Newport, Del. 19804.

VHFERS in Maryland, D.C., or Virginia. MSTN meets Sundays on 50.4 Mc/s at 8 P.M. Join us. Tnx. WA3EOP-MSTN Net manager.

RTTY GEAR WANTED: Mod 28 KSR, Mod 14 Repf., and 14 T.D. cash if reasonably priced. K. Schwieker, K4KQR, 1124 Opelika Road, Auburn, Ala. 36830.

WANTED: Will pay $1. a piece for old QST binders. Brother Geraid Malseed, Calvert Hall College, Towson, Md. 21204.

NEED: 500 cycle 75A-4 filter; Bendix 50V, 50 cycle synchros (2⅞" dia.) Sell: National Selectoject; Heath Q. Mult, HY-69 tubes (807's) W2QFR, 25 Cameron Place, New Rochell, N.Y. 10804.

CANADIANS: Expert amateur equipment repairs by Gov't licensed radio technician and amateur (VE6TW). Bob Fransen, Box 197, Sherwood Park, Alberta.

QUAD SALE: Boom-less-quad-10-15-20 meters, all metal electrically separated spreaders. Built to take the rugged weather and high winds. Never has been put up. Brand new, first come, first serve! for $50.00. F.O.B. K4JCK, Farmer Station, Ashboro, N.C. 27203.

LAMKIN 205-A F.M. Mod Monitor, Quad scale, 25-500 mc w/book like new, $200., BC 221 Feq. Meter w/book $35. WJ Davis, 4434 Josie Ave., Lakewood, Calif. 90713.

FOR SALE: Eldico SSB-100-F, $225. SSB-1000-F, new spare 4CX-300's, $250. James W. Craig, 29 Sherburne Ave., Portsmouth, N.H. 03801.

FOR SALE: Mint Drake T-4X—$290, or trade for SBE-34. W1BZT, 5 Longfellow Rd., Sudbury, Mass. 01776.

WANTED: CMA Wide range converter by Ameco, have cash or trade; Have BC-453 converted for 40 meters, in black wrinkle cabinet with power supply, $25. C. C. Coggins, 7125 Hunters Branch Drive, Atlanta, Georgia 30328.

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HEATH: HW-16 xcvr plus spkr, 5 xtals, key $100. General coverage GR-54 $60., GR-64 $25, or all for $175. Will ship collect. E. Strirratt, 76 Woodridge Ave., Cheektowaga, N.Y. 14225.

FOR SALE: NCX5MK2, XCV-27 calibrator, mint condx., Lo hrs. B. Estrem, W4YYK, BX88 Cropweel, Ala. 35054.

SELL OR TRADE: Collins R-388—$375.00. Want 75A4 R4B or Ranger II. J. Shank, 21 Terrace Lane, Ellzabeth town, Pa. 17022.

DX-1000 with manual. Good condx. Must sell now—$35. Want progress line FM Gear. WA4ZYU, Richard Beatie, 1904 114 Ave., Tampa, Fla. 33612.

WANT—Keyboard Base for 28 KSR. Will pay cash. Also need complete 28 KSR or ASR, W4AIS, 7 Artillery Road, Taylors, S.C. 29687.

ANTIQUE—RCA Radiola 17 wanted, state price and condx. R. Mendelson, 27 Somerset Place, Murray Hill, N.J. 07971.

SELL CV-253/ARL tuning unit 38-1000MHz, make an offer, no trades please; Robert Ireland, Pleasant Valley, N.Y. 12569.

MOTOROLA T43GGV, on 146.94, .76, .34, Narrow band, 12V, all accessories, $125, Richard Beatie, WA4ZYU, 1904 114 Ave., Tampa, Fla. 33612.

COLLINS 75A1—$95.00—mint condx. 32 V1—$85.00. Both $160. Jim Demetral, 16530 Skyline Drive, Tinley Park, Ill. 60477. Phone 312-532-4784.

FOR SALE: Collins 75A4, mint, S/N 4745, .5 & 3.1 kc. filters — $400. Johnson 250-23-3 MBox — $70. S. J. Chmell, WN9VY1, 2943 N. 73 Ave., Elmwood Park, Ill. 60635.

FOR SALE: DX100B and RME 4350A both for $175. Pick up only. K9KRW, Box 436, Highland Park, Ill. 60035. Call 312-432-7243 after 7.

SELL: New Johnson S. Auto Multimeter 114-501. Weston Multimeter Vy good condition. New 11 pc. small socket set. All for $30.00. M.O. Shipped Prepaid. A. R. Bergeron, 616 N. 11th, Carlsbad, N.M. 88220.

FOR SALE: Globepacer portable rcvr. RF gain & BFO added AM FM SW LW. Make offer. W2CVW, 13 Robert Circle, So. Amboy, N.J. 08879.
-paid.sPs/P-SPreefth

WANTED: 204A, 849, 212D, 833, 851, old 866, 872 tubes for collection. W7JI, 235 E. 15th Street, Tempe, Arizona 85281.

WANTED: High voltage transformer for Heath DX-100 trasmitter, also cabinet for Heath RX-1 receiver, Larry Waggoner, WA0QP.M, 7611 Cottontail, Wichita, Kan. 67212.

WANTED: Two WD-11 tubes for Radiola III. Also old radio magazines. A. J. Brewer, 4917 Monte Vista Dr., Knoxville, Tenn. 37914.

12 V Car Radios $15. Will supply photostat for conversion to 80M Ham Band. Also Heath 2er unchecked $25. A. E. Bodo. WA9YOZ, 4259 Harrison Street, Gary, Indiana 46408.

WANTED: Drake DC-4 12-VDC power supply. Sale or Trade: Hallicrafters SX-110 receiver. WB4ESE, Box 211, Lewisburg, Tenn. 37091.

WANTED: Warrior or equiv. kw linear. State cond. & price. Dickinson, 32 Debbie Pl., Berkeley Hts., N.J. 07922.

HELP! Need some VHF by-pass condensers 500 pf and or .001 mfo. Send price and quotation to K5VYY, 3728 Wilkie Way, Fort Worth, Texas 76133.

FOR SALE: Heath TV alignment generator IG-52, $50; signal tracer IT-12, $15. K1ZLL, David Minsk, 24 Rayton Road, Hanover, N.H. 03755.

WANTED: A Heathkit S.W.R. Bridge. Model number AM-2. For under $5.00. 1201 So. Birch Street, Denver, Colo. 80222. WN0WPS.

GIVE AWAY 500 good semiconductors to local young sters who show need. Call 399-1980 after 6 P.M. Ra Megirian, K4DHC, Deerfield Beach, Fla.

FOR SALE: Mobile forty meter CW transmitter com plete $30, Eddystone slide rule dial No. 893 new, $1 —W6BLZ, 528 Colima Street, La Jolla, Calif.

FOR SALE: Clegg 99er, $65, Knight V107, $20., Knigh C577, $15, Webster Band Spanner, $20. David Reese, M.D. 747 Madison Avenue, Charlottesvill Vo. 22903.

STANDARD SIGNAL GENERATOR, General Radi 805-C exc. cond., 100% re-tubed, manual. Make offe Roy Cone, W9YLU, 6731 N. Hermitage, Chicago, I 60626.

WANTED: Any set of coils for National FB-7A r ceiver, also tube socket adaptors, UX-199 base WD-II base. For sale: Antique Horn speakers ar Headphones. Joe Horvath—522 Third Street, Sa Rafael, Calif. 94901.

FOR SALE: Lampkin 105B frequency meter. Like ne condition, instructions included. L. F. Wertz, R. # Box 340, Fleetwood, Pa. 19522.

HEATH HP13W DC power supply: $45.00 or be offer. D. Knowles, 7742 Karen, Gurnee, Ill. 60031.

FOR SALE Tri-Ex T-652 crank-up tower. Like ne $185. W6TCQ, Torrance, Calif. Phone: 375-0106.

FOR SALE: Meters, volts, M.A. 813 tubes, 75 w portable xmitter, grid dip meters, what you nee S. Casey, 33 Grove Ave., Woodbridge, N.J. 07095

EICO Space Ranger Recv. New $50, Heath IO scope $50, EICO 315 & 378 signal generators $30 $35. All mint. Charles Evola, 14236 Lenore, Detr Michigan 48239. Phone 532-7756.

SELL OR TRADE: 285 issues of CQ magazine fr 1945 thru current issues, includes 15 CQ binde Will not sell separate copies. W2ELW, William Firestone, CD #4, Stokes Road, Medford, N.J. 080

WANTED: Collins S line and KW2 for best reasona cash price. State condition S/N first letter. J. Lyn 4741 Belwood Green, Arbutus, Md. 21227.

FOR SALE: EICO 753 CW transmitter. Very good c dition. Marlington High School, ARC, 10450 Mo Road, Alliance, Ohio 44601.

C.E. 100V, C.E. 600L, H.Q. 170, all in good condit Going mobile. N. V. Schneider, 6800 Sunnyb Lane, Atlanta, Georgia 30328

TRADE: BC221 with calibration book for Swan 5 or have 4-250's; socket & xformer for 4-1000; xf of all kinds. Les Basham, Cave Junction, Ore. 97

BOSTON VHF RTTY—Activity—51.192 MHZ—AF AM—Horiz Polarized—35 Active stations—Join Fun! More info for your S.A.S.E.—WA1DPX, Ray D 6 Herbert Road, Arlington, Massachusetts 02174

AMECO GENERAL CODE & THEORY COURSE cludes: Advanced code course (8½-18wpm), ama theory course (275 pgs.) and AMECO License G (FCC type questions). Used all for $5. Erik Stir 76 Woodridge Ave., Cheektowaga, N.Y. 14225.

COLLINS 75S3 rcvr, $425. Collins 32S3 xmtr 516F-2 supply, $575. WA8ONP, Al Schnorrenberg Jennings Ave., Salem, Ohio. 44460. Phone: (216) 7518.

FOR SALE: SX-146 rcvr with 500 cps, 2.1kc, and filters, 100kc cal. fine condx. $159.00. Globe Chie $20.00., bith $175.00. W5LNL, 5104 Meadowb Greenville, Texas 75401.

RTTY EQUIPMENT WANTED: Will buy or swap. do you have/need? R. Hendrickson, WB2APX, 1 Columbine, Wildwood, N.J. 08260.

FOR SALE: HT-46 175W xmtr, never used. Hallicrafters S-76 rcvr, aligned & FB $50. G. P W2EHT,. 578 Lake Shore Drive, Parsippany, 07054.

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KANSAS CITY area, moving, selling-out. SB-series, HA-14, Comdel, Magnecorder, SP-400-SX, many other items. W9ECV/0. Lawrence, Kansas. 913-843-6057.

GENERAL COVERAGE HALLICRAFTERS—Best SX122 —Xtal calibrator—speaker mint condx $179. K4JK, 2804 Broadview Dr., Huntsville, Ala. 35810.

6 METER Back Widow Transceiver with 110 Volt power supply $110. W6GOU, Scott Hartman, P.O. Box 3192, Beverly Hills, Calif. 90212.

WANTED: Scope, triggered sweep, Tektronix or similar, in working condition with manual. F. Hoge, 504 So. Pinehurst Ave., Salisbury, Md. 21801.

WANTED: Collins 310B, 32V3, 75A3, 75A4. Please give full details and price. Don Miller, P.O. Box 1007, Harrisonburg, Virginia. 22801.

NC300 w/cal, spkr, 6 & 2 mtr convtr $250.00. Viking II w/VFO best offer. ART-13 make offer. Johnson Low Pass Filter (250-20) $12. K5ZUV, 911 S. Liberty, Okmulgee, Okla. 74447.

WANTED: 1 Gonset Model 3349 AC power supply for G-76 Transceiver. Indicate condition when stating price. W3PVZ, 300 Third Avenue, Burnham, Pa. 17009.

WANTED: Link 1905-6 FM book or diagram. W7PVF, 640 S. 133, Seattle, 98168.

FOR SALE: Hallicrafters SR-160 transceiver=150w. PEP 100w. (80-40-20 meters). Also 500' of RG-59/U unused foam coax. WB6KIL, 617 Purdue, Claremont, Calif. 91711.

HAM TRANSFORMERS REWOUND. Using Hi temperature wire and insulation. Jess Price, W4CLJ, 411 Dunby Ave., Orlando, Fla. 32801.

WANTED: Westinghouse periguard detection system. Will swap 28 A.S.R. teletype or pay cash. J. Thomsen, W9YVP, 8280 S. Tennessee, Claredon Hills, Illinois 60514.

WANTED: Gud transceiver, reasonable. Also accessories and like new receiver. WA4LXX, F. E. Coble, 651 Collier Ave., Nashville, Tenn. 37211.

H & W 5100 and 51SB, Heath Tower, HE45B Lafayette. Write WA5CMC, 2309 Bullington, Wichita Falls, Tex. 76301.

SALE OR TRADE: 6M Xcvr, Knight TR106 and V107 VFO with base. New. Complete $80. S. Cohen, K4ACJ, 524 Michigan Ave., Miami Beach, Fla.

SWAP 2 new ampere 6156 for 2 good 4CX300A need trans former for OS8B scope. Sell Dow-Key switch DKC-RM-1 W3RSC, Russell W. Moore, 316 North Wales, R.D., North Wales, Pa. 19454.

WANTED: Waters Q-multiplier for 75S-1. Collins 399-C PTO. Also 70K-2 PTO in any condition. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Mass. 01056.

SELL: Box tubes, 2 new 813, 2 new 811, 2 used 812, 2 used 2RA3. Make offer or swap. E. M. Hollis, Rt. 2, Mead Is., Palmetto, Fla. 33561.

SELL: 3 el full size 20 mtr beam—$35. 10 sets QST '51 to '60—$25. W1BKG, M. A. George, 35 Ridgewood, Westfield, Mass. 01201.

WC4GSC: Pse QSL this special event station of October 1968 via W4DQD. SASE is not required. L. E. Rice, P.O. Box 2067, Ga. Southern College, Statesboro, Ga. 30459.

HEATH HX-11, 50-w C.W., Xmtr, w/4 novice xtals; for sale: $25.00. Factory checked—in good condition. R. Hannada, WB4CVC, Lincoln Memorial Univ., Harrogate, Tenn.

NEED: Operating manual, for R.M.E., 70 also any diagrams with voltage points, etc. Jeff Nelson, K7RZZ, 1414 N. E. 3rd Street, Vancouver, Wash. 98664.

FOR SALE: Crystals for KWM-2, etc. for 28.000-28.200; 28.700-28.900; 3.300-3.500; 4.4004.600; also 3.5 crystal. 1/2 price $2.50 each. WA0CPX—Ed Gray, Rt. 1, Burke, S.D. 57523.

SALE: Hy Gain 6 meter 6 element beam with AR22-rotor wire—$39.95. Good condition. Geffner, 48 Park Ave., East Merrick, N.Y. 11566.

FOR SALE: 6-Mter, Thor VI, make offer. I will pay shipping. Stan McAllister, 2709 Kay Street, Ceres, California 95307.

MAINE HAMS! The Portland amateur wireless assn. meets every Tuesday at 7:30. EDST, 227 Spring Street, Portland, Maine.

RANGER I $80, 6N2 xmtr, $80., Gonset Super 6 converter $15., 80 M mobile xmtr $25., 40M ARC-5 xmtr $10., 40 Mc. Tapetone converter, $25. Marty Feeney, K10YB, 38 Howard Street, Portland, Maine 04101.

SELL: New 4CX1000 and socket. Vacuum Var. Cap; two Simpson 3" panel meters; huge plate transformer. Package $125.00. WATHG, 6279 Stow Cyn., Goleta, Calif. 93017.

SWAP: Vacuum Variable, UCS 250, Good condx for 1 copy January 1961 73 Magazine, write WA6HYB, 624 First Avenue, Chula Vista, Calif. 92010.

FOR SALE OR TRADE: Two heavy duty Prodelin 6 ft. aluminum Disc. Reflectors. Make me an offer. Jack Holt, Iuka, Illinois 62849. Phone: 618-534-6197.

FOR SALE: Like new Factory wired Valient II $175.— T. G. Soukup, WA1AWX, Bob Hill Road, Ridgefield, Conn.

HOME BREW LINEAR: 1500 watts P.E.P. Bud cabinets, each stage metered. No TV; 10 to 80 mtrs. No shipping. Will swap for 6 or 2 Xcvr, pick up only $150.00. WB8SSM, Evening, 516-PR 5-3775.

HALLICRAFTERS SR42A 2M: $175.00. Clegg 22— $200.00 you pay shipping. Both with manual. 2 Mo. old. L. Brower, 9040 Cherry Ave., Morton Grove, Ill. 60053.

FOR SALE: Plans and specs forty foot crank-up tower. Send $2.00 to 1007 Jan Lee Street, Burkburnett, Tex. 76354.

WANTED: Late model Collins 51S-1 General Coverage Receiver—State Serial No., condition & price. Charles Simmons, 5024-A Idaho Ave., Plattsburgh, N.Y. 12903.

SWAP ONLY: One 20 Amp., 100 volt Variac for Heath Dummy Load, Vertical Antenna, Or? D. C. Pugh, WA6HYB, 624 First Ave., Chula Vista, Calif. 92010.

FOR SALE: ART-13—tvi'd w/cables, pwr supplies. 28v. DC at 12A, 400V. reg. at 6A; 1250V at .75A— $115 FOB, Bud, K2GFL, 226 Edgemont Dr., Syracuse, N.Y. 13214 (315) 446-7542.

FOR SALE: SX-71 and DX-35 with VFO. Make offer. W8RWM, 3109 Norwood Dr., Flint, Mich. 48503.

SELL: Xmit variables Cardwell XG, 110KS, GE 195, Hamm. HF BD 100E, International FCV-2 Conv. BC348/50 MC, make offer. E. M. Hollis, Rt. 2, Palmetto, Fla. 33561.

EDR Rotator and control box. TRW. Series 4A8, Exc. condx. $20. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805.

H.B. 813 G.G. Linear with self contained power supply. Trade for? Bill Clearfield, WA0IMY, 2594 So. Colo. Blvd., Denver, Colo.

FOR SALE: Hammurland HQ with clock and manual. Super B. condition. $110. Richard Urban, 909 Breezewick Rd., Towson, Md. 21204

TRADE OR SELL: Hallicrafters 6 and 2 mtrs transceiver, built in power supply. Good condition. Model SR-34AC. Henry Wroblewski, 3747 S. Harvey Ave., Berwyn, Ill. 60402.

FOR SALE: KWS-1. All new tubes, all Collins modifications. $6.95. Can ship. WA8HNM, L. Beyer, 10 W. 35, Holland, Mich. 49423.

FOR SALE: National NC-125 receiver .5 to 32 Mhz. Very good condition. $55.00. S. N. Silbert, 2066 Creston Ave., Bronx, N.Y. 10453.

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COAX RELAYS, 115 VAC, two at $4 each; five at $20 each; three 416B at $4 each; K8DTS, R. A. Leskovec, 25884 Highland Rd., Richmond Hts, Ohio 44143.

WANTED: Antique radio tubes made prior to 1920 S. M. La Dage, 431 Oakland Ave., Maple Shade, N.J. 08052.

WANT SCHEMATICS for Jackson model CRO-2 scope and Knight T-150A xmtr. Will copy and return. J. Carter, 3479 Mark Twain, Memphis, Tenn. 38127.

SOUTHERN CALIFORNIA AREA Collins 75S1, 32S1, 516F2, 312B4, Heath SB 200, $1080. FOB, W6RET, Bill Deane, 8831 Soverign Rd., San Diego, Calif. 92123.

NC-303 with Ameco 2 mtr CN-144 converter, manuals, $240 or trade for linear. K9SXY, 5652 S. Bishop, Chicago, Ill. 60636.

FOR SALE: Heath SB-300 receiver factory wired with all filters, $225. Heath Oscilloscope model 10-10, $20.00. T. Rutherford, W6NUI, 28810 Covecrest Drive, Palos Verdes Peninsula, Calif.

MICHIGAN HAMS: Lafayette HA-225 rcvr 80-10 mtrs plus marine & 48-54 mcs band. AM-SSB-CW. Good condx. $65, pick up. Gene WB8BJX, 305 Huron, Bay 48706.

QST's Most issues from 1954 to 1967 for sale, Bill Bryan, W8LGQ, Lakeshore Dr., R. 1, Hebron, Ohio 43025.

BC-348-R just plain works too good to cannibalize, sell receiver with AC pwr. supply, built-in AF filter, and military manual—$47.00. Dick Shuff, Plevna, Kansas 67568.

NOVICES: I have some xtals I wish to sell, 7.175, 21.156, 21.192, 21.201, 21.231. Cheaper than wholesale! Sell $1.25/1 or $6.00 for all. L. D. Sweet, WA5TVO, Box 51, Hobbs, N.M. 88240.

NAMEPINS: Catalog for stamp—many styles, colors—Club rates—R. Zach, Pike Place, RFD-4, Mahopac, N.Y. 10541.

HQ-170. W/factory noise blanker, 24 hour clock & matched speaker. Excellent condition. $170. W6NFW, P.O. Box 61, San Juan Bautista, Calif. 95045.

WANTED: Old Radio Supply Catalogs Duck, Manhatten, Allied, Lafayette, etc. Want Collins gear, Heath CM-1 Farrell, 2252 Dixie, Pontiac, Mich. 48055.

WANTED: Clegg Zeus, state price and condition. WA8ASV, Charles Secrest, 1211 Milbourne, Flint, Mich. 48504.

HAVE NEW STEADYREST for 15" Sebastian Lathe. Will trade for two meter equipment. Stan Coutant, Star Route 2, Box 804, Yucca Valley, Calif. 92284.

SELL: Fisher 80C preamplifier, like new, $45; Remington noiseless office typewriter, $35. V. R. Hein, 418 Gregory, Rockford, Ill. 61108.

FOR SALE: Old wireless Telegraphy manuals 1915-20. Other old Radio books and catalogs. K4PNY, 4103 N.W. 15th Street, Gainesville, Fla. 32601.

SELL: Novice xtals 2-80m, 4-40m, 5-15m $1 each or all $10 pp. Freq. meter BC-221-M calib. & man. $60. p.p. W0MAI, Box 895, Greeley, Colo. 80631.

SEARS EMPLOYEES Net meets Wed. 10 PM and Fri. 11 PM E.D.T. 3910 KC or thereabouts—K3YQD, Bill Leggat, Net Sec'y, 213 Cherry Street, Dunmore, Pa. 18512.

FOR SALE: Galaxy "Rejector" with AC supply, $18. Johnson 250-39 T-R Switch, $16. Both in very good condition & PPD. A. Emerald, 8956 Swallow Ave., Fountain Valley, Calif. 92708.

FOR SALE: Heath tunnel dipper, HM-10A, excellent, $19.00. Cal Enix, W8EN, 104½ W. Chicago Rd., Sturgis, Mich 49091.

WANTED: To buy dual VFO adaptor for Swan 400, 406, 420 comb. K2JIY, Don Thomas, 913 N. 4th Street, Millville, N.J.

FOR SALE: KWM-2 w/PM-2 pwr supply and D-104, no stand. Good condx. Make offer. Orig. shipping boxes. T. Woods, Box 1092, Kodiak, Ark. 99615.

FOR SALE: SR-160, A.C. & D.C., $250. 75S3-C, $595. F455J-08, $45. 75S3, $375. 2K-2, spare 3-400-Z, $575. Linear (4-1000), Heath KS-1, $200. James W. Craig, W1FBG, 29 Sherburne Avenue, Portsmouth, N.H. 03801.

COAX CABLE: Amphenol RG-17/U, Per 100 ft. coil $20.00. G. W. Richie, R No. 2, Box 149, Salem, Va. 24153.

HALLICRAFTERS S-120 general coverage receiver with manual, excellent condx. $45.00. Richard Beatie WA4ZYU, 1904 114th Ave., Tampa, Fla. 33612.

WANTED: Heath Apache transmitter, FOR SALE Heath HR-10, excellent condition, $50.00. Tim Tulon WN9ZUJ, 520 Christopher, Morrison, Ill. 61270.

FOR SALE: 100 Khz crystal. Never used. $4.00. Must sell. Write for details. WB8BEG, 24126 Martha Washington. Sfld, Mich. 48075.

WANTED: Collins 312 B5 PTO console; trade new unpacked Skyline four element fiberglass Quad and difference in cash. George Clark MD, W6GAW, 1741 La Coronilla Dr., Santa Barbara, Calif. 93105.

CANADIANS: Selling out—1 kw xmtr. CQ-QST-Xtal from 1933. Write for list. VE3BTQ, Jack Spall, RR1 Shanty Bay, Ont.

TWO KW ROTARY INDUCTOR. 22 microhenry inductor with counter dial for linear. $15 postage paid R. Clark, 806 Jones Ave., Maryville, Tenn. 37801.

HW-16 checked in factory, ten crystals, speaker. Good deal. $100 or ?. WA9ZRV, Kirt Fanning, 602 Edgewood, Lagrange, Ill. 60525.

WANTED: Model VX-501 VFO for NCX-5. Paul Wieger 625 Van Duzer Street, Staten Island, N.Y. 10304

FOR SALE: Johnson 275 watt Matchbox with couple and indicator—Eico 717 keyer—Electrophysics ke R. E. Fritz, Box 66, Clifford, N. Dak. 58016.

XMTR-500W—Complete—AM/CW unit in 6 ft. rela rack. Prestige item. 20 ft. tower. Sell cheap or trad WCE, G. S. Stephen, 8604 55th Rd., Elmhurst, N. 11373. Tel: 212-639-3982.

FOR SALE: TR44 CDR Rotor. Guaranteed perfec 100' new 9 cond. No. 18 Cable incl. $50.00. W6EU 2301 Canehill, Long Beach, Calif. 90815

WANTED: Manufacturing Co. of Electronics large small that would like to relocate. Write, H. Sharra 438 States Street, Weiser, Ind. 83672.

SELL: National NCX-D Mobile Power Supply like ne $55. will ship, CE 20A VFO & QT1 Exc. $90. Paul Smith, WA5FDT, Mena, Ark. 71953.

WANTED: Good Vibrokeyer. Sacrifice perfect Heath GR-54 general coverage receiver. $85.00. Two yea old expert wiring. Stephen G. Hawley, WA4UA Route 3, Box 476-B, Clarksville, Tenn. 37040.

FOR SALE: Hallicrafters HT32A, Johnson Thund bolt linear, Collins 75A4 receiver. Mint condx. $7 W3HQO, 8005 Palmetto Ave., Phila., Pa. 19111.

FOR SALE: Apatche TX-1, needs minor work, b offer over $50. Lafayette HA-230, good condx. $35 best offer. Consider trade for good oscilloscop Glenn Anderson, 1100 New Jersey Ave., Pine Bea N.J. 08741.

RTTY INFORMATION for the Amateur interested RTTY. F. DeMotte, P.O. Box 6047, Daytona Bea Florida 32022.

SELL: Drake excellent T-4X, R-4A, AC-4 $650. Trades. WB6RQK, Box 433, Sausalito, Calif. 949

HAMMARLUND HQ 129X for sale, mint conditi $60. Will not ship. 312/392-8226. Dick, Rolling M dows, Illinois 60008.

NEW JERSEY QSO PARTY—August 16-17. See Cont Calendar in July CQ for complete rules.

See page 110 for New Reader Serv

NOVICES: I have some xtals I wish to sell, 7.175, 21.156, 21-192, 21.201, 21.231. Cheaper than wholesale! Sell $1.25/1 or $6.00 for all. L D. Sweet, WA5TVO Box 51, Hobbs, N.M. 88240.

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R SALE: Hammarlund — HQ100 with clock and anual. Super B condition. $110. Richard Urban, 909 eezewick Rd., Towson, Md. 21204.

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NEW JERSEY QSO PARTY—August 16-17. See CQ contest calendar this month for complete rules.

WANTED: Conversion data & diagram for Motorola T44A, Thowe, 10734 Dunaway, Dallas, Texas. 75228.

WANTED: Heath SB110A 6 M SSB transceiver. Also Bird No. 43 wattmeter. Any condx. Will buy or swap or ? Marty Feeney, K10YB, 38 Howard Street, Portland, Maine 04101.

FOR SALE: Heath MR-1, MT-1 with manuals. Xmit new. WANTED: AN/ARC-21 or AN/ARC-58 or AN/ARC-65. Bill Clinger, 111 Bass Street, Liverpool, N.Y. 13088.

30-50 MC FM receiver, $60.00. Regency Model M-40 12 volt DC — tunable. With manual. Bob Hatter, K7RDH, 340 N. 5th Ave., No. 66—Phoenix, Ariz. 85003.

WANTED: Collins S line 32S3, PS, 75S3 or R4A, T4X. Give serial number and lowest price. Rev. Paul Bittner, 814 4th St. South, Virginia, Minn. 55792.

WANTED: Heathkit HW-16, state condition and price. W8HXZ, Rte. No. 2, Box 48F; Lowell, Mich. 49331.

SELL: Seneca 100 watt 6 and 2 CW and Fone transmitter with book $130. FOB D.A. MacDonald, W1PEX, 5 Fairland Street, Lexington, Mass. 02173.

WANTED: Antique radio tubes made prior to 1920. W2EZM, 431 Oakland, Maple Shade, N.J. 08052.

WANTED: Any teenager interested in forming a SSB net for the Eastern United States contact Tom Sommers, R.F.D. 1, Box 137, Bridgeport, Ohio 43912.

HAM RADIO GEAR, VHF/UHF, parts, etc. for sale. SASE for list. D. Etheredge, 12040 Redbank Street, Sun Valley, Calif. 91352.

HALLICRAFTER SX146 receiver new $150.00. Heath DX100 transmitter needs meter $50. Arthur Hall, 603 Glenpark Ct., Nashville, Tennessee. 37217.

FOR SALE: Heath DX-60 trans and HR-10 rec., both in good cond. Also new all band vert. All for $140.00. WB4COR, P.O. Box 445, Rockwell, N.C. 28138.

TRADE: Lab standards for Drake receiver. Sell: unused 2 KW linear components cheap. Samkofsky, 201 Eastern Parkway, Brooklyn, N.Y. 11238.

OLD OLD TIMERS CLUB membership available to all amateurs on the air for forty years. Send your QSL card to Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, N.E., Cedar Rapids, Iowa.

FOR SALE: Hy Gain 6 mtr, 6 element beam with AR 22 Rotor—wire—$39.95, good condition. Geffner, 48 Park Avenue East, Merrick, L.I., N.Y.

FOR SALE: Gonset VFO for 6,2,220. Hp model AC-4A Decade counters. Wilcox, 2605 Wards Rd., Lynchburg, Va. 24502.

CLEGG ZEUS & Interceptor Rec. mint cond. Complete. $475.00. G. Kennedy, 1103 W. Glenoaks Bl., Glendale, Calif. 91202.

FREQUENCY METER: TS-174/U, 20-250 Mc., with modulation, A.C. Power supply. Like new. $125. G. V. Richie, 643 Diamond Rd., Salem, Va. 24153.

SB-34 with book & microphone, excellent condition, $250.00. or better offer. Gerald E. Crawford, K7UPJ, 342 Spear Drive, Ft. Bragg, N.C. 28307.

FOR SALE: DX-60A, $55, Homebrew Electronic TR Switch $20. Both for $70. Mike Carney, 3110 Gerbert Rd., Cols. Ohio 43224.

FOR SALE: Hammarlund SP600 All band receiver. Best offer takes it. Tel. 884-7783. WN2ERQ, Lindenhurst, N.Y.

SAROC fun convention with entertainment only Las Vegas can present. January 7-11, 1970. QSP, QSL, SAROC, Box 73, Boulder City, Nevada 89005.

WANTED—QST's—Last four issues needed to complete 1916—FEB, MAY, JUNE, JULY. Any reasonable price paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., New York 11050.

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READER SERVICE

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Please send me information on the products and services which I have checked above.

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The GREAT NEW one SWAN 260

- AC and DC SUPPLIES BUILT IN!
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30 DAYS PARTS & LABOR GUARANTEE

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HQ 170C w/Spkr $139.00
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HG 10 $29.00
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SB 110A w/HP 23 $319.00
Six'er $29.00
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INQUE COMM.:
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IC 700RCVR
IC 700 Power sup $299.00

NEW ROHN 71 FOOT FOLD OVER TOWER. REGULAR $397. $269 COMPLETE.
NEW ROHN 51 FOOT FOLD OVER TOWER. REGULAR $321. $195 COMPLETE.
NEW SPAULDING-ROHN HEAVY DUTY SELF SUPPORTING 41 FOOT HINGE BASE TOWER. REGULAR $175. $129 COMPLETE.

HIGHEST TRADES! **NO ONE ANYWHERE** will beat our deal! We will **TOP** any advertised or written offer from any other dealer. We trade on both new and used equipment and we service what we sell. Instant credit on both new and used equipment. General Electric revolving charge and Master Card Credit.

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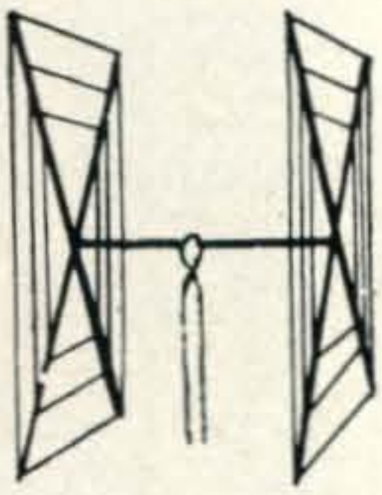
QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount: uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



10/15/20 CUBICAL QUAD SPECIFICATIONS

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

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

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

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

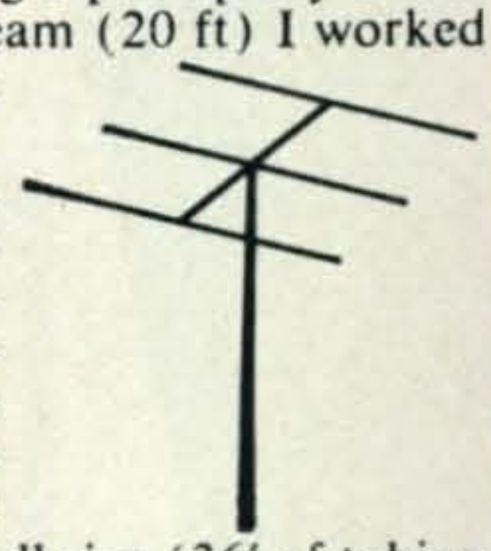
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9ADQ, 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	$19	4 EL 10	$18
3 EL 20	25	7 EL 10	32*
4 EL 20	32*	4 EL 6	18
2 EL 15	15	8 EL 6	28*
3 EL 15	19	12 EL 2	25*
4 EL 15	25*		
5 EL 15	28*		

*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, W2ODH, WA3DJT, WB2FCB, W2YHH, VE3FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5CLK. OZ4H. and over a thousand other stations.

V40 vertical for 40, 20, 15, 10, 6 meters	$14.9
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.9
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.9

HOW TO ORDER: Send money order. We ship immediately by REA Express, charges collect. Gotham ha and CB antennas are available for pick-up in: Rockford, Ill.; Orange, Calif.; Cleveland, Ohio; Dayto Beach, Fla.; Calgary, Canada; Hannibal, Mo.; Indianapolis, Ind.; South Bend, Ind.; Oklahoma City, Okla and in the Benelux Countries and Australia. Write f name and address of franchised distributor. Oth cities open.

GOTHAM
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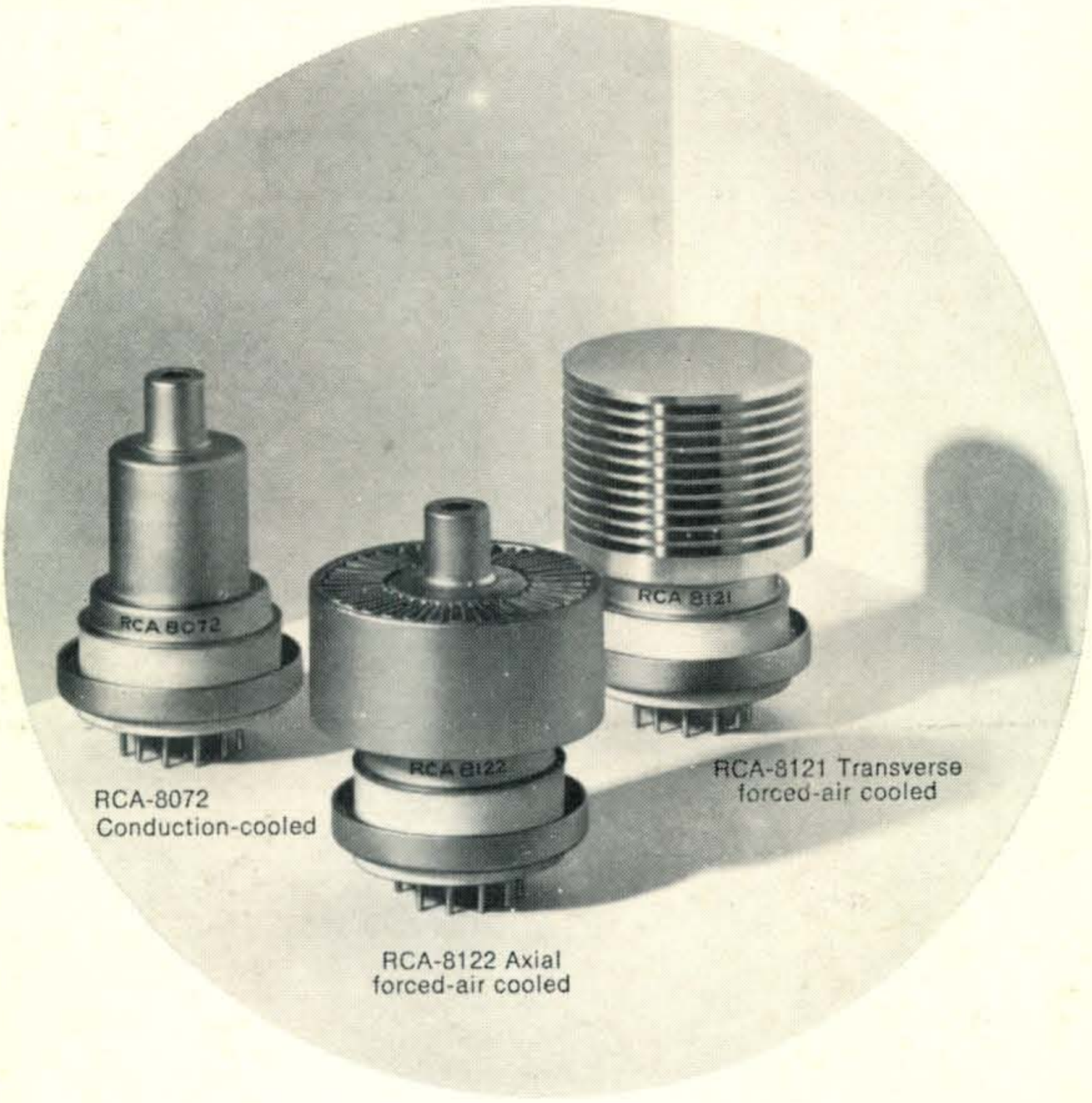

RCA-8072
Conduction-cooled

RCA-8121 Transverse
forced-air cooled

RCA-8122 Axial
forced-air cooled

Not just because it's an RCA beam power tube, either! We think you deserve power and reliability—and we know, just as leading manufacturers of communications equipment know, that the RCA-8122 has more of both. For a starter, it has more than 50% greater dissipation capability than older tubes of comparable size...and delivers up to full rated output with as little as 5 Watts drive all the way to UHF. It gives you design options, too; the RCA-8122 is usable with coaxial, strip-line, or conventional lumped component tank circuit.

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Ceramic-and-metal construction, exclusive electrode configuration, and precision-aligned grids eliminate mechanically-caused noise even at the high temperatures and severe vibration levels encountered in mobile service.

So whether you plan to buy or build, get the full story on the RCA-8122 as your first step. Write for a copy of the RCA-8122 Data Bulletin to RCA Electronic Components, Commercial Engineering, Section **G-15M,** Harrison, N.J. 07029. Or see your local Authorized RCA Industrial Distributor for a copy of the new Power Tube Product Guide, PWR-506C.