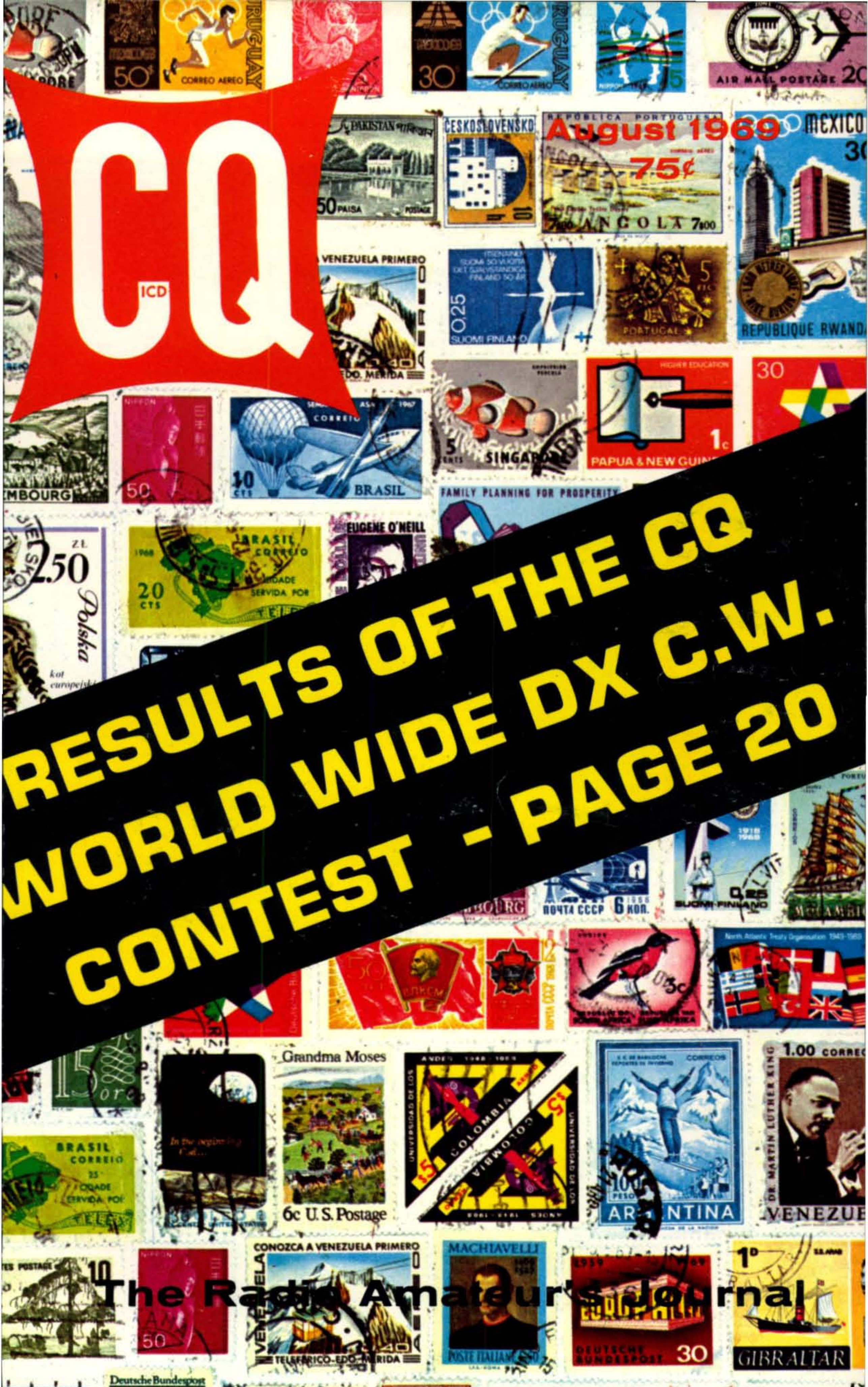
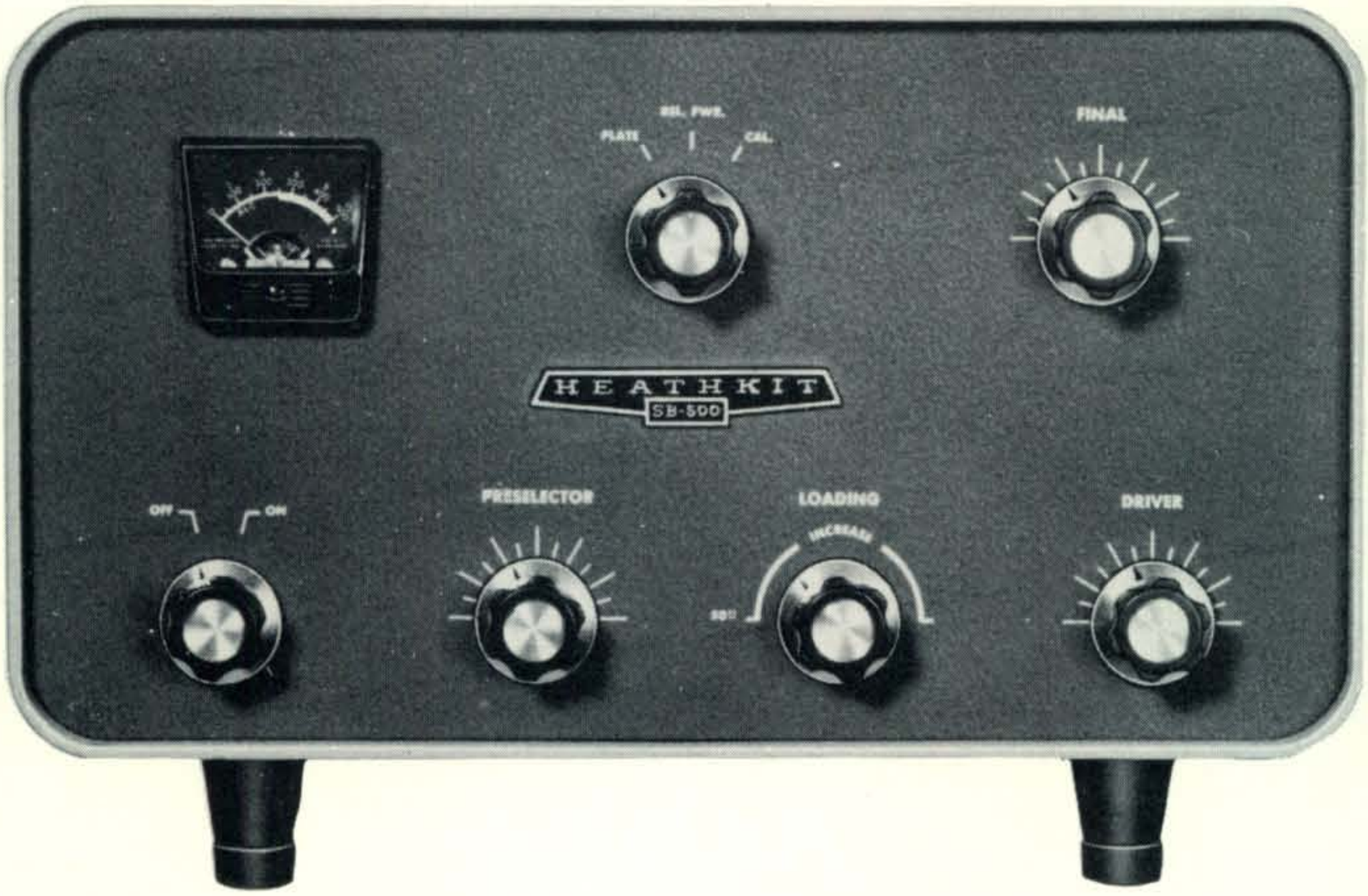

CQ
ICD
August 1969
RESULTS OF THE CQ
WORLD WIDE DX C.W.
CONTEST - PAGE 20
The Radio Amateur's Journal

The Heathkit® SB-500 Transmits And Receives On "2"



This One Accessory Adds "2" to Your Heathkit SB-Series Rig for only $179.95*

• Provides complete 2-meter capability for SB-101, SB-110A, HW-100 and the SB-301 / 401 combination • USB, LSB & CW operation • 144 to 148 MHz coverage • 130 watts PEP input . . . 50 watts PEP output • Highly sensitive receiver • Fast, easy tuning • No cable switching • Handsome SB-Series styling

Now, in answer to many requests, Heath has a fast, low cost way to put you on two meters . . . without having to buy a whole new rig. If you own an SB-101, SB-110A, HW-100 or the SB-301/401 combo, you're almost there. Here are the details on how to get on "2" — the SB-500 way.

Here's How It Works. In the receive mode, the SB-500 takes an incoming 2-meter signal and heterodynes it to either 6 or 10 meters, where the low band gear handles it in the usual way. On transmit, a 28 or 50 MHz driver output is heterodyned to 2-meters, amplified and coupled to the output.

Here's What It Delivers. When used with any of the gear above, the SB-500 2-Meter Transverter gives you complete 2-meter SSB or CW transceive operation from 144 to 148 MHz. A pair of inexpensive 6146's in a push-pull AB1 circuit deliver a husky 50 watts output into a 50 ohm nonreactive load. Final plate voltages are derived from the driving unit, but all other operating voltages come from a built-in power supply — no extra supply to buy. Receiver sensitivity is 0.2 uV for a 10 dB S+N/N ratio . . . that means solid copy QSO's. A front panel on-off switch places the SB-500 into operation or allows the low band gear to operate straight through to an antenna or drive a linear . . . a combination of complete rear apron jacks and internal relay switching eliminates troublesome cable changing. Reliable relay-controlled T/R switching too. Tuning is fast and easy, and a built-in meter monitors either final plate current or relative power. ALC voltage is supplied to the driver to aid in preventing over-driving and distorted signals. A built-in 1 MHz crystal calibrator is also included.

Solid, Stable Construction. The sensitive receiver and oscillator go together on well planned circuit boards. To insure stability and make adjustment more exact, the transmitter and power supply components are ruggedly chassis mounted. The SB-500 comes complete with all interconnecting cables too. Start enjoying the QRM-free world of 2-meters today . . . with the new Heathkit SB-500 . . . another hot one from the hams at Heath.

Kit SB-500, 19 lbs.....**$179.95***

SB-500 SPECIFICATIONS — RECEIVER: Sensitivity: 0.2 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **Spurious Response:** All are below 0.1 microvolt equivalent signal input, except at 145.310 MHz (50 MHz IF only). **Antenna Input Impedance:** 50 ohm unbalanced. **TRANSMITTER: DC Power Input:** 130 watts PEP. **Power Output:** 50 watts (50% duty cycle). **Output Impedance:** 50 ohm with less than 2:1 SWR. **GENERAL: Frequency Range:** Any 2 MHz segment between 144 & 148 MHz into 50 MHz or 28 MHz tuned IF. **Mode of Operation:** SSB or CW only. **Power Requirements:** (1) 120/240 VAC, 50/60 Hz at 82 watts (internal). (2) 700 to 800 VDC at 200 mA (from driving unit). **Fuse:** ¾ ampere slow-blow for 120 VAC (formerly 3AG); ½ ampere slow-blow for 240 VAC. **Front Panel Controls:** Meter-calibrate switch, final tuning, off-on (function) switch, preselector, final loading, driver tuning. **Chassis Controls:** Relative power adjust & bias adjust. **Rear Apron Connectors:** RF output, ALC, linear relay, relay, drive, power plug, low f receiver, low f antenna, fuseholder. **Tube Complement:** 6CB6 transmitter mixer, 6CB6 crystal calibrator, 6DS4 receiver RF amplifier, 6DS4 receiver mixer, 12GN7 transmitter RF amplifier, (2) 6146 final amplifiers, (types 6146A or 6146B may be directly substituted), 7059 heterodyne oscillator-amplifier, 8156 RF driver, 0A2 voltage regulator. **Diode Complement:** 5 silicon diodes, 750 mA, 500 PIV; 3 in power supply, 2 in ALC. 1 Germanium diode, IN191: REL PWR. **Cabinet Dimensions:** 12¼" W x 6⅝" H x 13" D. **Overall Dimensions:** 12¼" W x 7-15/16" H x 14" D including knobs and feet. **Net Weight:** 14½ lbs.

*Mail order prices; F.O.B. factory.

Meet The Adaptable 2-Meter Rig

Heathkit HW-17A
Adapts to AM or FM Modes, Fixed or Mobile

Wouldn't it be nice to have a 2-meter base station that installed in the car in seconds or worked FM or AM when you wanted? 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.

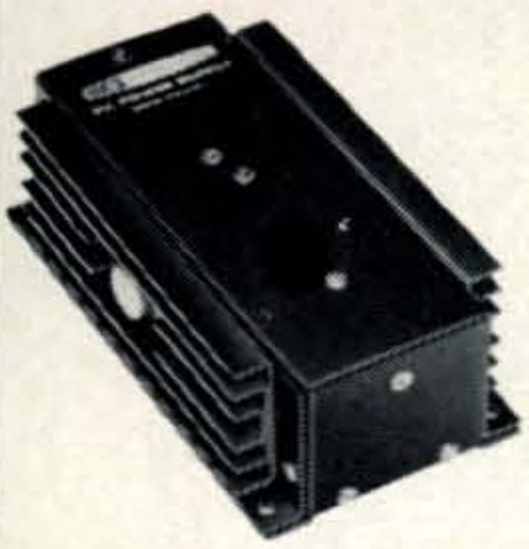
And to operate wideband FM, to use those repeaters around the country, just install the HWA-17-2 FM adapter.

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.

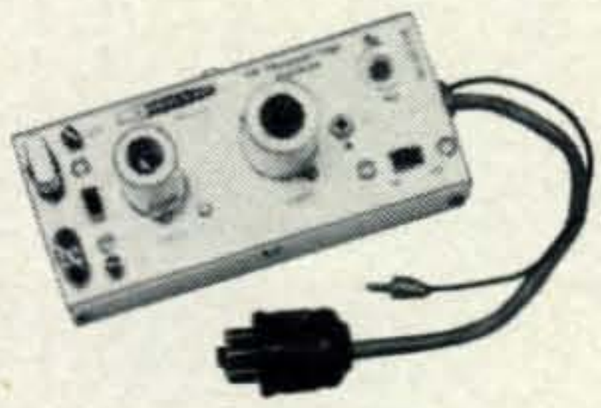
Kit HW-17A, 18 lbs. **$129.95***



Solid-State Mobile Power Supply

Supplies operating voltages for HWA-17A. Large heat sinks for cool 50% duty cycle. Circuit breaker protected. For neg. gnd. systems. Cables & connectors included.

Kit HWA-17-1, 5 lbs. **$24.95***



FM Adapter For HW-17 Series

Transmits wide band (15 kHz) FM. Just flip a switch for AM or FM. Two crystal positions (146.94 MHz crystal included). Installs without hole drilling.

Kit HWA-17-2, 2 lbs. **$17.95***

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City_____ State_____ Zip_____

Prices & specifications subject to change without notice.
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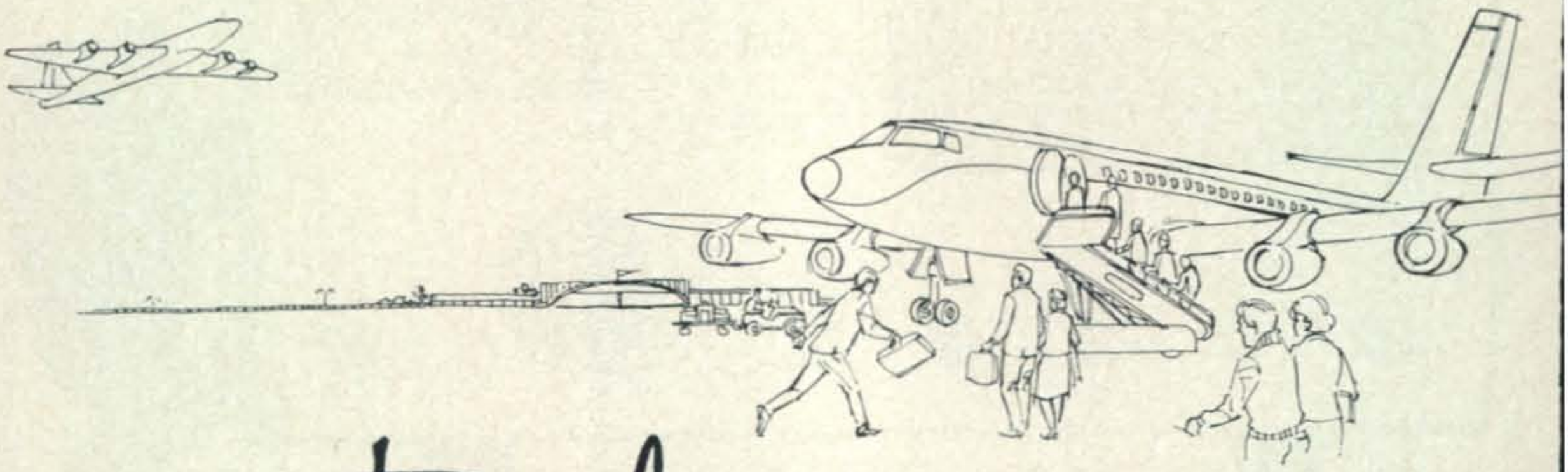

traveling companion

SWAN *Cygnet*

A 5 BAND 260 WATT SSB TRANSCEIVER WITH BUILT-IN AC AND DC SUPPLY, AND LOUDSPEAKER, IN ONE PORTABLE PACKAGE.

The Swan Cygnet is the most versatile and portable transceiver on the market, and certainly the best possible value.

The lightweight compact design of the Cygnet makes it an ideal traveling companion. You can take it with you on vacation or business trip, and operate from your motel room, summer cabin, boat or car. All you do is connect to a power source, antenna, and you're on the air.

AMATEUR NET PRICE

$435

SWAN
ELECTRONICS
For Better Ideas in Amateur Radio

OCEANSIDE, CALIFORNIA—A Subsidiary of Cubic Corporation

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AUGUST, 1969 VOL. 25, No. 8

CQ The Radio Amateur's Journal

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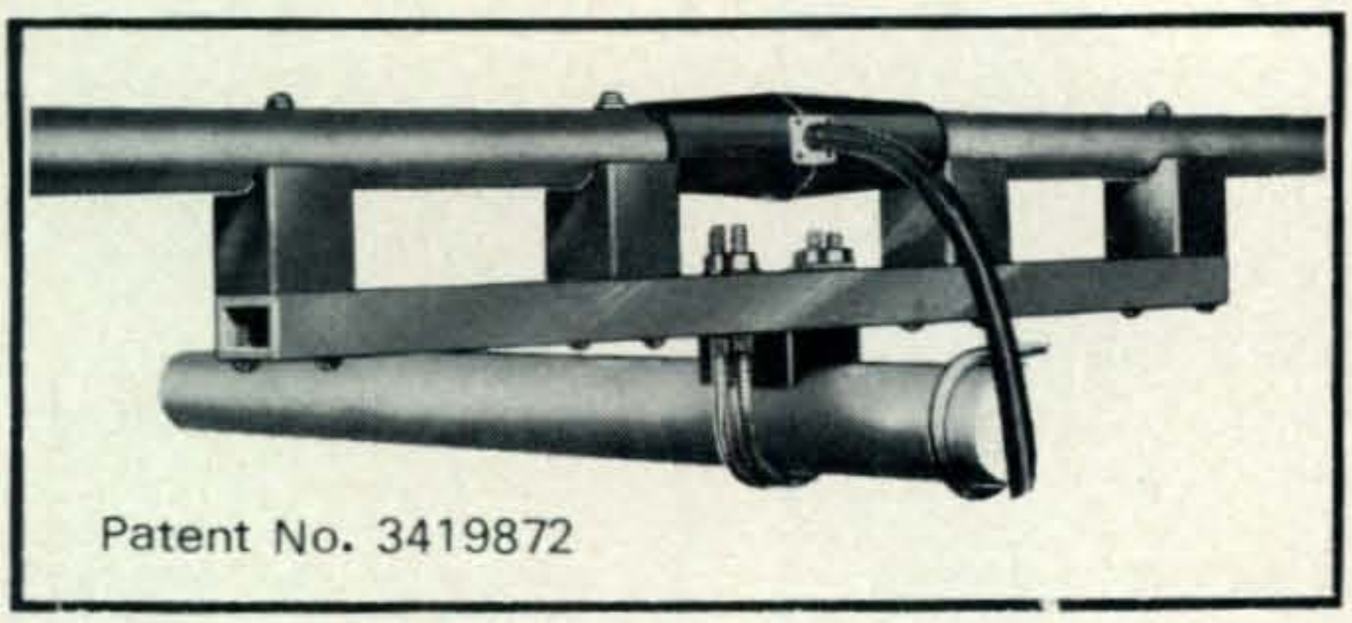
NEW! FROM MOSLEY

Two Single-Band Beams with



Patent No. 3419872

The Classic FEED

According to forecast, 1969 should be another great year for h. f. propagation conditions. Make the most of the DX openings on 10 and 15 meters with new Mosley single-band beams, the Classic 10 (Model CL-10) and the Classic 15 (Model CL-15). These beams offer the optimum spacing possible only on single-band arrays. But even more advantageous is their famous Classic Feed System (pat. no. 3419872) This "Balanced Capacitive Matching" provides maximum gain, increased bandwidth and more afficient performance because of its better electrical balance and weather proof design.

See these DX champions at your nearest Mosley dealer. For complete specifications and performance data, write factory direct for free brochure, Dept. 189.

Mosley Electronics Inc.

4610 N. LINDBERGH BLVD., BRIDGETON MO. 63042

See page 110 for New Reader Service

ZERO BIAS

THROUGHOUT this issue are page filler items asking: "Troubled by TXI? See page 78." TXI? It's a monicker dreamed up by Bill Scherer, W2EAF, *CQ*'s Technical Director. for a broad and increasingly troublesome form of radio interference, namely, r.f. interference with transistorized equipment.

Put simply, it is the problem of spurious generation of unwanted signals by transistors of all types when subjected to strong external r.f. fields. Transistors as a rule are composed of one or more semiconductor junctions—in function each junction is a semiconductor diode which can function either as a detector to produce an audio signal from an r.f. signal or as a non-linear device causing adverse spurious signal effects.

The picture should be taking shape now: transistors by the million being used in common devices ranging from TV sets to hearing aids to car ignitions to antennna rotators. Each transistor could be a potential interference source! With the growing number of transmitters on the air in the US alone, the likelihood of—and indeed the frequency of such interference is growing at a phenomenal rate. Unless steps are taken immediately to institute some corrective measures, TXI will continue to grow into a problem of such proportions that Television Interference (TVI) will seem insignificant by comparison! Those are strong words, but facts are facts, and only by facing these facts now before the problem explodes completely can the public —and certainly the amateur—be protected from the effects of such widespread radio havoc and the ensuing ruinous publicity.

Twenty-three years of TVI and forty-odd years of BCI have proven that radio interference, regardless of its source or blame for it, is a problem which is difficult to justify in the layman's mind, and frequently leads to ill feelings among otherwise good neighbors. The lesson of these years should be very clear: Work to prevent a little problem from becoming a big one. Now, while TXI is still a relatively minor occurence, work to prevent it from ever becoming a major phenomenon.

Through proper legislation manufacturers of devices using transistors *can* be required to incorporate precautionary measures against TXI.

On page 78, in W2AEF's Q & A Column, an interesting few paragraphs on the subject appear in which Bill makes some sincere and valid proposals. They're worthwhile reading.

Herbert Hoover, W6ZH

We are saddened to report the death of one of amateur radio's staunchest supporters, Herbert Hoover, Jr., W6ZH on July 9, 1969 in Pasedena, California, at the age of 65.

In addition to his familiar former role as President of ARRL from 1962 to 1966, W6ZH was involved at various times in activites ranging from Under Secretary of State under the late John Foster Dulles from 1954 to 1957, to his specialty (and profession), petroleum geology. Herb was born in London and received his bachelor's degree from Stamford University and master's degree from Harvard. He also held numerous honorary degrees.

Although not a politician, he was a diplomat who was instrumental in resolving a serious disagreement between Great Britian and Iran in 1964 over British controlled oil fields. He brought to amateur radio dignity and reason which only statesmen seem to have. Amateur radio mourns him.

Our Cover

On the cover is just a tiny sampling of the thousands of colorful foreign stamps passing through the *CQ* office each winter and spring on log entries for the mammoth *CQ* World Wide DX Contest. The contest is the world's largest and we believe the best. Evidently a few other fellows also feel it's pretty good, since we get nearly 3000 entries every year! Who gets the stamps? Oh, that's how we bribe W1WY into chairing the event each year. When he finishes tabulating the results, he gets to keep the stamps. Results of the c.w. section of the test begin on page 20.

73, Dick, K2MGA

See page 110 for New Reader Service

DRAKE 4 LINE *Superior performance—versatility!*

R-4B RECEIVER

Versatility . . .
Accuracy . . .
Dependability . . .

• **Linear permeability tuned VFO** with 1 kc dial divisions. VFO and crystal frequencies pre-mixed for all-band stability • **Covers ham bands** 80, 40, 20, 15 meters completely and 28.5 to 29.0 Mc of 10 meters with crystals furnished • **Any ten 500 kc ranges between 1.5 and 30 Mc** can be covered with accessory crystals for 160 meters, MARS, etc. (5.0-6.0 Mc not recommended) • **Four bandwidths of selectivity,** 0.4 kc, 1.2 kc, 2.4 kc and 4.8 kc • **Passband tuning** gives sideband selection, without retuning • **Noise blanker that works on CW, SSB, and AM** is built-in • **Notch filter and 25 Kc crystal calibrator** are built-in • **Product detector** for SSB/CW, **diode detector** for AM • **Crystal Lattice Filter** gives superior cross modulation and overload characteristics • **Solid State Permeability Tuned VFO** • 10 tubes, 10 transistors, 17 diodes and 2 integrated circuits • **AVC** for SSB or high-speed break-in CW • **Excellent Overload and Cross Modulation characteristics** • **Dimensions:** 5½"H, 10¾"W, 12¼"D. **Wt.:** 16 lbs.

$430.00

T-4XB TRANSMITTER

Use VFO of either R-4B or T-4XB for transceiving or separately.

• **Covers ham bands** 80, 40, 20, 15 meters completely and 28.5 to 29.0 Mc of 10 meters with crystals furnished; MARS and other frequencies with accessory crystals, except 2.3-3, 5-6, 10.5-12 Mc. • **Upper and Lower Sideband** on all frequencies • **Automatic Transmit Receive Switching on CW** (semi break-in) • **Controlled Carrier Modulation for AM** is completely compatible with SSB linear amplifiers • **VOX or PTT** on SSB and AM built-in • **Adjustable Pi-Network Output** • **Two 8-pole Crystal-Lattice Filters** for sideband selection, 2.4 kc bandwidth • **Transmitting AGC** prevents flat topping • **Shaped Grid Block Keying** with side tone output • **200 Watts PEP Input on SSB**— 200 watts input CW • **Meter indicates plate current and relative output** • **Compact size; rugged construction** • **Solid State Permeability Tuned VFO** with 1 kc divisions • **Solid State HF Crystal Oscillator** • **11 Tubes, 3 Transistors and 12 diodes** • **Dimensions:** 5½"H, 10¾"W, 12¼"D. **Wt.:** 14 lbs.

$449.00

HAMS SAY . . . *"Best Receiver Buy since the 2-B!"*

2-C RECEIVER

Excellent performance at low cost

• **Triple Conversion** • **Crystal-controlled First Converter** • **500 kc ranges** for 80, 40, 20, 15 and 10 Meters • **Also any 500 kc range** between 3.0 mc and 30 mc by inserting an accessory Crystal • **Temperature-compensated VFO Tuning** • **Selectable Sidebands** without retuning • **Three Bandwidths**—.4, 2.4, 4.8 kc at 6 db • **Solid-state** Audio, Product and AM Detectors, AVC Amp and Xtal Osc • **AVC Switch** (Fast, Slow and Off) • **SSB, AM and CW** with AVC and S-meter • **Works Break-in CW** with 2-NT Xmtr • **19 Tubes and Semi-Conductors** • **Dimensions:** 11 5/16"W x 6 3/32"H x 9 3/32"D. **Wt.:** 13½ lbs.

$229.00

Accessories available: 100 kc Calibrator, Q Multiplier, Matching Speaker, Noise Blanker, Crystals for other ranges.

CW TRANSMITTER

For Novice thru Extra Class . . .

2-NT CW TRANSMITTER

Built-in essentials and accessories

• **100 Watts Input** (can be reduced to 75 watts for novice) • **Operates Break-in CW, Semi Break-in CW or Manual CW** with Drake 2-C or other receivers • **Automatic Transmit Switching** • **Side Tone Oscillator** built in • **Antenna Change-over Relay** built in • **Pi-Network output** with fixed loading • **Lo Pass Filter** against TVI built in • **Drop-out delay** of change-over relay adjustable • **CW Coverage** on 80, 40, 20, 15, 10 Meters • **Simplified Tuning** • **Frequency Spotting** without xmtr output • **Grid Block Keying** • **Code Practice** in stand-by position • 13 Tubes and Semi-Conductors • **Dimensions:** 9⅞"W x 6 3/32"H x 9 3/32"D. **Wt.:** 12½ lbs.

$149.00

Accessories available: Antenna Matching Network, and Crystals.

All prices are Amateur Net. Prices and specifications subject to change without notice.
Drake products are available at your distributor . . . for a free brochure on any unit, write **Dept. 289**

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OUR READERS SAY

Youth Involvement

Editor, *CQ:*

I concur with you completely with regard to the topic of more youth involvement in ARRL affairs, and the initiation of an intermediate body lying between the ARRL member and the director, projected by your June editorial.

I have conducted meetings with other teenage amateurs in my section and we are contemplating running our own candidate, one in his late teens, to contend for the position of Connecticut ARRL Section Communications Manager this January.

It is certainly not our intent to perpetuate a running argument with regard to the older hams in this section holding ARRL leadership, but the fast is we are growing increasingly weary of the same cobwebbed, traditional clique of people and would earnestly like to see more intake of young blood.

Ralph J. Irace, WA1GEK/WB4LVO
Wethersfield, Conn.

Computers, Anyone?

Editor, *CQ:*

I am interested in contacting amateurs who are building computer terminals or doing any kind of computer work, hardware or software. We have at the University of Connecticut an IBM Model 360/65 which I can use and would like to do some amateur-oriented projects.

I would appreciate your passing along my address. Thank you.

Bill Waggoner, WA1JGS
1-C Hardwood Acres
Storrs, Conn. 06268

Philippine Operating

Editor, *CQ:*

I found the letters regarding "Philippine Operating" in the June and January issues most interesting. I would say that the Lauson letter was a more accurate description of the Philippine licensing situation.

I was based in the Philippines from 1965 to 1967. Prior to my departure for overseas I chanced to contact an Air Force man who had just completed a tour at Clark AFB. He advised that there was no point in taking Amateur Equipment to the Philippines because it was not possible to obtain operating authorization. I did not expect to be in the Philippines very long and I made no attempt to bring the equipment. Shortly after my arrival I heard about these special permits, and I found my tour extended.

I made the trip from Cavite to the Radio Control Office in Manila and was advised that I could get such a permit. In September, 1965 I returned to the US and brought my mobile rig back with me in a foot locker.

When I attempted to file an application, I was told that nothing could be done until after the presidential election. After the election I was advised that there was a new Secretary, and that it was uncertain what position he would take as to issuing these special licenses. After many trips to Manila they finally agreed to accept my application and it was filed along with schematics and antenna description. Much time elapsed and the explanation was that they had not made a decision on the matter.

I knew about the Goldwater Reciprocal Licensing Bill and I made a trip to the Thomas Jefferson Memorial Library and dug through back issues of QST to find the number of the bill. Armed with the number I obtained the pertinent copy of the Congressional Record in which it was published and furnished a photostat of it to the Radio Control Office. I haunted their R.C. office whenever I could take the time off. Still the answer was "no decision." Finally in 1967, and shortly before the end of my tour of duty, I received a courteous note that they would not grant the license since I was not a citizen of the Philippines. This fact must have been quite evident two years earlier!

I do not doubt that special permits have been issued to a few Americans with friends in high places, but this hardly applies to the usual GI operator or ordinary American civilians working on remote military bases.

Two of the names on the special permit list are familiar to me. Sam Lewbel's office was almost in the shadow of the US Embassy. Bill Long (W3EIV) was a High School classmate at W3WZ, but I have not had contact with him in more than 35 years. I suspect that he works for the State Department.

I sincerely hope that Foreign Secretary Ramos signs the Reciprocal Licensing Bill for the sake of all Frustrated American Amateurs in the P.I. It would be a noble gesture since I doubt that there is much pressure to obtain US calls by Philippine hams and thus, it would clearly be an expression of good will.

Edwin F. Morrison W3RY
California, Md.

Alien Operators

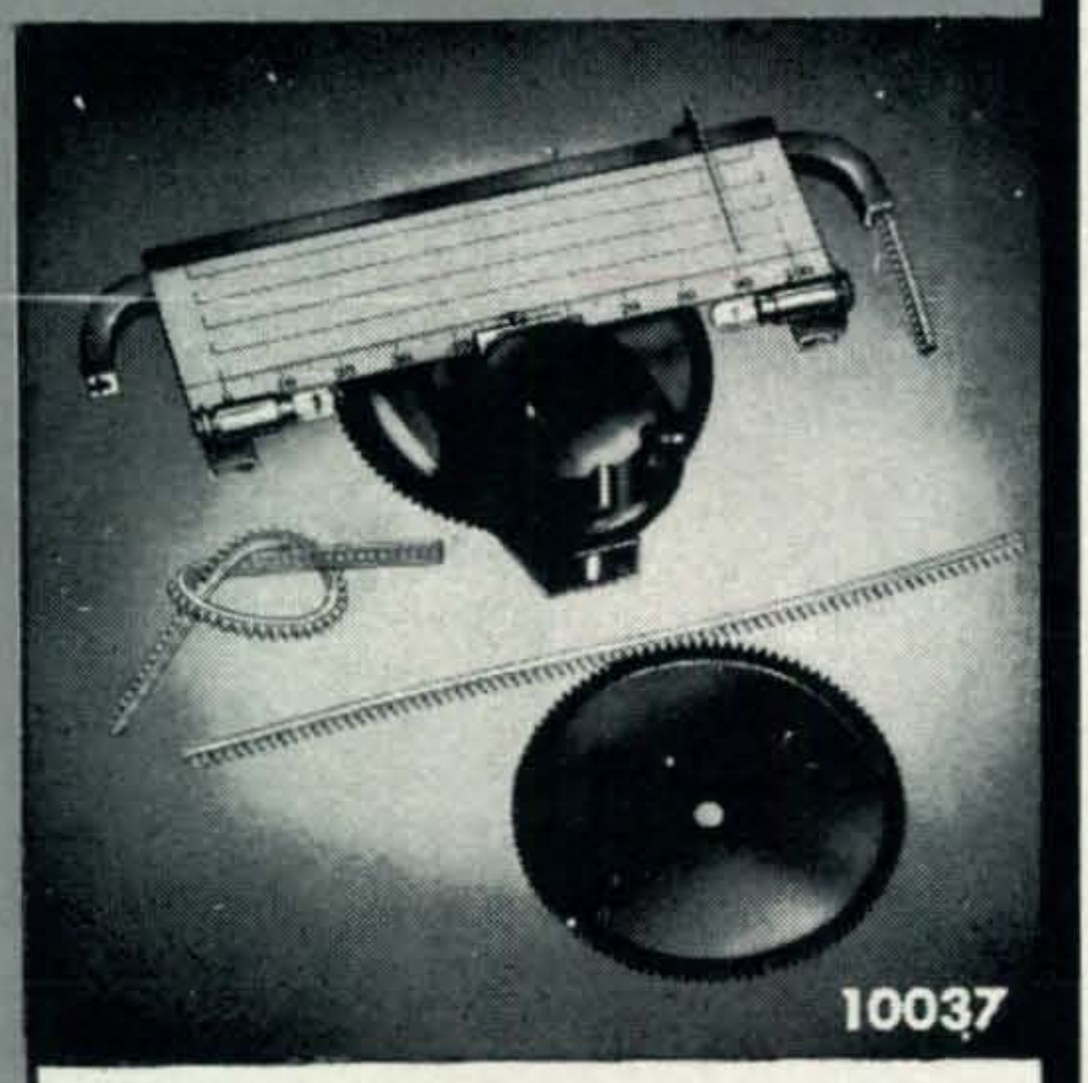
Editor, *CQ:*

My name is Marcel Saidman and I immigrated from Romania to this country in 1965. I am

See page 110 for New Reader Service

Designed for

Application



NO-STRING DIAL

No strings: no pulleys: no back lash: no flimsy assembly. The No. 10037 is a sturdy mechanically engineered "Designed for Application" dial assembly which completely eliminates the annoyances of string-driven pointers, eliminates all indicator stutter or wobble and provides positive pointer travel and resetability. The pointer is driven positively by a flexible but non-elastic molded gear driven rack which cannot slip, break or fall off a pulley. The geared flexible rack rides in a multi-slot extruded aluminum channel. This girder-like extruded piece provides mechanical rigidity to the assembly. Furnished complete with panel trim bezel and flexible coupling for output shaft.

JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

MALDEN

MASSACHUSETTS

specialized in foundations and underground structures and since my arrival I am with Stone and Webster Engr. Corp. in Boston.

I am complaining against the section of the Communication Act of 1934 which requires an applicant for a radio-amateur license to be a citizen of this country or to be an alien having an amateur license and whose government has a bilateral reciprocal agreement with the United States.

I would like to comment on that section as follows:

1. An alien who is already a "permanent resident" of the United States and has filled out and signed the "declaration of intention to become a United States citizen" has already been verified and approved by the American authorities and will in time become a citizen.

2. People in this catagory have most of the duties of the American citizens: they are paying taxes, serving in the American Armed Forces and those with the Signal Corps of the Army are regularly using military transmitters.

3. Based on reciprocal Operating Agreements radio-amateurs from 23 foreign countries can operate their own radio amateur station in this country. Are these radio-amateurs more American or more reliable to this country than we, the permanent residents?

My complaint could be considered as unreasonable if only American citizens could enjoy the right to get a license for operating a radio amateur station.

But as long as non-American people like tourists or short-time visitors are granted this right, why should it not be granted to us who are permanent American residents and have already declared our intention to become citizens? Why not to us who are tax-payers and thus are contributing to the welfare of the American community? Why not to us who are serving in the Armed Forces and thus are considered faithful to these United States?

Last year Congressman T. R. Kupferman introduced a Bill under the Nr. HR 16764. Being too late the Bill died in the House Committee on Commerce.

Another simiar Bill was introduced this year to the Senate by Sen. B. Goldwater under S. Res. 27.

We hope you will help us in passing this resolution in spite of the fact that we new emigrants have nothing to offer in exchange as other countries do, other than our blood, our affection for this country, or our strong desire to work hard for the welfare of this nation which welcomed us and where we found the freedom of which we were deprived in our native country.

Marcel Saidman, ex-YO3FZ
Brighton, Mass.

See page 110 for New Reader Service

Announcements

Rare County DXpedition

W7IEU will operate from SKAMANIA county, Washington, on September 2-3, also from KLICKITAT county, Washington, on September 4-5, and from WAHKIAKUM county, Washington on September 6-7. The operation will all be on c.w. and 60 to 70 kc inside the bands, 10 through 80 meters.

Creston, Iowa

The Iowa 75 meter phone net picnic will be held in Anson Park at Marshalltown on August 17th. All activities will begin around noon.

Decatur, Ala.

The North Alabama Hamfest will be held August 17th in the cafeteris of John C. Calhoun State Technical & Junior College located north of Decatur on U.S. Highway 31.

Saddle Brook, N.J.

The East Coast VHF Society is holding its 11th Annual Free outdoor Picnic Hamfest on Sunday, August 10, at Saddle Brook Park (on Saddle River Road) starting at 10 a.m. Games, contests (including Antenna Measuring contest), displays, demonstrations and many other interesting event for all age groups have been planned. Food and soft drinks will be available. Talk-in stations will be on the air. For more information write E. C. VHF Society, P.O. Box 1263, Paterson, N.J.

Belvidere, Illinois

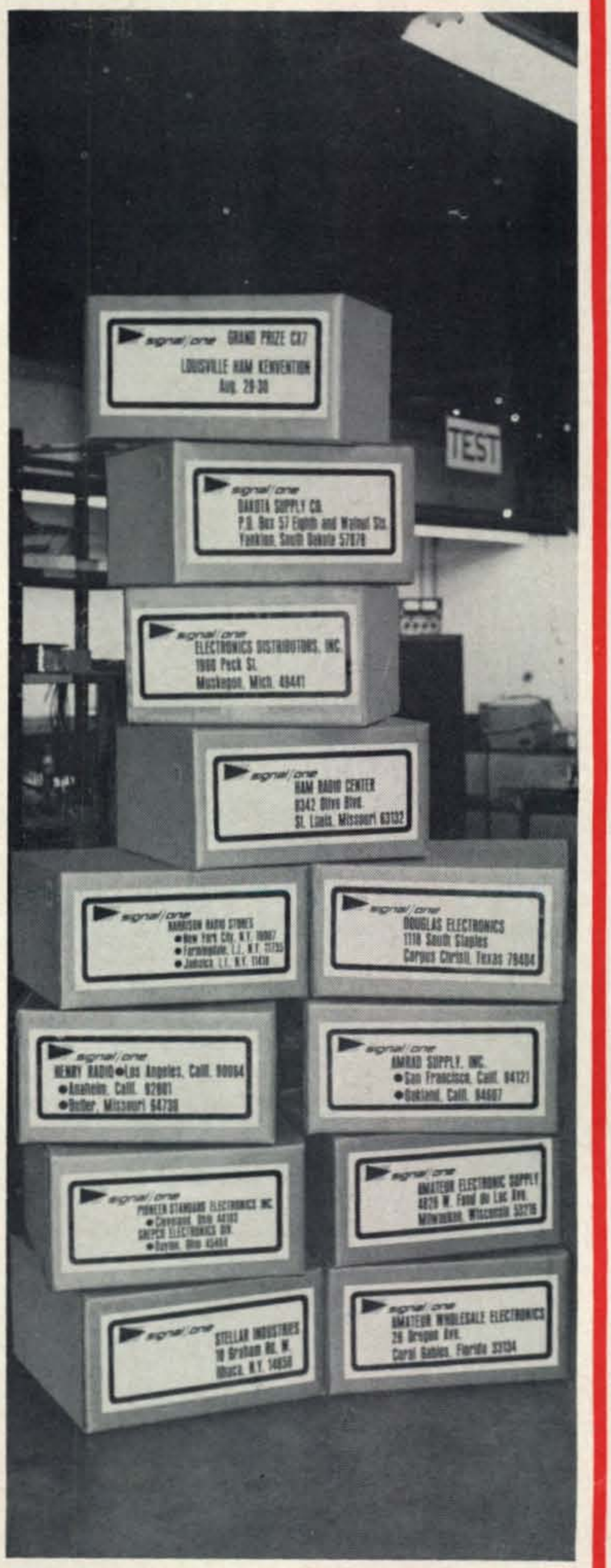
The Fourth Annual Hamfest sponsored by the Rockford ARA, Beloit ARC, Wisill VHF Club, and the Big Thunder ARC will be held on August 17 at the Boone County Fair Grounds north of Belvidere on Highway 76. There will be free coffee and donuts and refreshments will be available. For complete details write to Russ Jansen, K9TKT, Ridott, Illinois 61067.

Brandon, Florida

The Branon Amateur Radio Society will sponsor the First Annual Ham Camporee on August 22-23, at the Royall Park Campground, Riverview, Florida (off Highway 301). This campground has everything. There will be a demonstration of quick tree-top antennas and a tour of Busch Gardens. Pre-registration helpful but not required. For further details write BARS, P.O. Box 828, Brandon, Fla. 33511, attn: Gene WA4YNW.

Harrington, Delaware

The Amateur Radio Clubs of Delaware in a joint effort are planning the 1969 Delaware Hamfest, which will take place at Harrington on August 17. Previous affairs have been attended by over 1,000 amateurs from New Jersey, Maryland, Pennsylvania and Delaware.



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Springfield, Mo.

The Southwest Missouri Amateur Radio Club, Inc. will hold their annual picnic and hamfest on August 24, 1969. For complete information contact: Roy Testerman, WØFXU, Southwest Missouri ARC, P.O. Box 291, Springfield, Mo. 65801.

St. Louis, Missouri

The Central Communications Region (AFCS) will hold its Fourth Annual MARS conference, for Military and Civilian members, at the Sheraton-Jefferson Hotel in St. Louis on August 29, 30 & 31. Registration fee for the conference is $11.50 and includes, among other things, the banquet on Saturday, August 30th, which will have Sen. Barry Goldwater, AFA7UGA, as the primary speaker. For reservations and advance registration contact Mr. Eugene Depeneloza, AFBØAUX, 6320 Wydown Blvd., Clayton, Mo. 63105.

Reno, Nevada

The Nevada Amateur Radio Association is once again organizing their annual picnic at Bowers Mansion. The picnic is scheduled for August 30 and called the Sierra Hamfest. Last year over 200 amateurs and their families attended For full particulars contact: George Lyle, K7ZAU, 1047 Mark Way, Carson City, Nevada 89701, or by calling 702-882-5470 in the evening.

Puget Sound, Wash.

The Puget Sound Council of Amateur Radio Clubs will issue a Governor's Certificate to qualifying amateurs during Washington State Amateur Radio Week, September 1st through 7th. The certificate, signed by Gov. Daniel J. Evans, will be sent to out-of-state hams who contact ten Washington State hams, and in-state hams who contact twenty other Washington hams during the above period. Send list of stations worked, their QTH's, and the dates of the contacts to: The Puget Sound Council of Amateur Radio Clubs, Drawer A, McChord AFB, Washington 98438.

Haddonfield, N.J.

The South Jersey Radio Association is holding their annual hamfest at Molia Farm in Malaga, N.J. on September 7 (rain date Sept. 21). This promises to be their largest hamfesst to date. Numerous activities are planned for the entire family. Advance registration for non-members is $2.00 (which includes entire family) and closes August 31. General admission at the gate is $3.00. For complete details write to: Gene Bond, WA2MGV, 15 East Camden Ave., Moorestown, N.J.

Rock Island, Illinois

The Quad City Amateur Radio Club, W9YCR, will hold its annual Hamfest on August 24 at the Rock Island Arsenal, Rock Island, Illinois. Food will be available at the Arsenal Cafeteria.

[*Continued on page 101*]

See page 110 for New Reader Service

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Three months ago I riting you about dreem having. You remembering—it about working ee-x in the yeer 2069. I dreeming how mchoors working peeples on planets of ars reel far away.

Well, Hon. Ed. the more I thinking about , the less true I thinking it can being done. trying to figyour out how somebuddy can oing it.

Like take suppose you wanting to working irius III (that being third planet out from he star Sirius). First of all you got to look p where that star is in the hevvins. This king complicated star table, and reel accurate clock.

Now, if you finding that Sirius is in part of ky you can seeing, on acct. of earth's roayshun, then you can pointing your hundredbots parabola antenna at it. Note that it not attering whether it being nite or day on arth. Star still there!!

OK, once you getting parabola aimed rite, nd that no meen feet, you starting motor hat turning parabola so it following star as arth turning. If you not doing that, you osing star so fast it not being funny.

Once you have beem tracking good old irus, then you turning on xmitter. It can't e any old 2 kw. p.e.p. jobbie. No indeedy, s Sirius is some 16 million million miles way. So maybe you having pulsed million att job. You sending some kind of see-w, ith 100 microsecond pulse for dash, and naybe a 25 microsecond pulse for dot.

You can sending seek-you a few times, hen sineing. Or, maybe you making extrang xmission—say 5 minutes. Now, you think ou turning on your reseever and listening? Iah!! not on your tinny tipe. You know why ot? On acct. it taking your signal about 8

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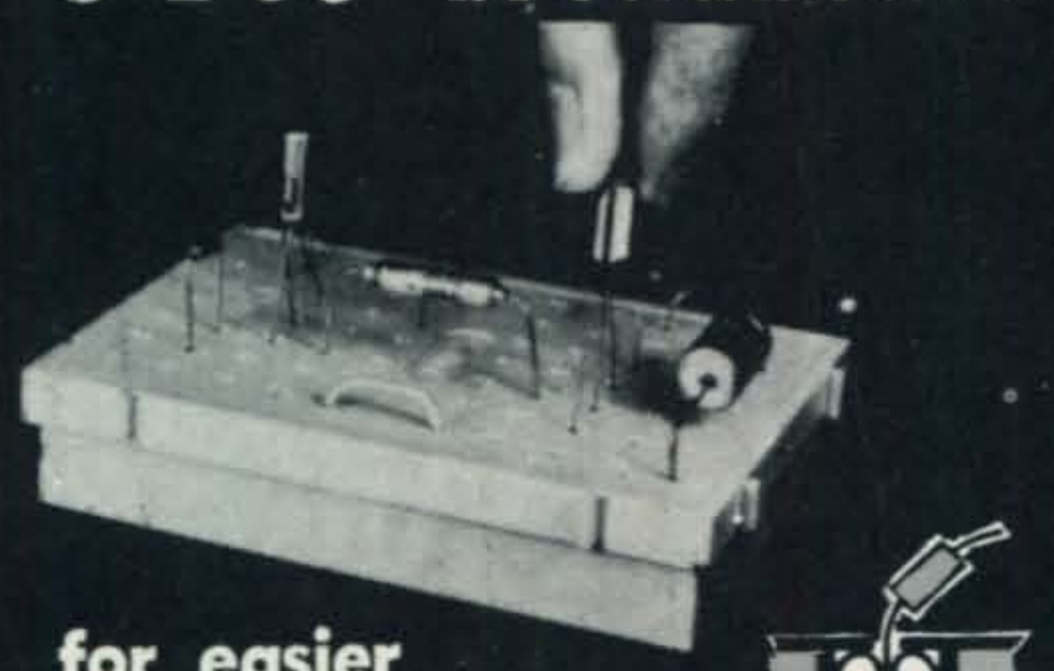

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yeers just to getting to Sirius, that's hov comes.

So, you getting out your calendar an making note to listening for answer about 1 yeers from now! That giving time for signal t get to Sirius III, have some amchoor ther heer you, and call back. You got to do som pretty fancy calculating to figyouring ou exact time to listening, taking into acct. lee yeers and all that jazz.

Of coursely, you can send seek-you ever day, so in 16 yeers you can listening ever day to see if anybuddy heering you. It su putting big damper on ragchewing thoug doesn't it, Hon. Ed!

If you wanting to talk to planet of Alph Centauri, it only taking about 8 yeers– yeers each way. But, after that, with tw planets worked, you in reel trubble to workin extra-solar dee-x.

Oh, maybe you can't wait 20 yeers to ta to Procyon, and 36 yeers for quickie-qso wi Altair. But now it getting reel tough. Foma haut taking 54 yeers, Pollux 62 yeers, Alde baren 108 yeers, give or take a week or tw and Regulus and Achernar 140 yeers. Ho Ed., you should live so long!

And what about poor amchoor at oth end. Say he on Alpha Centauri planet, 4 li yeers away. Four yeers after you send see you, he answer you with RST349. In 8 yee you heer this (if you listening) then you sen back his signal report. Twelve yeers aft you start, he gets your report, and sends yo an acknowledgement. Another 4 yeers a you know he got your report. A total of yeers!

On that basis, qso's to Sirius take 32 yee Procyon 40 yeers, and Altair 72 yeers. Tha it–that's all there is to work. Four lou plantes. Some dee-x. Hah! I thinking may we better having some contest for all stat on the moon, or all zones on Mars, or som thing easy.

On the other hand, maybe there is son way to making radio waves go faster th speed of lite. Hon. Albert Einstein not thin ing so. Howsumever, Hon. Scratchi not sure. I putting on my think-cap and seei what I can figyouring out. Don't throwi away your star-chart until you heering fro me.

Respectively yours,
Hashafisti Scratchi

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BY KATASHI NOSE,* KH6IJ

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With the liberalized ruling for 160 meter operation (one kilowatt in certain areas), manufacturers have one more headache to contend with as the demand for this band increases. Fortunately, for 100V and 200V owners, this fine transmitter has provision for an "X" band (you install whatever band you want, MARS, CAP, etc.) and no "cutting into" or reworking is necessary. If anything, the addition of the extra band enhances the value of the transmitter since the "X" band position normally is left blank both dialwise and coil-socket wise.

*4207 Huanui St., Honolulu, Hawaii 96816.

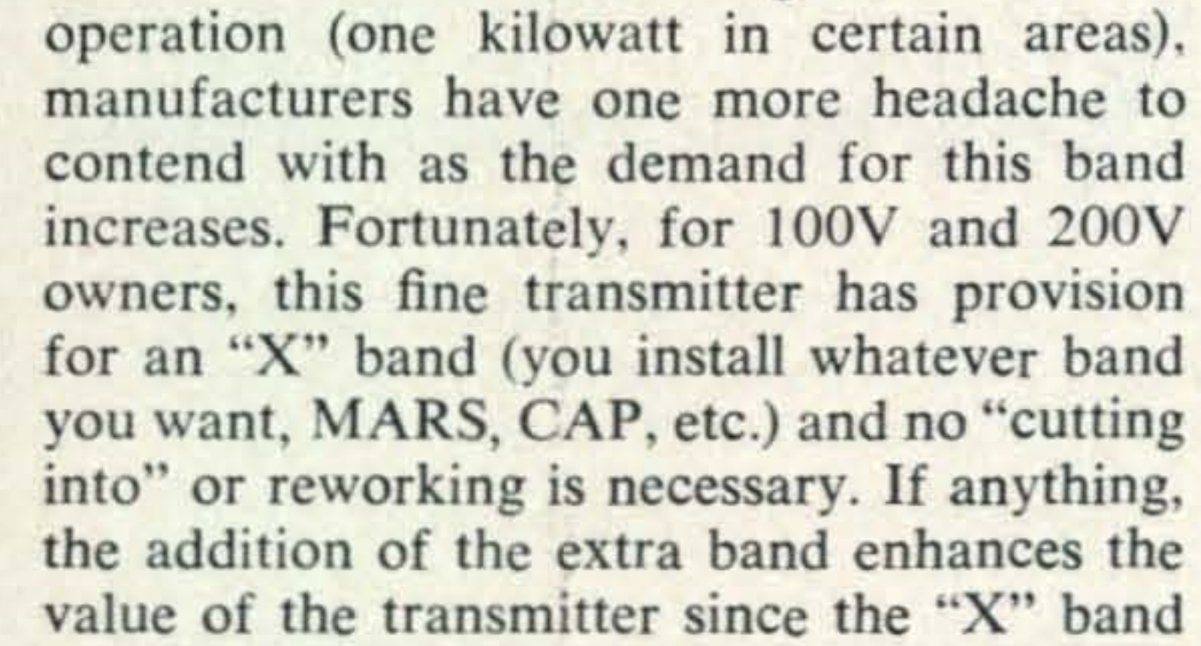

Fig. 1—Block diagram of the conversion process for 160 meter operation of the Central Electronics 100V and 200V.

The Conversion

Conversion merely entails winding some wire on a final coil form and scramble- winding three slug-tuned forms which are then plugged into holes already provided. The entire job can be done in a few hours if you have a grid dip meter, but even this is unnecessary if you don't mind the cut and try method. The conversion is actually easier to perform than to describe.

Circuitry

Refering to fig. 1, the 8 mc signal and 6-7 mc v.f.o. injection produce a first mixer output of 14-13 mc which is then converted to 1500-2500 kc output with 15.5 mc crystal injection. The output is amplified by a driver before application to the broadband final amplifier.

The Final Tank Coil

When the original conversion was performed some 12 years ago Central Electronics had not yet released conversion data and therefore the author had to feel his way around. The low level stages gave no trouble, as they could be scaled up from studying the high frequency coils. However, the final

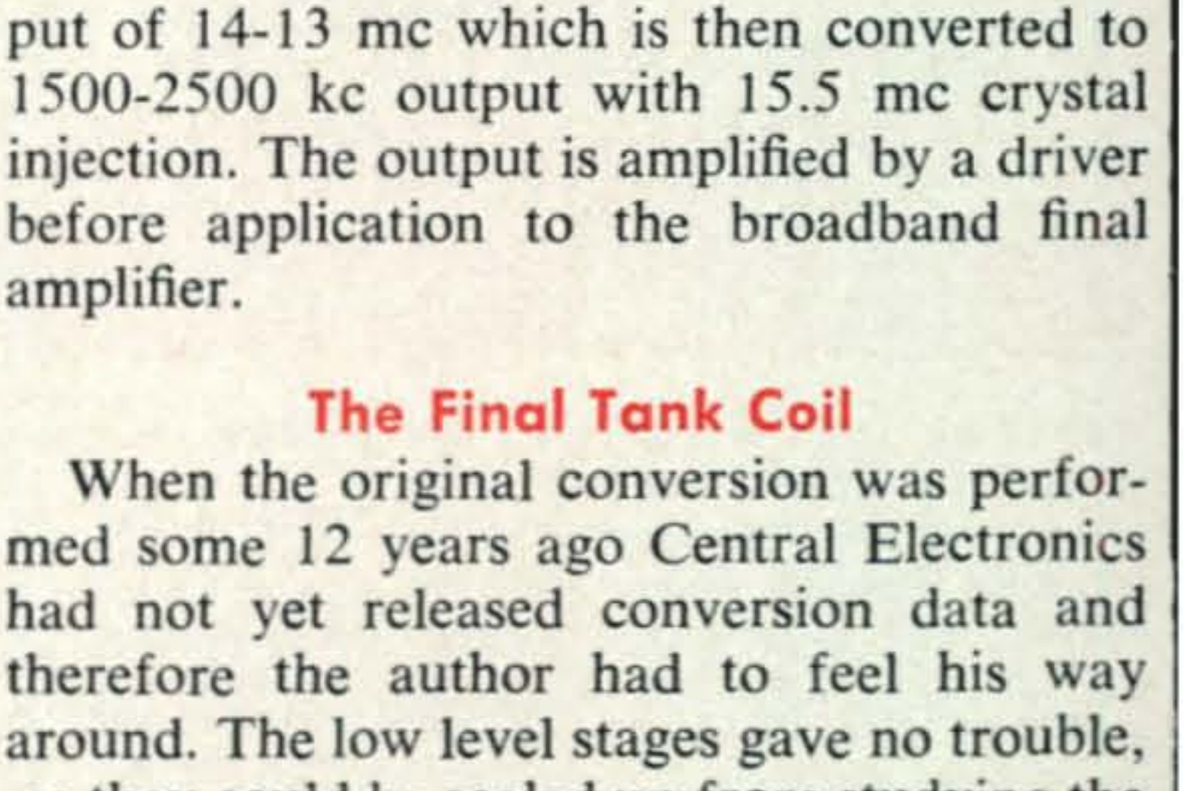

Fig. 2—Original method of broadcasting the final amplifier coil in the CE100V and CE200V.

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patented "broad-band" coil was a secret device and I could not duplicate it and small wonder as will be seen later.

Referring to fig. 2, the primary coils L_1 and L_2 resonate at the high frequency end of the desired passband. Part of secondary L_3 and L_4 is bifiliar wound with the primary. The bifiliar winding has a distributed capacity between the wires. This capacity appears as a series resonant circuit with L_4 at the low frequency end of the desired passband. By controlling the size of the bifiliar winding and the mutual coupling between L_1 and L_4 it is possible to show an essentially constant load to the amplifier plate across the desired bandpass assuming of coarse that a proper load is placed across the output.

The coils have a brass shim stock material between primary and secondary and there is no final tuning tank capacitor. Central Electronics said of their coil in a correspondence, "Although the coils appear simple to wind, the winding is not the problem—it is to make them work at proper efficiency and to have the required band-pass characteristic. Even with all our experience, we could get only a 50% yield." We hams don't appreciate the effort of some manufacturers and their production problems.

The Ham-Style Final Tank

Forget about broadbanding the final tank. If you are interested in covering both segments of the band there is no alternative but to use a tuning capacitor for which there is no room in the coil compartment. But, if you don't mind sticking to one segment or winding two separate final tank coils and plugging in the proper one, then this is the article for you.

Materials Needed

Two double slug paper coil forms, a final tank coil form, a 15 mc fundamental crystal in a Type HC6 or FA9 holder and #36, #28, and #22 magnet wire is required. In addition, six mica or ceramic fixed padding capacitors and 1 watt loading resistors are required. The exact value is not critical for these padding capacitors since they will be resonated by adjusting the slugs as indicated by a grid dip meter. Study the high frequency coil forms of the 100V or 200V and get the nearest physical size available. "Loop-stick" forms used for replacement in BC sets are satisfactory with the addition of another slug through the bottom end. The 15 mc slug form uses single slug and any conventional form is satisfactory.

Crystal Oscillator for First Mixer Injector

The crystal oscillator is the easiest to work with and so should be tackled first. The exact frequency is immaterial since the dial is uncalibrated anyway and you will have to calibrate it. The idea is to heterodyne the 14-13 mc output from the first mixer with a 15 mc signal to produce 1500-2500 kc output (if a 15,500 kc crystal happens to be chosen).

Unplug the coil set marked "crystal oscillator," unscrew the two Phillip screws and remove the aluminum cover. You will see a hole where the "X" band coil should go.

Referring to fig. 3(A), wind L_1 which is 21 turns of #22 enameled wire on a slug tuned form. Pad with a 50 mmf (or nearest available) mica capacitor. Before installing the coil, check the resonant frequency with a grid dip oscillator by coupling to L_2 which is merely a two turn output link of #28 wire.

Second Mixer Coil

Similarly, expose the second mixer coil set. This one is a little tricky since the "X" band and 80 meter coils are hooked up alike but the higher frequency coils have their leads reversed as will become obvious when comparing the coils as they are installed and the manual. The coil prongs are numbered and should correspond to the start and finish as indicated in the drawing.

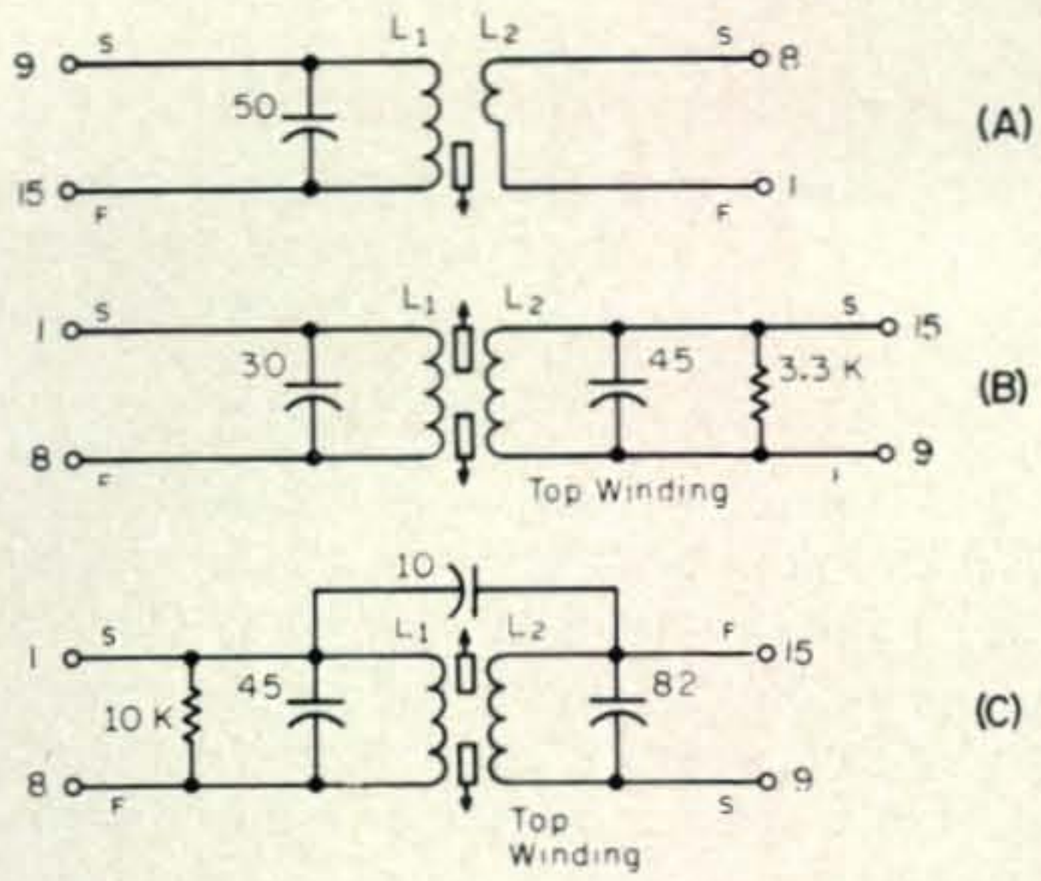

Fig. 3(A)—Crystal oscillator coil for 160 meters. The coil is constructed with the link (L_2) on top and the coil is peaked with the slug at the bottom of the L_1 winding. (B) Second mixer coil construction data. Two slugs are required, one at each end. (C) Driver coil for 160 meter operation. All capacitor values are in mmf. Letters S and F indicate start and finish of the windings.

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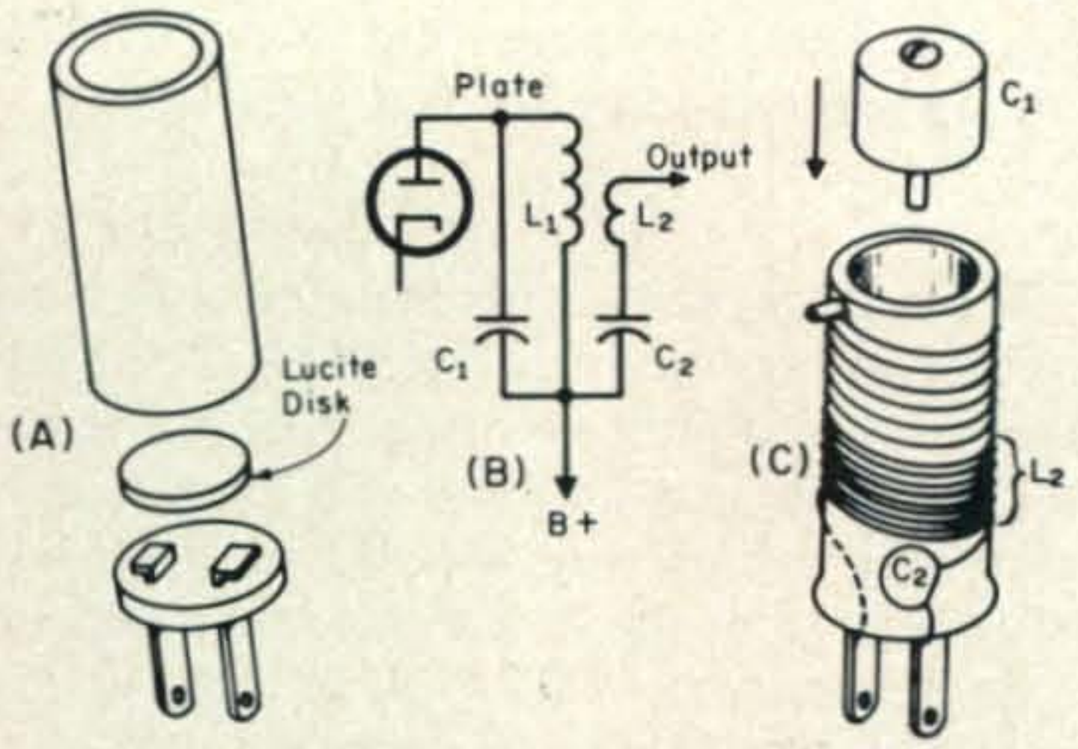

Fig. 4(A)—Coil form for the final tank is made from lucite tubing with pins adapted from a standard a.c. plug. The lucite parts are cemented together. (B) Schematic of the coil. Capacitor C_1, the padder, is 50 mmf at 6 kv. Capacitor C_2 is 0.001 mf 6 kv. The assembly, shown in (C), is described in the text.

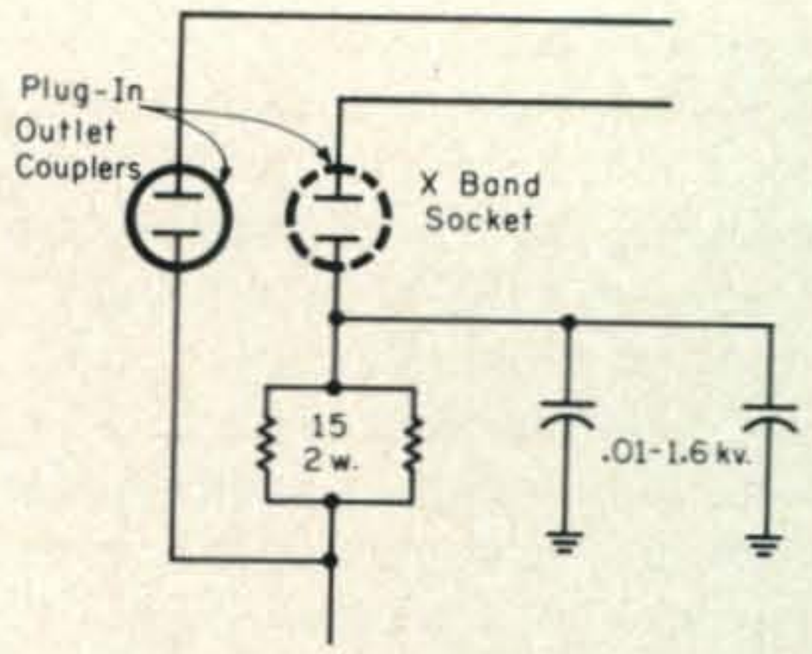

Fig. 5—Circuit of the plug-in output couplers showing the *R-C* decoupling network added for 160 meter operation in the "X" band position. On the 100V two 15 ohm resistors and two 0.01 mf capacitors are used. On the 200V a single capacitor and resistor is used.

Unless you have facilities to wind "honeycomb" coils, forget about the fancy winding job on the factory coils. Merely scramble-wind the wire by hand, simulating honeycomb style as much as possible to reduce distributed capacity. Alternately, take turns off the inside of a standard pie-wound r.f. choke and resonate with a grid dip meter. However, let me assure you that the pregnant looking coils work just as well as any old time radio serviceman who has had to handwind i.f. coils in an emergency, will tell you.

Steal some "gunk" from the other coils and melt with a soldering iron to hold things in place. Use the grid dip meter to get "within the ball park."

Driver Plate And Final Grid Coils

The driver plate and final grid coils are wound in the same manner as the second mixer coils. Refer to fig. 3(C) for further data.

Final Amplifier Plate Coil

Coil forms are no longer available from the manufacturer. The prongs are the same as those from a standard a.c. plug. Construct the form out of lucite tubing as shown in fig. 4 duplicating the dimensions of the other final coils. The prongs can either be made from copper sheets or from a standard a.c. plug.

Looking at the bottom of the coil with the top pin facing left, the spade pin nearest to you is the "B plus" and the spade pin away from you is the antenna output pin. Double check your set however, by checking continuity from coaxial output to the socket, and from the B plus lead to the other spade pin. The anchor pin at the top is the plate lead.

Starting from the top pin as an anchor, close-space wind about 125 turns of #24 wire, or as much as the coil form will take. Install a Centralab Type 858 transmitting ceramic capacitor of about 75 to 100 mmf capacity. Place this capacitor inside the coil form since there is no room elsewhere in the coil compartment. Check the resonant frequency with a grid dip meter before adding the secondary winding.

The output link should be wound with well insulated wire, preferably glass or Teflon insulation since it will have to isolate the d.c. from the output. A Centralab DD60 series 6000 volt 1000 or 1500 mf capacitor should be anchored to the spade pin and a 15 turn output link be wound and terminated at the other spade pin.

Use the oscilloscope output indicator and tune the various stages for maximum output. In the 200V (not 100V), the dial scale will not be illuminated unless a jumper is installed on r.f. bandswitch section 1F (nearest the front panel) from the white-black-yellow lead to the unused lug on the wafer.

Additional bypassing and decoupling of the B-plus supply was recommended in a flier from Central Electronics just before it went out of production. The author has not had a chance to try this additional bypassing but it is shown in fig. 5. ■

Suffering from TXI? Read Q & A on page 78.

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Looks aren't everything.

This new Ham Cat may be the best looking ham mobile antenna you've ever seen, but that's just the half of it.

After all, beauty is as beauty does, and this one does it better than any other ham antenna you can buy.

First of all, it's got a shake-proof sleeve clutch that folds over when you want to garage it.

Which also means you can change from one band to another in a couple of seconds by simply unscrewing one complete coil and tip rod unit and screwing another onto the foldover mast.

It's also strong enough to take a knock without bending. And the turnover mast is a hefty ⅝" solid rod of highly polished, heat-treated aluminum.

We've also done away with the old-fashioned plastic shrink tubing and sealed the light-weight precision-wound coils in an indestructible epoxy-fiberglass sleeve. (Which is a distinctive white that'll add to the beauty of your car.) And, all fittings are heavy chrome-plated brass.

The new Ham Cat combines higher Q with wider bandwidth performance, without using a lossy-heat generating coil like the others use. So it not only looks beyond your wildest dreams, it works beyond them, too.

It's also designed on a nominal 52 ohm impedance so you don't have to have any special matching. (Any length coax will work.)

The Ham Cat mobile ham antenna is at your Hy-Gain dealer (he's the best one under the sun) right now.

And it's there at a price all the others are charging for half of what you get in this antenna.

And that's the real beauty of it.

ELECTRICAL

- Nominal 52 ohm impedance—no special matching device needed.
- Widest bandwidth, highest power handling —Vs.—heat drift ratio available.
- Lowest VSWR in any mobile available.

MECHANICAL

- Turn-over mast is hefty ⅝" dia. solid rod of highly polished heat-treated aluminum.
- All connections are standard ⅜-24 thread.
- Mast folds over, swivels, and turns over. You can mount it on bumper deck. In addition, this flexibility makes it easy and simple to change coils.
- Coil and tip rods are a one-piece assembly. Coil diameters are constant, only lengths change.
- Shake-proof sleeve clutch facilitates quick band changeover and fold over for garaging.

THE Ham cat MOBILE HAM ANTENNA FROM HY-GAIN

HY-GAIN ELECTRONICS CORPORATION
P.O. Box 868-2
Lincoln, Nebraska 68501 AC-8

THE MOST ADVANCED ANTENNAS UNDER THE SUN

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Results of the

1968 CQ World Wide DX (C.W.) Contest

BY FRANK ANZALONE,* W1WY

THE c.w. section of this year's contest (November 1968) was not as we had hoped it would be. With the 4% increase in the phone returns we thought we would surely break 3000 logs for the whole contest this year.

However this was not the case. The increase made by the phone boys was offset by almost an equal decline in the c.w. returns. So we ended up with almost the same figure, 2914 logs, only 3 more than in 1967.

I was almost positive that the c.w. decline was due to a lack of entries from the US, however it turned out that the decline was from overseas, mostly the European area. Our boys more then held their own with a slight increase over last year.

My topic was going to be "frequency cutbacks cut down c.w. activity." So with egg in my face I'm left without an alibi. Could be the east coast dock strick last winter which

*Chairman, Contest Committee.

Don Wallace, W6AM and his son Bill, W6TCG talking over the results of the c.w. weekend. Just once we would like to see Don and Bill get a crew together and have W6AM join the ranks of the multi "Big Guns." How about it Don?

TOP SCORES

SINGLE OPERATOR

ALL BAND

KV4FZ	**1,947,456**	**LAØAD**	**1,035,188**
ZD8J	1,709,955	**W3GRF**	**1,024,125**
YV5ANT	1,437,588	OM3OM	1,016,644
ZL1AJU	1,096,779	W4YHD	997,548
JA1AEA	1,043,100	**9J2MX**	**994,224**

SINGLE BAND

28 mc		7 mc	
K1JGD	158,510	LZ1KPG	159,964
ZE3JJ	145,340	SM5BPJ	131,394
HZ1AB	132,390	W2LXK	106,526
W8VSK	131,733	LZ1KSF	101,008
VE1TG	122,018	W5WZQ	91,504
W3MFJ	102,742	W3FU	89,094
21 mc		**3.5 mc**	
CR6GO	530,550	OM1BY	43,560
PY2SO	479,385	DJ3KR	42,070
K1FNA/KG6	380,064	UQ2KAY	41,706
DU1UP	353,248	G3VWK	35,316
G3HCT	240,468	W1SWX	35,309
SM3VE	214,024	W2MEL	29,445
14 mc		**1.8 mc**	
PY4OD	**747,410**	DL1CF	2,235
W4AXE	396,414	OM1IQ	2,185
K4PHY/YV5	296,429	DL9KRA	2,112
K2KUR	253,450	OK1AWQ	1,984
ZL4BO	234,252	OK1ATP	1,904
VK2APK	230,103	OK2ZU	1,824

MULTI-OPERATOR SINGLE TRANSMITTER

DLØKF	**1,969,830**	DJ2BW/LX	1,526,328
K1DIR	1,729,408	UAØKFG	1,321,650
9F3USA	1,599,754	W2PCJ	1,260,480

MULTI-OPERATOR MULTI-TRANSMITTER

PJØCC	**8,258,787**	W4ETO	3,435,939
W3MSK	4,560,038	W4BVV	3,209,518
OH2AM	**4,118,688**	W3GM	2,982,650

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held up all foreign surface mail might have lost some logs. Many were received very late and in very poor condition.

We could certainly use more activity out of the Carribbean/Central America, South America, Africa and Oceania areas. Even the W3AA and W6RR awards failed to turn on these guys.

And how do you account for the big turnout of VE6's in the phone contest but not a single one on c.w.? Guess the boys have forgotten the code and gone to "yakking."

However I still insist that the frequency cut-backs, that went into effect the day before the contest, had a marked effect on the participation of the US hams. Many of the old standbys informed me not to expect them in this year's c.w. affair; a rather drastic way to show their disapproval, but understandable. The lower activity on the lower 25 kc of the effected bands was quite evident. I would still like to know how the "powers that be" arrived at November 22nd as the effective date when these restrictions went into effect.

So much for that, now down to some actual details. The Trophy winners, Top scores and other lists tell their own story. You will note the Herb Schoenbohm, KV4FZ is the all band winner. Herb reversed his position in the phone contest and topped the Ascension Island competition, this in spite of the lower QSO point handicap for W/K contacts. So John Beck, ZD8J last year's champ had to be satisfied with the runner-up spot because he could not match KV4FZ's output on the lower frequencies.

It was decided not to present the W3AA award for the Caribbean/C.A. area due to a lack of eligible entries. This award, and the African too, is only available to permanent residents of these areas. And its a contest policy that only *one* award may be won by the same station.

I'm sure you will recognize PY4OD, the single band winner. Talma was also the single band winner back in 1962, and all band winner in 1964.

And W3GRF needs no introduction, Lenny won the first USA award in 1964, and can always be found in the Top Ten.

The European winner Bob Snyder, LAØ-

LU6FA, the 14 mc winner for Argentina. Basilio should really tear the band wide open with such an impressive looking rig, but he did not put in a full week-end.

PLAQUE & TROPHY WINNERS

Single Operator, Single Band

World–North Jersey DX Association, Earl Lucas, W2JT Memorial Trophy. Won by Talma D'Angelo Drummond, PY4OD.

Single Operator, All Band

World–Larry LeKashman, W9IOP Trophy Won by Herb Schoenbohn, KV4FZ.
U.S.A.–Frankford Radio Club Trophy Won by Leonard Chertok, W3GRF.
Europe – W3MSK operators' Trophy. Won by Robert M. Snyder, LAØAD.
Africa–Gordon Marshall, W6RR Plaque Won by D. J. Andrews, 9J2MX.

Multi-operator, Single Transmitter

World–Dr. Anthony Susen, W3AOH Trophy. Won by Station DLØKF. (Oprs. DJ3UL, DJ4FZ, DJ6TN, DJ7SW, DL1-FL, DL1GN, DL2ZT)

Mult-operator, Multi Transmitter

World–Hazard Reeves, K2GL Trophy Won by Station OH2AM. (Oprs. OH2-BBM, 2BBR, 2BC, 2BCZ, 2BH, 2BQ, 2BS, 2KH, 2QV, 2SB)

Contest Expedition

World–Donald Miller, W9WNV, Dr. Harold Megibow Memorial. Won by Karl Kozlik, VK2BKM/LH.

SPECIAL CQ PLAQUE

World Champions
Multi-operator, Multi Transmitter

Station PJØCC. (Oprs. K1ANV, K3NPV, W1BDG, W1BIH, W1EOB, W1FJJ, W1-TX, W2ADE, W3ML, W4GF, W4KFC, W4ZM, W6RR)

Club Award

Potomac Valley Radio Club

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AD will be remembered for his operation as WØGTA/8F4 two years ago. This makes it a double for LAØAD this year, Bob having also won the phone section.

Returns from Africa hardly justified the award donated by Gordon Marshall, W6RR, but 9J2MX's score did make the Top Ten, so Mr. Andrews has got himself a Plaque. We hope this will stimulate some African activity.

Over in the multi divisions the DL boys made a clean sweep in the single transmitter section, having also won the phone contest.

The "Big Guns" sure put on a show. The PJØCC expedition by members of the Potomac Valley and Connecticut Wireless clubs, maintained their championship. The W3MSK crew will have to wait another year before they are eligible for the Trophy, so the Cup goes to the boys of the OH-DX-Ring. This is the first time that OH2AM has won the C.W. Trophy, although they do dominate the phone contest.

The Committee and its donor Don Miller are awarding the Contest Expedition Trophy to Karl Kozlik for his exceptional operation as VK2BKM/LH, making rare Lord Howe available to over 1000 contacts.

The *CQ* Club Award goes to the Potomac Valley gang again. The Frankford boys made a valiant effort and actually beat the PVRC in single operator scores total, but the big PVRC multi scores killed them.

The Northern Cal. Club finally topped the Southern Cal. group by a narrow margin. Mostly due to a concentrated effort in the multi-operator division.

Among the foreign clubs its still the Rhein-Ruhr DX group at the top of the list, although the expected increase over last year did not materialize. Many of the clubs that have been in contention in the past few years, have fallen by the wayside.

The list of club scores is somewhat curtailed because only clubs with three or more entries are being listed. So if you want to see your club listed you had better get after your members to send in their logs.

The highest score on a single band was again produced on 20 but 2nd and 3rd highest were made on 15 with CR6GO breaking the record on that band and PY2SO making her usual excellent showing. Sonia said that Jose's (the OM) sandwiches are improving so we can expect her back in the next one.

That's a new USA record on 20 for W4-AXE, nice going Jim. It was WA4PXP at the key, and with 6 elements at 127 feet, he had a lot going for him.

No new world records were set on the lower frequency bands but W1SWX did set a new USA record on 80.

The Czechs again dominated the Top Band although they did not take top honors. If you look over the band by band breakdown you will note that the multi stations ran up nice totals on 160, especially OH2AM and PJØCC, the later giving a new country to many a top bander.

Once again we were given a valuable assist by some of the European organizations. The Central Radio Club of Chechoslovakia sent all their logs in neat packages, sorted by bands and categories, with scoring corrections made by Karel Krbec, OK1ANK and Milos Prostecky, OK1MP. The Rhein-Ruhr entries were handled by Gerhard Schnautz, DJ1QP and the DM entries were similarly treated by Klaus Voight, DM2ATL. And T. Jokiel SP-5GH took care of the PZK logs.

[*Continued on page 98*]

The DJ2BW contest operation from Luxembourg. The crew at the entrance to the shack (?) L. to R. —DL1KS, DL8ML, DJ2BW & DJ7UK. The operating position, set-up in the wash room with DJ2BW and DJ6RX at the controls of the water cooled rig.

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umber groups after call tters denote the following: and (A-all); Final Score: umber of QSOs; Zones and ountries. Certificate win- ers are listed in **bold face.**

C.W. Results

SINGLE OPERATOR

NORTH AMERICA

United States

1FHU	A	469,068	618	85	179
EZD	"	201,720	336	72	133
WY	"	142,800	253	68	132
LMS	"	63,180	164	49	86
AX	"	53,361	149	44	77
1IWD	"	25,795	117	23	54
DXB	"	23,821	98	34	49
AWE	"	2,574	33	9	17
JGD	28	158,510	520	28	82
LWI	"	113,934	384	28	74
CNU	"	6,636	56	18	24
MDO	21	171,796	505	32	84
PLJ	14	1,400	21	9	16
WAI	7	81,116	300	25	69
EEF	"	15,416	134	11	30
WMH	"	264	8	5	7
SWX	3.5	35,309	188	18	49
BB	1.8	1,044	24	6	12
GGE	A	715,356	872	84	195
DJD	A	570,300	661	92	208
DXL	"	474,324	589	93	189
QIL	"	345,772	506	68	165
2BLV	"	226,464	342	81	143
DDK	"	224,504	296	87	179
HTI	"	208,008	339	78	138
BHM	"	203,196	308	81	155
HL	"	190,490	314	73	142
LA	"	173,667	280	69	150
LV	"	160,224	288	62	132
HUG	"	129,390	240	67	123
DXX	"	107,200	226	53	107
CPR	"	87,040	201	58	102
ZV	"	84,084	190	54	102
HDW	"	79,440	223	37	83
PADU	"	59,125	166	48	77
PRNL	"	54,696	158	43	86
LNB	"	50,568	135	48	81
CVW	"	50,218	145	42	77
MFY	"	50,112	150	38	78
AZS	"	37,318	134	31	63
CKR	"	30,330	118	29	61
JJ	"	17,578	68	37	57
MB	"	16,044	69	37	47
EA	"	14,910	73	26	45
HL	"	8,288	56	23	33
PM	"	5,470	74	28	49
GR	"	4,399	43	23	30
BCK	"	2,944	33	11	21
KH	"	2,809	45	17	30
B	"	2,546	29	14	24
N/W2	"	544	11	7	8
OJD	28	86,292	316	27	67
DD	"	55,642	225	25	61
JH	"	40,117	183	23	54
KJ	"	19,082	115	18	40
EP	"	17,050	109	16	39
UC	21	130,410	423	29	76
VD	"	91,624	326	28	76
UR	14	253,450	646	37	100
O	"	99,678	314	32	79
P	"	58,743	188	33	74
CW	"	13,629	80	19	40
OUP	"	12,815	85	20	35
ZPB	"	5,382	51	14	25
XK	7	106,526	374	25	73
T	"	15,240	90	16	44
EL	3.5	29,445	172	18	47
GT	"	8,880	82	15	25
QS	1.8	646	19	6	11
RF	A	1,024,125	953	111	264
UW	A	988,552	938	105	259
FW	"	727,608	720	109	257
PG	"	708,180	883	89	201
N	"	568,176	730	86	181
DD/3	"	529,064	556	104	224
Z	"	406,380	539	85	175
W3CI	"	219,480	320	84	152
W3GRS	"	181,472	293	69	143
K3BNS	"	172,115	415	46	99
WA3EPB	"	136,374	253	69	122
W3WJD	"	119,727	261	51	108
W3EVW	"	75,831	172	59	98
W3JET	"	52,540	126	58	90
W3KA	"	48,342	166	30	64
W3EQA	"	39,270	130	39	66
W3GHD	"	35,020	128	43	60
WA3KOS	"	33,120	101	46	74
W3CGS	"	33,110	112	38	57
W3BGN	"	30,377	182	38	68
W3LMZ	"	26,312	102	39	49
W3CBF	"	20,999	86	24	59
W3HVM	"	17,136	85	29	43
W3PN	"	11,072	58	22	42
W3GAU	"	3,027	45	22	27
W3AXW	"	2,318	30	19	19
W3QOR	"	2,145	20	19	20
W3MFJ	28	102,742	375	27	67
K3HPG	"	54,782	218	26	60
W3QQL	"	53,320	213	26	60
WA3HMM	"	6,993	59	12	25
WA3FYJ	"	6,380	56	17	27
WA3GUL	14	87,042	330	30	59
W3PZW	"	78,600	280	32	68
W3EAN	"	13,668	92	17	34
W3MQ	"	7,938	54	17	32
W3YCI	"	4,343	40	18	25
W3FU	7	89,094	325	29	64
W3NB	"	32,777	156	20	53
W3FHR	3.5	243	10	4	5
W4YHD	A	997,548	890	116	272
K4II	A	531,434	585	103	216
K4THA	"	490,468	522	96	218
W4KXV	"	330,880	521	76	144
K4EZ	"	295,708	440	80	156
W4SYL	"	273,585	321	99	206
W4ZSH	"	228,990	365	67	147
W4DM	"	197,184	332	68	140
W4TMR	"	185,840	334	70	132
W4MYA	"	143,027	323	49	109
W6HQN/4	"	128,520	320	76	128
K4CFB	"	79,350	181	51	99
W0YVA/4	"	66,750	194	48	77
W4OMW	"	60,240	185	42	78
W4RNL	"	59,535	164	38	67
K5FSE/4	"	45,577	140	42	77
W4WBC	"	39,780	127	50	67
W4WSF	"	31,584	114	34	62
K4TSJ	"	26,418	87	48	71
W4GHV	"	20,661	81	37	60
W4KMS	"	13,527	58	35	46
K4RDU	"	8,892	54	20	37
WB4IRD	"	8,832	57	31	38
W4EZ	"	5,814	41	20	31
WB4KGJ	"	4,416	34	18	28
W4FCJ	"	4,370	32	20	26
WN4IHK	"	400	25	6	2
W4OVJ	28	98,406	339	28	71
WB4EPJ	"	58,638	234	26	61
W4HOS	"	34,034	156	23	54
W4DRK	"	20,496	128	19	37
W4BI	21	113,145	400	27	68
W4AXE	14	396,414	836	39	123
W4HM	"	133,632	400	32	84
W4SNU	"	104,333	367	29	72
W4ZCY	"	101,898	321	33	78
W4FRO	"	59,186	200	30	71
W4BYB	7	75,576	286	26	68
K4IX	3.5	36	3	2	2
WA4SGF	1.8	144	12	6	6
W5GO	A	474,621	578	97	194
K5BOC	"	377,200	502	95	169
W5BUK	"	130,536	243	71	125
W5WMU	"	67,938	186	49	85
K5DGI	"	21,120	92	28	52
W5EU	"	18,236	66	30	66
W5MSG	"	408	9	9	8
WA5UIZ	28	12,288	94	20	28
W5ONQ	"	140	6	5	5
W5EOT	21	115,949	435	29	72
WA5NUK	"	51,570	205	29	61
W1NQT/5	"	31,388	145	26	50
W5KC	14	95,584	289	33	83
W5OBS	"	91,410	294	34	76
W5LLB	"	90,160	291	34	78
W5WZQ	7	91,504	284	31	81
K6NA	A	613,632	782	100	172
K4BVD/6	A	609,939	702	109	194
WB6HGU/6	"	501,722	597	110	189
W6CYX	"	474,580	556	118	187
W6QY	"	357,455	509	96	149
W6EJJ	"	333,676	491	92	146
K6KA	"	287,401	461	95	136
WA6EPQ	"	252,348	427	72	132
W6TZD	"	251,328	379	95	142
WA6TQK	"	248,144	424	81	127
W6NKR	"	203,904	300	101	135
K6DR	"	201,388	353	89	110
W6BIP	"	192,378	384	79	125
W6ERS	"	184,008	278	95	151
W6AM	"	177,508	310	73	121
W6CY	"	156,946	283	75	119
K6MG	"	126,192	295	65	97
W6JKJ	"	106,197	222	81	98
W6NEX	"	102,630	212	68	97
W6EJ	"	88,517	212	59	84
W6JKR	"	68,425	164	67	94
K6EV	"	67,968	169	59	85
WB6UDC	"	50,082	173	45	57
W6VK	"	36,816	121	54	64
W6CLM	"	34,560	122	50	58
W6HOC	"	32,549	95	54	67
K6AUC	"	20,536	107	29	39
K6TZX	"	16,920	79	45	45
W6BIL	"	15,225	67	41	46
W6GBY	"	10,332	60	30	33
W6OL	"	7,252	66	12	25
W6BVB	"	3,984	32	25	23
W6EJA	"	1,850	27	12	13
WA6IQM	"	1,612	18	15	16
W6ISQ	28	34,254	181	25	41
W6DCC	"	18,753	118	24	33
K6YFV	"	555	14	7	8
WA6IVN	21	150,176	491	32	72
W6AFI	"	92,610	355	28	62
K6YRD	"	83,640	348	27	58
K6ERT	"	81,792	281	28	68
W6TCQ	"	71,544	246	26	62
WB6NWK	"	22,630	125	21	41
W6HJ	"	12,886	78	23	33
WA6JAN	"	911	20	8	9
WA6BVY	"	559	16	7	6
W6CS	14	44,361	169	35	58
W6CYV	"	27,156	101	31	62
K6JB	"	24,850	120	27	43
K6EIV	7	26,076	178	23	30
K6AO	"	21,147	140	24	33
W6DQ	3.5	4,624	54	15	19
W6ITY	1.8	99	7	6	5
WB6NRK	"	42	12	4	3
W7IR	A	665,022	639	117	249
W7MB	"	261,408	410	92	132
W7AYY	"	252,333	436	85	122
W7CNM	"	88,426	181	74	105
WA7BOA	"	35,769	221	47	84
K7CHT	"	22,638	122	27	39
W7IV	"	126	7	7	7
W7DI	28	49,280	217	27	53
W7CRT	"	29,648	165	24	44
W7VY	14	165,188	462	37	85
W7RQN	"	100,225	363	31	64
W7DV	"	79,674	275	34	64
WA7IUQ	"	17,380	121	22	33
W7JLU	7	2,424	41	12	12
K1ZND/8	A	517,292	581	100	216
K8HZU	A	500,956	619	93	185
W8YGR	"	60,996	139	56	100
WA8ZGC	"	41,148	116	58	69
W8KZO	"	39,982	135	33	69
W8DQL	"	23,256	102	30	46
WA8GGN	"	18,172	70	31	37
W8BVF	"	14,200	70	28	43
W8SS	"	12,529	69	30	37
W8BQV	"	8,881	52	21	38
WA8DOY	"	7,257	46	25	34
K8QYG	"	6,664	49	17	32
W8BQV/8	"	1,457	18	15	16

TOP U.S.A. SCORES

Single Operator

All Band	**W3GRF**	**1,024,125**
28 mc	K1JGD	158,510
21 mc	W1MDO	171,796
14 mc	W4AXE	396,414
7 mc	W2LXK	106,526
3.5 mc	W1SWX	35,309
1.8 mc	W1BB	1,044

Multi Operator

Single Trans.	K1DIR	1,729,408
Multi Trans.	W3MSK	4,560,038

SP5AUY, the young 21 mc winner for Poland. Jack finds our contest "very interesting" and being a young fellow, has many more to look forward too.

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WA8VVU	"	1,100	16	11	14
W8IDM	"	200	7	4	6
W8VSK	**28**	**131,733**	**387**	**33**	**86**
WA8NYB	"	102,306	320	29	73
WA8TFJ	"	68,604	263	28	63
W8JAQ	"	11,100	78	18	32
W8DSO	21	9,480	79	11	29
W8TWJ	"	1,520	27	5	14
WA8CIA	**14**	**66,606**	**224**	**33**	**69**
W8EW	"	34,580	159	27	49
WA8MCR	"	9,706	72	20	26
W8AQZ	"	2,030	25	12	17
WA8ZZZ	"	55	4	2	3
K8HKM	**7**	**47,579**	**219**	**23**	**56**
K8DOC	"	6,353	59	13	24
W8BDO	"	3,630	42	11	23
W8AJW	3.5	1,386	36	8	10
K1PBW /8	**1.8**	**1,008**	**27**	**7**	**11**
W9AQW	**A**	**765,919**	**800**	**102**	**241**
K9KDI	"	501,900	572	91	209
K9CUY	"	412,380	528	98	192
W9RQM	"	344,172	470	89	169
W9ARV	"	253,016	400	81	143
K9CSW	"	251,544	391	81	142
W9GFF	"	179,670	274	79	147
W9DWQ	"	138,387	252	68	125
W9EZ	"	76,327	204	40	87
WA9REC	"	59,292	184	49	73
WA9HJM	"	40,940	174	56	89
W9QWM	"	11,926	67	28	39
W9MUR	"	11,524	61	27	40
K9VQK	"	11,210	65	21	38
W9EVX	"	5,768	39	25	31
WA9WXL	"	4 680	44	13	23
K9TNA	"	3,827	32	18	25
W9ZTD	**28**	**87,792**	**316**	**25**	**69**
W9LKI	"	81,438	289	29	69
W9VBV	"	50,676	206	25	57
W9VZP	"	40,638	180	26	52
W9JUV	"	23,616	112	23	49
K9UQN	"	14,478	91	21	36
W9BG	"	6,903	42	22	37
W9YYG	"	49	4	4	3
K9YHB	**21**	**123,066**	**415**	**29**	**77**
WA9LMY	"	71,104	283	27	61
W9AEM	"	23,465	124	21	44
WA9SUJ	"	23,170	116	24	46
W9OHH	**14**	**72,821**	**246**	**32**	**71**
W9WYB	"	23,359	116	25	46
W9JOO	"	20,572	99	26	48
W9BZU	"	2,555	27	15	20
W9HUZ	**7**	**35,646**	**165**	**25**	**53**
K9BGL	"	30,636	150	24	50
WA9JDT	"	3,762	41	10	23
W9PNE	**1.8**	**165**	**14**	**5**	**6**
WØHP	**A**	**605,379**	**593**	**101**	**200**
WAØEMS	"	473,748	575	103	188
WØLQN	"	254,980	383	80	129
WAØKDI	"	154,732	272	74	128
WØDAK	"	69,361	173	53	86
KØCNC	"	28,782	125	33	49
WØDYA	**"**	**14,630**	**71**	**27**	**43**
WØNFL	"	11,502	56	28	43
WAØOML	"	1,377	13	9	9
KØARS	**28**	**26,418**	**131**	**24**	**50**
KØPMZ	"	7,222	51	19	27
WØQQQ	"	4,756	44	18	23
W9ECV/Ø	"	1,404	19	9	18
WØPAN	**21**	**24,721**	**154**	**20**	**39**
KØTPF	"	20,150	116	24	41
WAØCVS	**3.5**	**2,511**	**36**	**13**	**18**

Alaska

KL7JDO	**A**	**148,423**	**500**	**58**	**73**
KL7MF	"	107,300	674	30	44
KL7EWA	**14**	**63,350**	**370**	**24**	**46**

Canada

VO1AW	**A**	**341,499**	**655**	**61**	**140**
VE1EK	**A**	**11,972**	**72**	**32**	**41**
VE1TG	**28**	**122,018**	**538**	**23**	**64**
VE1AMX	**21**	**10,800**	**86**	**14**	**34**
VE1AJJ	**14**	**25,024**	**240**	**15**	**31**
VE1AE	"	20,672	113	17	47
VE2NV	**A**	**464,035**	**589**	**93**	**202**
VE2AYU	"	334,048	669	70	138
VE2WA	"	309,963	413	96	181
VE2YU	"	51,729	154	49	80
VE2AJ	"	32,012	104	44	62
VE2BV	**14**	**71,904**	**272**	**28**	**68**
VE4BN	"	200	14	5	3
VE3GCO	**A**	**251,865**	**497**	**69**	**124**
VE3EDC	"	171,310	409	71	114
VE3CWE	"	51,534	147	56	70
VE3GJQ	"	5,200	45	12	2
VE3BS	**28**	**47,360**	**245**	**21**	**53**
VE3BMB	**21**	**69,842**	**260**	**26**	**68**
VE5GG	**14**	**73,312**	**368**	**26**	**53**
VE7SV	**A**	**818,350**	**980**	**118**	**207**
VE7EH	"	245,323	708	73	94
VE7IQ	"	60,800	339	41	39
VE7IG/7	**28**	**80,730**	**501**	**26**	**43**
VE7LB	**21**	**134,504**	**693**	**30**	**56**
VE7HQ	"	2,489	45	9	10
VE7QC	**14**	**4 050**	**66**	**13**	**14**
VE7BDJ	**3.5**	**14,472**	**184**	**17**	**19**

Mexico

XEØGEN	**A**	**684 200**	**1402**	**86**	**134**
(Operator W6GEN)					
XEØDUS	**"**	**289 863**	**1309**	**48**	**59**
(Operator K4FW)					
XE2AAG	**21**	**21,936**	**198**	**19**	**29**

Panama

HP1AC	**21**	**19,160**	**218**	**14**	**26**
HP1BR	**14**	**20,100**	**116**	**22**	**45**

Puerto Rico

K5FKT/KP4	**A**	**145,431**	**556**	**41**	**76**

Virgin Islands

KV4FZ	**A**	**1,947,456**	**2517**	**107**	**229**
KV4AM	**14**	**54,352**	**254**	**30**	**56**

AFRICA

Angola

CR6GO	**21**	**530,550**	**1409**	**37**	**94**
CR6AI	**14**	**118,877**	**391**	**31**	**76**

Ascension Island

ZD8J	**A**	**1,709,955**	**1742**	**108**	**225**

Canary Islands

EA8EY	**A**	**16,350**	**113**	**16**	**34**

Ghana

9G1HM	**14**	**86,870**	**307**	**22**	**48**

Malawi

7Q7AM	**A**	**37,410**	**153**	**39**	**47**

Mauritius

VQ8CC	**A**	**388,992**	**703**	**73**	**119**
VQ8CJ	**14**	**19,159**	**150**	**18**	**31**

Mozambique

CR7HC	**21**	**5,280**	**57**	**14**	**18**

Rhodesia

ZE8JN	**A**	**402,151**	**911**	**56**	**93**
ZE3JO	**"**	**29,181**	**141**	**27**	**44**
ZE3JJ	**28**	**145,340**	**567**	**27**	**59**
ZE1BF	**14**	**78,702**	**345**	**28**	**50**
ZE2KV	"	28,900	170	26	39
ZE5JJ	**7**	**23,500**	**167**	**20**	**30**

South Africa

ZS5XA	**A**	**664,200**	**1140**	**71**	**129**
ZS2RM	"	231,200	500	62	98
ZS6AJO	"	80,052	321	36	48
ZS1ACD	"	20,351	150	22	25
ZS2HI	**14**	**227,656**	**745**	**32**	**72**
ZS10	28	90	10	2	1

Swaziland

ZD5X	**A**	**125,097**	**250**	**63**	**84**
ZD5M	**14**	**17,030**	**98**	**23**	**42**

Zambia

9J2MX	**A**	**994,224**	**1285**	**89**	**175**

ASIA

Ceylon

4S7DA	**A**	**154 475**	**319**	**72**	**113**
4S7AB	**14**	**13,268**	**80**	**26**	**36**

Hong Kong

VS6AA	**28**	**47,753**	**356**	**14**	**39**

India

VU2RM	**A**	**75,012**	**229**	**55**	**86**
VU2URZ	**14**	**14,579**	**104**	**25**	**36**

Israel

4Z4AG	**28**	**4,374**	**91**	**4**	**12**

Japan

JA1AEA	**A**	**1,043.100**	**1262**	**105**	**180**
JA3GZN	**A**	**748,429**	**1235**	**79**	**130**
JA2HO	"	241,417	476	82	105
JA1VX	"	226,122	463	63	106
JA1XUY	"	115,570	317	61	69
JA2LA	"	106,634	302	53	78
JA7CQB	"	106,248	277	67	85
JA1SR	"	98,568	264	67	81
JA2JAA	"	93,280	308	43	63
JA1PTI	"	73,851	427	50	53
JA2ITH	"	69,819	244	49	62
JA7FC	"	56,286	286	48	58
JA3LGG	"	51,976	208	43	46
JA1KYV	"	40,950	151	45	60
JA3DEO	"	38,454	148	48	54
JA1JKG	"	38,193	163	40	47
JA1AYO	"	37,740	149	46	56
JAØDJE	"	22,933	123	34	37
JA2OJ	"	18 389	93	34	37
JA2EDC	"	17,850	90	34	41
JA1SMA	"	17,556	100	33	33
JA7GAX	"	17,394	163	19	20
JA1BNW	"	17,028	96	34	32
JA8SW	"	16,650	97	33	32
JA7JW	"	16,120	118	26	26
JA6ADZ	"	15,808	75	33	43
JA5IU	"	13,744	134	35	44
JA2DXZ	"	10,624	67	31	33
JA7BVA	"	9,412	73	26	26
JA3IUH	"	8,640	82	22	23
JA2NQG	"	4,600	45	24	26
JA1IZ	"	3,724	37	18	20
JA9NB	"	2,448	29	17	17
JAØBOP	"	2,205	33	13	12
JH1AWN	"	1,306	44	13	14
JA1PIG	"	315	11	8	7
JA6TQ	**28**	**57,013**	**298**	**26**	**45**
JA7ARZ	"	50,902	289	26	36
JA1WRP	"	43,620	257	24	36
JA8QR	"	31,995	254	18	27
JA8BYP	"	21,708	208	18	18
JA3IG	"	16,281	196		9
JA7UQ	"	15,744	139		19
JA7EYB	"	6,984	73		18
JA4AEZ	"	6,963	76		17
JH1CXE	"	3,240	16		9
JH1EYB	**21**	**188,034**	**585**		**36**
JH1GMP	**21**	**127,503**	**483**		**31**
JA1KRV	"	112,252	519		27
JA1KVT	"	102,870	441		29
JA3LLA	"	89,295	480		24
JA1LXE	"	62,550	294		29
JA1SKE	"	61,578	331		24
JAØCUV	"	59,521	272		28
JA1DDZ	"	50,864	267		26
JA8BUX	"	43,120	273		24
JA2TH	"	40,545	259		21
JA8AYN	"	34,301	293		20
JA1PTO	"	31,212	213		21
JA6FFV	"	27,094	164		24
JA9BFM	"	25,025	161		26
JA1SSE	"	25,023	160		22
JA2KOW	"	15,810	115		21
JA1BZM	"	11,700	92		20
JA1VHV	"	8,800	97		19
JAØDWY	"	7,869	68		20
JA1SBH	"	7,105	78		17
JA3QWA	"	2,398	43		11
JA1GDN	"	1,188	18		13
JAØDVA	"	840	19		10
JAØED	"	567	13		10
JA1XRH	"	135	9		3
JA5BJC	**14**	**110,968**	**394**		**33**
JA6PN	"	63,063	246		33
JA1NLX	"	59,049	289		32
JA2CPD	"	39,294	207		29
JA3OFL	"	21,899	159		26
JA8GR	"	15,428	118		25
JA1FGB	"	11,280	102		21
JA2EMP	"	10,488	114		18
JA2AYC	"	3,520	46		16
JA4AQR/5	"	3,185	42		16
JA3IG	"	1,120	11		9
JA6IZP	"	1,104	20		11
JA6YE	"	840	18		10
JAØGZ	"	275	15		6
JA1EUV	**7**	**73,425**	**312**		**32**
JA8JL	"	24,908	181		22
JA1PPW	"	12,341	118		19
JA1UAK	"	10,437	98		22
JA2AAQ	"	10,101	106		17
JA1MUD	"	2,120	44		11
JAØAJH	"	1,764	45		9
JA2IPE	"	1,215	29		8
JA7FAS	"	1,064	37		7
JA3IVW	**3.5**	**1,083**	**20**		**10**
JA3BCT	"	240	13		6
JA1RQA	**1.8**	**12**	**2**		**2**

Laos

XW8CS	**A**	**563 445**	**786**		**95**
XW8CR	"	106,908	395		65

Pakistan, West

AP5HQ	**A**	**190,128**	**583**		**38**

Ryukyu Islands

KR6NR	**A**	**203.112**	**525**		**61**
KR6KQ	**14**	**7,257**	**177**		**17**

Saudi Arabia

HZ1AB	**28**	**132,390**	**578**		**21**

U.S.S.R.

Asiatic

UA9WS	**A**	**474 012**	**744**		**60**
UA9MR	**A**	**337,246**	**605**		**66**
UA9MK	"	62,322	248		34
UA9GC	"	35,140	102		23
UA9HM	"	27,219	163		17
UA9PP	"	22,572	85		50
UV9DB	"	14,063	102		15
UA9NJ	"	12,838	108		17
UA9CT	"	12,617	116		9
UA9DC	"	12,243	77		15
UA9MQ	"	6,864	72		20
UW9WB	**28**	**71,198**	**266**		**32**
UA9TT	"	21,689	182		13
UA9YLG	"	11,424	112		8
UA9UG	**21**	**59.540**	**441**		**21**
UA9WJ	"	31,781	189		17
UA9AB	"	5,474	47		13
UA9OO	**14**	**68.880**	**323**		**25**
UA9UY	"	45,771	263		24
UA9AN	"	8,697	83		14
UA9ND	"	8,505	86		11
UA9XN	"	8,277	104		12
UA9OS	"	5,940	72		16
UA9MY	"	1,056	28		7

Karl Kozlik, operating VK2BKM/LH where he made over 1000 contacts from rare Lord Howe and made many DXers happy with a new one. And which earned him the Contest Expedition award.

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Single Operator — All Band

tation	QSO's						Zones						Countries					
	1.8	3.5	7	14	21	28	1.8	3.5	7	14	21	28	1.8	3.5	7	14	21	28
V4FZ	55	242	464	779	515	462	7	11	20	32	21	16	7	34	42	60	45	41
D8J		60	168	624	516	374		8	19	33	29	19		8	37	70	69	41
V5ANT	1	54	330	682	483	285	1	5	13	30	22	12	1	5	27	60	51	34
L1AJU		24	60	332	467	412		8	12	34	30	25		6	12	68	56	40
A1AEA		36	165	457	409	195		12	22	30	20	21		12	40	60	40	28
AØAD		64	94	438	222	439		10	14	25	22	23		34	37	53	47	43
3GRF	4	46	175	222	276	230	3	11	19	27	30	21	3	19	49	69	69	55
M3OM	9	254	362	500	225	105	2	7	19	28	25	22	4	35	53	73	57	35
4YHD	6	47	111	183	291	252	5	9	19	30	29	24	6	22	50	70	64	60
J2MX			49	459	430	347			11	32	23	23			16	62	50	47

Multi-Operator — Single Transmitter

LØKF		327	573	513	629	287		9	29	28	30	32		35	71	67	64	65
1DIR		96	265	334	323	245		17	26	35	30	28		35	69	88	75	69
F3USA		27	128	514	435	495		8	10	30	29	27		13	30	64	67	60
J2BW/LX		323	392	336	454	332		10	19	29	26	28		40	57	76	52	50
AØKFG		53	199	599	598	245		9	23	32	25	21		10	38	65	49	25
2PCJ		92	216	291	272	213		11	22	31	24	26		33	60	76	62	59

Multi-Operator — Multi-Transmitter

JØCC	57	371	1181	2129	1341	967	4	13	25	37	29	27	5	33	66	89	68	63
3MSK	20	162	484	761	759	510	6	24	32	39	34	31	10	50	78	110	96	79
H2AM	126	290	571	955	902	433	2	16	28	40	35	34	11	52	70	102	94	82
4ETO	7	149	446	742	514	516	5	20	24	37	30	29	4	44	63	102	75	74
4BVV	12	140	420	579	659	430	6	19	28	35	33	24	7	44	61	93	83	61
3GM	12	135	381	700	523	326	6	18	22	37	31	27	8	43	61	97	75	68

Top scores band-by-band breakdown

DU	"	198	7	5	6	UL7GQ	"	26,828	180	28	48	**LZ1CW**	**28**	**46,057**	**288**	**24**	**55**	OM2BMF	"	29,055	160	26	39
CQ	**7**	**28,644**	**244**	**13**	**31**	UL7CA	"	6,240	57	15	25	LZ2KFD	14	1,127	41	5	18	OK2BIP	"	14,700	113	21	28
WL	"	26,325	207	10	25	**UL7AST**	**28**	**26,496**	**228**	**12**	**34**	**LZ1KPG**	**7**	**159,964**	**792**	**34**	**82**	OM1MP	"	11,600	92	20	30
F	"	7,227	103	11	22	UL7JG	"	17,204	153	13	31	LZ1KSF	"	101,008	675	31	76	OK1AHZ	"	9,495	73	20	25
						UL7GR	**21**	**44,446**	**240**	**22**	**49**	LZ1DZ	"	60,384	694	17	51	OM1APV	"	4,608	50	14	18
AG	**A**	**305,946**	**573**	**64**	**143**	**UL7HV**	**14**	**18,048**	**150**	**17**	**30**	LZ1KSA	"	43,260	379	18	52	OM1OO	"	3,640	64	9	11
AF	"	196,911	530	50	103	UL7YR	"	12,455	117	18	29			Czechoslovakia				**OM1BMW**	**21**	**78,565**	**324**	**31**	**64**
DV	"	31,944	321	35	31	UL7YP	"	8,316	79	17	27	**OM3OM**						OM1AGQ	"	48,546	339	20	34
ZK	"	18,277	284	26	23	**UL7AU**	**7**	**42,834**	**291**	**18**	**41**		**A**	**1,016,664**	**1455**	**103**	**257**	OM1ABP	"	45,496	203	28	60
TP	"	10,332	112	16	26	UL7JI	"	1,652	48	5	10	**OM1PD**	**A**	**754 110**	**907**	**119**	**223**	OK1ALG	"	33,948	192	23	46
LL	"	3,422	36	17	22			Kirghiz				OM2QX	"	375,524	760	86	183	OK3KGI	"	29,304	190	23	49
US	"	112	9	4	4	**UM8IE**	**14**	**53,130**	**315**	**23**	**47**	OM1ARN	"	319,088	847	56	140	OM1MX	"	25,244	170	21	43
SL	**21**	**97,989**	**462**	**28**	**61**	UM8AO	"	9,920	123	14	26	OM2BLG	"	192,324	604	55	131	OK1AII	"	25,200	165	24	46
W	**14**	**37,972**	**339**	**19**	**25**			Tadjik				OM3CGP	"	141,282	596	39	102	OK3CDL	"	18,125	155	19	46
ZI	"	24,225	231	21	30	**UJ8AB**	**A**	**46,812**	**175**	**32**	**62**	OM2BHV	"	134,850	580	56	130	OM2BNA	"	17,490	172	20	35
BQ	"	21,352	210	12	22	UJ8AH	"	17,472	119	32	46	OM2BFT	"	107,859	377	44	113	OM2BBI	"	12,878	122	17	30
YE	"	20,142	145	25	29			Turkoman				OM3CES	"	80,983	350	28	133	OK3CU	"	10,058	114	18	29
MI	"	17,574	189	24	34	**UH8AE**	**A**	**341,352**	**605**	**55**	**143**	OM2BWI	"	65,750	377	31	94	OK1PT	"	7,436	65	20	24
TD	"	15,867	164	20	23	UH8DH	"	76,092	312	34	68	OM2LN	"	64,960	302	40	105	OM2BPF	"	4,332	70	13	15
UQ	"	15,732	224	17	29	UH8BO	"	40,920	175	28	60	OM1ADM	"	61,457	150	64	87	OK1FAK	"	3,136	39	13	15
SA	"	11,132	112	14	30	**UH8DT**	**14**	**10,384**	**84**	**14**	**30**	OK3CAU	"	51,867	353	31	82	OK1AQO	"	1,026	36	8	11
LS	"	12,960	161	21	27			Uzbek				OM2BNZ	"	46,980	181	51	111	OM2BJR	"	126	14	4	3
IW	"	10,980	120	19	26	**UI8FB**	**A**	**15,030**	**131**	**15**	**30**	OK1AOV	"	34,760	238	30	80	**OK1ALW**	**14**	**109,410**	**502**	**32**	**73**
YD	"	10,413	119	14	25	**UI8AI**	**28**	**14,525**	**166**	**12**	**23**	OM1RX	"	33,372	185	31	72	OM2BEW	"	39,816	260	24	55
ZS	"	7,047	137	14	15							OM1KZ	"	27,348	188	30	56	OK2BFS	"	21,274	218	19	43
PD	"	6,552	102	16	20			EUROPE				OM2BFX	"	26,200	213	26	74	OM1EG	"	20,709	255	15	44
ML	"	1,430	25	11	11			Aaland Island				OK1AIA	"	23,520	209	25	71	OM1NW	"	11,300	167	13	37
UF	"	975	43	6	9	**SM5BGK/OH0**						OM2BPE	"	20,664	322	16	56	OM3BT	"	11,124	133	14	40
FB	3.5	3,525	86	13	12		21	89,356	484	26	63	OK1KYS	"	20,202	141	19	55	OK2WDC	"	11,020	174	12	36
		Armenia				**SM5DHK/OH0**						OM1XN	"	15,900	167	17	43	OK3JV	"	10,595	75	19	46
EA	14	33.936	219	15	41		7	66,649	532	23	60	OK2SFS	"	15,162	118	25	32	OM3KOW	"	9,954	203	9	33
JJ	"	5,285	60	11	24	**SM5MX/OH0**						OK2KFP	"	13,230	167	11	52	OM1EP	"	6,776	77	11	33
AD	7	59,760	440	12	36		3.5	27,456	353	15	49	OM1AZQ	"	12,615	128	19	68	OK1FAF	"	6,027	117	10	31
		Azerbaijan						Austria				OM2PAE	"	10,478	114	18	54	OK2BNI	"	5,719	102	11	32
AM	**A**	218,280	462	73	131	**OE1WO**	**21**	**7,055**	**78**	**17**	**28**	OK1FAE	"	10,266	107	18	40	OM1UY	"	5,250	90	10	32
BD	21	12,555	98	15	30			Belgium				OM2BCI	"	7,296	49	31	45	OK1ADH	"	3,813	53	14	27
BQ	14	34,099	209	17	44	**ON4XG**	**A**	**350,700**	**738**	**66**	**144**	OK2BLC	"	6,908	70	16	28	**OM1XW**	**7**	**41,684**	**472**	**17**	**51**
		Georgia				**ON5WL**	**7**	**1,950**	**65**	**7**	**19**	OM1CIJ	"	1,593	29	13	14	OM3DT	"	27,540	311	16	44
LA	**A**	378.056	820	47	125			Bulgaria				OK2BBQ	"	812	26	9	20	OM3ALE	"	27,335	315	12	43
DR	28	55,705	308	17	48	**LZ2ZZ**	**A**	**279,246**	**772**	**56**	**147**	OM2BEY	"	63	9	3	4	OM1AHG	"	17,710	235	12	43
		Kazakh				LZ1AG	"	139,700	383	67	153	**OM3DG**	**28**	**81,729**	**392**	**29**	**52**	OK1MSS	"	6,916	167	7	31
GW	**A**	177.840	463	60	120	LZ2EA	"	86,520	322	48	120	OK1GT	"	69,660	297	28	62	OK1MAD	"	4,768	151	5	27
IE	"	170,940	502	45	95	LZ2GS	"	888	29	8	16	OM2DB	"	40,788	224	26	40	OM1MSJ	"	315	22	4	11
IT	"	72,891	355	31	60							OM1TA	"	32,000	179	25	39	**OM1BY**	**3.5**	**43,560**	**464**	**17**	**49**

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OK3CED	"	17,472	286	10	38	G3VMK	3.5	35,316	427	12	42	DJ4HR	"	60,720	272	35	85			Ireland			
OK2HI	"	9,881	328	7	34	G3IAR	"	18,894	302	10	37	DJ7PB	"	56,544	296	24	52	EI5F	A	24,057	139	29	
OK2YL	"	7,385	201	6	29	G3PFZ	"	8,262	234	9	25	DL1ES	"	52,334	191	46	91			Italy			
OK1ATR	"	5,705	152	7	28			Faroe Islands				DJ1LD	"	47,736	210	38	79	I1ASE	A	206,761	526	74	
OK1MGM	"	3,267	96	5	28	OY4OV	14	3,770	85	8	21	DJ6SI	"	38,430	217	30	75	I1PER	"	46,350	216	44	
OM3BG	"	1,564	68	5	18			Finland				DL9EM	"	37,291	174	36	53	I1AUM	21	4,284	80	11	
OK1MAA	"	1,320	56	3	21	OY4OV	14	3,770	85	8	21	DL6BP	"	34,992	153	41	67	I1FGP	14	69,065	396	26	
OK1BV	"	969	51	4	15	OH2XF	A	114,791	276	64	127	DL9YC	"	31,977	160	28	71	I1PPI	"	40,014	270	21	
OK1XC/P	"	221	21	3	10	OH3YI	"	110,032	337	56	152	DL6QH	"	29,997	164	32	57	I1ALU	7	24,550	319	11	
OM1IQ	1.8	2,185	109	4	5	OH5UQ	"	61,560	224	43	71	DJ2EL	"	22,019	109	35	62	I1CZQ	"	20,433	286	11	
OK1AWQ	1.8	1,984	122	3	13	OH4RU	"	49,500	229	43	89	DJ1QL	"	6,816	88	15	33	I1BER	"	11,440	121	12	
OK1ATP	"	1,904	132	3	13	OH2RI	"	47,725	301	32	83	DJ1VP	"	5,368	45	21	23			Jan Mayen			
OK2ZU	"	1,824	128	3	13	OH2YL	"	33,078	114	22	39	DL9RP	"	4,796	41	16	18	JX2BH	A	90,092	420	33	
OK1WT	"	1,290	85	3	12	OH2DN	"	4,171	55	15	28	DJ2DR	28	77,004	320	29	63	JX5CI	14	5,508	78	13	
OK1STU	"	1,053	89	2	13	OH6XY	"	1,404	38	11	25	DL4PX	"	41,325	208	29	46			Luxembourg			
OK2HZ	"	1,020	67	3	12	OH2VZ	"	858	22	13	17	DL6DF	"	27,960	180	22	38	LX9LS	A	53,408	327	27	
OL1AKG	"	812	72	2	12	OH3TY	28	19,224	104	27	45	DJ9ON	"	26,384	154	23	45	(Operator W0IYP)					
OM2DW	"	714	52	2	12	OH1PG	"	2,150	40	11	14	DL1TA	"	16,377	128	23	30			Netherlands			
OL2AKS	"	440	58	2	9	OH2BCD	"	1,026	21	9	9	DL1QT	"	11,935	80	23	32	PAØSNG	A	256,158	674	64	
OL6AKO	"	435	34	6	9	OH2XK	21	59,892	367	27	57	DJ1XL	"	2,725	34	12	13	PAØVB	"	120,560	390	56	
OM1AIJ	"	300	46	2	8	OH5WH	21	59,616	383	24	57	DJØJX	21	100,036	480	30	59	PAØLV	"	58,707	365	33	
OK1JOE	"	225	31	2	7	OH5RZ	"	4,851	78	12	21	DL8RE	"	66,306	346	27	59	PAØWAD	"	17,244	194	20	
OL6AKP	"	225	31	2	7	OH5SF	"	2,700	50	8	17	DJ4UF	"	66,281	354	24	55	PAØUV	"	5,550	51	14	
OM2BMN	"	165	18	2	9	OH8RV	"	608	30	6	10	DL1RB	"	11,776	107	20	26	PAØTA	"	4,524	55	13	
OK2PBX	"	144	18	2	7	OH2RD	"	64	4	4	4	DJ3KR	3.5	42,070	410	17	53	PI1PT	28	6,990	91	14	
OK1AES	"	51	17	1	2	OH3XZ	14	20,920	197	17	33	DJ5DT	"	17,325	232	10	45	PAØABM	21	22,976	198	19	
OK2BJJ	"	16	9	1	3	OH7NW	"	2,220	30	12	25	DL1CF	1.8	2,235	148	3	12			Norway			
		Denmark				OH1VA	7	48,314	377	27	71	DL9KRA	"	2,112	110	4	12	LAØAD	A	1,035,188	1257	94	
OZ3PO	A	53,466	172	38	76	OH1PS/2												LA2Q	"	55,414	323	32	
OZ2UA	"	13,845	120	19	46		3.5	21,890	352	12	43	DM2BTO	A	96,824	299	57	125	LA2KD	"	47,256	199	44	
OZ4FF	"	10,899	151	19	44	OH2MA	"	11,515	255	9	38	DM2ATD	A	94,400	263	62	98	LA1YM	"	567	17	12	
OZ4H	"	6,731	66	22	31			France				DM3BE	"	49,400	272	34	96	LA9M	"	550	25	3	
OZ2NU	"	4,940	72	13	39	F3AT	A	205,520	647	45	95	DM3MSF	"	39,556	191	41	83	LA9HC	21	21,050	155	19	
OZ4RT	28	26,136	137	27	45	F8TQ	"	198,510	499	50	145	DM2CHM	"	31,992	101	51	78	LA2NL	"	2,970	52	12	
OZ7G	"	17,845	149	16	27	F8TC	"	118,874	492	37	61	DM2DEO	"	30,282	167	31	72	LA6U	7	13,158	153	13	
OZ7BG	21	160,720	558	33	79	F8TM	"	96,815	337	43	102	DM4YEL	"	26,145	112	43	62			Northern Ireland			
OZ7NB	14	4,080	71	11	23	F6KAL	"	33,630	197	31	64	DM2AUD	"	24,745	182	31	70	GI6YM	A	12,000	149	13	
OZ7YY	7	32,844	334	16	52	F9BB	"	18,407	129	28	51	DM3UE	"	20,140	94	44	62	(Operator GI3XGI)					
OZ9FW	3.5	21,520	128	23	44	F2SQ	"	1,558	42	9	10	DM2BZN	"	17,910	78	40	50			Poland			
0Z4OA	"	1,278	74	3	15	F8SF	"	1,350	32	12	18	DM3XUE	"	16,055	84	36	59	SP2IU	A	120,666	421	55	
		England						Germany				DM2DLJ	"	11,753	79	27	46	SP5AFL	A	109,140	485	46	
G3HDA	A	969.612	1123	107	250	DJ5BV	A	673,576	870	100	213	DM3XI	"	10,439	55	33	40	SP8AFS	"	84,942	403	41	
G3FXB	A	695,372	963	85	191	DL7AA	A	662,905	806	105	204	DM2BBE	"	9,727	125	15	56	SP6BZ	"	66,960	316	47	
G6PD	"	253,791	620	55	108	DL7AV	A	594,542	739	105	233	DM2BNI	"	7,434	55	29	34	SP9ABU	"	51,870	235	39	
G3TXF	"	197,175	458	55	110	DL6WD	"	408,720	674	80	180	DM2CCM	"	4,941	68	13	48	SP5AG	"	51,054	276	35	
G2DC	"	179,967	368	73	116	DJ7IK	"	352,452	711	89	187	DM2ATL	"	3,542	50	18	28	SP9ZD	"	50,400	210	42	
G2AJB	"	105,878	356	55	112	DJ3WU	"	265,122	490	78	156	DM2BKI	"	3,440	77	10	43	SP5BIL	"	39,100	223	31	
G3JFF	"	55,074	261	51	86	DL1AM	"	242,000	498	78	172	DM2BYN	"	3,320	31	17	21	SP8ARU	"	35,748	231	28	
G3TIF	"	48,287	196	36	73	DL1MD	"	202,664	460	68	128	DM3VGO	"	588	37	7	14	SP2AJO	"	31,200	163	34	
G6VC	"	25,550	187	22	28	DJ8FF	"	192,469	502	58	139	DM2AVA	"	525	30	5	16	SP9CEM	"	24,380	222	26	
G3NVK	"	22,698	168	28	69	DL8UF	"	156,484	498	52	90	DM2BJB	"	440	24	5	15	SP3BES	"	19,662	186	19	
G2BOZ	28	97,644	493	24	55	DL7CF	"	153,435	350	62	131	DM2CDL	28	7,515	63	19	26	SP3KCL		15,276	183	18	
G3UQR	"	45,954	313	22	32	DL7BQ	"	151,840	390	58	102	DM2BML	"	3,565	55	9	14	SP3CAR/3					
G3RZI	"	36,366	243	23	34	DL1JF	"	150,290	374	62	128	DM3SNM	"	730	33	6	4		"	13,860	164	16	
G3IGW	"	31,570	235	17	38	DL8YR	"	144,992	428	59	138	DM4WKL	21	784	29	7	9	SP3AIJ	"	13,740	90	27	
G3JKY	"	26,076	196	18	23	DL8BS	"	111,891	359	51	100	DM3GL	14	1,449	31	8	15	SP8AWP	"	13,120	124	24	
G2NH	"	14,500	109	24	34	DL8AJ	"	106,113	306	41	122	DM2AVG	"	902	47	6	16	SP9BQX	"	12,358	95	30	
G3WP	"	276	23	3	2	DLØII	"	87,615	300	42	93	DM2BPB	"	280	18	4	10	SP4CPB	"	8,866	130	16	
G3HCT	21	240,468	848	32	84	DL7NP	"	83,620	225	57	91	DM5BG	"	210	15	4	10	SP9AGS	"	6,496	96	16	
G3RUX	"	39,648	327	18	41	DJ3YU	"	73,932	299	44	78	DM4SLG	7	1,012	51	4	19	SP9BPF	"	2,504	58	20	
G3ESF	"	34,821	222	25	48	DL6WE	"	70,470	219	56	118	DM5GL	"	99	10	2	9	SP6PT	"	2,294	26	15	
G3NSY	"	23,925	237	17	38	DL2JO	"	64,975	277	39	74	DM2BOG						SP2AHD	"	2,184	43	12	
G3FKM	14	172,376	652	32	84	DJ2TI	"	64,084	292	44	104		3.5	21,008	373	10	42	SP2AOB	"	1,392	18	14	
G3JVJ	"	20,727	153	19	44	DL2NS	"	62,520	521	35	85	DM2CIM	"	7,700	153	7	37	SPAWV	"	1,292	35	8	
												DM3PEL	"	6,760	162	7	33	SP8AWL	28	9,384	70	21	
												DM4ZWL	"	5,088	166	5	27	SP5AUY	21	32,823	231	21	
												DM2AOI	"	3,480	108	5	24	SP3AUZ	"	28,748	231	22	
												DM4XNL	"	3,168	97	6	26	SP1BHX	"	12,939	113	22	
												DM4HJ	"	1,680	74	4	20	SP8CFZ	"	9,090	113	16	
												DM3XHF	"	946	44	3	19	SP8HR	"	4,921	73	12	
												DM3TUF	"	560	32	4	16	SP6OQ	"	3,825	70	11	
												DM4ZSA	"	555	42	3	12	SP6BAA	"	2,862	41	12	
												DM4MQN	"	378	23	3	15	SP2KAC	14	61,060	360	25	
												DM6VAK	"	240	16	4	12	SP3KAU	"	53,475	397	22	
												DM3TNA	"	182	14	3	10	SP9PT	"	44,544	285	26	
														Greece				SP2PAH	"	37,950	340	23	
												SVØWP	14	90,618	744	22	44	SP3KBN	"	14,196	156	16	
														Hungary				SP4BWO	"	12,272	146	15	
												HA8UD	A	246 036	790	52	122	SP8BMF	"	6,510	107	13	
												HA7LU	"	76,568	362	35	101	SP3BQD	"	5,060	49	16	
												HAØLC	"	29,492	248	29	72	SP6BCA	"	4,176	116	9	
												HA1VA	"	15,876	150	21	60	SP9UH	"	3,810	101	7	
												HA8UE	"	12,388	105	29	47	SP9DH	7	36,556	334	17	
												HA2RB	"	10,942	109	18	30	SP8CCC	"	16,905	273	11	
												HA6NC	"	10,780	120	23	47	SP8MJ	"	15,484	223	11	
												HA3GJ	"	9,594	198	10	29	SP5ATO	"	10,485	167	9	
												HA9PE	"	3,150	61	14	36	SP1CNW	"	6,848	188	8	
												HA3MJ	14	4,623	75	10	13	SP2KDS	"	6,474	144	8	
												HA3GK	7	216	24	4	5	SP9BRP	"	1,560	63	6	
												HA9PH	3.5	4,830	156	6	24	SP6BXM	"	63	7	4	
												HA3NA	"	1,449	64	4	19	SP5ZA	3.5	14,895	314	9	
														Iceland				SP6UK	"	3,645	141	5	
												TF3SG	A	55.100	273	30	65	SP2RW	"	3,120	107	4	
												TF3OJ	14	33,840	208	22	50	SP6CDP	"	3,080	113	4	

Anatol, UA1DG and Zina, UA1MQ shared the same rig during the contest and submitted individual logs for their 14 mc operation.

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DF	"	2,064	91	4	20	
AZB	"	1,518	81	4	19	
DCR	"	1,491	92	4	17	
CNR	"	748	46	4	13	
		Portugal				
DI	7	1,431	35	10	17	
		Romania				
DL	A	170,240	497	58	132	
APJ	"	77,500	379	45	90	
CR	"	48,132	217	41	85	
DD	"	32,538	196	30	72	
VJ	"	31,640	334	16	54	
AW	"	28,832	217	28	78	
AWR	"	25,750	197	30	73	
AIR	"	22,098	131	16	42	
YZ	"	17,286	214	17	50	
GP	"	11,088	116	18	48	
QO	"	9,230	120	15	56	
AKL	"	3,772	74	13	33	
APT	"	1,333	43	10	21	
AFE	14	4,123	107	6	25	
EX	7	16,116	247	11	40	
IL	"	9,682	152	12	35	
IO	"	8,811	225	8	25	
IE	"	1,386	82	5	13	
ARZ	"	1,056	44	6	16	
UK	3.5	1,911	89	5	16	
		Scotland				
CFS	A	215,757	587	60	123	
AHS	"	168,151	590	34	105	
GDR	21	30,039	331	18	39	
GKX	"	14,147	129	16	31	
		Sicily				
IGA	7	6,120	106	9	25	
		Spain				
AR	28	2,750	58	8	17	
		Sweden				
SMG	A	654,368	875	103	235	
SD	"	231,734	617	55	163	
SC	"	123,808	425	45	101	
SSF	"	113,730	349	56	114	
SRE	"	105,523	353	53	128	
SYD	"	92,904	391	45	113	
SUK	"	92,544	482	62	130	
SDS	"	78,155	296	43	102	
SXT	"	72,744	235	56	112	
SU	"	37,664	172	35	72	
ST	"	29,667	162	29	64	
SMT	"	29,568	172	33	63	
SH	"	10,240	81	27	53	
SX	"	8,968	78	17	42	
SIH	"	8,268	98	19	59	
SDW	"	5,453	69	14	27	
SQ	"	4,700	59	17	30	
SZD	"	588	26	8	13	
HLU	28	100,382	388	30	76	
HCU	28	100,049	371	32	72	
HRQ	"	55,968	236	30	66	
HHW	"	54,450	209	30	69	
HFH	"	30,108	152	27	51	
HL	"	15,989	115	23	36	
HPI	"	8,316	50	24	39	
HY	"	5,566	41	20	26	
HE	21	214,024	754	35	89	
HDQ	"	125,712	585	27	54	
HV/8	"	117,467	538	30	67	
HRW	"	112,817	483	31	70	
HXE	"	75,900	372	29	69	
HOR	"	75,739	458	28	61	
HXS	"	42,453	220	25	64	
HOL	"	27,300	212	20	65	
HAW	"	18,095	120	21	44	
HNX	14	60,306	468	19	50	
HNX	"	13,558	152	19	50	
HV	"	11,280	206	11	36	
HMP	"	10,368	150	20	54	
HRS	"	10,017	112	15	38	
HO	"	5,890	95	11	27	
HKP	"	4,789	50	17	25	
H	"	3,838	83	11	27	
HV	"	2,590	37	13	24	
HPJ	7	131,394	639	36	86	
HCE	"	34,515	405	19	46	
HPB	"	9,786	132	11	31	
HM	3.5	12,285	242	8	37	
		Switzerland				
HB	A	797,076	1128	87	219	
HD	"	80,464	337	36	71	
HI	"	52,100	375	36	64	
HA	"	31,527	182	32	81	
HX	21	46,644	257	24	54	
HGH	"	1,809	31	11	16	
H	14	126,700	553	29	71	
HS	7	6,970	139	8	26	

		Yugoslavia				
YU4HA	A	148,680	508	48	162	
YU1KO	"	45,384	301	32	92	
YU1NPZ	"	42,875	233	41	84	
YU1NGO	"	35,114	272	24	73	
YU2OB	28	10,220	115	10	25	
YU2NFJ	"	10,176	81	19	34	
YU1BCD	21	189,312	761	30	72	
YU3TXT	"	15,840	181	21	34	
YU1SF	7	14,098	241	11	42	
YU3EYZ	"	7,252	166	9	28	
YU3DUV	"	5,328	123	8	28	

U.S.S.R.

		European				
UA3KBO	A	760,026	937	120	274	
UA3UJ	A	566,150	869	95	230	
UA1ZL	"	278,428	650	60	128	
UA4QM	"	237,061	526	72	181	
UA3FL	"	152,856	495	56	142	
UA4SM	"	143,780	535	46	112	
UA3NG	"	128,832	448	55	121	
UW3NE	"	106,800	325	52	98	
UA3DB	"	79,032	240	56	92	
UA6NX	"	78,585	388	48	107	
UW6AO	"	73,152	373	40	87	
UA1UD	"	66,978	351	34	88	
UW3RY	"	60,799	220	46	117	
UA3TA	"	51,060	209	41	97	
UA3GO	"	36,432	225	26	73	
UA4LK	"	23,287	220	21	52	
UA6NY	"	15,600	162	24	56	
UA3MR	"	13,260	139	24	44	
UA4MX	"	11,385	119	17	39	
UA3RQ	"	10,452	102	22	45	
UA3KUO	"	9,288	114	15	39	
UV3MM	"	8,448	57	28	38	
UA1BP	"	6,656	101	18	46	
UA3RO	"	5,850	81	13	32	
UA1MQ	"	4,462	69	17	21	
UA1DG	"	4,280	79	12	28	
UA4IM	"	4,095	98	13	26	
UW3EL	"	2,664	40	12	27	
UV3TA	"	1,005	41	12	24	
UW3FY	"	204	9	8	9	
UA3AZK	28	23,546	190	20	41	
UA3JD	"	9,850	101	17	33	
UV3XX	"	8,648	103	15	32	
UV3QZ	"	5,544	65	12	24	
UA4MA	"	2,296	52	9	19	
UA3DL	"	1,720	42	6	14	
UW3UG	"	940	37	7	13	
UV3QQ	"	576	22	6	12	
UV3AAE	"	456	24	5	7	
UA4RZ	21	81,408	440	32	74	
UA4PA	"	76,505	403	31	76	
UA1DH	"	35,154	282	19	44	
UA1RJ	"	27,576	274	21	51	
UW3FW	"	18,585	161	19	40	
UA1TL	"	17,325	188	16	39	
UA3YR	"	17,242	97	23	51	
UV3TQ	"	10,229	115	16	37	
UW3CM	"	1,160	22	10	19	
UA3ND	"	144	16	3	6	
UA1IJ	14	137,800	671	31	69	
UA4KWP	14	74,671	403	29	60	
UA6UO	"	69,902	415	29	65	
UA1NR	"	48,888	259	27	57	
UA1IN	"	22,680	282	16	44	
UA3AJ	"	19,760	238	15	37	
UA4ZA	"	19,520	167	18	43	
UW6CF	"	18,228	240	15	34	
UA1YY	"	17,118	153	16	38	
UA3PE	"	14,612	158	15	37	
UW4IK	"	13,818	124	16	26	
UA3DU	"	13,515	144	23	30	
UA6BV	"	12,300	159	13	37	
UW3HD	"	10,920	146	13	29	
UW3YT	"	5,148	93	11	25	
UA4LU	"	5,049	79	8	25	
UW1GB	"	4,028	72	12	26	
UA4QO	"	3,298	57	9	25	
UW3AB	"	2,496	36	9	23	
UW6CY	7	4,205	121	9	20	
UW3TM	"	2,201	55	8	23	
UA3GB	"	1,593	50	9	18	
UV3AG	"	1,272	36	7	17	
UV3XZ	"	800	35	6	14	
UW3HV						
	3.5	21,624	369	10	43	
UA6AL	"	15,840	312	9	35	
UA1DX	"	10,320	238	7	33	
UV3AH	"	4,995	117	8	29	

		Estonia				
UR2OP	28	6,528	60	20	28	
UR2MS	"	2,314	46	10	16	
UR2AO	21	86,768	472	29	59	
UR2FU	14	65,832	479	21	57	
UR2LO	"	65,065	466	25	52	
UR2KBQ	7	4,480	129	7	25	
UR2EK	3.5	12,833	279	8	33	
UR2JW	"	3,600	150	5	19	
UR2MG	"	1,416	62	4	20	
		Kaliningrad				
UA2DM	A	135,168	415	53	123	
		Latvia				
UQ2PZ	A	62,905	417	31	84	
UQ2PY	"	51,296	348	28	84	
UQ2AH	"	14,628	138	27	42	
UQ2CC	"	8,680	63	21	41	
UQ2MU	"	8,566	115	13	31	
UQ2LL	14	114,048	600	28	68	
UQ2PM	7	28,320	391	14	46	
UQ2YA	"	25,011	248	17	46	
UQ2DB	"	30	3	3	3	
UQ2KAY						
	3.5	41,706	581	15	48	
UQ2PP	"	224	16	3	11	
		Lithuania				
UP2NV	A	773,168	976	106	262	
UP2NK	A	729,218	897	104	239	
UP2BY	"	2,100	60	9	26	
UP2OQ	28	200	8	5	5	
UP2CV	21	1,325	27	10	15	
UP2PA	14	149,548	681	30	68	
UP2BL	"	7,296	192	9	29	
UP2OX	7	22,495	335	14	41	
UP2NA	"	13,635	257	11	34	
UP2ON	3.5	20,448	410	8	40	
UP2OE	"	6,970	198	6	28	
UP2AY	"	2,075	83	5	20	
		Moldavia				
UO5RO	A	14,970	158	35	37	
UO5AT	14	14,850	187	12	42	
		Ukraine				
UB5CV	A	958,434	1248	95	240	
UY5AZ	A	506,620	925	85	207	
UB5LS	"	335,509	813	71	160	
UB5CI	"	234,192	569	76	162	
UB5TR	"	196,134	645	52	142	
UY5TX	"	124,742	397	56	138	
UB5PG	"	48,125	301	35	90	
UB5SG	"	33,475	215	24	79	
UT5LF	"	33,440	251	25	70	
UT5MD	"	32,307	227	29	60	
UB5JK	"	31,254	292	23	66	
UY5TE	"	16,932	172	22	61	
UY5AB	"	16,652	83	38	55	
UB5OA	"	16,560	136	26	46	
UY5GB	"	14,322	179	17	49	
UB5PO	"	11,932	127	22	54	
UB5NS	"	10,205	159	16	49	
UY5LF	"	10,012	73	31	48	
UT5ZF	"	6,555	101	18	39	
UT5SY	"	5,198	92	18	28	
UY5XH	"	5,120	88	11	29	
UT5HP	"	285	9	6	9	
UT5AA	28	95,694	528	26	56	
UY5OE	"	36,825	231	23	52	
UY5AG	"	11,020	85	20	38	
UT5CE	"	10,534	116	16	30	
UB5MZ	21	89,262	480	26	61	
UB5TQ	"	64,190	361	31	67	
UB5RS	"	17,262	151	21	42	
UT5BP	14	55,000	369	27	61	
UT5IW	"	34,276	285	19	57	
UT5BW	"	14,573	154	17	42	
UY5UI	"	5,704	70	12	34	
UB5OA	"	1,500	35	9	16	
UT5EH	7	33,040	411	15	44	
UT5NG	"	24,698	342	12	41	
UY5CW	"	15,628	238	11	36	
UY5OO	"	6,225	149	7	18	
UB5VK	"	6,105	173	5	28	
UB5WK	3.5	16,254	369	7	35	
UT5BX	"	10,320	236	8	32	
		White Russia				
UC2WP	A	209,241	644	62	139	
UC2AI	"	14,640	84	33	47	
UC2CX	28	13,330	90	23	39	
UC2WJ	"	198	6	5	6	
UC2KAN						
	3.5	5,568	183	5	24	

OCEANIA

		Australia				
VK2EO	A	330,264	556	60	138	
VK2VN	"	89,540	267	50	60	
VK2APK	14	228,053	703		75	
VK3RJ	28	13,262	126	16	22	
VK3QV	"	3,213	153	9	12	
VK3APJ	21	171,666	578	32	67	
VK3AXK	"	101,892	417	27	57	
VK3ABA	"	27,434	162	22	36	
VK3QI	14	20,776	144	21	32	
VK3APN						
	3.5	5,046	103	13	16	
VK3OP	"	2,052	45	9	10	
VK3XB	"	1,560	43	9	6	
VK4FH	A	159,848	465	54	62	
VK5FM	A	103,785	416	25	60	
VK5KO	"	12,555	222	45	41	
VK6RU	A	667,212	832	96	186	
		British Phoenix				
VR1P	A	41,448	209	53	33	
		Christmas Island				
VK9DR	A	8,610	76	20	21	
		Guam				
K1FNA/KG6						
	21	380,064	1157	32	97	
WAØKKR/KG6						
	14	44,652	266	25	36	
		Hawaii				
KH6AA	A	167,892	576	48	54	

The neat lay-out at JA1NLX. Akira likes the CQ WW Contest because it permits single band operation, allowing plenty of time for sleep when the band goes dead.

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KH6FRQ	7	1,197	57	4	3
Lord Howe Island					
VK2BKM/LH					
	A	**703,296**	**1095**	**85**	**137**
Philippines					
DU1AT	**A**	**481,644**	**822**	**91**	**113**
DU1UP	**21**	**353,248**	**1081**	**33**	**79**
DU1CE	"	138,776	539	30	58
New Zealand					
ZL1AJU					
	A	**1,096.779**	**1295**	**109**	**182**
ZL1AMO	**21**	**62,030**	**295**	**23**	**46**
ZL1IL	"	13,975	115	18	25
ZL4BO	**14**	**234,252**	**748**	**34**	**74**

SOUTH AMERICA

Argentina					
LU7AS	**A**	**37,754**	**149**	**38**	**48**
LU6FA	**14**	**122,061**	**357**	**30**	**57**
LU5FEH	"	45,045	284	23	32
Brazil					
PY3BXS	A	4,817	53	15	14
PY7SR	"	4,698	54	12	17
PY1CKV	28	3,952	84	8	8
PY2SO	**21**	**479,385**	**1211**	**38**	**97**
PY4OD	**14**	**747,410**	**1621**	**39**	**116**
PY1PK	"	14,615	269	22	33
PY7AEW	"	5,056	51	17	19
PY3ANP	"	3,150	54	12	9
PY2YC	"	396	13	6	5
PY7VNY					
	3.5	420	28	3	2
PY2BJH	**1.8**	**99**	**6**	**4**	**5**
Chile					
CE4AD	**A**	**39,760**	**243**	**28**	**28**
CE2CR	21	3,406	48	13	13
Colombia					
HK4ALE	**A**	**109,263**	**481**	**34**	**43**
Neth. Antilles					
PJ2VD	**3.5**	**18,704**	**225**	**10**	**18**
Peru					
OA4PF	**A**	**523,926**	**795**	**89**	**145**
Trinidad					
9Y4KK	**A**	**259,492**	**761**	**55**	**61**
Venezuela					
YV5ANT	**A**	**1,437,588**	**1835**	**83**	**178**
YV1DP/5	**21**	**28,195**	**198**	**18**	**31**
K4PHY/YV5					
	14	**296,429**	**845**	**34**	**85**
YV4OY	"	66,588	360	24	38
YV5BKA	**7**	**17,329**	**190**	**11**	**20**

Multi-Operator Single Transmitter

NORTH AMERICA

U.S.A.				
K1DIR	**1,729,408**	**1,263**	**136**	**336**
W2PCJ	**1,260,480**	**1,084**	**114**	**290**
W8UM	**932,719**	**878**	**117**	**262**
W4ZXI	**829,380**	**814**	**106**	**239**
W3MWC	**812,772**	**845**	**103**	**218**
WØAIH	**705,875**	**788**	**110**	**215**
K6CQF	**682,605**	**763**	**125**	**190**
W9EXE	**624,526**	**726**	**105**	**209**
W4TRC	578,452	688	97	195
K3JYZ	543,515	659	87	206
W6KG	538,958	700	103	171
WA6UFW	530,604	643	111	178
W8IPA	483,039	507	94	187
W6GFS	457,920	608	102	168
WA2IZS	364,896	522	82	170
W3KT	283,866	393	84	169
K6EVR	235,640	600	37	100
W6QJW	234,588	476	95	131
K5YPS	**110,871**	**404**	**26**	**71**
K3JLK	38,850	122	40	71
Alaska				
KL7GKA	**207,220**	**647**	**65**	**65**
Canada				
VE2DCW/2				
	403,555	**708**	**67**	**148**
VE1ASJ	**475,803**	**747**	**87**	**174**
VE4MF	**129,129**	**370**	**54**	**89**
VE6AED	**79,734**	**376**	**43**	**54**
Sint Maarten				
PJ5MO	**330,540**	**1,123**	**57**	**83**

AFRICA

Ethiopia				
9F3USA	**1,599,754**	**1,599**	**104**	**234**

ASIA

Japan				
JA6YCU	**873,422**	**1,007**	**119**	**200**
JA1YHA	299,314	535	92	126
JA6YAF	195,545	421	79	106
JA1YUL	94,355	315	55	58
JA9YCE	54,990	233	44	46
JA1YDU	49,896	199	50	58
JA6YFL	178,398	374	79	108
Korea				
HL9US	**566,004**	**1,082**	**82**	**120**

U.S.S.R.

Club Stations

Asiatic				
UA9KQA	**660,558**	**863**	**68**	**199**
UA9KAG	476,718	765	68	165
UA9FU	138,840	483	21	83
UA9KOG	135,061	308	37	94
UW9KDL	31,382	171	22	49
UA9KMD	26,145	206	21	42
UA9KJA	15,444	125	11	33
UW9KDI	11,460	188	15	45
UA9KDL	9,780	88	17	28
UA9KYA	3,969	63	10	17
UAØKFG	**1,321,650**	**1,694**	**110**	**187**
UA0KUV	215,327	688	47	86
UA0KZD	82,983	593	41	28
UA0KZB	35,348	293	26	23
UAØKSB	33,524	252	22	36
UA0KCW	18,718	196	22	27
UA0ZH	6,162	167	17	17
Azerbaijan				
UD6KAB	**375,760**	**675**	**66**	**154**
Georgia				
UF6KAE	**367,296**	**686**	**53**	**139**
UF6KAM	229,274	593		
UF6KAR	37,950	207		
Kazakh				
UL7KAA	**719,055**	**1,093**		
UL7KFE	25,916	142		
UL7KLF	14,910	153		
Kirghiz				
UM8KAB	**34,844**	**228**		
Uzbek				
UI8KTA	**4,887**	**63**		

EUROPE

Bulgaria			
LZ1KSM	**379,920**	**1,030**	
LZ1KAA	344,955	1,041	
LZ1KRD	236,338	809	
LZ2KAF	138,317	558	
LZ1KDZ	108,768	630	
LZ1KRB	60,416	369	
LZ2KSK	59,334	522	
LZ2KRZ	40,248	297	
LZ1KBG	31,150	272	
LZ2KRM	19,497	255	
LZ2KSU	2,220	56	
Czechoslavakia			
OK3KAG	**739,152**	**1,133**	
OM1WC	568,576	1,198	
OM1KTL	559,170	893	
OK2KJU	78,228	374	
OM1KZD	5,060	70	
Denmark			
OZ5DX	837,495	1,237	
OZ1LO	656,448	1,116	
OZ7DH	427,056	822	
England			
G3SSO	**1,003,563**	**1,225**	
GB2SM	667,392	1,152	
G8FC	461,833	1,035	
G5BK	167,265	504	
Finland			
OH5UX	**500.358**	**892**	
OH2BFJ	125,892	321	
Germany			
DLØKF	**1,969,830**	**2,329**	
DLØWR	1,561,480	1,738	
DLØWW	795,400	1,088	

United States Club Scores

Potomac Valley Radio Club	**29,523,987**
Frankford Radio Club	22,001,615
Northern California DX Club	13,952,597
Southern California DX Club	13,797,267
Golden Triangle DX Club (Fla.)	7,309,826
Florida DX Club	5,661,121
Northern Illinois DX Assoc.	4,311,865
Connecticut Wireless Assoc.	4,224,394
Order of Boiled Owls (N.Y.)	3,595,267
North Jersey DX Association	3,251,940
128 Contest Club (Mass.)	3,023,769
Laurentian DX Club (Montreal)	3,146,446
Western Washington DX Club	2,911,838
Southern Pacific A.R.C. Society	1,735,441
West Park Rodiops (Ohio)	1,288,933
Central Michigan A.R.C.	1,233,632
Rochester DX Association (N.Y.)	812,709
Minnesota Wireless Association	686,818
Ohio Valley A.R. Assoc.	606,631
Miami Valley A.R.C. (Ohio)	465,757
QCWA DX Club (N.Y.)	352,904
Sagamon Valley DX Assoc. (Ill.)	278,384
Brightleaf A.R.C. (N.C.)	209,342
Richardson A.R.C. (Texas)	194,270
Oak Park AR.A. (Mich.)	173,410

Canada

Northwest DX Association	3,023,769
Calgary Amateur Radio Assoc.	1,512,190
Canadian DX Assoc. (Toronto)	1,456,510
Edmonton DX Club	969,066

Foreign Club Scores

Rhein-Ruhr DX Association	21,124,78
OH-DX-Ring-Ry. (Finland)	14,192,80
Saar-Pfalz Radio Club (Germany)	6,887,83
Lampertheim-Beugstrasse (Germany)	3,430,53
Radio Club Venezolano	3,383,90
Akademisk Radioklubb (Norway)	2,484,55
Uruguay DX Club	2,475,41
Gateway to Europe R.C. (Germany)	2,445,83
Wetterau DX Assoc. (Germany)	2,286,47
Leningrad Radio Club (USSR)	2,109,94
Kiel Canal Activity Group (Germany)	1,969,83
Kaunas Politechnic A.R.C. (Luth.)	1,681,45
SP-DX Club (Poland)	1,560,32
Sakhalin Island R.C. (USSR)	1,321,65
Moscow Citizens R.C. (USSR)	1,073,51
Swiss DX Club (Switz.)	1,019,71
Lvov DX Club (Ukraine)	974,68
Kiev Radio Club (Ukrain)	592,21
DM-DX Club (East Germany)	571,79
Mauritius Amateur Radio Society	418,97
Radio Club of Latvia	304,99
Kharvov Radio Club (Ukraine)	287,78
Beograd "Mihailo Pupin" (Yugoslavia)	276,57
Hammarbyhoejden Wireless (Sweden)	183,46
Radio Club Derventa (Yugoslavia)	148,68
Plovdiv Radio Club (Bulgaria)	139,70
Radio Club of Tallinn (Estonia)	117,98

See page 110 for New Reader Servi

	685,359	1,135	89	182
	538,620	1,016	80	155
	517,671	1,266	79	170
	251,878	677	68	146
	502,775	917	73	148
	242,946	606	67	131
	220,770	637	58	107
	Hungary			
Q	**299,706**	**770**	**70**	**139**
	98,134	452	37	102
B	58,088	312	34	78
A	42,432	257	33	69
K	33,504	201	27	69
I	16,320	160	18	42
	13,090	168	19	51
D	10,868	206	12	40
	Luxembourg			
YLX				
	1,526,328	**1,837**	**112**	**257**
	Norway			
	742,668	**1,117**	**91**	**220**
	Poland			
	92,421	**397**	**48**	**115**
	51,040	348	27	83
	Sweden			
	1,218,440	**1,524**	**102**	**230**
	347,814	744	71	155
	41,888	207	36	52
	Wales			
W	**156,624**	**554**	**45**	**111**
	Yugoslavia			
	391,058	**792**	**74**	**177**
D	85,715	437	45	110

U.S.S.R.

Club Stations

	Estonia			
W	**337,620**	**1,122**	**60**	**144**
D	62,961	582	21	72
	European			
D	**758,764**	**1,178**	**111**	**261**
C	**407,340**	**874**	**83**	**209**
D	371,365	898	67	190
B	264,377	774	63	178
D	255,136	614	69	169
A	222,069	536	71	166
S	213,400	640	58	142
	197,285	601	59	152
A	11,780	407	47	133
S	92,826	399	47	115
F	91,339	448	39	90
A	45,889	200	35	74
D	44,928	271	38	79
F	36,714	370	21	58
K	32,108	178	30	62
C	28,322	180	30	68
B	27,648	233	25	71
S	25,550	174	26	76
A	20,720	153	19	55
I	15,252	223	13	49
B	10,584	119	22	47
	9,300	143	20	40
	5,014	180	9	14
	Kaliningrad			
S	**10,653**	**153**	**15**	**62**
	Latvia			
A	**638,100**	**1,090**	**85**	**215**
	214,605	686	65	106
R	211,684	712	54	133
K	151,008	584	57	119
E	36,584	254	23	45
N	24,381	278	17	64
D	13,276	185	14	29
W	12,328	223	11	35
N	3,149	59	15	32
	Lithuania			
A	**215,031**	**548**	**61**	**162**
	103,248	553	34	110
B	102,592	743	29	73
G	59,360	386	23	83
U	25,848	275	26	46
	Moldavia			
U	**3,920**	**68**	**9**	**19**
	Ukraine			
F	**721,612**	**1,111**	**102**	**254**
A	605,744	1,245	87	202
B	605,220	1,067	97	233
S	279,930	635	69	151
D	227,556	753	54	142
M	195,026	684	51	118
P	195,020	559	58	138
UB5KAU	193,880	672	50	135
UB5KFF	184,549	630	48	131
UB5KID	179,252	607	51	113
UBKKO	158,015	780	37	106
UB5KAG	71,250	404	33	81
UB5KKB	55,596	302	34	89
UB5KBA	55,020	218	45	86
UB5KAW	52,692	235	38	86
UB5KDS	36,816	256	26	52
UB5KLD	33,575	171	27	58
	White Russia			
UC2KAC	**52,924**	**413**	**26**	**75**
UC2KBK	52,398	458	19	52
UC2KMZ	33,512	441	16	43
UC2KNU	30,870	191	24	46

Multi-Operator Multi-Transmitter

NORTH AMERICA

W3MSK	**4,560,038**	**2,696**	**166**	**423**
W4ETO	**3,435,939**	**2,374**	**145**	**362**
W4BVV	3,209,518	2,240	145	349
W3GM	2,982,650	2,077	141	352
W6GP	**2,180,864**	**1,712**	**146**	**302**
W3TV	2,002,296	1,546	131	325
K4CG	1,456,031	1,258	118	283
W6ISA	1,405,457	1,284	131	258
W3YLJ	1,354,263	1,118	129	308
W7SFA	**1,280,485**	**1,256**	**124**	**231**
K6AHV	1,201,925	1,151	135	232
W3OV	1,183,330	1,141	110	255
K3JH	1,181,505	1,085	104	261
W2CXM	**1,000,644**	**956**	**111**	**255**
W6ANN	968,000	952	121	231
K6UYC	844,998	859	117	224
W6WX/6	806,520	911	116	196
K6AN	701,099	748	118	211
W3NX	561,156	631	95	208
W6SR/6	550,830	639	110	191
VE6AVE	9,240	126	28	7

ASIA

JAØYAN	**339,822**	**691**	**83**	**103**
JA3YBF	272,000	626	76	94
KA2NY	**302,760**	**720**	**70**	**104**

EUROPE

OH2AM	**4,118,698**	**3,277**	**155**	**412**
OH1AA	2,192,125	2,215	136	339
U1A	**2,109,944**	**2,849**	**114**	**274**
SK5AJ	**1,971,840**	**2,366**	**121**	**295**
DL4FB	**1,396,850**	**1,935**	**107**	**243**
OY6FRA	**719,865**	**1,771**	**67**	**188**
UB5KBB	**563,693**	**910**	**93**	**238**
DLØMU	507,185	930	79	166
OH2AL	454,701	902	77	190
OH6AA	270,756	903	58	149
OH3AG	222,992	715	51	125
LA2AB	**121,128**	**547**	**45**	**123**

SOUTH AMERICA

PJØCC	**8,258,787**	**6,046**	**135**	**324**

Our thanks to the following stations who sent in their logs for checking purposes. DK2BZ, DJØTA, DL4PV, DM-2ADO, DM2AUF, DM2BJD, DM2AXM, DM2BNJ, DM2-BNL, DM2BWK, DM2BYE, DM2CLM, DM3DBM, DM3TF, DM3WSO, DM3XVD/p, DM3-YYA, DM3ZOC, DM4CF, DM-4UA, DM4WPL, DM4YCF, DM5VL, K5FKT/KP4, LA4LL, LZ1YW, OK1AKG, OK1KCD, OK2BBJ, OK2OU, OK3ALE /p, OH1LA, OH2BAC, OH6-NH, OH6VR, OHØNI, OZ2LW, PY2BKO, SM3CJD, SM5BDY, SM6RSM/6, SM7MS, SM7-DIE/7, SP2LV, SP3CGA, SP-9AOA, SP8-1079, UA3FK, UA6KPA, UA6LC, UA9ES, UB5ES, UB5OP, UW4HW, UY5OB, UY5ZI, UA2-12533, VE3DV, VK2AND, W2WZ, WA-3KOI, W4RAE, W4WSX, OH3-UQ/W6, YO3KSD, YO6-5706.

M.O.S.T. Station Operators

& DK1KW, DK1PG. **DJ2BW/LX** & DJ1ER, DJ6RX, DL1KS, DL8ML, DL9OH. **DJ4ZR** & DJ9IE. **DJ6JC** & DJ5WY, DJ9KL, DL3DA. **DK1VN** & 9 Operators. **DL8AM** & DJ2XP. **DL8CM** & DL8CH. **DLØAAA:** DJ4XG, DJ5DA, DL3BK, DL3OH. **DLØKF:** DJ3UL, DJ4FZ, DJ6TN, DJ7SW, DL1FL, DL1GN, DL2ZT. **DLØWR:** DJ4AX, DJ6TK, DJ8SW, DJ9YI. **DLØWW:** DJ1NT, DJ1YP, DJ2SX, DJ3GR, DJ5JI, DJ6NT, DJ9CE; DL2UU, DL3ZA. **G3SSO:** G2HDU, G3FXA, G3LCJ, G3PEO, G8KG. **G5BK:** G3CEG, G3LDA, G3OLN, G3TVW, G3WKH. **G8FC:** G3GNS, G3JFH,G3JUT, G3KLK, G3TTH, G3SVG, G3SVK, G8AX. **GB2SM:** G3CRP, G3HZL, G3JEA, G3JUL, G3NYY, G3OHP, G3SZG, G3TLG, G3TUM, G3UFM, G3VJG. **GW3NJW** & GW30AY. **HA3KNA:** HA3NB, JANOS. **HA4KYH:** Club. **HA5KDQ:** Club. **HA5YAD:** Club. **HA8KUX:** Club. **HA9KOB:** Club. **HA9KOL:** Club. **HA9KPE:** Club. **HL9US:** K4BAI, WA3EHT, WA9ZMT, WB6POH. **JA1YDU,** JA1LLX, JA1PLQ, JA1SNA, JA1TGY, JA8BGP. **JA1YHA:** JA1SHC, JA1TBA, JA1UQD, JA3LCL, JA5ALN, JA8DIM, JH1OFW. **JA1YUL:** JA1LHR, JA1QZY, JA2CEC, JA3OLQ, JA4BYK, JA7AXG, JA7CQW, JA9BJZ. **JA6WAF:** Club. **JA6YCU** & JA6BXA, JA6DSE, JA6ECF, JA6ENR. **JA6YFL:** JA6DMC, JA6EFR, JA6ELV, JA6FFK, JA6HNQ. **JA9YCE:** JA9BGX, JA9BPH, JA9BYN, JA9CGK, JA9CXS, JA9CXZ, JA9DED, JA9DEE, JA9DHO. **K1DIR** & W1BPW. **K3JLK** & K3LJZ. **K3JYZ** & WØUCE, WA3HTQ. **K5YPS** & K5SNI. **K6CQF** & VE3DXV, W6CUF. **K6EVR** & W6UED, W6VPH. **KL7GKA** & K4JLD. **LA1H:** LA8UL, LA9OI. **LZ1KAA:** Club. **LZ1KBG:** Club. **LZ1KDZ:** Club. **LZ1KRB:** Club. **LZ1KRD:** LZ1FJ, LZ1ZO, Boby. **LZ1KSM:** LZ1GG, LZ1LL, LZ1PP, LZ1SS, LZ1WW. **LZ2KSK:** Club. **LZ2KAF:** Stefan, Todor. **LZ2KHM:** Club. **LZ2KRZ:** Club. **LZ2KSU:** Club. **OH2BFJ** & OH2LP. **OH5UX** & OH5UY, OH5WA. **OK2KJU:** Club. **OK3KAG:** OK3-CIR., OK3DI, OK3ZAG, OG3ZIR, OM3ZIR. **OM1KTL:** Club. **OM1KZD:** OK1AVV, OK1AWW, OK1EX, OK1FO, OK1-15683. **OM1WC** & OK1APJ. **OZ1LO** & OZ3QN, OZ7GI.**OZ5DX** & OZ4UN, OZ5WQ, OZ7BQ. **OZ7DH** & OZ6OX, OZ7OF. **PJ5MO:** PJ2ME, W4GSM. **SK6AB:** SM2BJI, SM6CZZ, SM6DXK, SM6-VR. **SK6AD:** SM6AMR, SM6BDM. **SKØBW:** SMØCXU, SMØ-DZL, SMØEIE. **SP8KAF:** Club. **SP8KAR:** SP8AJK, SP8BWV. **UA1KMK:** UA1UG, UA1TZ. **UA3KAO:** UV3CO, UW3BO, UW6BK, Slava. **UA3KZO:** UA3EX, UA3EZ, UV1EQ, UA3-1471, UA3-14710. **UA4KKC:** UA4LA, UA4LG, UA4LM, UA4LN, UA4LU. **UA9FU** & UW9GN. **UA9KAG:** UW90L, UW9PT. **UA9KQA:** UA9QD, UA9RJ, UA9RQ, UA9RR. **UAØKFG:** UA0-FE, UA0EH, UAØFM, UWØFK, UWØFM, UWØFP. **UD6KAB:** UD6AY, UD6BW, UD6-0019. **UF6KAE:** UF6AP, UF6AS, UF6-AS, UF6BD, UF6BX, UF6HA, UF6HF, UF6HK, UF6HS, UF6HW, UF6-6260. **UF6KAR** & UF6GE. **UP2KPI:** UP2NMH, UP2MMA. **UQ2KAA:** UQ2AO, UA2AQ, UQ2PN, UQ2-0371. **VE1ASJ** & VE1DH. **VE2DCW/2** & WA2UPC. **VE4MF** & VE4JB. **VE6AED** & VE6AVR. **W2PCJ** & WB2CKS. **W3KT** & WA3ATX. **W3MWC** & W3WJD. **W4TRC:** K4LRL, W4CHK, W4DMS. **W4ZXI** & K4MZU, K4SHB. **W6GFS** & WB6KBK. **W6KG** & W6DOD. **W6QJW** & W6VNJ. **W8IPA** & K8CFM. **W8UM:** K8-QKY, WA8CZH, WA8OBG, WB2FIT. **W9EXE** & K9YOE, W9-YYG, WA9OTY. **WØAIH** & KØZXE. **WA2IZS** & W2UI. **WA6UFW** & K6AUC, W6BH, WA6IQM. **YU1BPQ:** Club. **YU3EY** & YU3TBM. **9F3USA:** K7ZBN, W4DIW, W4EJP, W4SYX, W5QHD.

M.O.M.T. Station Operators

DL4FB & DJ1KG, DJ9CN, DJ9RT, DK1IO, DK1KQ, DL3BA, DL4RW, John. **DLØMU:** DJ1FC, DJ9TQ, DJ9TS. **JA3YBF:** JA3EBT, JA3FGJ, JA3KGF. **JAØYAN:** JA2DHL, JA2LQG, JA3KUD, JA7BHG, JAØAIF, JAØDRH. **K3JH** & K3JLI, WA3-FFR. **K4CG:** K3WUW, K4POL, K4ZA, WB4GTS. **K6AHV** & K6DC, K6PJY, WB6BAZ, WB6HDH, WB6QJD. **K6AN** & K6ALH, W6RGG. **K6UYC** & W6KNE, W6OSU, W6WWQ, WB6-CWD. **KA2NY:** K6ZBV, K9OCX, Dennis. **LA2AB:** LA7UH, LA8WF, LA8YB, LA9XH. **OH1AA:** OH1NK, OH1PI, OH1RG, OH1SU, OH1SY, OH1WR, OH2YV. **OH2AL:** Club. **OH2AM:** OH2BBM, OH2BBR, OH2BC, OH2BCZ, OH2BH, OH2BQ, OH2BS, OH2KH, OH2OV, OH2SB. **OH3AG:** Club. **OH6AA:** OH5TM, OH6NH, OH6WI, OH6XP, OH6YA, OH6YD, OH6ZH. **OY6FRA:** OY2H, OY2J, OY3B,OY3H, OY4R, OY5NS, OY5Q, OY7M, OY7ML, OY8NR, OY9IM. **PJØCC:** K1ANV, K3NPV, W1BGD, W1BIH, W1EOB, W1FJJ, W1TX, W2ADE, W3ML, W4GF, W4KFC, W4ZM, W6RR. **SK6AJ:** SM5AD, SM5CAK, CM5CBN, SM5CEU, SM5EAC, Arne. **U1A:** UA1AJ, UA1DA, UA1FN, UA1KAC, UA1KBW, UW1AB, UW1BG, UW1CX. **UB5KBB:** UB5LM, UT5TC, UY5DP, UY5OC, UY5OM. **VE6-AVE:** Club. **W2CXM:** WA2UJM, WA3HRV, VE2BOK. **W3GM** & W3BIP, W3BYX, W3DRD, W3GHM, W3HHA, W3KV, W3NOH, W3TGM. **W3MSK** & K3EST W3FYS, W3IN, W3ZKH, W4CRW, W8CON, WAØGQI, WAØSDC. **W3NX** & W3NNK. **W3OV** & K3HTZ. **W3TV** & W3AOH, W3LMM, W3LOE, W3UHN. **W3YLJ** & WA3DTO, WA3GJU. **W4BVV** & K3OAE, K9OPF, W3BY, W3DPJ. **W4ETO** & W4BRB, W4CKB, W4JDR, W4LCP, W4OBK, W4TLN, W4WS, WØBE, W0YCR, WA4DHU. **W6ANN** & W6DFY, WA6GFD, WB6FCE. **W6GP** & K9LBQ, K9ZMS, W6DGH, W6DOX, W6JPH, W6RW, WB6OLD. **W6ISA:** K6SDR, K6VZA, W5CWQ, W6ITY, WA6CZR, WA6LBP, WB6EFA, WB6-LFR, WB6LNW, WB6OLR, WB6OYG, WB6OYU, WB6VTM. **W6SR/6** & K6OZL, W6GQK. **W6WX/6** & K6EBB, WB6KIG. **W7SFA** & K7HAX, W7DL, W7ENW, W7LAV.

See page 110 for New Reader Service

A MUST FOR EVERY DXER

DX AWARDS LOG

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

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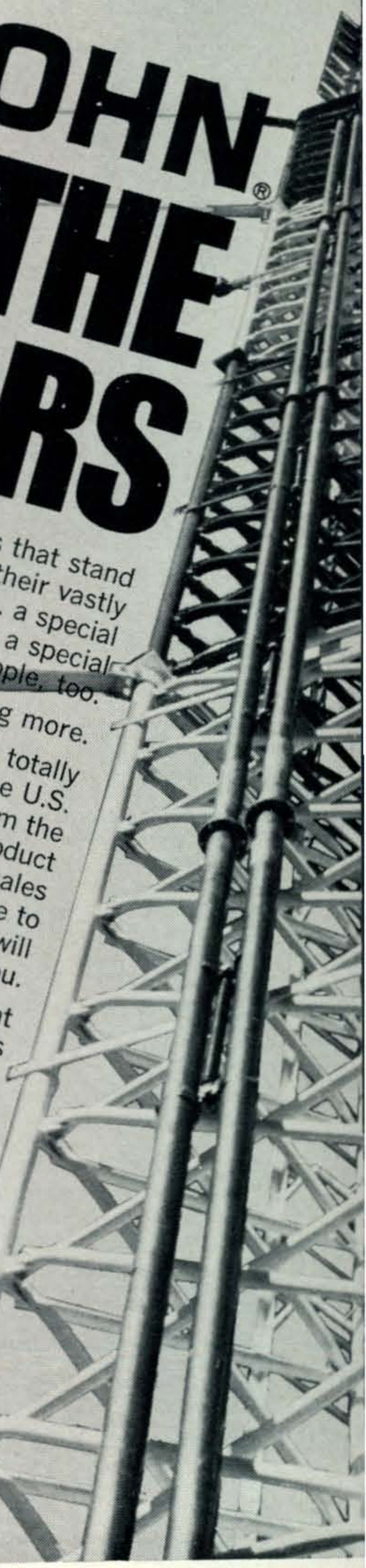

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SIGNALS FROM SPACE

BY GEORGE JACOBS,* W3ASK

SINCE the first SPUTNIK was launched in 1957, nearly 1,000 man-made satellites and spacecraft have been successfully rocketed into space. The United States is responsible for approximately 600 of these launchings; the Soviet Union 400; France 4; and Italy and Australia 1 each. The USA total includes 3 satellites built by British scientists, 2 by Canadians, 2 by the European Satellite Research Organization (ESRO), and 1 each by France and Italy.

Communications in one form or another play a vital role on every satellite and spacecraft launched. The vast amounts of scientific data collected in outer space by satellites are sent back to earth over radio telemetry channels; astronauts and cosmonauts keep in touch with the world below them via spacecraft-to-earth communication links; spectacular live color television shots of the moon, and close-up photos of Mars and Venus have been flashed back to earth recently over communication links; beacon transmitters aboard every satellite permit pinpoint tracking from the earth, and the smallest movements of many satellites can be controlled remotely from the earth by radio control circuits.

By mid-1969, at least 400 satellites were in orbit, of which no fewer than 50 were transmitting radio signals of one type or another back to earth on frequencies between approximately 19 and 402 mc.

Table of Satellite Frequencies

The following table lists those frequencies on which orbiting satellites launched by the United States were transmitting radio signals back to earth as of the end of June, 1969. The transmitters on many of these satellites are expected to to continue operating throughout 1969, and beyond.

The USSR has launched more than 280 satellites to date in their COSMOS scientific and space exploratory series, in addition to more than 100 other scientific, communication, interplanetary and lunar satellites as well as several manned spacecraft. Since most of the Russian satellites remain in orbit or transmit radio signals for only a few days, their frequencies are not shown in the table. For the most part, however, signals from Russian COSMOS satellites can usually be heard on frequencies between 19.990 and 20.010 mc in the high frequency range. COSMOS satellites have recently been launched on inclinations of approximately 48, 51, 65, 72 and 81 degrees, and have had periods ranging between 88 and 93 minutes.

Space-listeners have reported that many COSMOS satellites change frequency while in orbit; using 19.995 mc when first launched and changing to 19.990 mc shortly before re-entry.

Signals from Russian satellites in the METEOR weather satellite system (apparently containing cloud-cover information). have recently been reported on 461.5, 464 and 466.5 mc. These satellites have a period of approximately 97 minutes, and are inclined about 81 degrees to the equator.

Russian satellites in the scientific PROTON series have been reported operating on 19.910 mc, with an inclination of approximately 51 degrees and a period of about 92 minutes.

Man In Space Frequencies

While most of APOLLO's communications will be carried out on microwave frequencies in the 2,000 mc range, some will take place on v.h.f. and possibly on h.f. as well. Communications between the lunar module and the APOLLO command module may take place on 296.800 and 259.700 mc. The command module's recovery beacon, used during splash-down, is expected to operate on 243.000 mc a.m., and there is a s.s.b. h.f. backup beacon on 10.006 mc.

For more complete details concerning the

*11307 Clark Street, Silver Spring, Md. 20902

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Table I—List of Frequencies on which Satellites could be heard as of May 15, 1969

Freq. (mc)	*Satellite Name*	*Purpose*	*Period (Minutes)*	*Inclination (Degrees)*	*Remarks*
20.005	EXPLORER–22	Geodetic studies	105	79.6	Command, tone modulated
40.010	EXPLORER–22	"	"	"	"
41.010	EXPLORER–22	"	"	"	"
136.020	EXPLORER–33	Scientific	70673	56.7	Command, c.w. beacon & telemetry
136.050	IRIS	Scientific	98	97.2	"
136.078	ALOUETTE–1	Ionospheric studies	105.4	80.4	"
136.080	ALOUETTE–2	"	121	79.8	"
136.080	ISIS–A	Ionospheric studies	128.3	88.4	"
136.140	EXPLORER–34	Interplanetary studies	6216	71.5	"
136.142	RELAY–2	Exp. Communications	194.7	46.3	Command telemetry
136.170	ESRO–1	Auroral studies	100.3	93.7	Command, c.w. beacon & telemetry
136.171	EXPLORER 22	Geodetic studies	105	79.6	Command telemetry
136.200	OGO–1	Geophysical studies	3843	57.5	Command, c.w. beacon & telemetry
136.200	OGO 3	"	2913	64.5	"
136.200	OGO 4	"	96.6	85.9	"
136.200	OGO 5	"	3746	43.8	"
136.259	OAO–A2	Astronomical studies	100.3	34.9	"
136.290	OSO 3	Solar studies	95.4	32.8	"
136.290	OSO–5	"	95.6	32.9	"
136.290	EXPLORER–40	Atmospheric studies	118.3	80.6	Command, c.w. beacon & telemetry
136.320	EXPLORER–36	Gravity studies	112.2	105.7	"
136.350	EXPLORER–38	Radio Astronomy	224.3	120.8	Command telemetry
136.380	EXPLORER–31	Ionospheric studies	121.2	79.8	Command, c.w. beacon & telemetry
136.410	EXPLORER–37	Solar studies	98.5	59.4	"
136.410	ISIS A	Ionospheric studies	128.3	88.4	Command telemetry
136.410	INTELSAT 2 F-1	Communications	717.9	18.2	Command, c.w. beacon & telemetry
136.441	OAO A2	Astronomical studies	100.3	34.9	"
136.470	ATS 1	Applied technology	1436	1.3	Command telemetry
136.470	ATS 2	"	123.1	28.3	"
136.500	NIMBUS 3	Weather	107.4	99.9	Command, c.w. beacon & telemetry
136.530	EXPLORER–37	Solar studies	98.5	59.4	Command telemetry
136.560	ARIEL 3	Scientific	94.6	80.1	Continuous c.w. beacon & telemetry
136.590	ALOUETTE–2	Ionospheric studies	121	79.8	Command telemetry
136.590	ISIS–A	Ionospheric studies	128.3	88.4	"
136.591	ALOUETTE–1	Ionospheric studies	105.4	80.4	"
136.620	RELAY–2	Exp. Communications	194.7	46.3	"
136.620	EXPLORER–39	Air Density studies	117.3	80.7	Continuous c.w. beacon & telemetry
136.650	HEOS A	Magnetic Field studies	6700	28.2	Command, c.w. beacon & telemetry
136.653	SN-39	Solar studies	107.3	89.8	Command telemetry
136.710	OSO 4	Solar studies	95.5	32.9	Command, c.w. beacon & telemetry
136.770	ESSA 2	Weather	113.4	100.8	Command, c.w. beacon & telemetry
136.770	ESSA 5	"	113.5	101.9	"
136.770	ESSA 6	"	114.8	102	"
136.770	ESSA 7	"	114.9	101.7	"
136.770	ESSA–8	"	114.6	101.8	"
136.770	ESSA 9	"	115.2	101.7	"
136.800	DODGE	Gravity studies	1316	6.2	"
136.800	EGRS–13	Geodetic studies	107.3	99.3	"
136.830	ERS 28	Scientific	576.2	25.9	Transmitting only in sunlight
136.860	ERS 21	Scientific	1435.8	3.0	Command, c.w. beacon & telemetry
136.860	TETR–2	Test & Training	97.4	32.8	"
136.890	IRIS	Scientific	98	97.2	Command telemetry
136.950	ESRO–1	Auroral studies	100.3	93.7	"
136.950	NIMBUS–3	Weather	107.4	99.9	Command, telemetry & photo (APT)
136.980	ALOUETTE–1	Ionospheric studies	105.4	80.4	Command telemetry
136.980	ALOUETTE–2	"	121	79.8	"
136.980	INTELSAT 2 F-1	Communications	717.9	18.2	"
137.290	EXPLORER–38	Radio Astronomy	224.3	120.8	Command telemetry
137.350	ATS–1	Applied technology	1436	1.3	"
137.350	ATS–2	"	123.1	28.3	"
137.500	ESSA–2	Weather	113.4	100.8	Command, telemetry & photo (APT)
137.500	ESSA–6	Weather	114.8	102	Command, telemetry & photo (APT)
137.590	EXPLORER–37	Solar studies	98.5	59.4	Command telemetry
137.620	ESSA–8	Weather	114.6	101.8	Command, telemetry & photo (APT)
137.950	ISIS–A	Ionospheric studies	128.3	88.4	Command telemetry
162	EXPLORER–22	Geodetic studies	105	79.6	Command, tone modulated beacon
235	ESSA–5	Weather	113.5	101.9	Command telemetry
235	ESSA–7	Weather	114.9	101.7	"
324	EXPLORER–22	Geodetic studies	105	79.6	Command, tone modulated beacon
360.090	EXPLORER–22	"	"	"	"
400.250	OGO–1	Geophysical studies	3843	57.5	Command telemetry
400.250	OGO–3	"	2913	64.5	"
400.250	OGO–4	"	96.6	85.9	"
400.250	OGO–5	"	3746	43.8	"
400.349	OAO–A2	Astronomical studies	100.3	34.9	"
400.650	EXPLORER–40	Atmospheric studies	118.3	80.6	"
400.850	OGO–1	Geophysical studies	3843	57.5	"
400.850	OGO–3	"	2913	64.5	"
400.850	OGO–4	"	96.6	85.9	"
400.850	OGO–5	"	3746	43.8	"
401.500	NIMBUS–3	Weather	107.4	99.9	"
401.750	ISIS–A	Ionospheric studies	128.3	88.4	"
466.000	NIMBUS–3	Weather	107.4	99.9	"

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APOLLO communications system and a listing of all frequencies used, see "Said the Spider in the Sky", by H. W. Kelley, which appeared in the June, 1969 issue of *CQ*.

Cosmonauts of the Soviet SOYUZ 4 and 5 spaceships launched earlier this year used frequencies 15.008 and 20.008 mc in the h.f. range, while other Soviet manned spacecraft have used 17.365, 18.035, 19.996 and 143.625 mc for voice and telemetry transmissions.

Listening to Satellites

Signals from many of the satellites operating in the h.f. region, especially from the Russian COSMOS series have been reported heard on ordinary shortwave receivers using nothing more than a simple vertical or dipole type antenna. Signals from the higher power satellites operating in the v.h.f. band (136-138 mc) have often been reported using relatively inexpensive v.h.f. receivers, or on shortwave receivers equipped with a suitable frequency converter. An outside antenna, preferably one with directivity and gain is highly recommended for receiving most satellite signals.

The satellite which can usually be heard with the least difficulty are those which transmit continuous c.w. signals. These signals, which are often used as tracking beacons, can usually be identified by their steady tone when the receiver's beat frequency oscillator (b.f.o.) is in the ON position. Telemetry signals are often more difficult to receive, since in most cases telemetry data is transmitted for only brief periods upon command from the ground. Telemetry signals usually consist of two or more musical sounding tones transmitted at the same time, or as in the case of many Russian satellites, of a series of dots and dashes or varying lengths.

There are so many satellites now in orbit, it is necessary to command-operate more and more of their transmitters in order to share the few remaining frequencies and to avoid interference between them. Note in the table the number of times that three, four and sometimes five satellites share the same frequency!

Identifying Satellites

Satellites are usually identified by their orbital characteristics. Among the most important characteristics are *inclination* and *period*, both of which are given in the table for each satellite.

Inclination is the angle that the satellite's orbit makes with the earth's equator as the satellite crosses the equator in a south-north direction. By plotting the inclination on a map or globe, it is possible to determine quite easily the direction in which the satellite is travelling. If a rotatable directional antenna is being used to receive satellite signals, the inclination value will help to determine in which direction to aim the antenna for strongest reception.

The satellite's period is the time it takes, in minutes, for a satellite to complete an orbit. By timing reception on successive orbits, it is often possible to identify a satellite by its known period.

The exact time that a satellite passes overhead, or its nearest approach to a listener's location as it orbits in space can be determined by noting the *Doppler shift* on the satellite's signal. The relative velocity of the satellite with reference to a listener on earth causes the satellite's signal to change pitch in much the same manner that a train's whistle changes pitch as the train approaches and moves away from an observer.

As a satellite approaches a receiving location, its frequency will be slightly higher than its actual frequency, and it will appear to be decreasing. The satellite's true frequency will occur at the instant of closest approach, and will continue to decrease for a short time as the satellite passes by. At 20 mc the Doppler shift will be approximately one kc, while at 136 mc the shift can be as much as six kc, for satellites in orbits below a thousand miles.

Three additional satellites in the Orbiting Vehicle (OV5) scientific satellite series were successfully launched by the United States on May 23. OV5-5 has an inclination of 33 degrees, a period of 3120 minutes and transmits on 136.650 mc; OV5-6 has an inclination of 33 degrees, a period of 3115 minutes and transmits on 136.380 mc; OV5-9 has the same parameters but transmits on 136.530 mc. All three transmitters are command-controlled from the ground.

On June 5, the United States launched its sixth satellite in the OGO flying laboratory series. OGO-6 is designed to study the interaction between solar radiation and the earth's atmosphere and magnetic field. The satellite has a period of 100 minutes and is inclined 82 degrees to the equator. Its command-controlled transmitters operate on the same frequencies as previous OGO satellites; 136.200, 400.250, and 400.850 mc. ■

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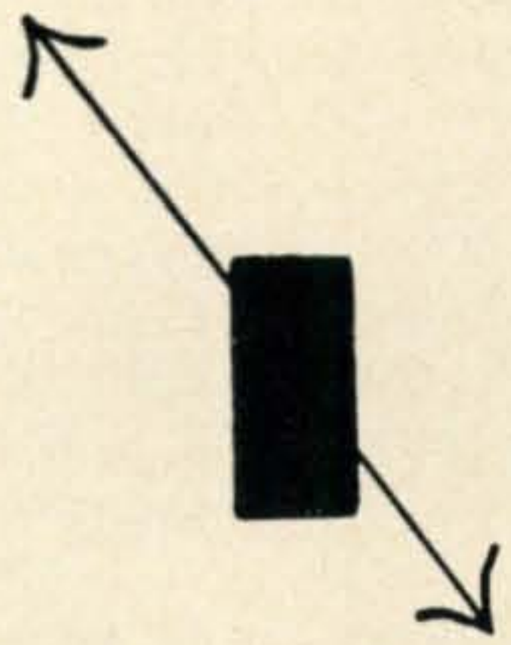

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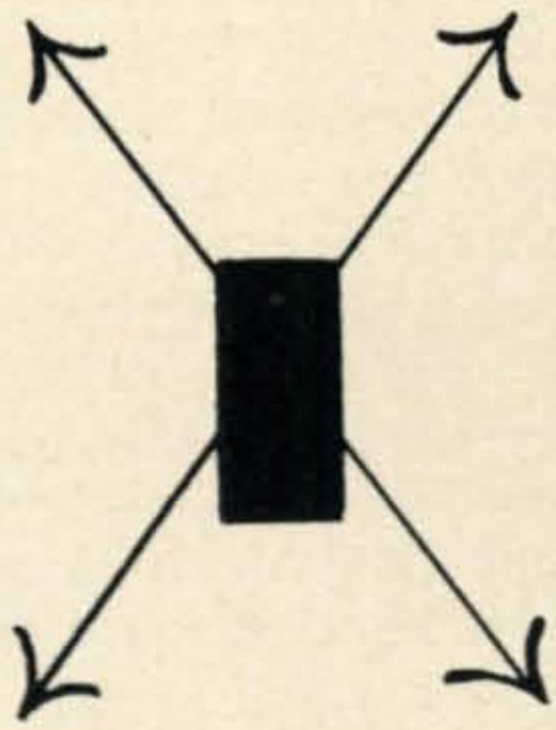

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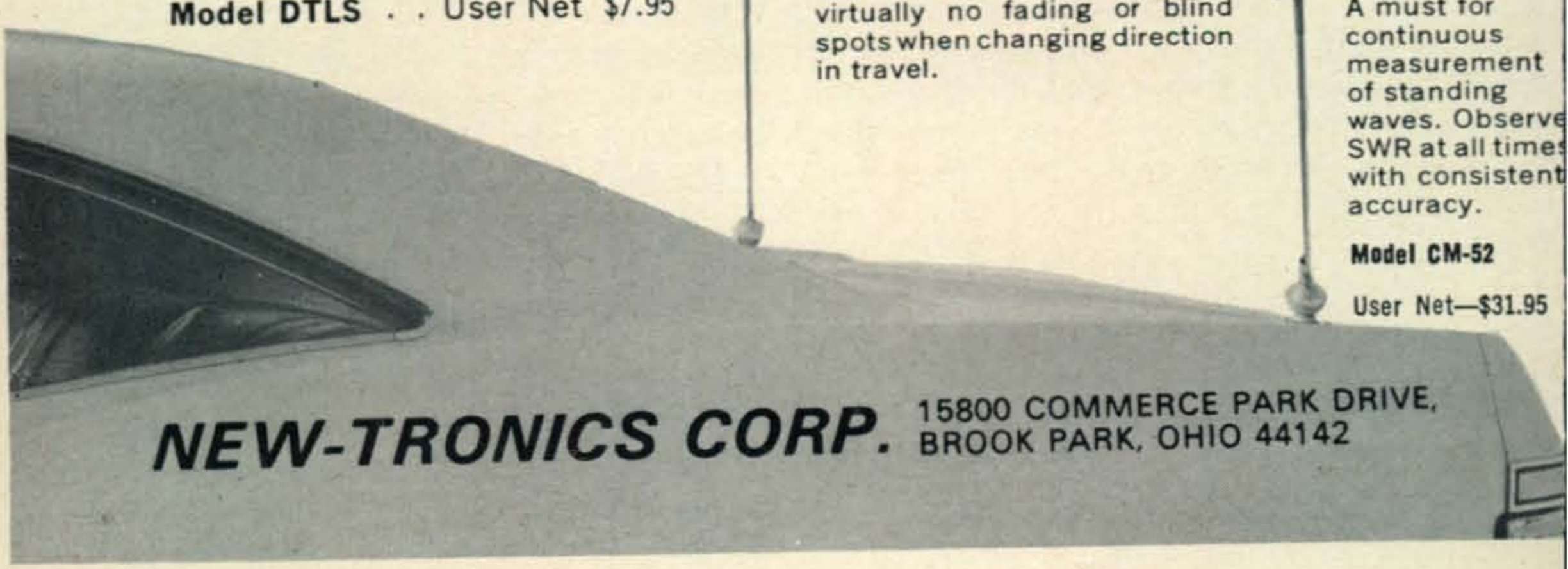

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SLOW SCAN TELEVISION

The preceeding installment of this two part article discussed the possibility of using a sampling technique to generate a slow scan television picture from a conventional fast scan closed circuit TV camera. This second part gives the complete circuit details to convert a typical fast scan TV camera to a slow scan camera for the transmission of long distance (DX) television whenever the occasion demands.

MANY amateur television enthusiasts have on hand a tube type vidicon camera or have acquired a low priced Japanese transistor camera. Either of these types is useable but it should be kept in mind that a thorough understanding of the particular camera is necessary. Needless to say a camera schematic is necessary because you should be able to locate the particular circuit called out in this discussion. It is also important to keep in mind that 60 cycle hum may become a problem and it may be necessary to mount the camera power supply transformer away from the vidicon in a separate box. The hum will vary from camera to camera and may be negligible in some cameras.

In order to get started, examine the block diagram shown in fig. 8. Two ramp (sweep) generators are required. The 15 cycle sweep is synchronized to the 60 cycle lines and provides the basic horizontal line rate for the slow scan TV picture. The sweep voltage drives one set of deflection coils in the fast scan camera when it is operated in the slow scan mode. This generator also provides signals for blanking and synchronizing.

The 1/8 cycle ramp generator provides the "sliding pulse" reference to generate a

*Waldron, Indiana 46182.

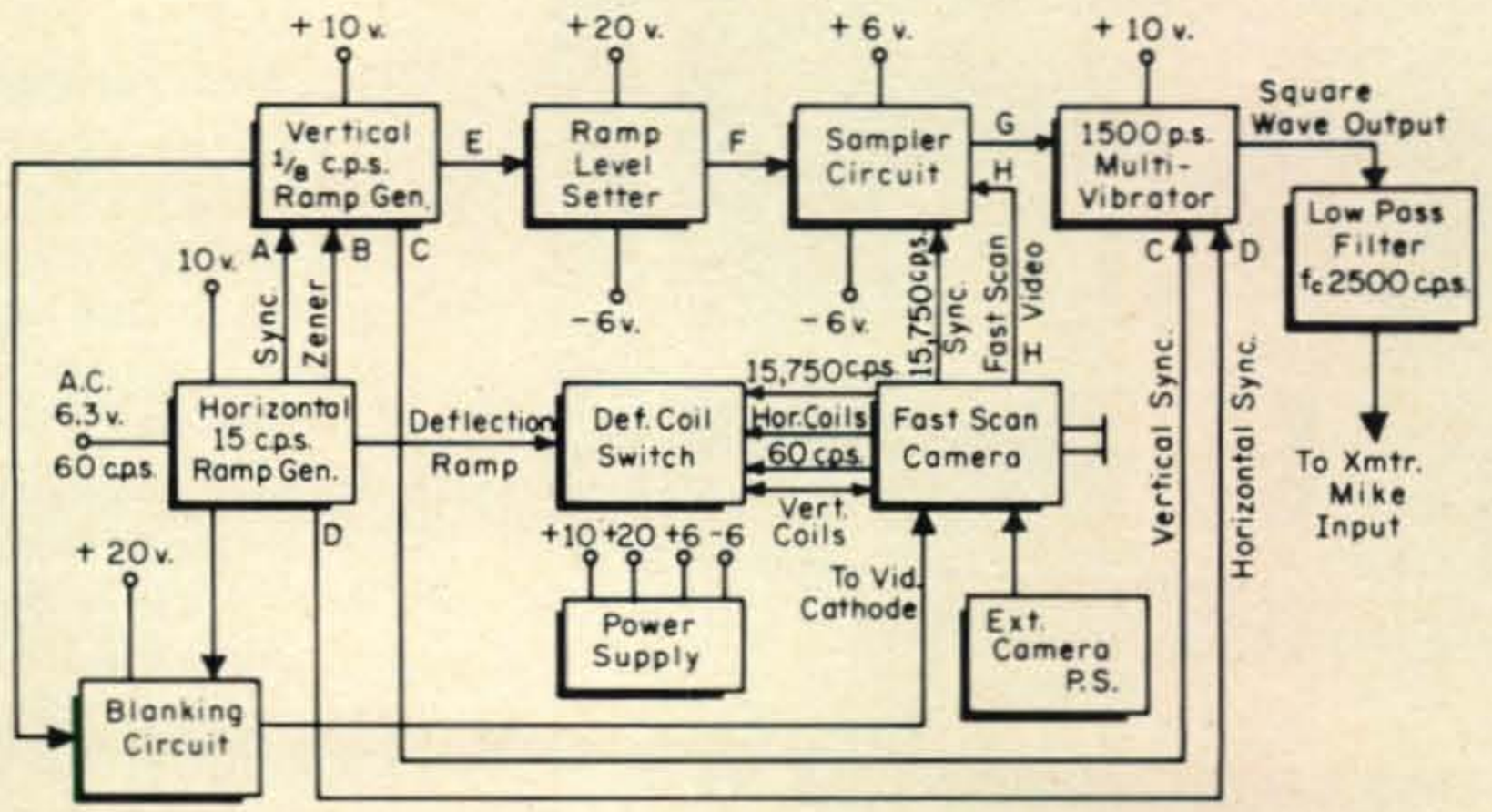

Fig. 8—Block diagram of a slow scan sampler camera.

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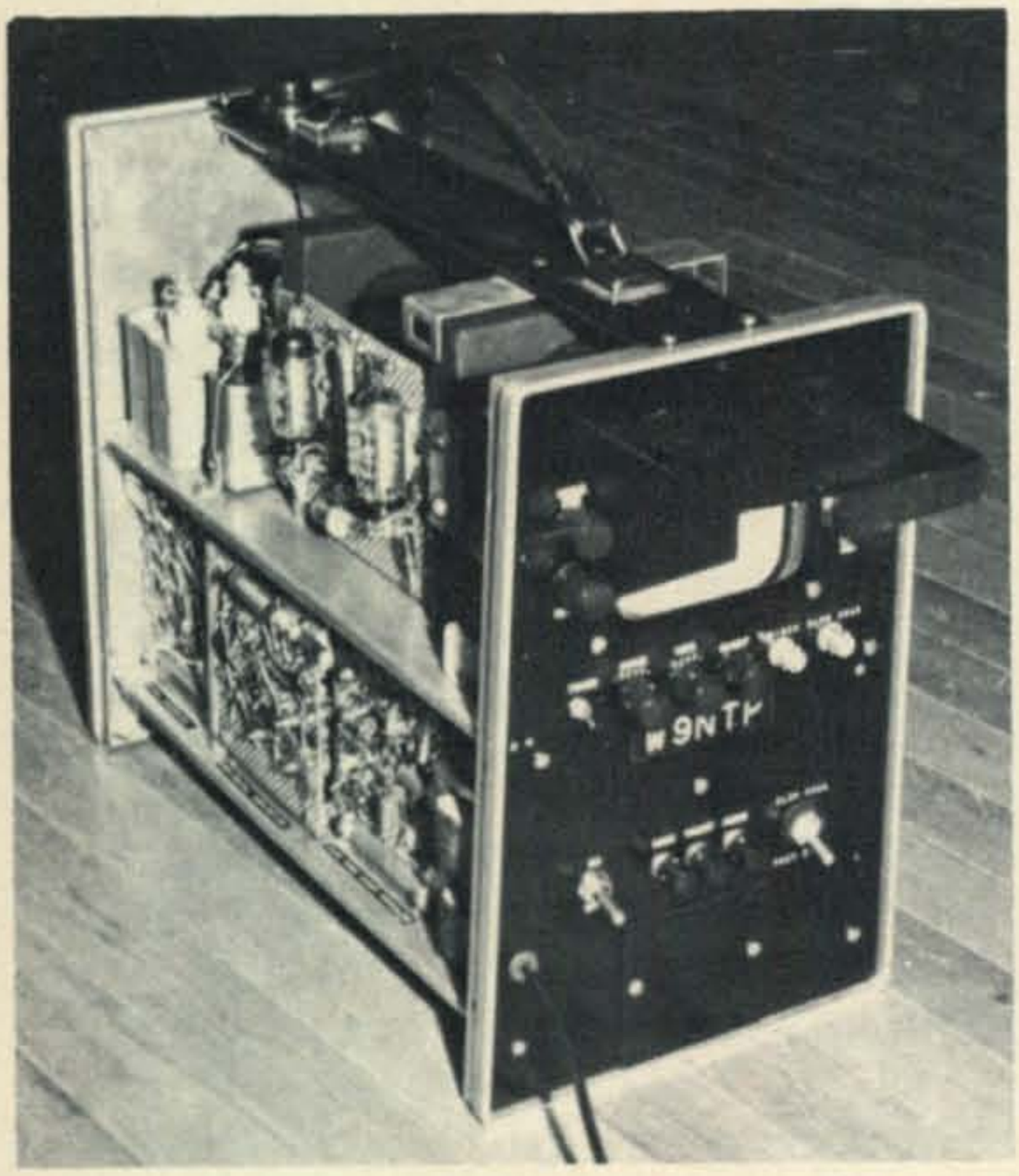

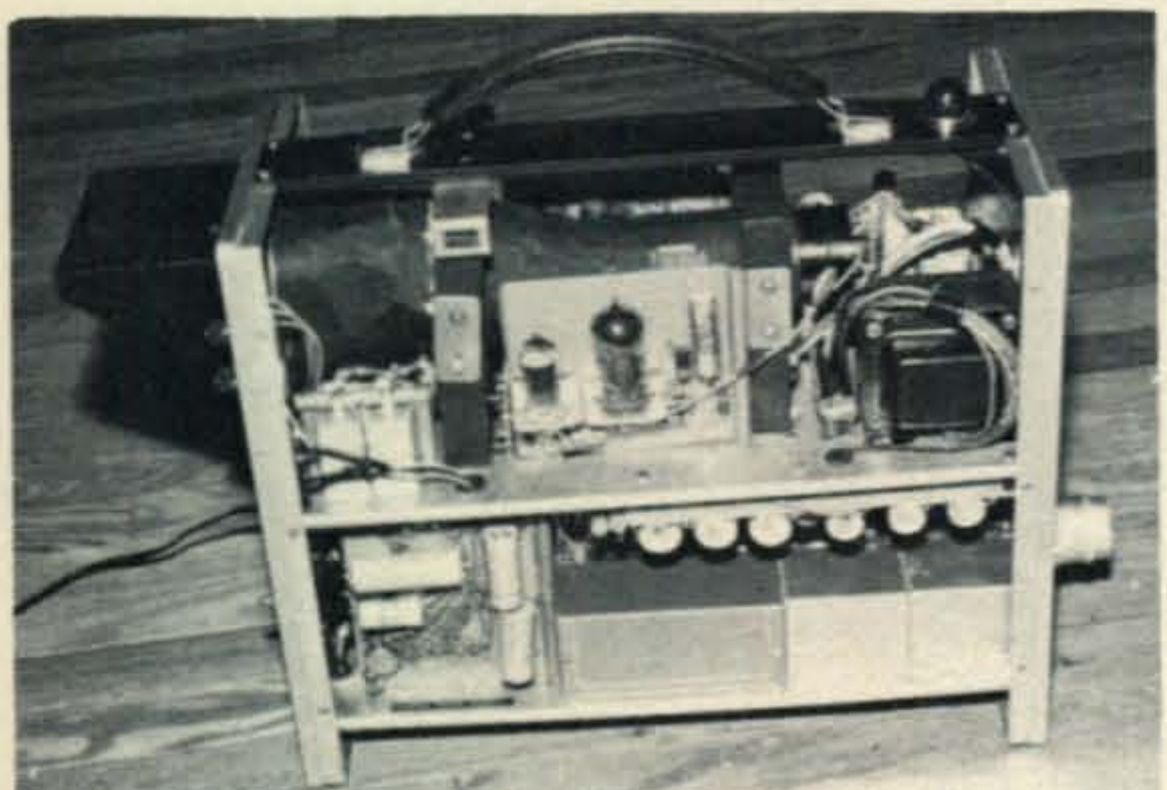

Views of the interior of the W9NTP sampler camera which includes a monitor scope. Construction is on glass epoxy vector board. The boards are supported by slotted dowels.

pulse at a 15,750 cycle rate that moves in time across the original fast scan raster. The ramp level setter adjusts the d.c. voltage level and magnitude of the ramp to center the sampling pulse. It will be remembered from the first part of this two part article that the sampling process moves in a perpendicular direction from the top left corner of the picture down across the original horizontal scanning lines and repeats the cross scanning a small distance to the right of the first line. This continues for 8 seconds until 120 cross lines are created. Because of the cross scanning the resulting slow scan picture will be on its side and in a mirror image format. The first model of the camera had a mechanical mount that rotated the camera 90 degrees. To take care of the mirror image, the XYL made a sign for ID with my call letters written backwards. Those of you that like better solutions can use the alternate method of switching the deflection coils in the manner shown in fig. 16(A). This may require a camera that has the same inductance deflection coils in the horizontal and vertical directions. This can be easily accomplished if you have built your own fast scan camera which is highly recommended. ATV Research in Dakota City, Nebraska generously provided the author with matched coils.

The 1500 cycle multivibrator is standard among all slow scanners. Circuit details will be discussed later but the two sync signals from the 15 cycle and 1/8 cycle ramp generators cause the multivibrator to shift its frequency to 1200 cycles. The lack of picture information causes it to oscillate at 1500 cycles (black frequency) and the presence of a white signal cause it to change its frequency toward 2300 cycles. This filtered square wave from the multivibrator is next fed into the transmitter through the microphone jack.

The power supplies are zener regulated from surplus house zeners (Polypaks) and provide the necessary regulation.

The sampling circuit consists of a Schmitt trigger that has applied to it two ramps (15,750 c.p.s. and 1/8 c.p.s.). The combination of the two ramps cause the Schmitt to trigger at a changing period throughout the 15,750 cycle period for the frame time of 8 seconds. A pulse is generated from the variable firing period of the Schmitt and a field effect transistor (FET) is gated on for the time of the pulse. If the fast scan video is applied to the "source" of the FET it will be gated on for the length of the pulse to the output

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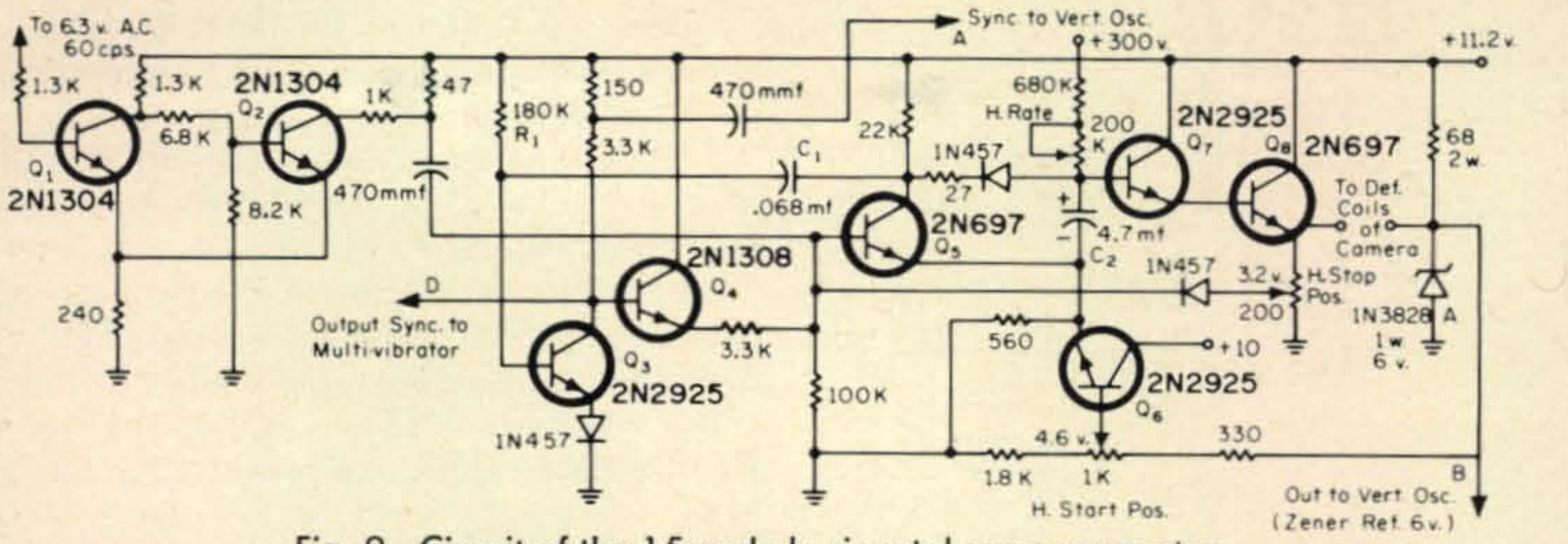

Fig. 9—Circuit of the 15 cycle horizontal ramp generator.

"drain." Since it will be necessary to "box-car" (hold the sample until the next gating pulse) this pulse to increase its energy content, the drain is connected to a 200 mmf capacitor. A high impedance Darlington bipolar transistor pair provide the high impedance discharge path for the FET and provides a low impedance sampled "slow scan signal" to the multivibrator.

Circuit Discussion

Horizontal Ramp Generator

The slow scan ramp generator shown in fig. 9 consists of a monostable multivibrator and an RC charging network to form the sawtooth sweep. In order to maintain lock with the 60 cycle line, transistors Q_1 and Q_2 distort and sharpen the sine wave signal to provide a sync pulse for triggering the monostable formed by Q_3, Q_4, and Q_5. The RC combination formed by R_1 and C_1 determine the retrace time and the width of the sync pulse from the generator. Transistor Q_5 acts as the discharge transistor for the RC network formed by C_2 and the resistors connected to plus 300 volts. Provision is made to limit the start and stop of the charging by means of start and stop potentiometers that set the beginning and ending of the voltage across C_2 to make sure that the ramp is charging over the time period between the end of the sync pulse and the beginning of the following one. In the adjustment of the H RATE, START and STOP potentiometers, it is helpful to display a Lissajou figure on an oscilloscope to form the familiar 4 to 1 pattern.

Vertical Ramp Generator

The operation of the 1/8 c.p.s. oscillator shown in fig. 10 is basically the same as the 15 c.p.s. oscillator. The sync signal is provided by a pulse from the 15 cycle oscillator. In this case the timing network has a much greater time constant as can be seen in the values of C_3 and C_1. The setting of the START and STOP potentiometers will be described later. The output ramp is centered about 6.2 volts and has a range from 5.2 to 7.3 volts.

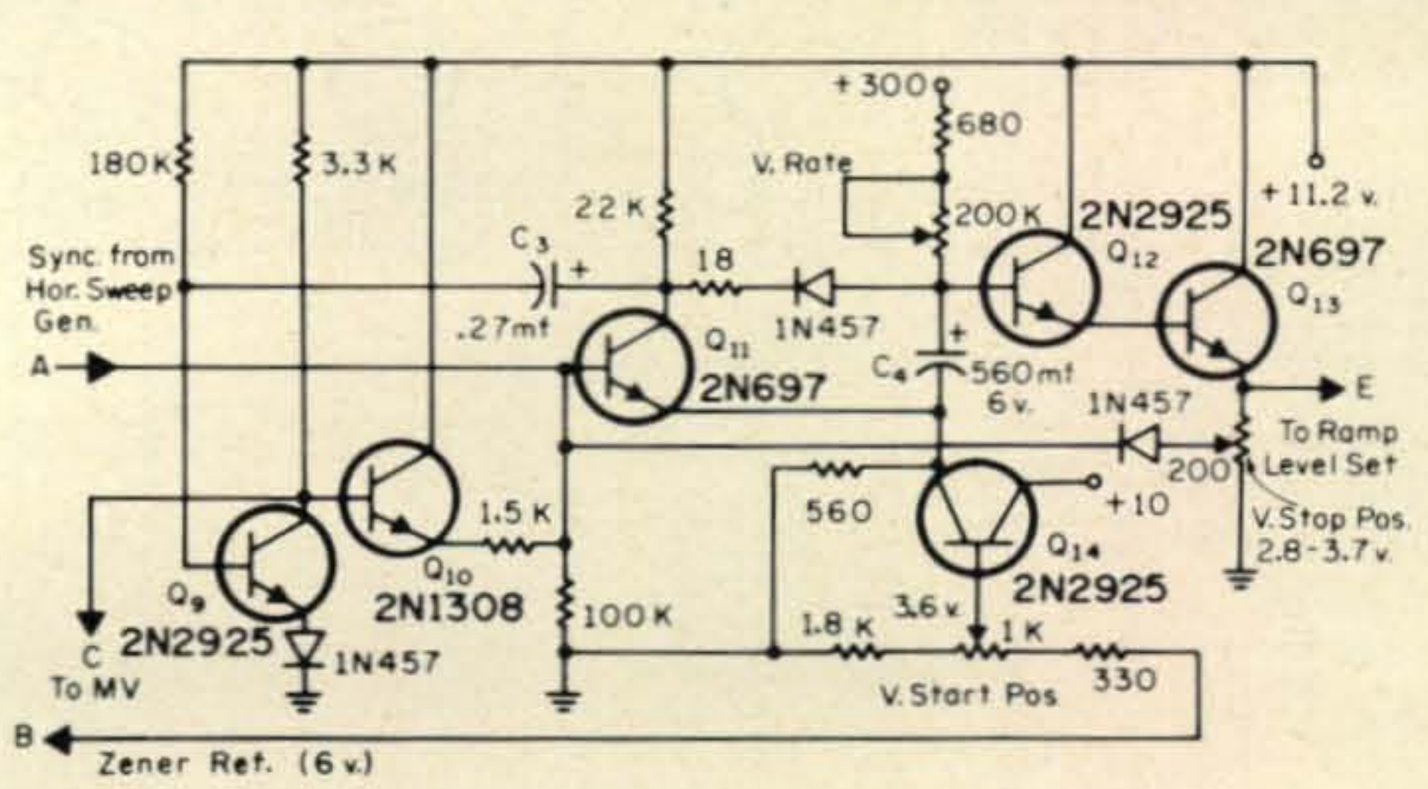

Fig. 10—Circuit of the 1/8 cycle ramp generator.

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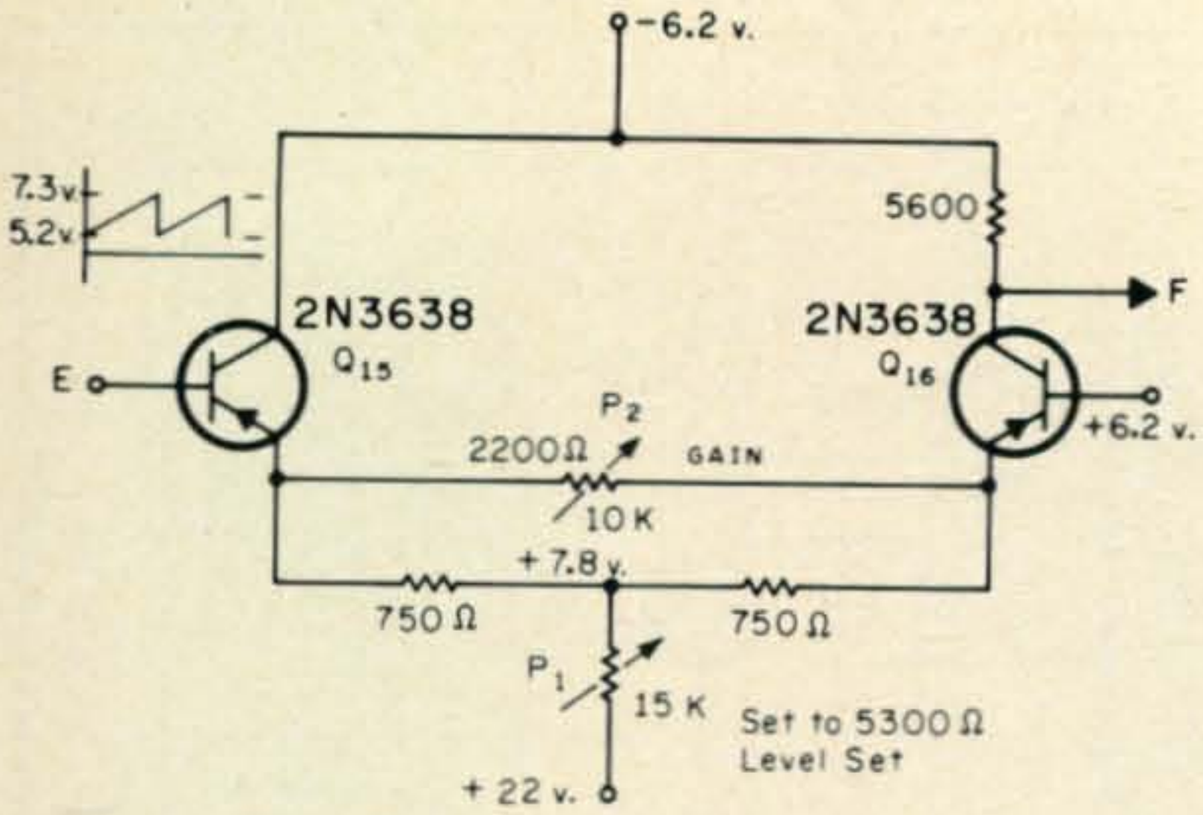

Fig. 11—Circuit of the ramp level setter and d.c. amplifier.

It is for this reason that the output must go to the ramp level setter to provide the correct level and amplitude ramp to the Schmitt trigger circuit. It is important to note that this sweep (1/8 cycle) does not drive deflection coils as was the case of the 15 cycle ramp generator.

Ramp Level Setter Circuit

In order to amplify the 1/8 cycle ramp and set its average level it is necessary to use d.c. amplifier circuits. The differential amplifier configuration shown in fig. 11 serves to do this and maintains the same phase output as the input. The ramp from the 1/8 cycle generator is applied to the base of transistor Q_{15}. A d.c. voltage is applied from a zener reference to the base of transistor Q_{16}. The schematic shows the measured voltages when the ramp has been adjusted properly.

It should be stated that the results of proper operation of this circuit can be seen on a *fast scan monitor* when the complete system is operating properly. A faint white vertical line moves from the left side of the screen to the right side in 8 seconds. Potentiometers P_1 and P_2 provide the d.c. level and amplitude adjustment to the Schmitt sampling circuit to cover the screen. Maladjustment is evident when the white line does not cover the whole screen in 8 seconds or does not quickly appear to repeat after one scan.

Sampling Circuit

The basic principle of the Schmitt circuit is such that it is used as an amplitude comparator to mark the moment when an arbitrary waveform reaches a reference level. When the reference level is reached the output makes an abrupt change. Another name for the circuit is the emitter coupled binary.

In fig. 12 transistors Q_{17}, Q_{18}, and Q_{19} take the 4 volt negative pulses from the fast scan camera and generate a 15,750 cycle ramp at the emitter of Q_{19}. This 4 volt negative signal can be derived at various places in the fast scan camera and usually comes from the retrace pulse generated during the horizontal flyback time.

Transistor Q_{27} provides an emitter follower output for the 1/8 cycle ramp. Both ramps (15,750 c.p.s. and 1/8 c.p.s.) are added together through 2700 ohm resistors to the base circuit of Q_{20}.

The Schmitt circuit consists of transistors Q_{20} and Q_{21}. The addition of the 1/8 cycle

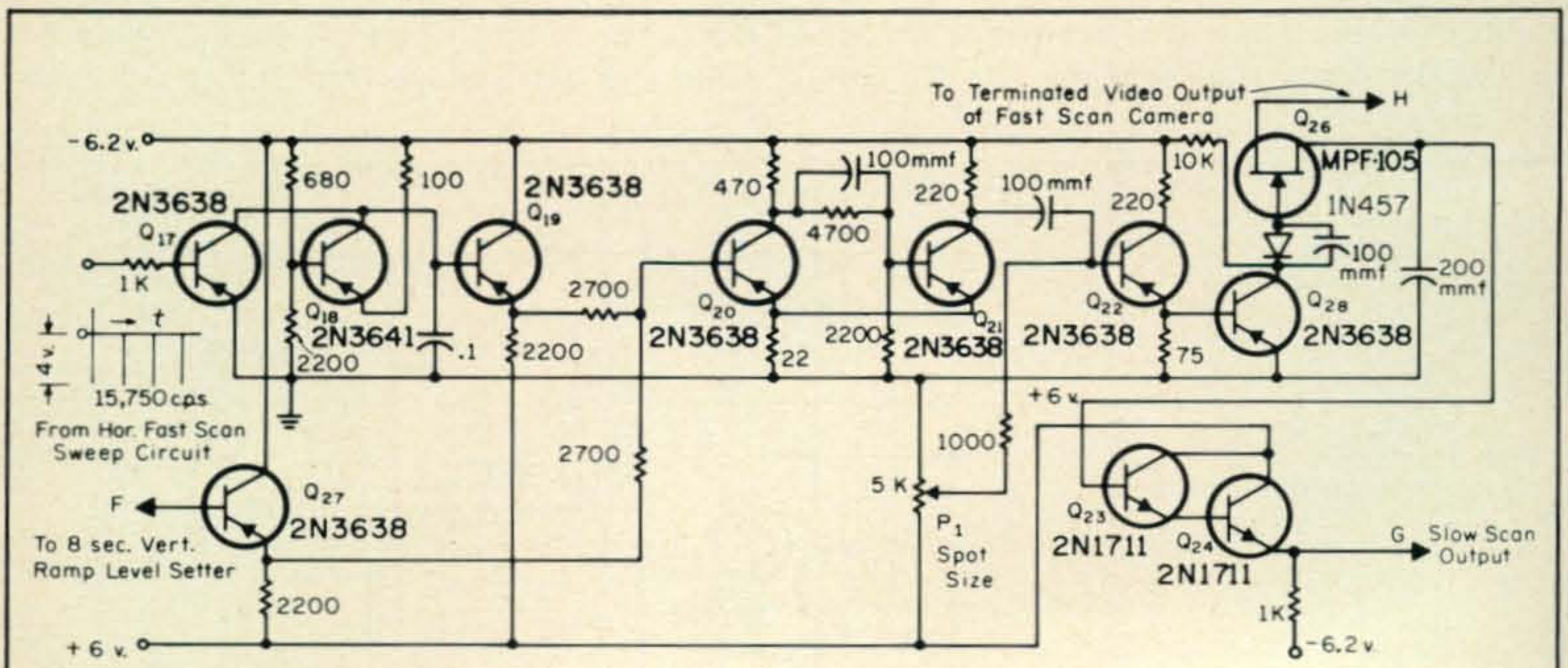

Fig. 12—Circuit of the slow scan sampler, Schmitt trigger and boxcar circuit.

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ramp to the 15,750 cycle ramp causes the Schmitt to fire at a slightly different time for each cycle of the 15,750 cycle waveform.

Figure 13 shows this addition and how the time between the firing points of the circuit changes (t_1 *vs.* t_2) for a given firing voltage. The result is that a succession of pulses with a constantly changing period is generated. The output is Q_{21} is differentiated by a 100 mmf capacitor and the conduction of transistor Q_{22} is controlled by the SPOT SIZE control, P_1. This adjustment makes the sampling pulses wider.

Transistor Q_{22} has an emitter follower output that feeds the sampling circuit consisting of transistors Q_{28} and Q_{26}, an MPF-105 junction FET. The fast scan video is fed into the source of the FET at a point *H* and this video is gated through the FET for the time of the Schmitt generated pulse. The drain of the FET connects to a boxcarring capacitor and a high impedance Darlington combination of transistors Q_{23} and Q_{24}.

The purpose of the boxcarring capacitor is to hold the sampled video at the sampled value until the next sample. The low frequency energy is increased in this way.

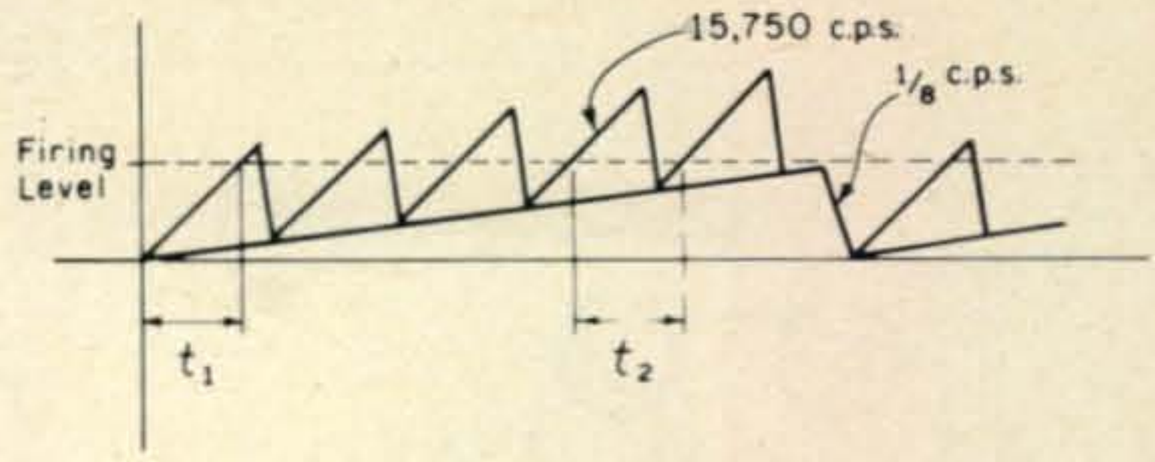

Fig. 13—Waveform showing the addition of the two ramps to generate the sliding pulse. (Drawing is not to scale.)

Multivibrator Circuit

The multivibrator shown in fig. 14 is a free running symmetrical solid state type. There are three adjustments required to set the output frequencies for sync, black and white to 1200 cycles, 1500 cycles and 2300 cycles respectively. It is easy to see that the frequencies are changed by changing the voltages to which the timing components are returned. All of the adjustments are somewhat inter-related in the initial set up and require several sequential adjustments to bring the frequencies into proper range.

It should be noticed that potentiometers P_1 and P_2 should be ganged but satisfactory adjustment can be made with individual potentiometers if an oscilloscope is used to keep the duty cycle symmetrical. The circuit diagram, fig. 14, shows the voltages that must be applied to the multivibrator for initial setup.

The output if the MV is amplified, filtered and fed into the microphone input of a tape recorder or the transmitter. One word of caution should be given here. It is very important that no higher audio components than 2300

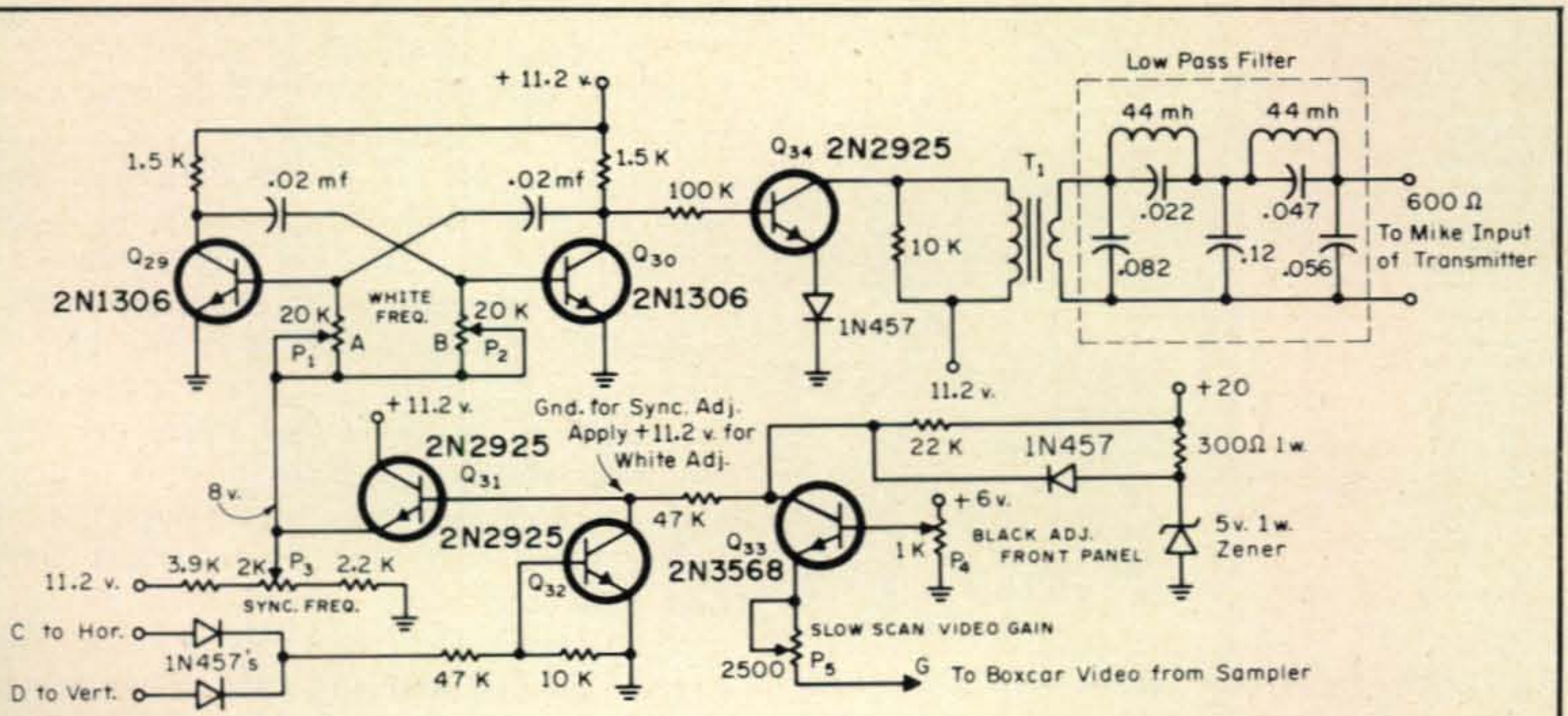

Fig. 14—Multivibrator circuit. The frequencies involved are: White-2300 cycles, Black-1500 cycles and Sync-1200 cycles. Transformer T_1 is a Knight 6T17PC, 10K primary to 500 ohm secondary. The two 44 millihenry coils in the low pass filter are toroids normally used in RTTY construction.

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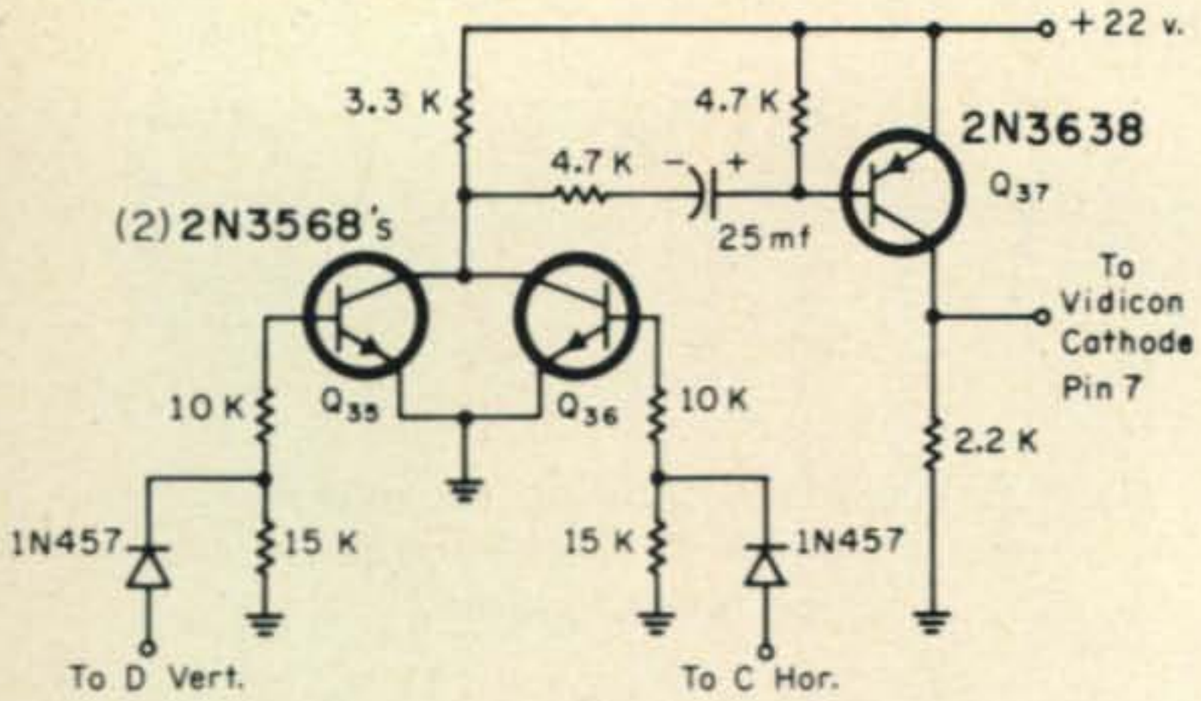

Fig. 15—Circuit of the Vidicon blanker for 15 cycles and 1/8 cycles. The 2200 ohm collector resistor of Q_{37} should be the only ground return for the vidicon cathode.

cycles are transmitted through the transmitter. The FCC rules state that the bandwidth should be no greater than 3 kc (s.s.b.). It is our intention to keep it considerably below that. The square wave from the MV should be run through a low pass filter that has a cutoff of no more than 2500 cycles. Perhaps your mechanical filter in the transmitter will do this for you but why take a chance? A typical low pass filter with a cutoff frequency of 2500 Hz is shown in fig. 14.

Distortion can also occur if you overdrive the first audio tube before the mike gain control in the transmitter. Modern transmitters may prevent spurious outputs but several very popular ones do not. The author owns one of these that does not. If in doubt check the width of your signal with your receiver in the narrowest bandwith mode. It should be no more than 3 kc. It is important that slow scanners operate carefully in order not to undo the great selling job of MacDonald and others with the FCC.

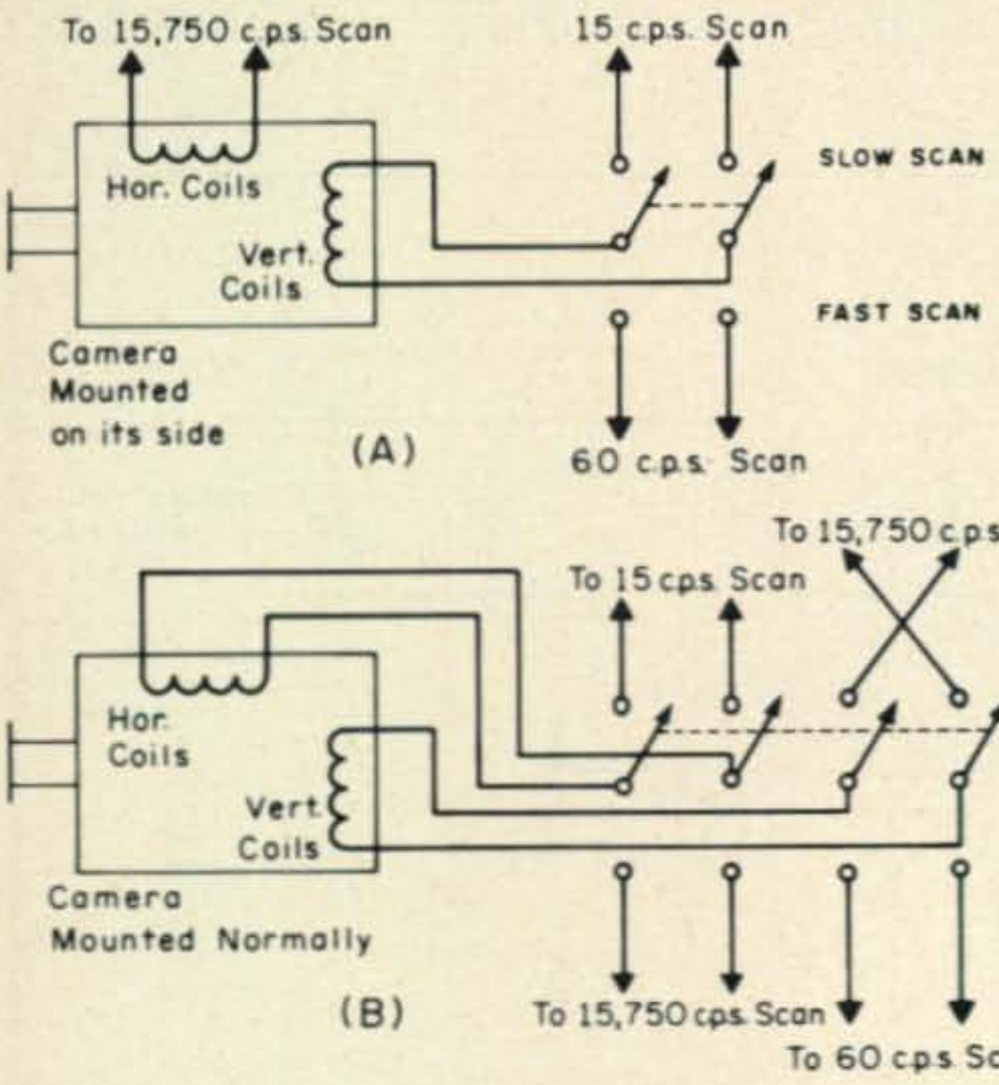

Fig. 16(A)—Deflection coil hookup if the camera is mounted on its side. With this arrangement writing appears in its mirror image form as was illustrated in the text. (B) Deflection coil hookup permissible if the horizontal and vertical coils have the same inductance (not usually the case). This arrangement eliminates the mirror image problem.

Vidicon Blanker For the Slow Scan Sweeps

The fast scan camera will have blanking for the original two fast scan sweep rates. It is probably best not to modify this original circuit in the camera but to add the simple blanker shown in fig. 15. The cathode of the vidicon in the camera should be lifted from ground and returned to ground through the 2200 ohm resistor shown. Some means should be provided to remove the +22 volts when it is desired to view the picture on a fast scan monitor since the slow scan blanking will show as flicker.

The two sync signals are fed into the bases of transistors Q_{35} and Q_{36} and since they share a common collector resistor add to turn on and off the base circuit of Q_{37} for the two slow scans. The cathode of the vidicon will be driven positive for the sync signals and cut off the vidicon for the required period of time.

Deflection Coil Switching

As mentioned several times before, in order to obtain a slow scan picture that is sitting upright and not a mirror image of itself it is necessary to switch deflection coils in the fast scan camera.

For those that are not sure of the inductance of their deflection coils it is recommended that the simplest circuit shown in fig. 16 be followed. It is only necessary to replace the 60 cycle scan with the 15 cycle scan with a simple d.p.d.t. switch or relay. Be sure that you don't lose sweep voltage at any time while the vidicon "beam" is turned high or the target may be damaged.

For those that have symmetrical deflection coils the more complicated circuit is recommended. Here not only is the 60 cycle sweep replaced with the 15 cycle sweep but the horizontal and vertical coils are interchanged and one is reversed. There is a complete explanation of the reason for this in Part 1 of this series. Again the author recommends the simpler of the two circuits until you have all the circuits checked out. In case you

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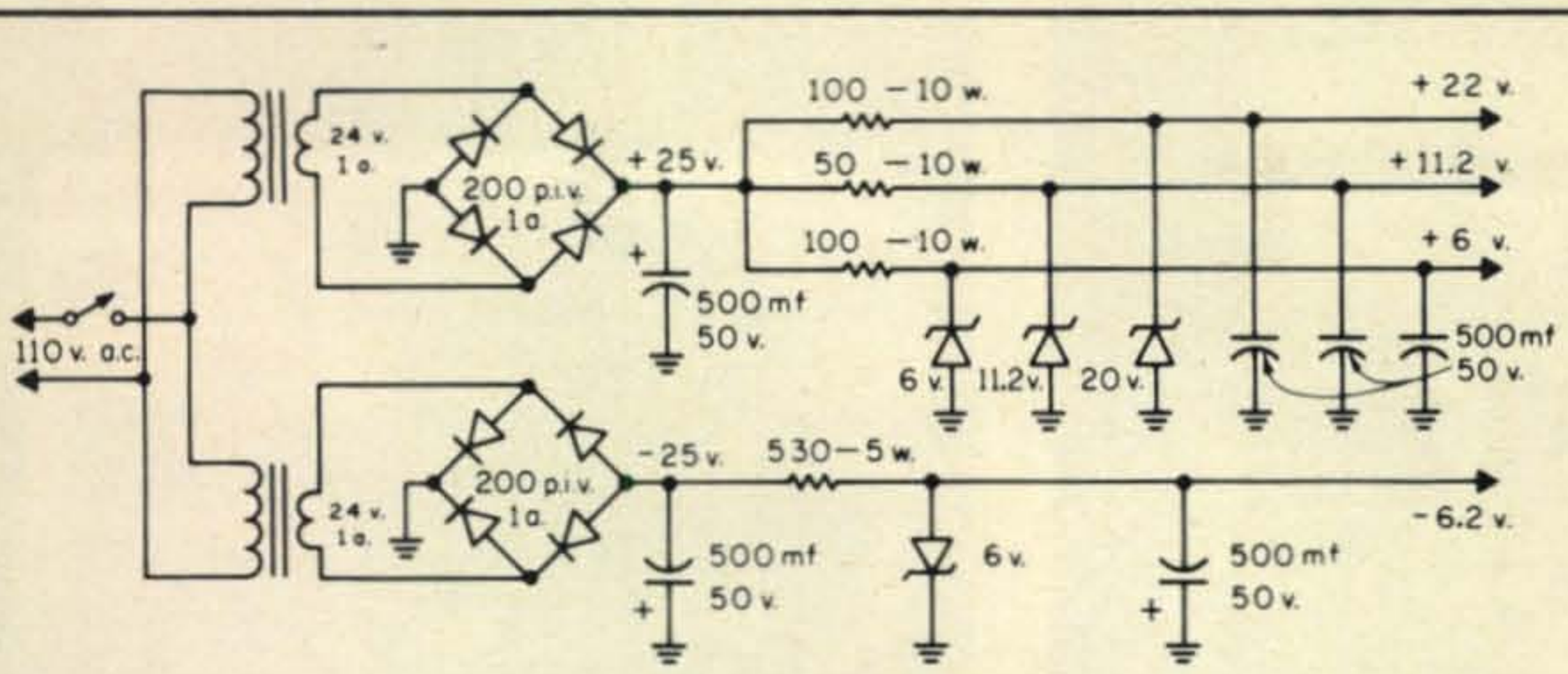

Fig. 17—Power supplies for the sampler camera. The regulation and ripple characteristics are discussed in the text.

are wondering what happens if you don't replace the 60 cycle scan with the 15 cycle scan you may recall that 4 pictures are created side by side on the slow scan monitor.

Power Supplies

Since both polarity voltages are required in the camera modification, two 110/24 volt, 1 amp filament transformers are used. This circuit is shown in fig. 17. A bridge rectifier circuit gives full wave rectification for both polarities. It is important to use the largest filtering capacitors possible since 60 and 120 cycle hum is the plague of all slow scanners.

Zener diodes are used for all regulated voltages and it may be necessary to make slight adjustments in the dropping resistors to make sure that the zeners are regulating for full load. The zener voltage should be constant from no-load to full load.

As a final test of adequate filtering, connect an oscilloscope adjusted for high sensitivity to the outputs of the power supply and add filter capacitance until the hum level drops to the millivolt level.

It was mentioned earlier that hum problems caused by magnetic fields may necessiate the removal of the camera transformer to an external box. It is advisable, if possible, to put all of the transformers in this box far away from the vidicon and sensitive circuits.

Construction

Since this is supposed to be the computer age it seemed fitting to build each circuit on a computer type card. Home made cards were constructed from glass epoxy vector board. The cards are approximately 4" × 5" and a flat plug obtained at the local surplus house was bolted on the bottom to mate with the equivalent chassis mounted plug. A dowel rod was slotted to provide a support on one side of the home made card. The components are mounted on one side of the vector board by means of pins provided for this purpose. Wires were put on one side to connect the components. A jig holder with an extension cable and plug is sometimes used to adjust the card mounted potentiometers that were inaccessible in the completed enclosure. The author feels that this method of construction has nearly the compactness of printed circuit cards while providing the flexibility required for circuit changes and simplicity for home construction and maintenance.

The author built a complete fast scan camera and sampler and included a monitor in the same box. Plug-in cards were used for the transistor circuitry. The photos show this camera-monitor combination. It has several modes and generates both fast and slow scan pictures and is also able to display either fast or slow scan pictures on the monitor tube which has a P_7 phosphor.

In any case the circuitry is not difficult to make work in any configuration. Regardless of whether home made plug-in cards are used or not, the use of the green glass epoxy vector boards is highly recommended. They will not break and construction is very fast and looks good. It is very easy to modify for circuit changes.

The power supply should be tested un-

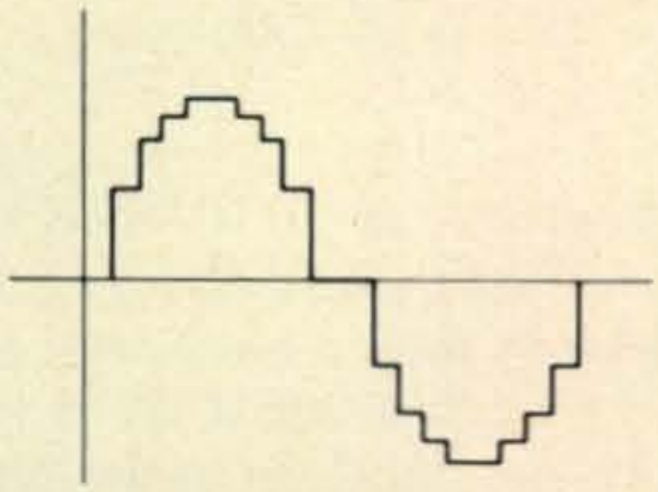

Fig. 18—Boxcarred 1000 cycle waveform as viewed at point G of fig. 12 in a test of the sampler operation.

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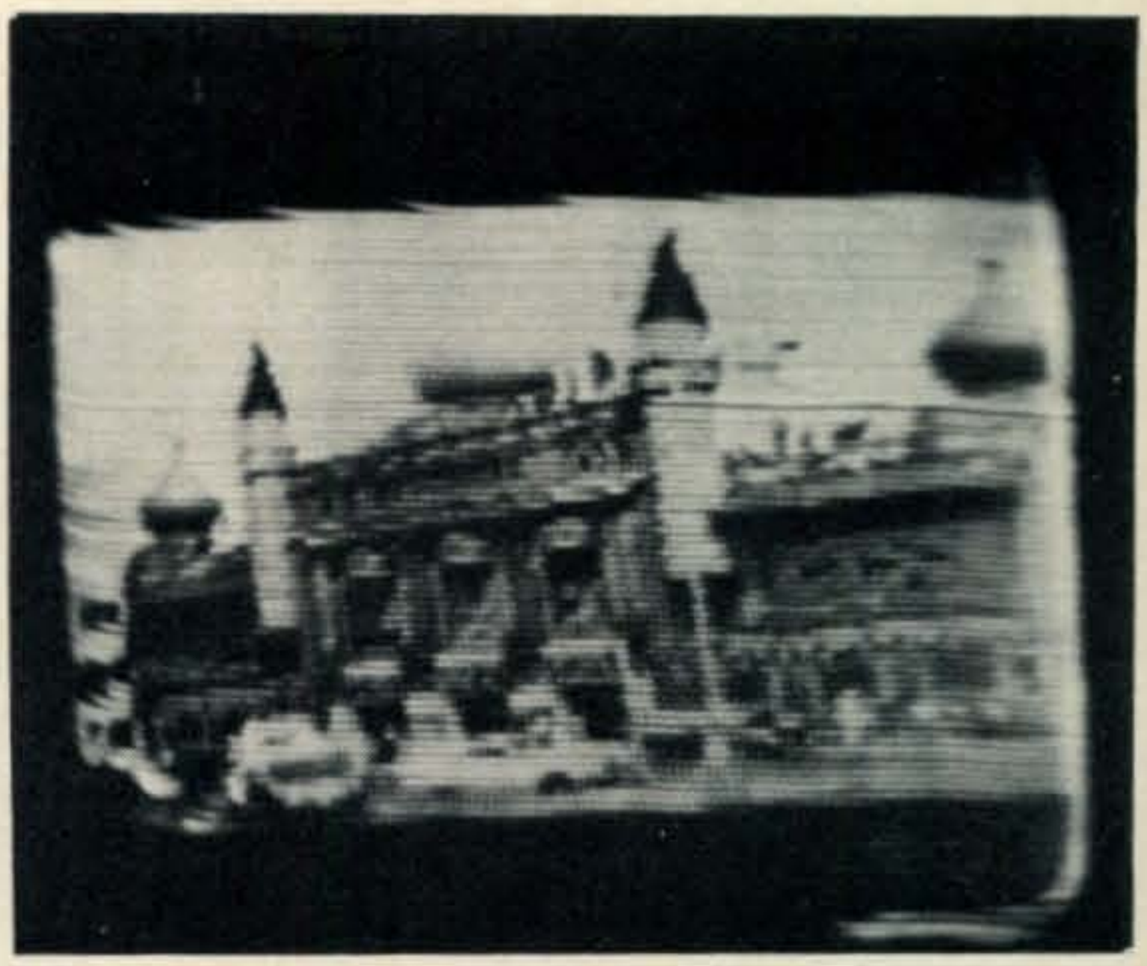

Comparison photographs from the fast scan (left) and slow scan monitors. The photos were taken with Polaroid cameras using several close up lenses in tandem which limited the quality of the picture.

loaded initially to make sure that the dropping resistors are not overheating. The voltages should measure the proper amount as shown in fig. 17.

The outputs of the power supply should be checked both unloaded and loaded on a cathode ray oscilloscope to make sure that the ripple is in the millivolt range.

Next, the horizontal oscillator (15 c.p.s.) should be aligned. Remember to connect the 6.3 v, 60 cycle voltage to the input of Q_1 to provide the line synchronization. The plus 300 volts which is needed for this sweep circuit can be obtained from the fast scan camera since one of the vidicon anodes is run at 300 volts. With the vertical input connected to the output of transistor Q_8 and the horizontal input connected to 60 cycle lines the display should show the familiar 4/1 Lissajou pattern.

If the circuit has been properly constructed the adjustment of the H START pot, H STOP pot and H RATE pot will result in a Lissajou pattern of some submultiple of 60 cycles.

In the author's case the exact potentials measured at the arms of the respective potentiometers is as follows:

H START pot. +4.6 v.

H STOP pot. +3.2 v.

Once the 4/1 pattern is observed the c.r.o. can be switched to the ordinary display. A 15 cycle sawtooth should be observed at the output of Q_8. Check to see if the 6 volt zener is working before going on to the vertical ramp generator.

The vertical ramp oscillator receives its synchronization from the horizontal oscillator previously aligned. As in the case of the horizontal oscillator the three potentiometers labeled V RATE, V START, and V STOP must be adjusted. Since the rate is so slow a d.c. coupled c.r.o. or 20,000 ohm per volt v.o.m. can be connected to point E at the output of transistor Q_{13}. The voltages measured at the arms of the potentiometers are as follows:

V START +3.6 v.

V STOP +2.8-3.7 v.

The output voltage varies from 5.2 to 7.3 volts and feeds the ramp level setter discussed next. The timing is best adjusted with a stop watch. There should be no hesitation in the cycle when the ramp retraces to recycle at the end of the 8 second period.

The ramp level setter is shown in fig. 11 with the measured supply voltages shown. The measured voltage at the intersection of the 750 ohm resistors is 7.8 v.

The two potentiometers for level set and gain should be readjusted after the system is in operation. As mentioned before, a white sampling line is visible in the fast scan monitor when sampling. The line should move from one side of the screen to the other and retrace without hesitation.

The sampler circuit is not critical to adjust. A 15,750 cycle ramp should be observed at the emitter output of transistor Q_{19}. A 1/8 cycle ramp should appear at the emitter output of transistor Q_{27}. At the emitter output of transistor Q_{22} small narrow spikes of voltage can be seen with the aid of a c.r.o. These are

[*Continued on page 99*]

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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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CQ Reviews: The Swan Model 250-C 6-Meter Transceiver

BY WILFRED M. SCHERER,* W2AEF

THE Swan Model 250 6-Meter Transceiver was reviewed earlier in *CQ*;[1] but since then, a revised version, the Model 250-C, has become available. Inasmuch as present and prospective users usually are interested in differences between original and newer versions of a piece of gear, at this time we'll discuss the changes incorporated in the Model 250-C. We'll also recap some of the basic features of the 250-series, a block diagram and specific details for which may be found by reference to the earlier review.

Full coverage of the 6-meter band is provided for operation with 240 watts p.e.p. input on s.s.b., 180 watts input on c.w. and 75 watts carrier on a.m. (using one sideband only). Other features are: adjustable Pi-network for matching to loads of 50-500 ohms, p.t.t. operation or v.o.x. (with accessory unit), product and envelope detectors, operation from 117/234 v.a.c. or 12 v.d.c. external power supplies.

Single conversion is used throughout with a high order of frequency stability achieved by the use of a solid-state v.f.o. and a crystal-controlled b.f.o./carrier oscillator.

The v.f.o. tunes over a 500 kc range for which the frequency dial is calibrated in 5 kc steps. Any desired 500 kc segment on the 6-meter band is selected by shifting an mc-range-setting capacitor to calibrated points related thereto. Swan's customary velvet-smooth two-speed drive mechanism, equipped with large easy-to-handle knobs, is furnished for tuning the v.f.o.

Filter-type s.s.b. generation and selectivity is obtained with a 2.8 kc bandwidth crystal filter.

Revised Features

Most of the changes incorporated in the Model 250-C involve the receiver section, the most notable of which it at the r.f. front-end where two 6CW4 Nuvisitors in a cascode-type circuit are used in place of a single neutralized 6HA5 triode as originally used in the Model 250. An improved noise figure and better sensitivity is realized with the new setup. A 6HA5 triode mixer has been retained. The front-end circuitry is shown at fig. 1.

Traps—Two parallel-tuned traps are connected in series with the antenna input which is matched for 50 ohms by means of a tap on the r.f.-input inductor. One trap is tuned to 28 mc for improving the rejection of images that may be due to signals on the 10-meter band. Its effectiveness is attested by the fact that the image rejection measured 80 db.

The other trap is tuned to 58 mc to minimize the possibility of "birdies" from TV Channel 2.

V.F.O.—Another change is that the v.f.o. is completely shielded with its components installed above the chassis. The mc-range-setting capacitor is now adjusted by a 6:1 ratio control that has a dial which may be locked at any chosen setting. The dial is calibrated for the settings required for each 500 kc segment of the 50-mc band. The mechanics of

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*Technical Director, *CQ*.

[1] "*CQ* Reviews the Swan Model 250 6-Meter Transceiver," *CQ* July 1967, page 57.

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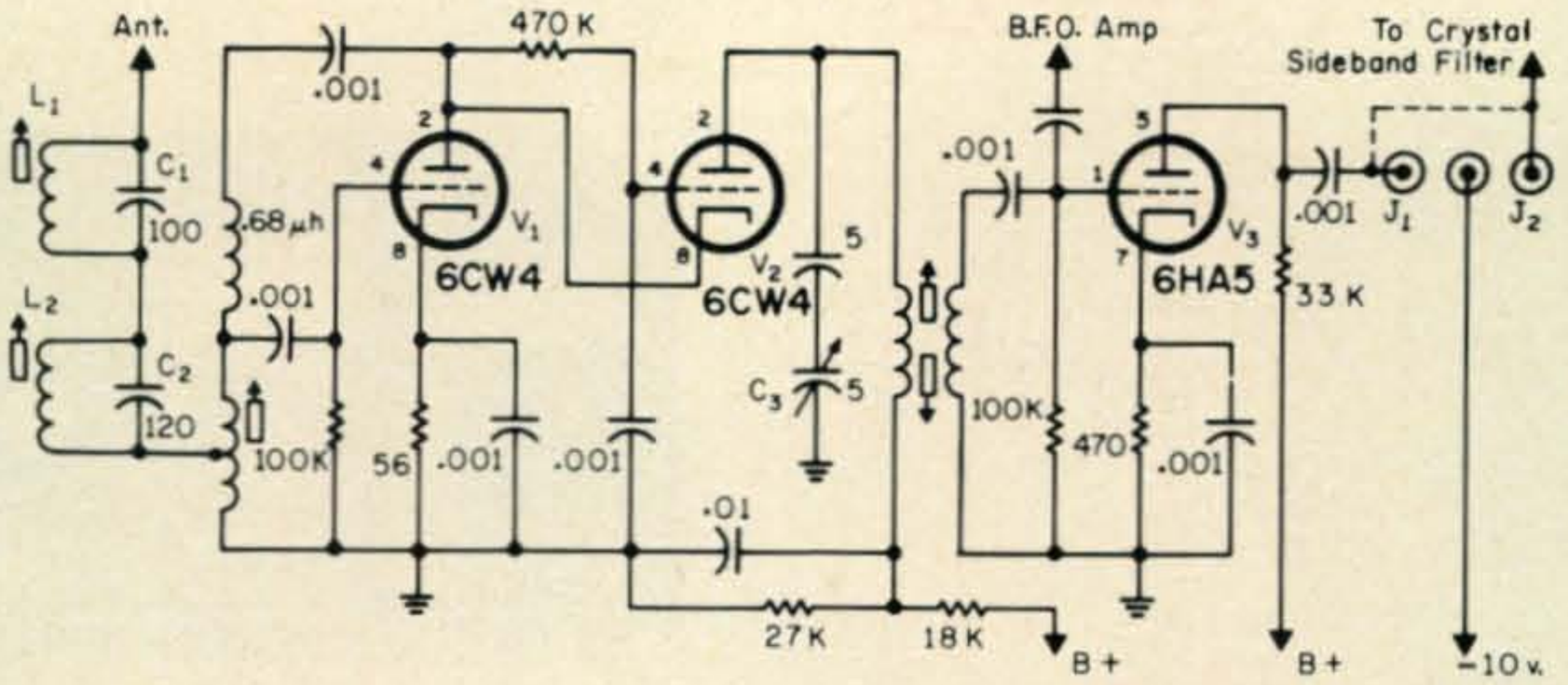

Fig. 1—Front-end circuitry for the Swan 250-C. L_1 C_1, L_2, C_2 are 28 mc 58 mc traps, respectively, as explained in the text. The grids of V_1 and V_3 are fix-tuned, the plate of V_2 is tuned with a variable capacitor (C_3) that is ganged to the tuning capacitors for the v.f.o. amplifier, transmitter mixer and driver. A noise silencer or blanker may be installed in place of the jumper between J_1 and J_2.

the setup make it easy to precisely adjust the capacitor and to subsequently prevent its accidently being knocked off calibration. In addition, a built-in crystal calibrator furnishes markers at the 250 kc intervals, thus allowing an accurate setting of the capacitor to be made for proper correlation with the frequency readout on the v.f.o. dial.

An accessory socket on the rear of the set permits an external v.f.o. (Swan Model 210) to be fed to the v.f.o. buffer/amplifier for split-frequency operation.

I.F.—In the Model 250-C the i.f. has been changed from 10.7 mc to 10.9 mc which thus requires a 200 kc shift in the range of the heterodyning signals from the v.f.o. This move evidently has been made to eliminate certain spurious responses.

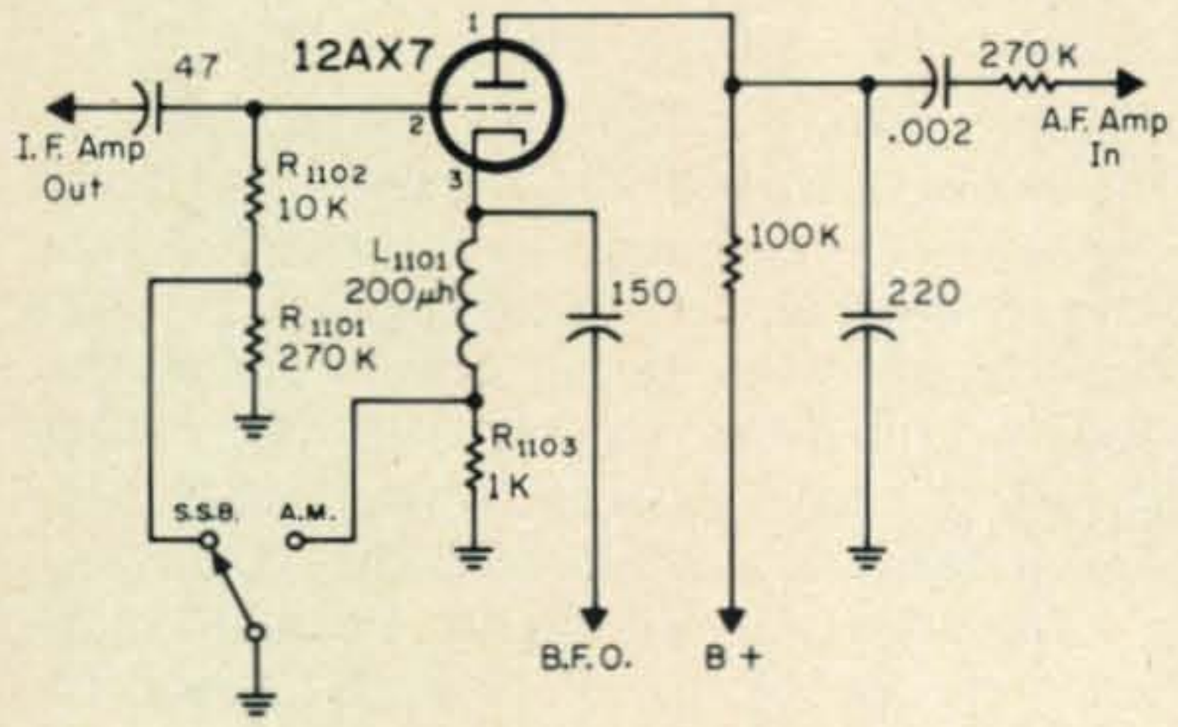

Fig. 2—Product/Envelope Detector circuitry used in the 250-C. The triode normally functions as a conventional product detector. The tube is made to function as a grid-leak type envelope detector for a.m. by the mode switch which sets up cut-off bias on receive to disable the b.f.o., grounds the bottom end of L_{1101} (shorting out R_{1103}) and removes the ground from R_{1101}-R_{1102} junction thus providing a grid leak of 280 K.

Detectors—One triode section of a 12AX7 is used for the product detector in a conventional setup of this type; however, by switching certain circuit elements, it also is made to function as an envelope detector for a.m. The arrangement is the same as that used in the Model 250, but since the circuitry was not shown in the former review, it is now presented at fig. 2.

Sideband Selection—A choice of operation on either the upper or lower sideband is now provided and is accomplished by switching crystals at the b.f.o./carrier oscillator for a 3 kc frequency change to either side of the crystal sideband-filter. The v.f.o. frequency is not compensated for this frequency shift thus necessitating that the v.f.o. be retuned 3 kc when sidebands are changed.

A.G.C.—A modification in the a.g.c. system is that the gain of the 1st and 2nd i.f. amplifiers is controlled from the same a.g.c. line and with the same time constants. The a.g.c. now also controls the r.f.-input amplifier and an a.g.c. charging-bypass diode is incorporated to prevent the time-constant capacitor from charging during transmit and hanging up on the switch back to receive. The r.f.-gain control has been rearranged so that it varies a negative potential applied to the a.g.c. line.

Noise Silencer—There is no built-in noise limiter as in the Model 250, but through the use of rear-apron phono jacks, the circui

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between the receiver mixer and the crystal filter may be opened and a noise silencer (or noise blanker) may be installed thereat where it can be most effective, since it then functions before any noise-pulse stretching can take place at the crystal bandpass filter.

The Swan Model NS-1 Noise-Silencer accessory is available for the job. It consists of a two-stage 10.9 mc amplifier using f.e.t.'s with the often found i.f. noise-limiter setup using two self-biased diodes shunted across the amplifier output as shown at fig. 3. Operating voltage is obtained from a third phono jack.

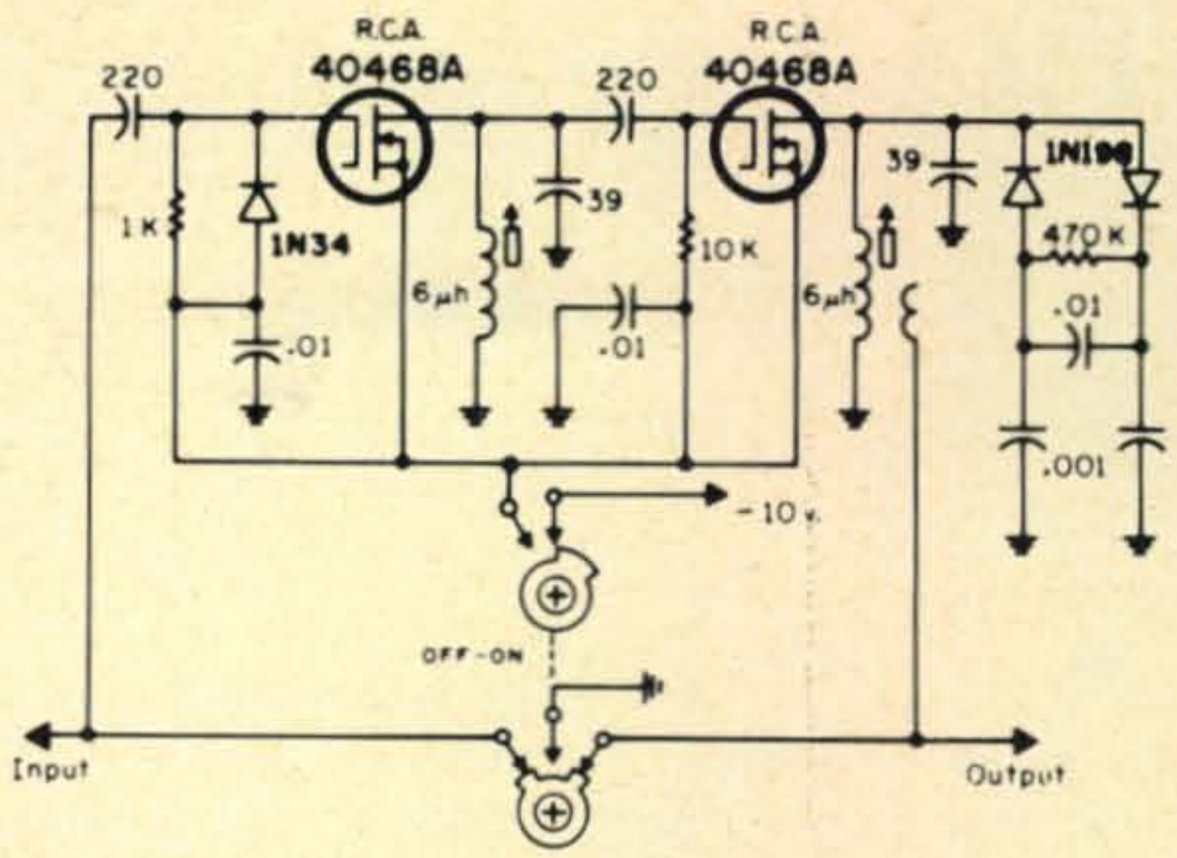


Fig. 3—Circuit for the Swan NS-1 Noise Silencer for use at J_1, J_2 (fig. 1). Two f.e.t.'s make up a 10.9 mc amplifier with self-biased noise-limiting diodes shunting the output.

Transmitter—The only apparent changes related to the transmitted section are that a 6JH8 is used in place of a 7360 in the balanced modulator, auxiliary relay contacts are located on the antenna-transfer relay instead on the XMT-REC relay, the latter relay switches the screen and plate voltages on or off for receive and transmit as needed on the related stages without simultaneously opening or closing the tube-cathode returns as is done in the Model 250.

Metering—Besides indicating the p.a. cathode current or relative output power, the meter now is automatically switched on receive to indicate signal strength up to 70 db over S-9. On transmit, the meter automatically indicates the p.a. cathode current; while on tuneup it shows the relative output.

Controls—The only other change in the way of controls is that the mode switch selects either u.s.b., l.s.b. or provides for a.m. on receive. The function switch has five positions: CALIBRATE, RECEIVE, TRANSMIT, C.W. and TUNE.

The normal operating position for s.s.b. or a.m. is at RECEIVE, in which case either v.o.x. or p.t.t. operation may be had. An outboard accessory is required for the latter. The Swan VX-2 v.o.x. accessory is a solid-state affair which also may be used for v.o.x.-type of break-in with c.w.

R.F. Filtering—The rear of the socket for the connections to the external power supply is enclosed in a copper box with r.f. chokes therein and feedthrough-type bypasses employed on the voltage-supply lines for minimizing stray r.f. radiation or TVI. The power-supply requirements are the same as those for the Model 250.

Performance

The performance of the 250-C, both on receive and transmit, was found to be essentially the same as reported earlier for the Model 250, but with the following exceptions or additions:

RECEIVER NOISE FIGURE: 3 db. SENSITIVITY: 0.1 μv for 10 db S+N/N (on s.s.b.). The front-end apparently is optimized for operation on the lower portion of the band, inasmuch as the gain and the sensitivity both decreased as the receiver was tuned higher in frequency, particularly above 52 mc with an eventual drop in sensitivity to 1 μv for 10 db S+N/N at 54 mc.

IMAGE REJECTION: 80 db with receiver tuned to 50.2 mc, 60 db at 51 mc. Where operation usually is conducted at the higher frequencies and if adverse images thereat are experienced, the 28 mc trap may be retuned for higher rejection. This must be done with a tool passed through the p.a. compartment, so extreme care must be taken to avoid contact with high voltage therein.

Spurious-Signal rejection otherwise was at least 60 db and i.f.-signal rejection was 70 db. A more desirable a.g.c. release time also was experienced.

The Swan Model 250-C 6-Meter Transceiver is priced at $420, less power supply. It is a product of Swan Electronics, Oceanside, California. —*W2AEF*

Troubled with TX-I? Read this month's Q & A Column on page 78

See page 110 for New Reader Service

CQ Reviews:

The S-DeC Unit

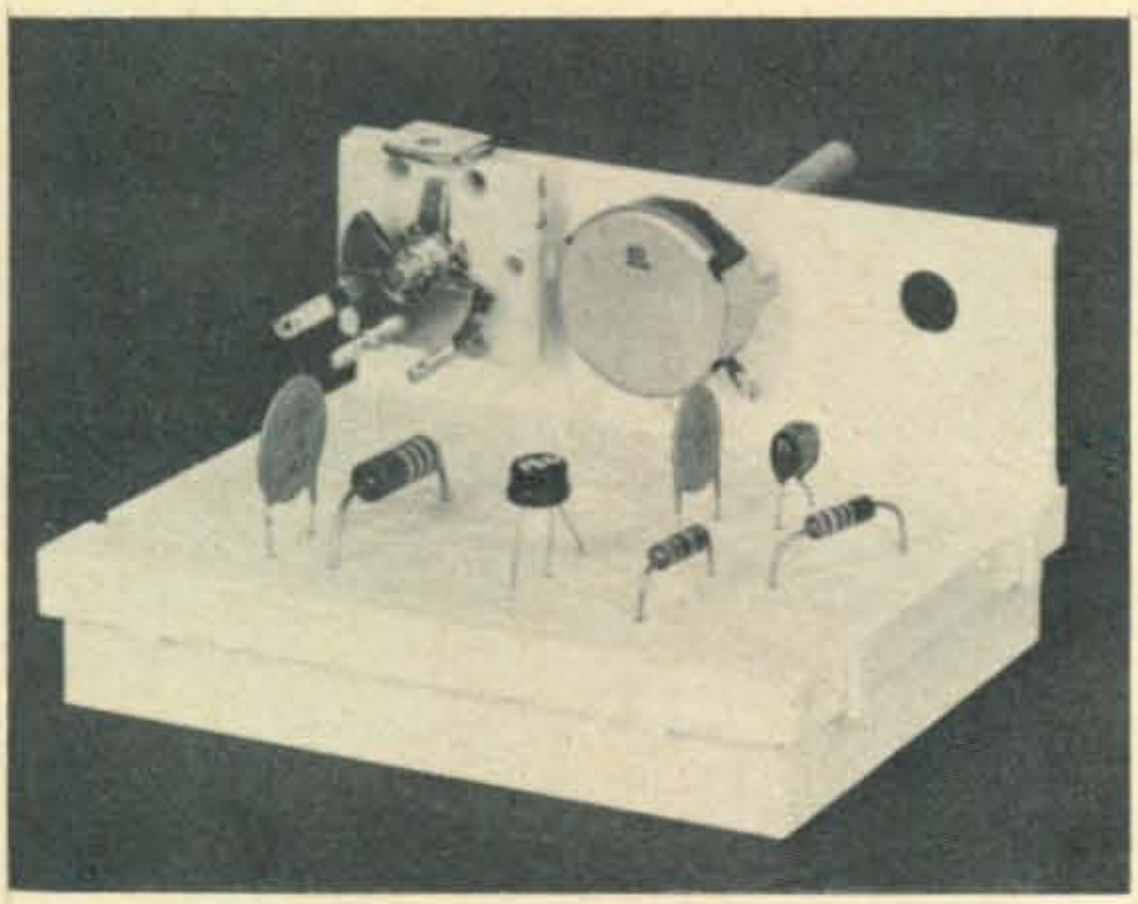
BY WILFRED M. SCHERER,* W2AEF

A RECENT product is the S-DeC unit which is a universal-type circuit board into which electronic components may be inserted and automatically interconnected for rapidly breadboarding electronic projects, experimental or developmental circuits, test setups, etc., without the need for soldering

Each S-DeC consists of a 4¼" × 2¼" × 7/8" plastic box on the top of which are 70 holes. In back of each hole is a phosphor-bronze dual-leaf spring-type contact which grips the component lead when it is inserted into the hole. Wires up to .040" or number 18 may be accepted. The contact points are divided between two independent panels, each of which has 7 rows of 5 contacts each. The contacts in each row are connected together and thus form one circuit run to which 5 separate wires from different components may be connected.

As shown at fig. 1, each contact hole is identified by a numeral for a reference that makes it possible to plan aforehand and note on a schematic diagram the individual contact holes required for each component.

*Technical Director, *CQ*.



An S-DeC shown with the accessory panel installed, illustrating controls mounted on the panel and the leads of other circuit components inserted at the contact holes on the face of the unit.

If needed, the components may easily be rearranged for circuit changes or different value-ones may be substituted simply by pulling out their leads and reinserting them at the required contact holes. This is particularly helpful where experimental projects are involved.

Also supplied with the S-DeC is an accessory kit which includes a small panel with 3/8"-diameter holes in it for the installation of controls such as a potentiometer, small switch, variable capacitor, etc. The panel mounts vertically into slots along one side of the box. In addition, solderless connections to these components may be made using small springs provided in the kit. A spring is pushed over the component lug, the connecting lead is inserted in the lug hole and the spring is then released to trap the wire lead. There also are several clips that can be mounted on the edge of the panel for holding other type components such as a small coil form or a ferrite-rod antenna.

Interlocking keyways on the sides of the box make it possible to join two or more S-DeC's together in order to provide larger circuit area or to couple together additional electronic functions.

From the radio-amateur's point of view the S-DeC would be most valuable for experimental work or for testing various set-ups; however, instructions are supplied with the S-DeC for assembling various transistorized projects, some of which may be useful for the amateur or of interest for the hobbyist. The projects include: an electronic flasher, a binary counter (×2), *L/C* oscillator, 3-stage a.f. amplifier, code practice oscillator, 3-transistor standard-broadcast radio receiver, u.h.f. microphone, light-operated switch, phase-shift a.f. oscillator and a Wein-bridge oscillator.

In respect to these, the contact holes are spaced apart by about 3/8", so where a transistor with short leads is used, it will have to be plugged into a socket the terminals of which are connected to the required S-DeC

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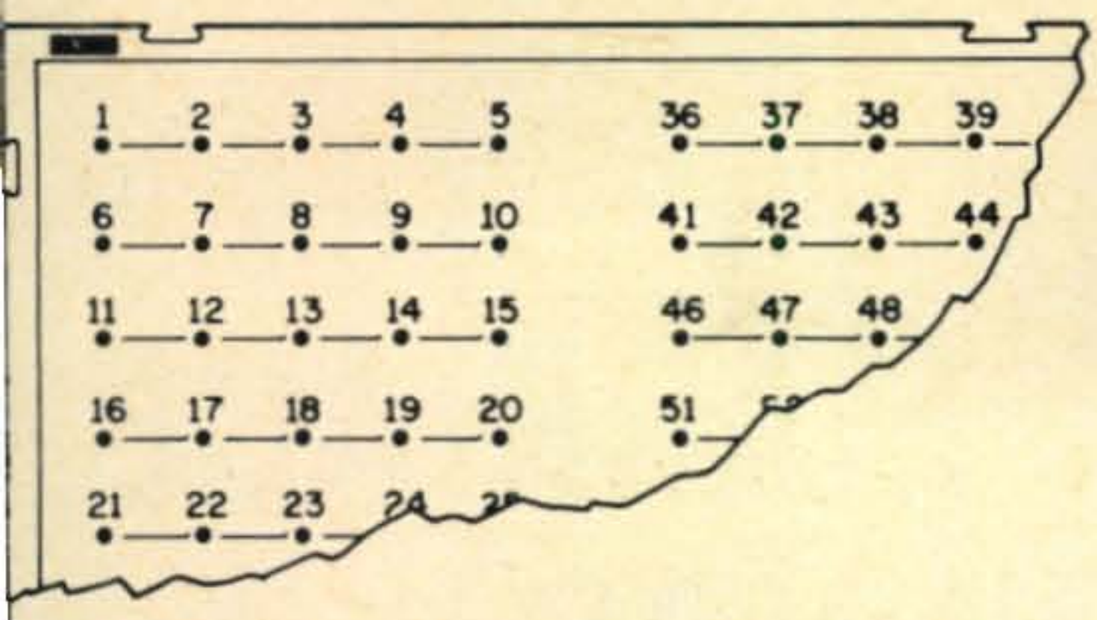

Fig. 1—Drawing of a portion of an S-DeC showing the layout for the contacts. The horizontal lines between the contact-holes show the parallel connections for each group of five contacts. Similar lines and the numerals are embossed on the S-DeC for the user's guidance.

ontacts.

So far we have put an S-DeC to good use h checking out several transistorized circuits n connection with which optimization of the ircuitry and component values was handily etermined; for checking out component alues and circuitry for low- and high-pass lters; and for setting up various *L/C* cominations to be checked with a g.d.o. for a esired frequency.

Technical specifications for the S-DeC are s follows:

Insertion & Withdrawal Forces (.040" ire) after 1000 insertions: 2-3 oz. wt. Resisance between adjacent contacts (total): 10 egohms. Insulation resistance between djacent rows: 10,000 megohms. Capaciance between adjacent rows: 3 mmf. Conacts: Phosphor-Bronze to BSS 407/2 selfnish: Maximum Temperature: 70° C.

The S-DeC is priced at $5.75 complete ith the accessory kit and a leaflet of procts. Also included is a jig for shaping the omponent leads to the correct dimensions lated to the required contact holes. The upplier is Intratec , 399 Jefferson Highway, rlington, Virginia 22202. —W2AEF

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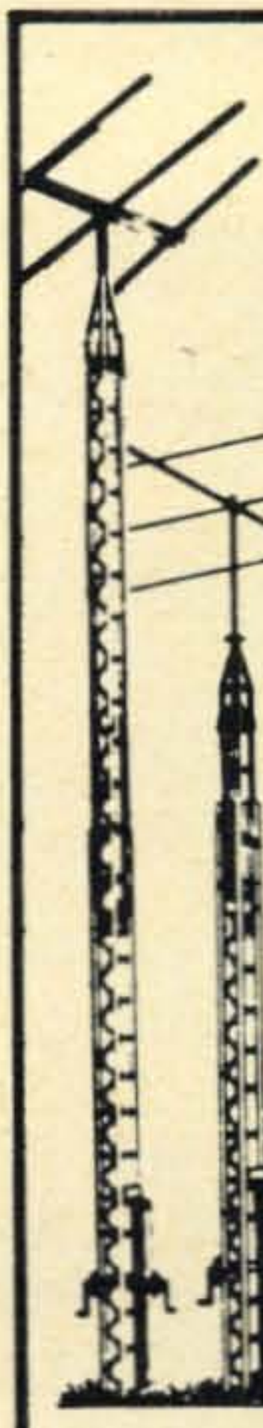

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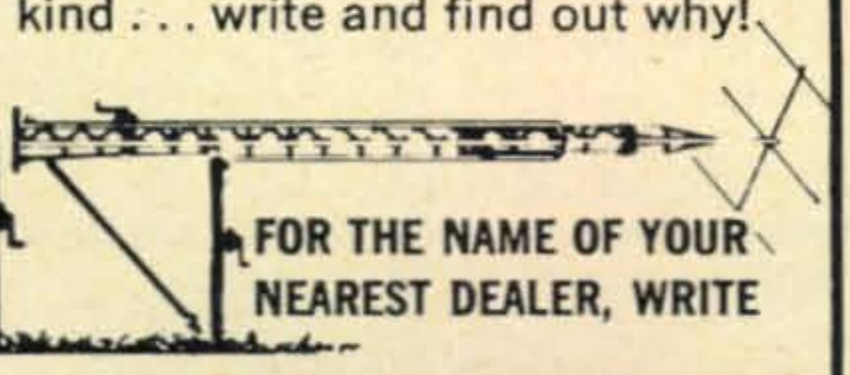

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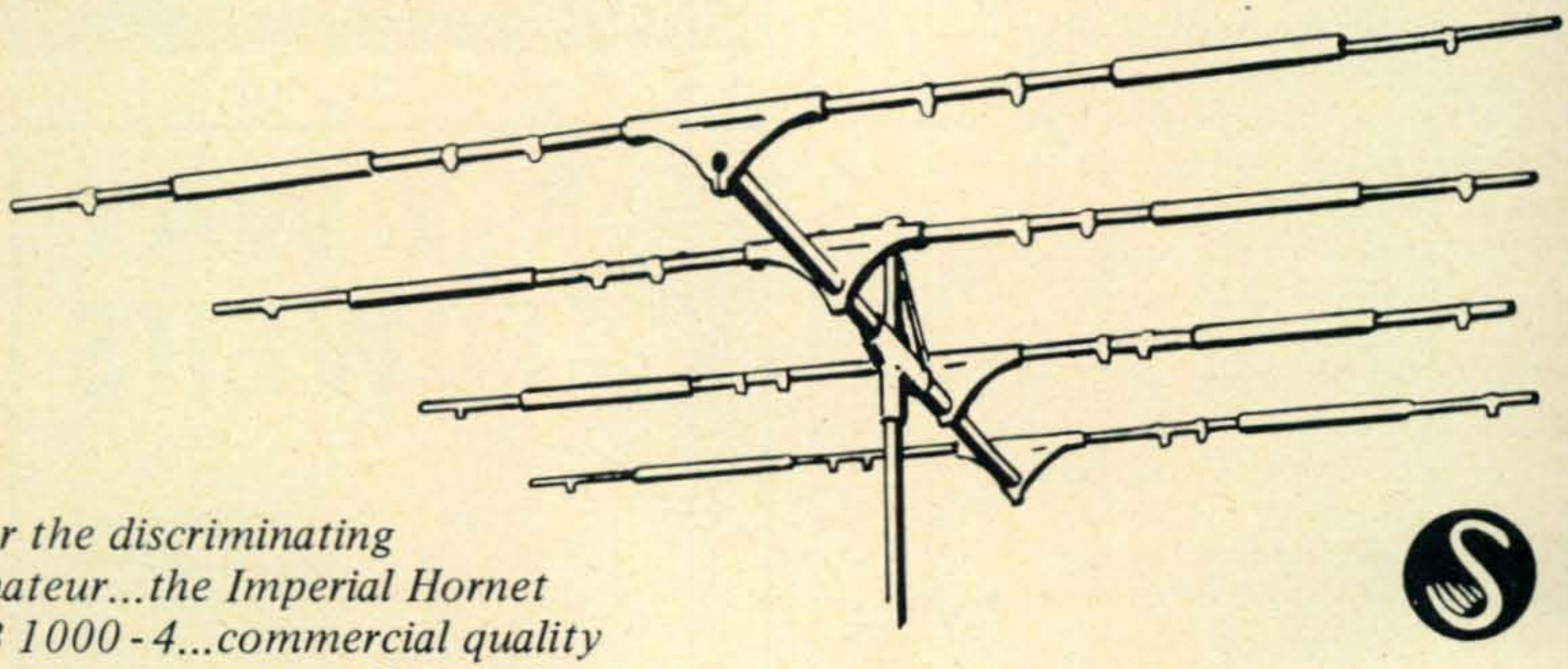

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CONVERTING THE HEATH CB-1 TO SIX METERS

BY WALLACE O. ENDERLE,* W6GNV/4

This article describes the conversion of a CB transceiver to 6 meter operation. Also included is a simple audio squelch circuit.

THE necessary complexity in equipment which is required as a result of crowding on the citizens band has relegated the venerable Heathkit CB-1 to the back shelf in many areas of the country. On the other hand, the Heathkit "Sixer," which is very similar in design, has an excellent current reputation on six meters since crowding is seldom a problem. Conversion of the CB-1 to six meters is quite a simple and inexpensive job, but you should be sure that the unit works on the citizen band before tackling the conversion.

Obtain the following items for the receiver portion of the conversion and tackle it first:

4½ inch length of insulated hook up wire #18 to #22).

1 each 50 mmf 600 volt disc ceramic capacitor.

4½ inch length of heavy insulated wire or RG-58 coax.

The part numbers in the step-by-step instructions refer to the schematic on page 6 of CB-1 Manual.

1. Remove 270K resistor (R_{205}) from across antenna jack. Simplest method is to break the resistor in half and clip off the ends.

2. Remove wire connection between antenna jack and trimmer capacitor (C_{209}).

3. Rotate the antenna jack one half turn so that its ground lug is next to the trimmer capacitor C_{209}.

4. Remove trap coil (L_{203}) from across trimmer capacitor C_{209}.

5. Solder adjacent end of trimmer C_{209} to the ground lug of antenna jack.

6. Carefully remove the heavy insulated wire between the end of trimmer C_{209} and pin 12 of TRANSMIT-RECEIVE SWITCH.

7. Break and remove the 2.7K resistor (R_{101}) from between pin 8 of tube 6AN8 (V_{1A}) and the tie strip lug which is connected to the center of the tube socket.

8. Remove the 12 mmf capacitor, C_{102}, across terminals of coil L_{101} and also remove 3 turns of wire from coil. This coil connects to pin 8 of 6AN8 (V_{1A}).

9. Remove the 2.2 mmf capacitor, C_{101}, from between pin 10 of transmit-receive switch and top of coil L_{101}.

10. Bare both ends of a 4½ inch length of insulated hook-up wire and connect one end to the ground terminal of coil L_{101}; make two turn link around lower portion of the coil and connect the free end of the wire to pin 10 of TRANSMIT-RECEIVE switch.

11. Remove capacitor C_{110} from across detector coil, L_{102}, and remove 3 turns from coil L_{102}.

12. Remove the 100 mmf capacitor, C_{111},

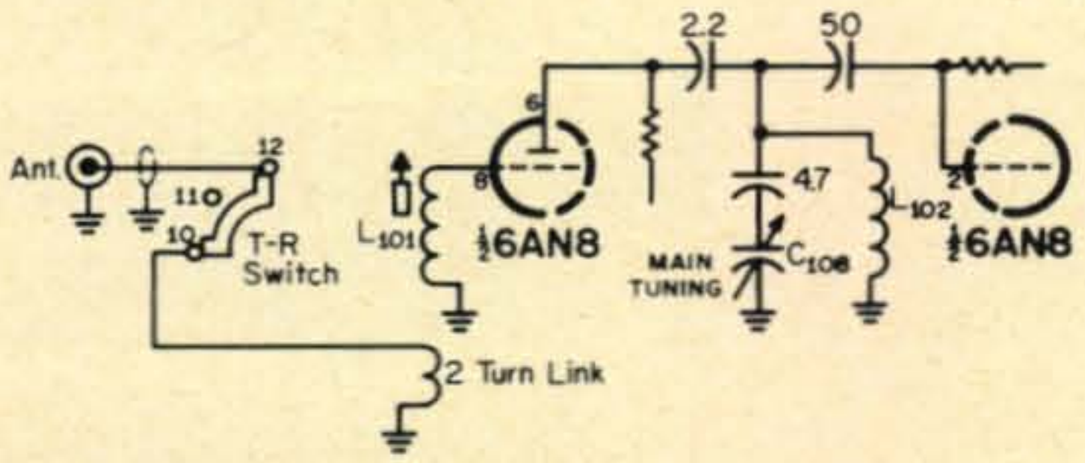

Fig. 1—Modified receiver circuit of a Heath CB-1 converted for 6 meter operation. Only the changes are shown.

*205 Maple Avenue, Fairfax, Virginia 22030.

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and replace it with a 50 mmf capacitor between pin 2 of V_{1B} and the top of the detector coil, L_{102}.

13. Remove the upper end of the 2.2 mmf capacitor, C_{107}, from the main tuning capacitor, C_{108}, and connect the end directly to top of coil L_{102}.

14. Connect the 4½ inch length of heavy insulated wire (or center conductor of same length of RG-58 coax) directly between the center pin of the antenna jack and pin 12 of TRANSMIT-RECEIVE switch. If coax is used, ground outer shield to the chassis connector at the phono plug.

Except for adjusting the tuning range and peaking the r.f. stage, the receiver is now converted for sensitive 6 meter reception. As converted, a total coverage of approximately 1.5 mc of the band is possible, and this can be set to cover the most active portion of the band by adjustment of the slug in the detector coil, L_{102}. Upon completion of the transmitter conversion which follows, use pages 41 to 44 of the CB-1 manual for adjustment techniques. The circuit, after modification is shown in fig. 1.

Transmitter Conversion

Obtain the following items for the transmitter portion of the conversion.

1-10,000 ohm 1/2 watt resistor.

1-100 mmf 600 volt ceramic disc capacitor.

1-10,000 ohm 2 watt resistor.

1-crystal, HC-6/U style, 5th harmonic cut, for desired transmit frequency (50.25 to 50.5 recommended).

Step-by-step instructions for transmitter conversion are given below.

1. Disconnect the ground lead of the crystal socket at the lug on the side of the 6AU8 (V_{4A}).

2. Remove R_{201}, 47K resistor, from across the crystal socket.

3. Disconnect and remove the lead between the crystal socket and pin 2 of the 6AU8 (V_{4A}).

4. Disconnect the ground end of the 0.001 mf capacitor, C_{202}, and connect it to the closest pin (now open) of the crystal socket.

5. Connect a 10K 1/2 watt resistor between ground and the other end of the crystal socket.

6. Connect pin 2 of the 6AU8 (V_{4A}) to the ungrounded end of the crystal socket.

7. Connect a 100 mmf capacitor from the other end of the crystal socket to ground. (Note: If crystal is not active, a 50 mmf capacitor may be used instead.)

8. Remove the 12 mmf capacitor, C_{203}, from across the oscillator coil, L_{201}.

9. Remove 3 turns from the oscillator coil, L_{201}.

10. Remove the 12 mmf capacitor, C_{208}, from across the amplifier coil, L_{202}.

11. Remove 2 turns from the amplifier coil, L_{202}.

12. Replace the plate voltage dropping resistor (R_{202}) for the oscillator section of the 6AU8 with a 10K 2 watt resistor.

13. Using the 3½ inch length of heavy insulated wire removed in step 6 of the receiver section conversion (or a 3½ inch length of RG-58 coax), connect the open end of two turn link on transmitter coil, L_{202}, to the open end of the trimmer capacitor C_{209}. If coax is used, ground the shield to the antenna jack.

14. Place a 6 meter crystal in the socket. (Note: Only harmonic cut crystals will work satisfactorily in this conversion, as in HW-29 conversion of the Sixer.)

15. Except for tune-up as indicated on pages 41 to 44 of CB-1 manual, the basic conversion is completed and a very efficient watt transceiver is now yours. The circuit of the converted transmitter section is shown in fig. 2.

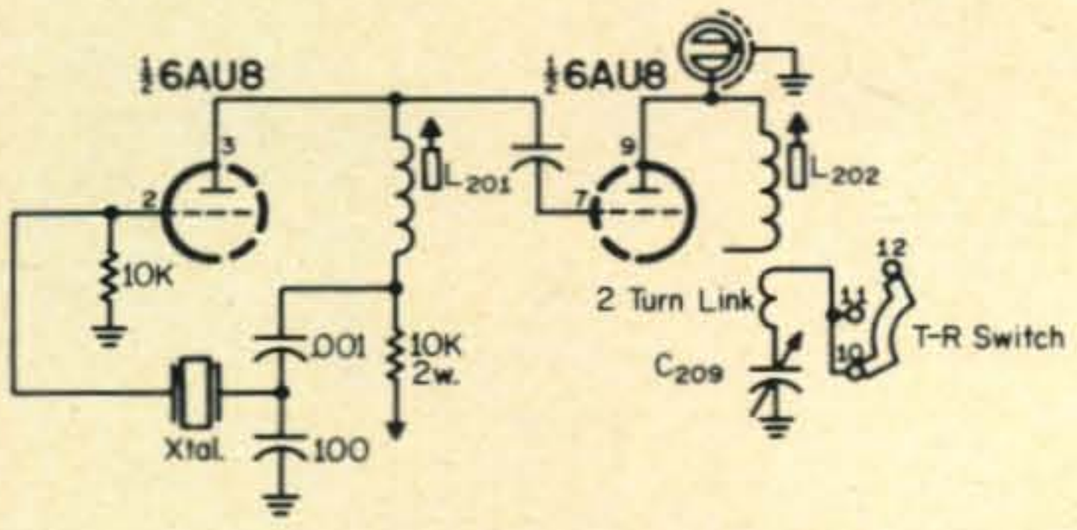

Fig. 2—Modified transmitter circuit of a Heath CB-1 converted for 6 meter operation. Only the changes are shown.

Audio Squelch

For construction and installation of the audio operated squelch circuit, the following items will be needed:

1-s.p.d.t. sensitive relay (4K to 8K, 3½ to 1½ ma respectively).

1-germanium or silicon diode such as 1N34 or 1N83.

1-NPN medium gain transistor such as 2N35A, 2N228 or 2N697 (Q_1).

1-5 ohm 1 watt resistor.

2-11K 1/2 watt resistors.

1-1200 ohm 1/2 watt resistor.

1-d.p.d.t. slide switch.

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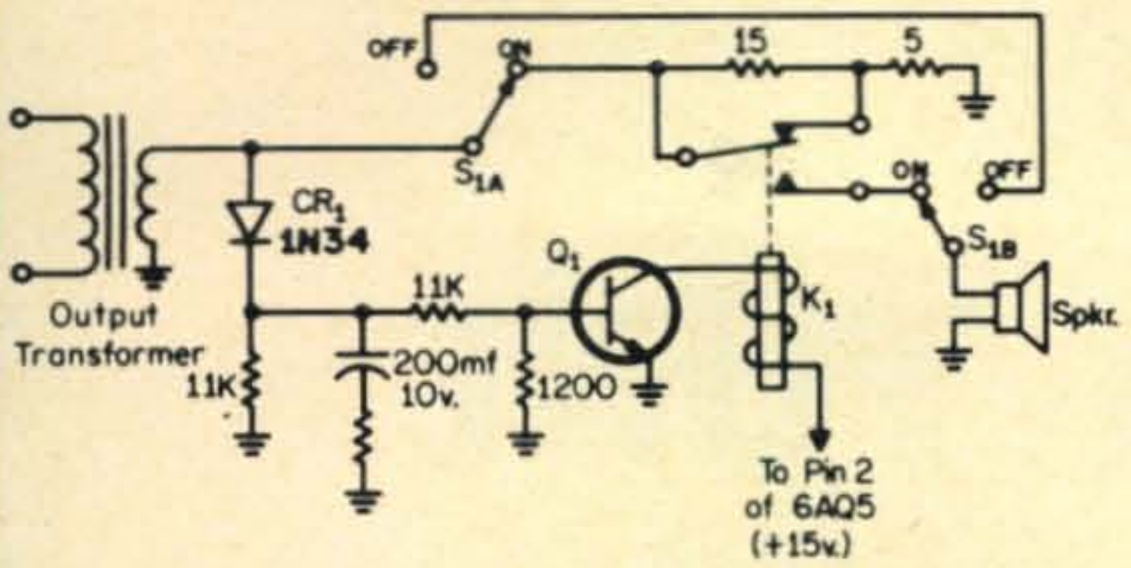


Fig. 3—Circuit of an audio squelch that can be added to the Heath CB-1, modified for 6 meter operation.

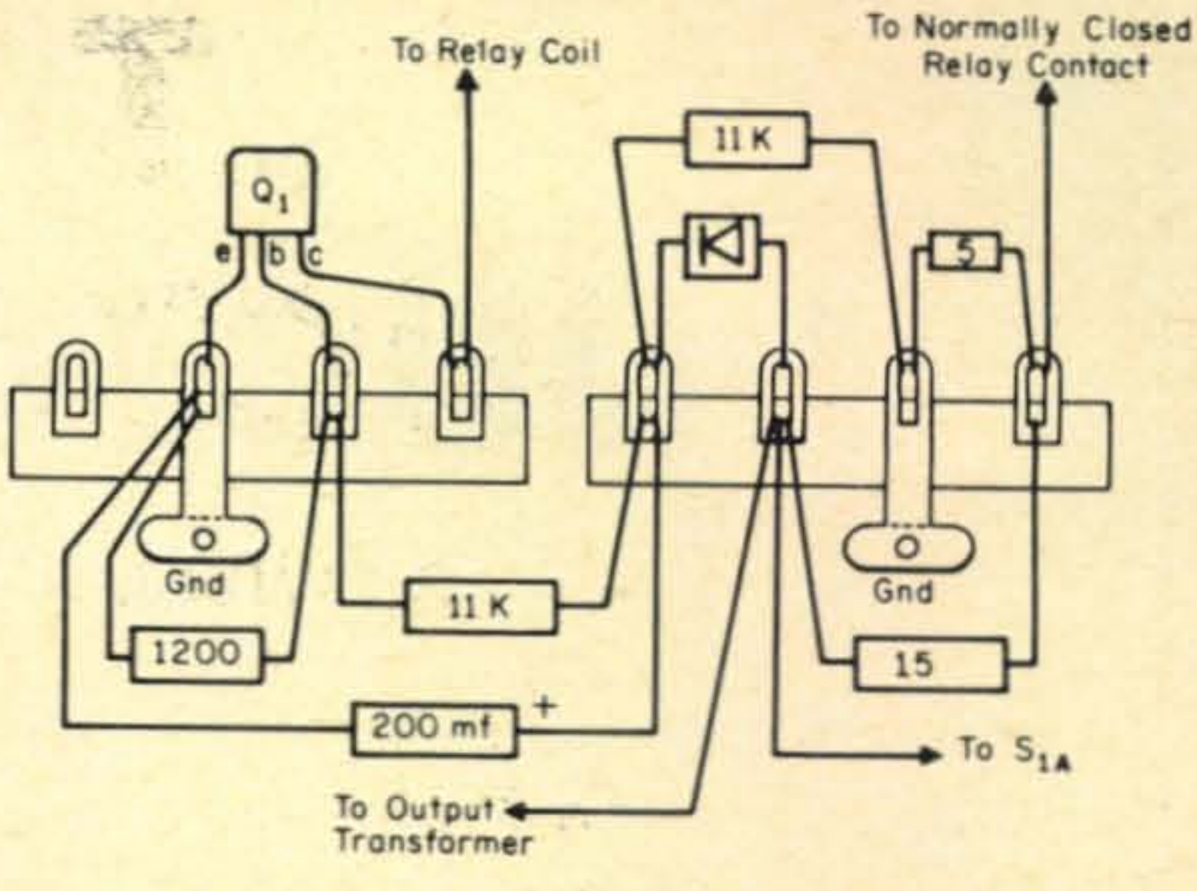


Fig. 4—Pictorial layout of the audio squelch construction.

1-15 ohm 1/2 watt resistor.
1-200 mf 10 volt electrolytic.
2-4 lug terminal strips.

The circuit of the squelch used is shown in fig. 3 and a pictorial for the construction is shown in fig. 4. The audio voltage that appears across the secondary of the output transformer is rectified by CR_1 and filtered by C_1. This voltage forward biases Q_1 so that its collector current triggers K_1 connecting the speaker to the output. Switch S_1 bypasses the squelch circuit.

The relay may be mounted on the transceiver power transformer by sanding the top of the transformer and soldering a copper or tin bracket at this point. The remainder of the circuit components mount on the terminal strips that are located on a bracket at the back of the speaker. The switch can be mounted on the front panel above the pilot and transmit lights.

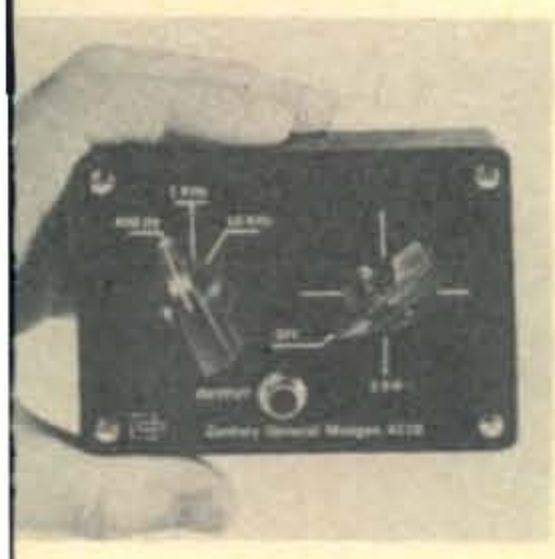
This circuit is only useful for strong local stations since it depends on the increase in audio strength of speech over the normal hiss of the superregenerative detector. With squelch on, the audio gain control must be first advanced until the circuit triggers with noise, and then backed off until the noise cuts off. A strong modulated signal will then trigger the circuit on. The 200 mf capacitor will tend to hold the circuit on during short pauses in the speech. Carrier alone will not trigger this circuit nor will it work on signals with weak modulation.

Two CB-1's have been converted in the above manner and I have had a ball with both. Hope you have the same success. ■

New Amateur Products

Diode and Transistor Checker

A NEW low-cost diode and transistor checker is being marketed by Texscan Technical Products, which is a go-no-go checker operating at very low current levels. Designated the DT-100, the device is ideal for checking semiconductor devices before and after installation in a p.c. board, and for sorting "economy bulk-packed" transistors for dead ones. The DT-100 can also be used for in-circuit testing of these components, a distinct time and transistor saver. Priced at $14.95, it is available from Texscan, Technical Products Division, 7707 Records St., Indianapolis, Ind. 46226.



Mini Solid State Audio Generator

FOR those troubleshooting jobs away from the workbench, the new Minigen 4110 pocket sized solid state audio signal generator by Century General Corp. will fill the bill. Measuring less than 3″ × 4″ × 1⅝″, the instrument supplies 0-2.5 v. output at any of three switch selected frequencies: 400 c.p.s., 1 kc, and 10 kc. The 10 kc output can be easily converted to 5 kc by a simple internal change. Stability is excellent, and the 4110 operates for months from a single 9 v. transistor radio battery. The price is $14.95 from Century General Corp., 90 Broad Street, New York, N.Y. 10004.

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THE INDUCTO-TUNER

BY WILLIAM I. ORR,* W6SAI

A versatile antenna system for 1.8 to 30 mc, patterened after the AN/SRA-25, makes use of a 35' whip, a variable impedance matching transformer, a loading coil and an s.w.r. bridge. It will also work into random lengths of wire.

AN antenna system that will operate over the complete frequency range of 1.8 to 30.0 mc is a handy device to have at hand. It permits operation on amateur bands that might normally be out of the range of the main antenna installation and also allows efficient operation on MARS frequencies plus good reception on RTTY stations outside the amateur bands. If the main station antenna becomes inoperative, the auxiliary all-frequency, general purpose antenna may be quickly pressed into use. It can also serve as an auxiliary antenna for DX operations when the user wishes to monitor two frequencies simultaneously. In addition, if the auxiliary antenna exhibits polarization opposite to the main station antenna, it is very useful when propagation anomalies render the main antenna virtually useless. All in all, if you have never used an auxiliary antenna of this type, you really don't know what you have missed in the way of convenience provided by a reliable all-frequency back-up antenna system.

The antenna described in this article is a simplified version of the military type AN/-SRA-25 antenna system designed for semi-portable, low power (100 watts p.e.p.) s.s.b. installations. The AN/SRA-25 system was a semi-automatic device that provided means for electrically adjusting a standard 35 foot vertical whip antenna for operation as a quarter-wave grounded Marconi element for four separate frequency ranges covering the h.f. spectrum. The military device was pretuned and motor driven for automatic frequency selection. The amateur version, on the other hand, dispenses with this auxiliary equipment and allows the tuner to be used with a random length wire antenna, if desired. A remote control relay system may, of course, be added by the amateur, but this (in my mind) tends to spoil the simplicity of the antenna system.

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

The 35 Foot Whip

The 35 foot vertical whip seems to be a standard item of military hardware, as it is used for fixed land-based operations and also on various Naval vessels. Indeed, when the TV shots of the Apollo-8 recovery operation were observed, the carrier *Yorktown* seemed to be bristling with antennas of this type. In any event, an antenna of this type is easy for the radio amateur to assemble and erect and is modest in cost.

If the whip is operated against ground Marconi-fashion, the terminal feed point impedance of the antenna goes through the usual gyrations covering positive and negative reactance and various values of radiation resistance, ranging from an ohm or two at 1.8 mc to several hundred or a thousand or so ohms at a point of half-wave resonance. Some form of antenna tuner is therefore necessary to transform this wide range of impedance values presented by the whip to a nominal value of 50 ohms, suitable for match to modern s.s.b. transmitters and transmission line. The reactance, too must be accounted for in some fashion.

Various antenna tuning schemes have been presented over the years. Most of them function as an L-C circuit in series or parallel with the antenna to provide the correct amount of inductance or capacitive reactance values to make the 35 foot whip appear electrically as a quarter-wave antenna. The AN/SRA-25 tuning unit does exactly this job, and include

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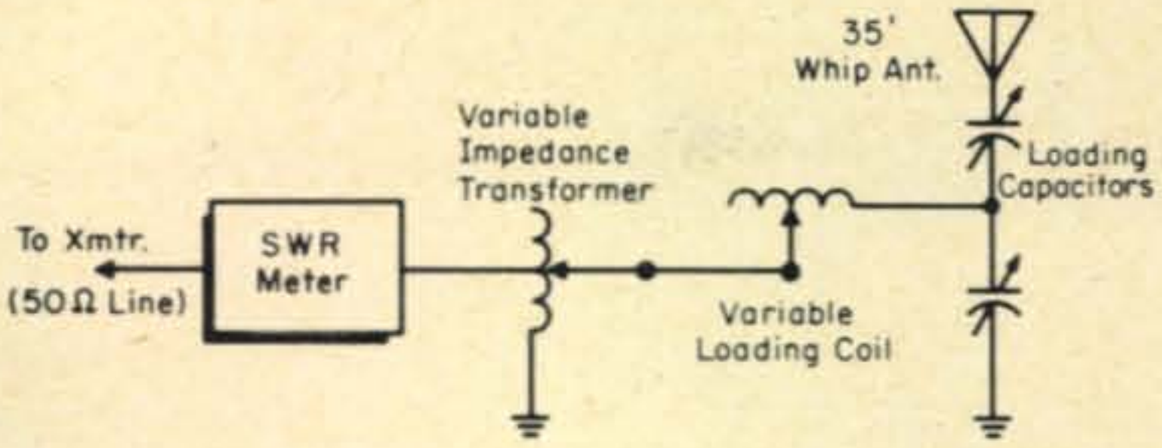

Fig. 1—Block diagram of the matching system used to feed a 35' whip over a frequency range of 1.8 mc to 30 mc. The variable impedance transformer is a center tapped rotary coil and with the loading coil and capacitors, permits matching of the antenna to a 50 ohm line. The s.w.r. bridge, incorporated into the tuner, indicates the proper match.

a unique variable transformer for adjusting the impedance of the antenna to the 50 ohm impedance of the transmission line, regardless of the transmitter frequency in the h.f. range of the antenna system.

The Matching System

A block diagram of the matching system is shown in fig. 1. The system is composed of a reflectometer device which indicates antenna impedance and reactance plus controls to adjust the degree of reactance and value of antenna impedance presented to the transmission line. A frequency selector switch permits the operator to choose the following operating ranges:

1—50 ohm dummy load
2—1.8-4.0 mc
3—3.6-7.0 mc
4—5.0-10.0 mc
5—8.0-19 mc
6—18-30 mc

The dummy load position enables the transmitter to be initially loaded for optimum performance at the proper impedance before it is switched to the antenna resonating and matching circuits.

The low frequency range (switch position 2) is covered in two segments; however. only one of these segments is available at a time. The extra frequency range extension below 2.5 mc is covered by the insertion of a fixed loading coil in series with the variable loading coil. This coil is normally out of the circuit except for operation on channels between 1.8 and 2.5 mc.

Resonance may thus be established by the series connected loading coils to provide a point of maximum current at the antenna terminal of the tuning unit. At the higher frequencies (30 mc, for example), the antenna is about two half wavelengths long and a point of high voltage exists at the antenna terminal of the unit. Sufficient inductance is therefore added to bring the overall electrical length to the nearest current loop, which is two and one-quarter wavelengths. Reactance adjustment capacitors compensate for usual excursions of reactance near half-wavelength frequency points.

At the lower frequency end of the operating range (2 mc, for example), the whip is a fraction of a quarter wavelength and must

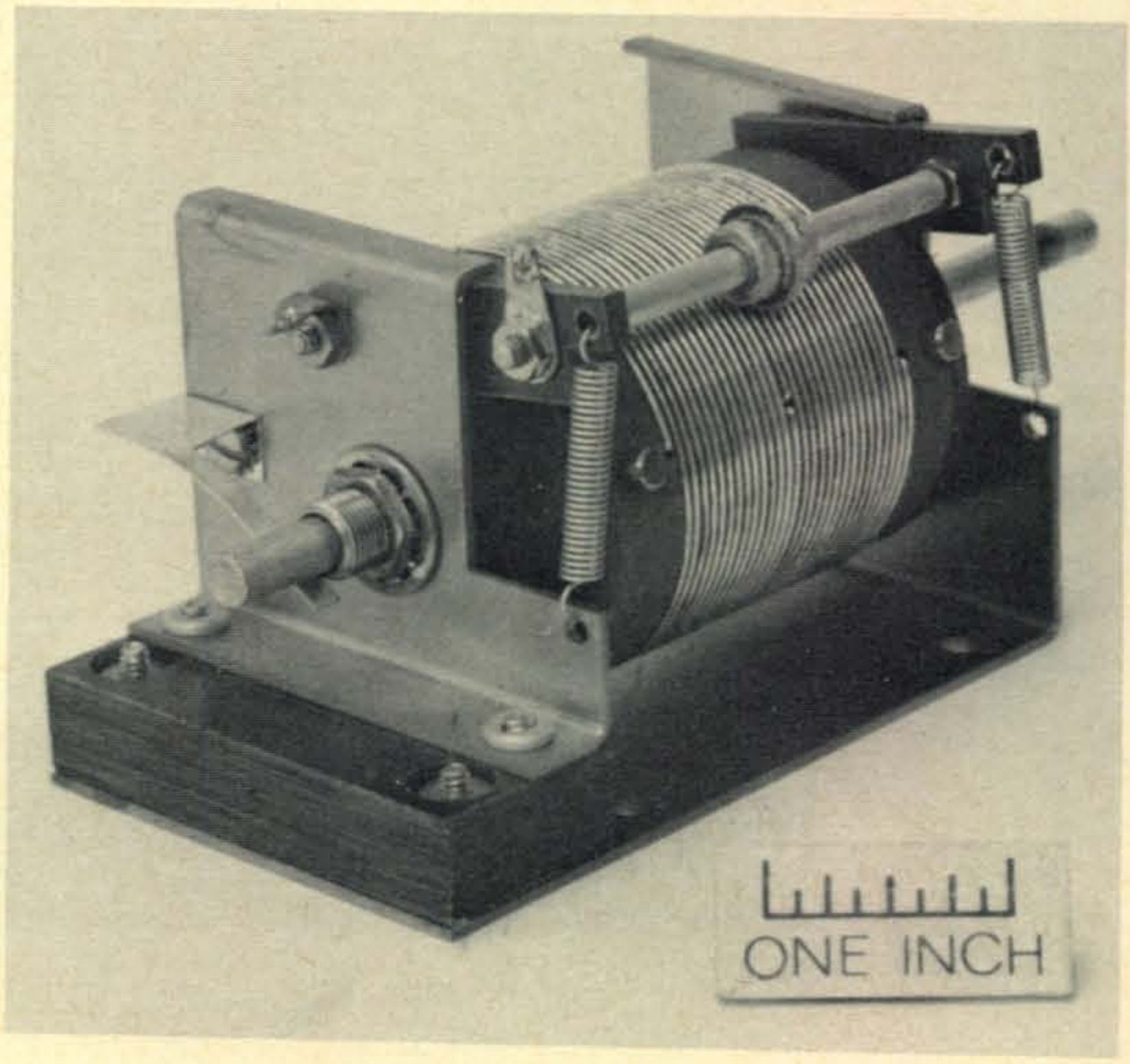

Fig. 2—Variable impedance matching transformer used in the AN/5RA-25 tuning unit is a center tapped rotary inductor. The shaft is split at the center and insulated. Wiping contacts on each end of the shaft make connection to the center tap and one end of coil winding. The opposite end of winding floats.

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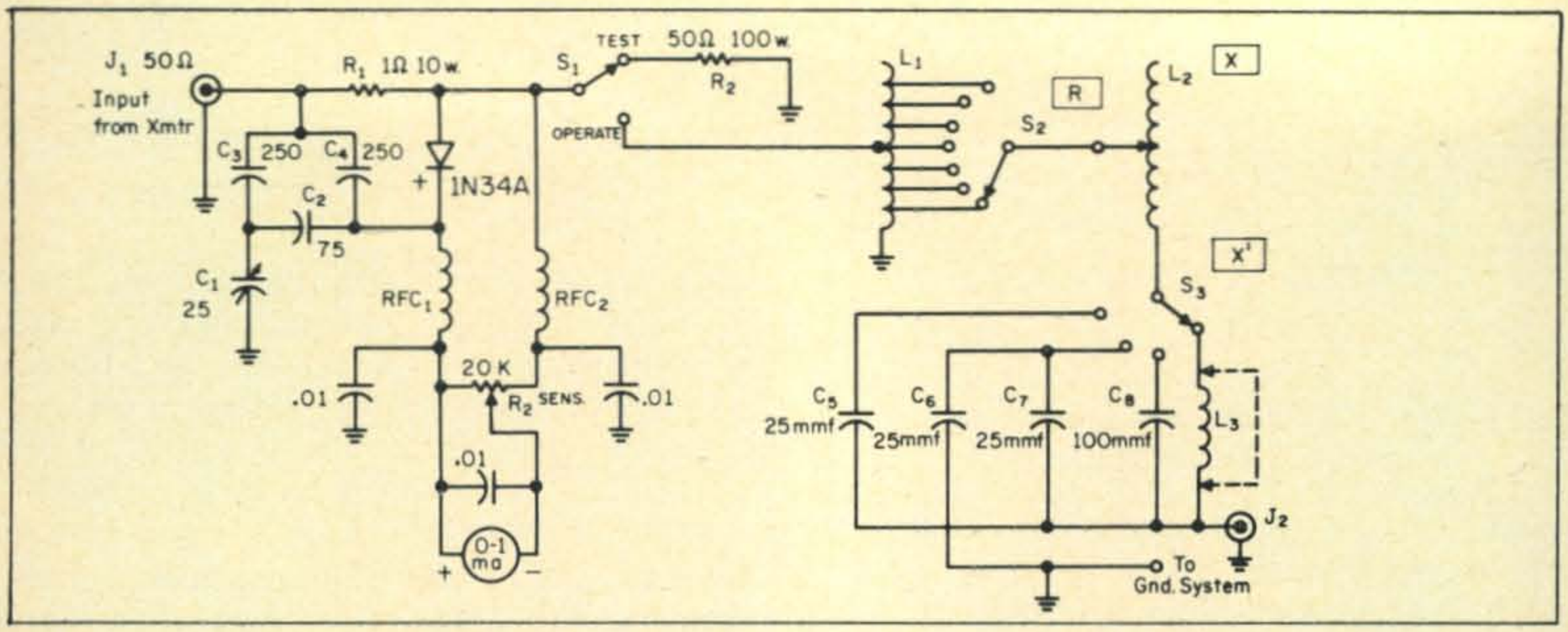

Fig. 3—Circuit of the Inductor-Match antenna tuner patterned after the AN/SRA-25 tuning unit. Components L^1 and S^2 eliminate the need for the variable impedance transformer shown in fig. 2. The two 0.01 capacitors are ceramic types.

Parts List

C_1—25 mmf ceramic trimmer; Centralab 822-CN or equiv.
C_2—75 mmf silver mica.
C_3, C_4—250 mmf silver mica.
C_5, C_6, C_7—24 mmf, 7500 volts; Centralab 850S-25Z or equiv.
C_8—100 mmf, 7500 volts; Centralab 850S-100N or equiv.
L_1—32 μh (approx.) 36 t. #20, 2" dia. 2" long tapped every 3 turns; Air Dux #1616 or equiv.
L_2—Rotary inductor, approx. 25 μh; Johnson 229-203 or equiv.
L_3—15 μh (approx.) 20 t. #16, 2" long; Air Dux #1610 or equiv.
R_1—Ten 10 ohm 2 watt composition resistors in parallel. See fig. 4.
R_2—50 ohm 100 watt non-inductive dummy load. Sprague type 453-E Koolohm or equiv. Use ten 500 ohm 5 watt resistors in parallel for 100 watts p.e.p. or 50 watts average power.
RFC_1, RFC_2—2.5 mh; National R-100 or equiv.
S_1—S.p. 2 pos. ceramic deck, Centralab 2501 or equiv.
S_2—S.p. 11 pos. ceramic deck, Centralab 2503 or equiv.
S_3—S.p. 4 pos. ceramic deck, Centralab 2501 or equiv.

be electrically loaded to establish the proper resonance. This is accomplished by the use of the rotary loading coil, just as in the case at 30 mc, however, the total inductance requires the use of the additional series-connected coil.

When resonance is established, the resistive load presented to the transmitter by the whip and series loading coil varies over a range of approximately 2 to 100 ohms. This may be transformed to a nominal value of 50 ohms by means of an air core matching transformer. In the military unit, the matching transformer took the form of a variable inductor having a center-tap connection. This coil differs from the common rotary coil in that the winding is tapped and one end is free. The opposite end of the coil is grounded. Such a device poses a tricky construction problem as the center-tap point must be brought out by means of a wiping contact to provide electrical continuity as the coil is rotated. The unit used in the AN/SRA-25 tuning unit is shown in fig. 2. The shaft of the inductor is split and insulated at the center and the two portions are joined by a phenolic coupling. Wiping contacts at the shaft ends permit two rotary joints to make connections to the coil center-tap and also to the moving tap point. The supports at each end of the inductor are insulated from each other and electrical connection to the unit is made at these supports.

When the rotary inductor is set so the moveable tap is at the mid-point of the coil, the transformation ratio is 1:1. As the coil is rotated and the tap moved towards the ground end, a step-down ratio is achieved, which increases in magnitude as the tap approaches the grounded end of the coil. On the other hand, when rotation is reversed, the moveable tap approaches the free, or "hot" end of the coil and a step-up ratio is achieved, which increases in magnitude as the tap approaches the free end of the coil. Thus the resistive component of antenna impedance may be matched over a large range by rotating the variable ratio transformer.

The two main controls of the matching

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unit thus provide impedance transformation and reactance cancellation over the operating range of the tuning unit. Since fixed high voltage series capacitors are used, no high voltage buildup on variable air capacitors occurs in the unit and danger of flash over is nonexistent. This is especially important when the unit is used in humid climates or at high altitudes.

The Inducto-Match

An amateur version of the military unit may be constructed without the necessity of using the rotary matching transformer, which is a difficult unit to build. A satisfactory substitude for this unique device is a tapped transformer which, while not affording infinite resolution, provides a sufficient number of discrete transformation ratios so that the match to the antenna may be made very close. As in the case of the military unit, a simple s.w.r. meter is incorporated in the device to permit the operator to establish the correct settings of the various controls. A schematic of the Inducto-Match is shown in fig. 3. The panel identifiers of the various controls are shown in boxes.

To the left of the TEST-OPERATE switch, S_1, is a simple s.w.r. meter connected in *reverse* position. When the s.w.r. ratio at the input terminals is 1:1, the meter will read zero, with increased reading for higher values of s.w.r. Thus it is only necessary to "tune for zero" to establish correct antenna resonance. The bridge capacitor of the s.w.r. meter is made up of three separate silver mica capacitors connected in a triangle, as shown in fig.4. This tends to provide a better meter null at the higher frequency end of the spectrum.

The bridge resistor, R_1, is made up of ten 10 ohm, 2 watt composition resistors grouped in a bunch and parallel connected. The physical arrangement is also shown in fig. 4. Leads should be reasonably short. The leads from the r.f. chokes to the meter contain only d.c. and their length is not critical.

The TEST-OPERATE switch, S_1, permits the operator to select the antenna tuner or a dummy load as the terminating device. When placed in the OPERATE position, the antenna tuner is in use. Coil L_1 is a length of air wound inductor mounted to the back of switch S_2 by its leads. Coil L_1 is placed at right angles to coils L_2 and L_3. Rotary coil L_2 is run from a counter dial, while coil L_3 is placed to the rear of L_2, and is shorted out for operation above 2.5 mc. The simplest way to accomplish this is to jump the coil with a short length of wire having copper battery clips at the ends. The jumper is removed for operation below 2.5 mc. Reactance switch, S_3 and its capacitors are placed near the antenna terminal, J_2.

Aside from the placement of parts in the s.w.r. bridge, construction of the Inducto-Match is not critical. It is only suggested that sufficient space be allowed around the inductors so that their Q is not degraded by the presence of nearby cabinet walls or other large metallic objects.

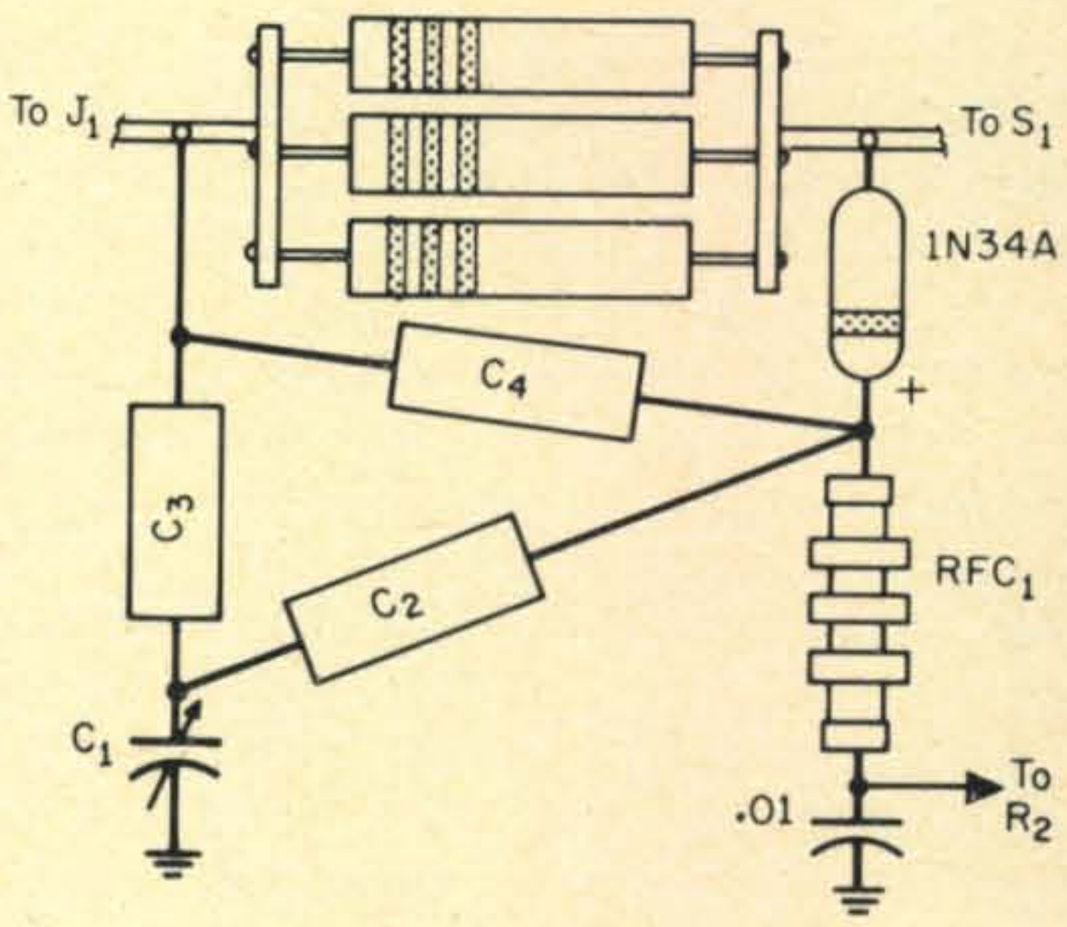

Fig. 4-Recommended physical layout for the s.w.r. bridge components. Resistor R_1 is made up of ten 10 ohm composition resistors mounted between two 1" diameter copper discs.

Moni-Match Operation

Operation of the Moni-Match is very simple. The antenna is attached and the transmitter tuned up with the TEST-OPERATE switch in the TEST position. The transmitter is tuned into the dummy load with reduced transmitter power. The switch is then thrown to the OPERATE position. Unless by a fortunate stroke of fate, the tuning unit will not be properly resonated and a reading will be observed on the s.w.r. meter. The SENSITIVITY control is set to provide a near-full scale reading on the meter. The impedance transformation switch (labelled R), the reactance switch (labelled X'), and the rotary coil (labeled X) are varied until the s.w.r. reading declines. With proper setting of these controls, the meter reading may be made to approach zero, indicating that the transmitter "sees" a 50 ohm nonreactive load.

It is recommended that tuning be done at low power, especially when "hunting" for

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the proper settings of the controls. Sensitivity of the s.w.r. meter is sufficient that good readings may be obtained with power levels as low as 10 watts.

Ground Systems

A final word about the ground connection. As with any Marconi antenna system, overall system efficiency depends to a great extent upon the resistance of the ground system. Most grounds are none too good and an effort should be made to establish as good a ground as can be obtained under the circumstances. The ground should be backed up with a few radial wires cut to the most-used operating frequencies.

In the author's case, the ground system is composed of two ground rods driven into clay type soil, plus three sets of radial wires cut for 3.8 mc, 7 mc and a MARS frequency in the 2 mc region. Two radials are used for each frequency and each radial is a quarter wavelength long. All radials are connected in parallel at the junction of the ground rods, and a short, heavy strap is run from this junction to the Moni-Match unit. The mediocre ground, backed up by the radials does a fine job at the lower frequencies. At 14 and 21 mc, the ground system seems to function well as the antenna performs and no r.f. is noticed on the equipment or the microphone.

At 28 mc, a bit of r.f. on the microphone was noticed, and advancing the audio gain control of the transmitter brought about a feedback condition. This was promptly cured by attaching a single "radial" wire 8'6" long to the rear of the transmitter cabinet and letting it fall to the floor behind the operating table. The feedback disappeared and operation was normal on all frequencies.

The low frequency radials are made up of insulated wire, stapled to the sides of the house and the fence about a foot or two above the ground. The position or height of the radials is not important, so long as they do not actually lay on the ground. The radials form part of a tuned system which is severely detuned if the radials are allowed to run along the surface of the ground.

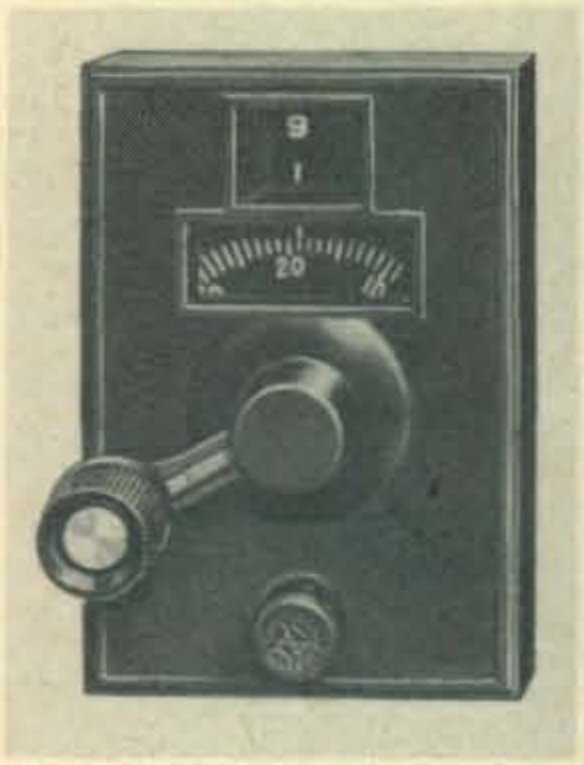
While this particular system was designed to be used with a 35 foot whip or wire antenna, it has been used with various other antennas of random lengths. Conceivably, an antenna length could be found which would not be tuneable with this device at some certain frequency, but over the months of use, such an unlikely length has never been found. At the present time, it is used with a 70 foot wire for operation over the 1.8 to 7.3 mc frequency range with good results. It has also been used with a 190 foot wire antenna over the same frequency range, and also on 80 and 40 meters with a 12 foot whip.

The components specified in fig. 3 were designed to be used up to the 500 watt p.e.p. level with a Swan 500-C transceiver. Operation at the 1000 watt p.e.p. level with a Collins 30L-1 linear amplifier has produced good results, with no damage to the tuner or flash-over at switch points. ■

New Amateur Products

Millen Counter Dial

A RUGGED new turns counter dial has been developed by the James Millen Manufacturing Co. Designated the #10031 dial, the new design feature a 0-99 turn digital readout and a vernier scale calibrated 0-100. A crank handle and dial lock are built in as is a 1/4" drive shaft coupling. The new smaller size dial is ideal for those vacuum variable capacitors and rotary inductors as described in the "Inducto-Turner" article above. The bezel is replaceable with a larger size one where it is necessary to match the older type Millen #10030 turns counter dial. For more information and mechanical specs, write Mr. Wade Caywood, Sales Manager, Millen Manufacturing Company, 150 Exchange Street, Malden, Mass. 02148.



Snaplite Call Letter Sign

AMATEURS wanting to display their call letters on their cars will welcome a new lighted sign by Snaplite Displays, Inc., which is designed to mount on the car's package shelf so the illuminated call is visible through the rear window. The sign measures 12" × 3" × 1" thick; the call letters are in reverse on a black field. The Snaplight sign sells for $9.95, from Snaplight Displays, Inc., Rockford, Ill.

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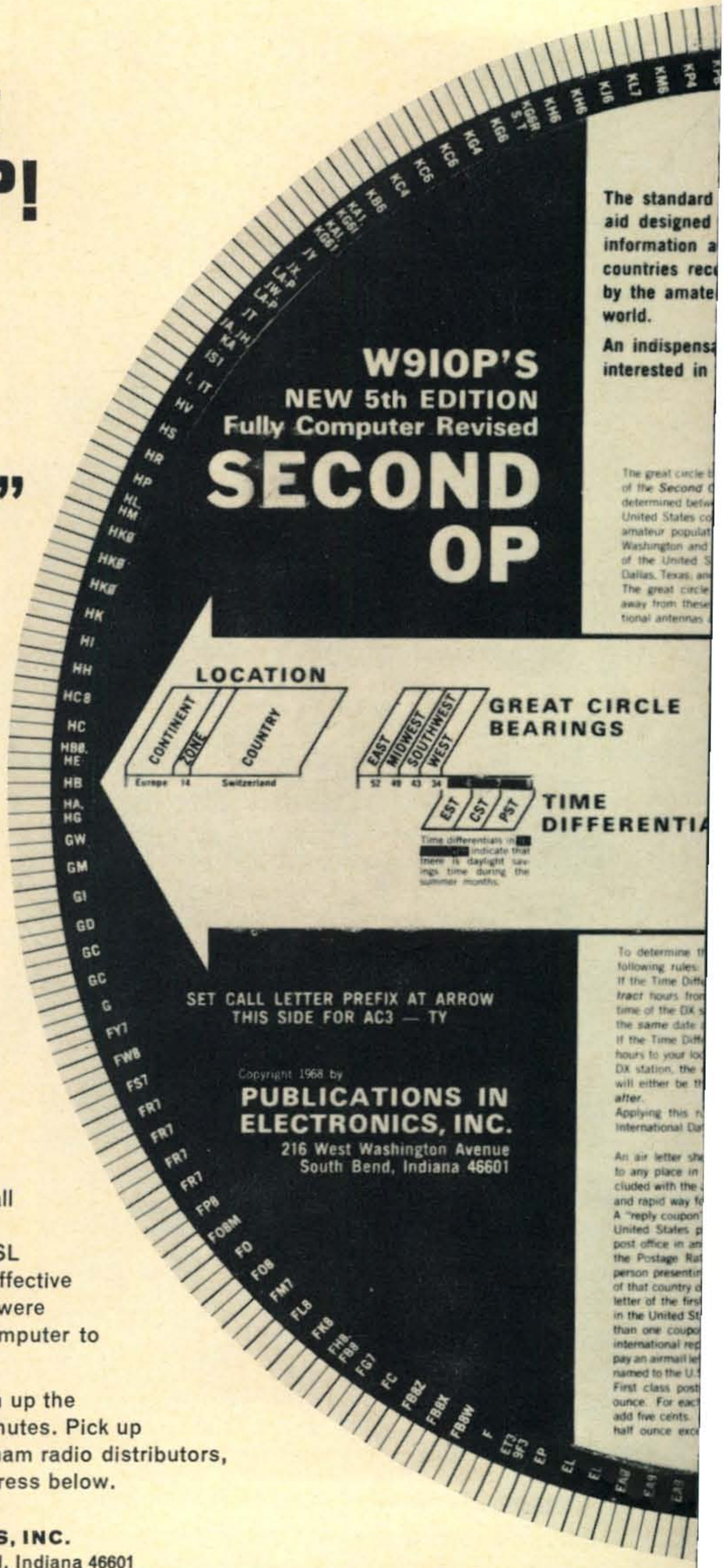

AUSTRALIS-OSCAR

Amateur Radio's Next Satellite In Space

BY GEORGE JACOBS,* W3ASK

If all goes according to plan, Australis-Oscar, the fifth in a series of satellites designed and built by radio amateurs, is expected to be launched early this Fall. In anticipation of this event, W3ASK, CQ's Space Communication Editor, discusses the technical characteristics of the satellite, how its signals can be received and tracked, how its telemetry signals can be used for scientific experiments, and how QSL cards can be obtained for space-listener reports.

THE design and construction of the AUSTRALIS-OSCAR satellite began "down-under" during 1965, under the direction of thet Melbourne University Astronautical Society. It was built, as are all OSCAR amateur radio satellites, entirely on a voluntary basis, and without payment to the project's participants. Although the Wireless Institute of Australia gave the project a small grant for the purchase of materials, most of the components used in the satellite were donated by Australian firms.

The satellite was completed and shipped to Project OSCAR headquarters in California during mid-1967 for final testing and to await assignment to a launch vehicle. This past spring it was shipped across the continent to AMSAT[1], where it is now going through final preparations for a hoped-for piggy-back ride into space aboard a NASA vehicle early this fall.

The Satellite

AUSTRALIS-OSCAR 5, as it will be called once it is successfully launched, is a 35-pound rectangular satellite, measuring 17 × 12 × 6 inches. Its aluminum case has been designed to withstand the accelleration and vibration that the satellite is expected to undergo as it rides into space. It is hoped to keep the internal temperature of the satellite within limits by applying a special paint pattern to its surface.

The electronics within the satellite is reresented in fig. 1. Two telemetry-beacon transmitters aboard will operate in bands allocated internationally to the radio amateur service. One transmitter will operate on 144.050 mc in the two meter band, with a power of 50 milliwatts. Operation will be continuously from the time the satellite is put into orbit until its batteries are exhausted, about two months later.

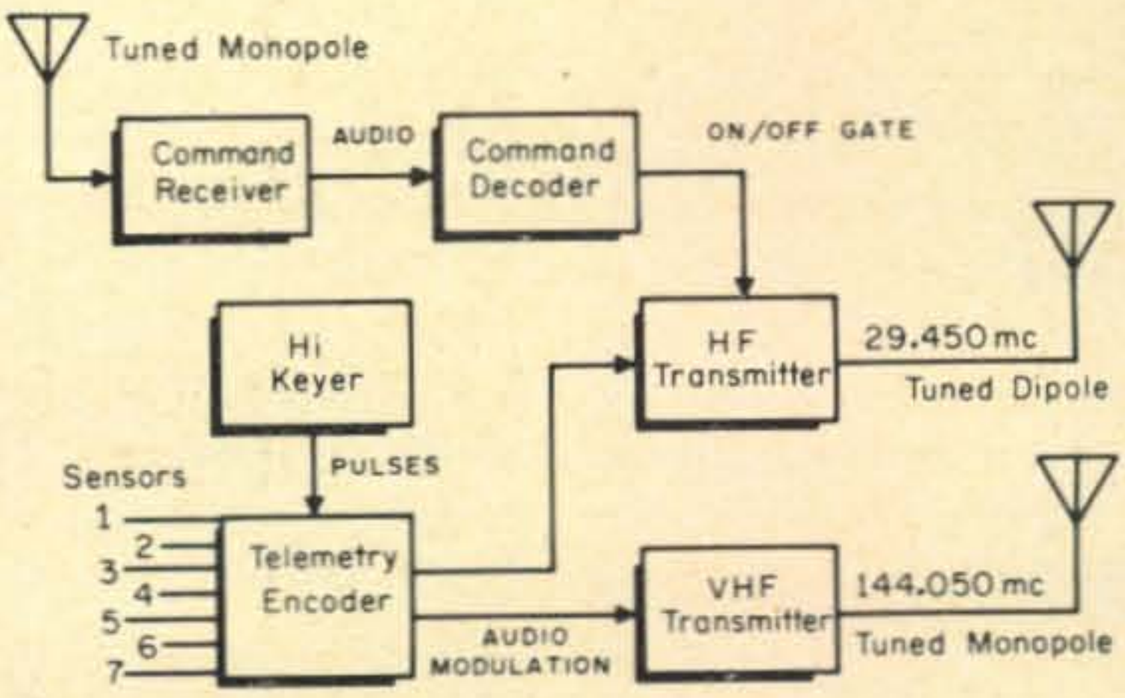

Fig. 1—Block diagram of Australis—Oscar 5 satellite's electronics.

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

[1]Jacobs, G., "Radio Amateur Satellite Corporation (AMSAT) Formed On East Coast". *CQ*, June, 1969 p. 52.

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AMSAT members examine the Australis-OSCAR A satellite after receiving it from Project OSCAR Headquarters.

The second transmitter will operate on 29.450 mc in the ten meter band, with an average power of 250 milliwatts. It will be commanded to switch on and off by a number of pre-selected, specially equipped amateur radio tracking stations. The command decoder and receiver system in the satellite will be activated by coded signals transmitted by these stations. It is planned to operate the ten meter station only on weekends in order to conserve battery power. Turn-on time is planned for about 0700 GMT Fridays, and turn-off time about 0700 GMT Mondays. This should enable all parts of the world to receive data from the ten meter transmitter.

Power for the satellite is supplied by 28 size "G" manganese alkaline cells wired in two identical 20-volt series strings. Each string supplies one transmitter, and the rest of the electronics is run from both strings through protective diodes. If one string should fail, only one transmitter would cease operating, but the rest of the system would continue to function.

The satellite also contains a HI Morse Code keyer and a seven channel telemetry system which relays to earth temperature, spin rate and battery measurements.

Antennas will rise from four of the satellite's six faces. A 17-ft. tuned dipole will be used with the ten meter transmitter, a 19-in. tuned monopole with the two meter transmitter and a short receiving antenna will pick up command signals from the ground.

Once in orbit, the satellite is expected to have an initial spin rate of approximately 4 r.p.m. A magnetic attitude stabilization system (MASS), which consists of a permanent bar magnet and permalloy hysteresis wires has been designed to stabilize the satellite after a few days, so that one of its faces will always be pointing towards the earth. This is expected to reduce tumbling and eliminate signal fading which bothered reception of signals from previous OSCAR satellites. The Australian-built satellite will be the first amateur satellite to employ such a system.

Satellite's Purpose

AUSTRALIS-OSCAR 5 *will not* contain a transponder, and it will not be possible to communicate through it. The satellite is intended instead to be a flying laboratory which will serve as a testground for systems and techniques that will be used to develop more advanced models of amateur communication satellites in the future.

This will be the first satellite to operate on 10 meters. Since there are a greater number of receivers among radio amateurs and space-listeners that can tune ten meters, a greater participation in satellite tracking, telemetry decoding and propagation studies is expected this time than was the case with previous OSCAR satellites. The satellite's transmissions on 10 and 2 meters are expected to yield much worthwhile scientific data about the ionosphere during the present period of relatively high solar activity.

Orbit

The chances are excellent that the AUSTRALIS-OSCAR satellite will be placed in a sun-synchronous, circular, polar orbit.

In a sun-synchronous orbit, the satellite will pass nearest to directly overhead at the same times every day. Based on an 1110 GMT lift-off these should occur around 3 P.M. local standard time each afternoon and again around 3 A.M. local standard time each morning. The daylight passes will be from the south to north (ascending node), and the nighttime passes from north to south (decending node).

From its circular altitude of 900 miles, the satellite will "see" an area of the earth's surface approximately 4600 miles in diameter. The latitude of the receiving location will determine how many consecutive passes will be within reception range. At the equator four passes a day will be within range—two during daylight and two during darkness. At 40 degrees north latitude, about the middle of the United States, three, or perhaps four consecutive passes should be within range each afternoon and morning, while in polar regions almost every pass will be within range. On the near overhead passes, the satellite's

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signals may be heard for as long as twenty minutes. Passes to the east or west will be heard for progressively shorter duration the farther east or west they are.

Up to date orbital information will be transmitted by W1AW[2]. These transmissions will include times and longitudes of equatorial crossings (ascending nodes), as well as the approximate times the satellite will be over selected areas. Once an orbit has been established for the satellite, advance fly-by calculations can be made using the orbital parameters discussed above.[3]

The above data will help determine when the satellite will be within "line-of-sight" radio range. It should be remembered, however, that the satellite's ten meter transmitter may often be heard when the satellite is far out of range, as a result of ionospheric reflection. Out-of-range reception of the two meter transmitter may also be possible at times.

Telemetry System

The telemetry system aboard the satellite will convert impulses produced by seven strategically located sensors into audio tones. These tones will modulate both the ten and two meter transmitters, which relay the information back to earth.

An eighth telemetry channel is linked to an automatic keyer, which produces the familiar HI in Morse code. (.... ..).

The eight channel telemetry system operates in the following sequence:

Channel 0	HI identification
Channel 1	Battery current drain
Channel 2	X axis stabilization
Channel 3	Battery voltage
Channel 4	Y axis stabilization
Channel 5	internal temperature
Channel 6	Z axis stabilization
Channel 7	Skin temperature of package

In all cases the measured value is specified by an audio frequency and not by time counts as in previous OSCAR satellites.

The HI channel consists of a 1.6 second tone followed by a 1.6 second HI burst, all repeated once again for a total time period of approximately 6½ seconds. The HI is transmitted not as m.c.w. but as a.f.s.k. Thus the tones do not key on and off, but switch between two tones of different frequency. This channel is used only for identification and the tones do not convey any telemetry data.

The HI channel is followed by seven tones, each about 6½ seconds long and each sending telemetry data. The total time required to transmit HI and the seven telemetry signals is close to 52 seconds, and the cycle is repeated continuously.

The audio frequency associated with each telemetry channel may vary between 400 and approximately 2000 c.p.s. depending upon the level of the parameter being measured.

Telemetry Decoding

The telemetry system aboard the satellite has been specially designed so that it can be decoded using relatively inexpensive equipment.

One convenient method for decoding the telemetry is to use an oscilloscope and a calibrated audio oscillator. The received audio telemetry signal is applied to the vertical input of the oscilloscope and a sine wave from the calibrated oscilloscope is applied to the horizontal input. The frequency of the audio oscillator is adjusted until the Lissajous figure on the face of the oscilloscope is a stationary ellipse, indicating that both frequencies are the same.

If the oscilloscope timebase is calibrated, the audio frequency oscillator may not be required. In this case, a set number of cycles can be displayed on the scope, and the frequency determined from the calibrated timebase. If the timebase is free-running, use as little sync as possible to avoid changing the calibration.

If an oscilloscope is not available, the frequencies of the received telemetry can be matched by ear against a calibrated audio oscillator. Even with poor signal to noise ratios this method can give results accurate to within about 10 c.p.s. at 2000 c.p.s. If the signal to noise ratio is good, the best method to use is a direct-reading frequency meter or digital counter, if one is available.

If a tape recorder is used to record data, its speed should be accurate to within five percent, at worst, or results can be seriously in error.

A stop watch with a sweep second hand is almost a must to ensure that the correct channel is being measured. If the tones of two adjacent channels have approximately the same

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[2]Transmission schedules for W1AW can be obtained from the American Radio Relay League, 225 Main St. Newington, Conn. 06111. They are also published monthly in *QST*.

[3]Scherer, W. M., "The Oscalator", *CQ*, Aug. 1965, p. 54.
Giro, G., "Predicting OSCAR's Orbit With Ease", *CQ*, June, 1962, p. 58.

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frequency, it may be very difficult to tell when the transmission on one channel ended and the other began, except by the 6.5 second timing period.

The following equations *should* be used:[4]

CHANNEL 1:

$$\text{Current in milliamperes} = \frac{f}{9} - 63$$

Linear to 1400 c.p.s.

CHANNEL 3:

$$\text{Voltage in volts} = 27.5 - \frac{f}{80}$$

Linear to 1300 c.p.s.

CHANNEL 5:

Internal Temperature (C°) = .0642 f − 34.1

Linear to 1200 c.p.s.

CHANNEL 7:

Skin Temperature (C°) = .0692 f − 36.9

Linear to 1200 c.p.s.

Channels 2, 4 and 6 contain axis stabilization data. This is in binary form and no conversion will be required. The tones on these channels will change frequency as the satellite tumbles. The steadier the frequency, the smaller the spin rate. After the first few days in orbit, the satellite's MASS system should take over to reduce spin. If this works as planned, telemetry channels 2, 4 and 6 will confirm a reduced spin rate.

Those planning to decode the AUSTRALIS-OSCAR telemetry signals are advised to practice measuring the frequency of an audio tone in less than 6 seconds, with a read-out accuracy of at least ten percent.

Satellite Reception

Any good communication receiver of the type used by most radio amateurs and shortwave listeners, should be adequate to receive the satellite's ten meter signals. Receivers without at least one stage of tuned r.f. amplification may require a preselector.

The satellite's two meter signal should be received adequately on most of the v.h.f. type receivers used by radio amateurs, if the receiving system has a noise figure of about 4 db or better and the i.f. bandpass is not too wide.

Both transmitters aboard the satellite are amplitude modulated, with a maximum modulation frequency of 2000 c.p.s. Receivers used to copy these signals should have a bandwidth of at least 4000 c.p.s. A b.f.o. should *not* be used to receive telemetry signals, since the beat note might make it impossible to accurately measure the frequency measure the frequency of the telemetry tone. A b.f.o. would, however, be useful for Doppler measurements and for receiving weak signals.

An antenna with at least 10 db gain will be required to receive satisfactory telemetry signals from the two meter transmitter. It is desirable that it be circuitry polarized to reduce signal feeding. The helix is perhaps the best all around antenna for this purpose[5], although an array of crossed Yagis would also be suitable. The Yagis should be pointed in the same direction, one mounted vertically and the other horizontally on the same boom, and configured to give the 90 degree phase shift required for the system to act as a circularly polarized array.

To track the satellite from horizon to horizon, the two meter receiving antenna should be steerable in elevation as well as in azimuth.

Other type horizontally or vertically polarized fixed antennas with appropriate gain can be used, but the signal will be heard for shorter periods of time, and with somewhat greater fading.

The satellite's more powerful ten meter transmitter is expected to often produce signals considerably stronger than the two meter transmitter. Any h.f. antenna with a gain of at least 3 db should be adequate for reception. If the antenna is steerable in both elevation and azimuth, signals will be heard for the maximum time possible on each pass. A pair of fixed, crossed horizontal dipoles, mounted a quarter wavelength above ground (about 7½ feet), should give reasonable good omnidirectional reception without the need for steering. Such an antenna system would also reduce signal fading.

Telemetry & Reception Reports

The AUSTRALIS-OSCAR 5 satellite will transmit telemetry continuous on 144.050 mc, and on 29.450 mc on Fridays, Saturdays and Sundays. The purpose of these signals are to constantly monitor the condition of the satellite and to determine its precise orbit. Project participants are urged to obtain telemetry data from either transmitter whenever possible, since acquisition and reduction of this data is one of the projects major objectives.

To enable rapid evaluation of the telemetry and orbital reports by computer techniques, all reports *must* be in the same form. For

[4]Updated, enlarged calibration curves will appear next month in *CQ*, or can be obtained by writing AMSAT, P.O. Box 27, Washington, D.C. 20044. Please include s.a.s.e.

[5]De Mar, "The Basic Helical Beam", *QST*, Nov. 1965, p. 20.

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Inching our way through the crowd we get a closer view of the Australis-OSCAR 5 satellite with the Telemetry Sensor Terminal Block in the foreground.

this purpose, special reporting forms have been prepared and their use is absolutely essential.[6] Data reported in any other way cannot be handled by the computer, and will be of little value. Report forms, calibration curves, and instructions for their use, can be obtained free of charge, from the nearest Regional Director listed below. Be sure to indicate the number of forms desired and include a self-addressed stamped envelope or IRC with the request.

North and South America:
AMSAT
P.O. Box 27
Washington, D.C. 20044

Asia and Australasia:
Project Australis
Union House
University of Melbourne
Parkville, Victoria
Australia 3052

Europe and Africa:
Mr. W. Browning, G2AOX
47 Brampton Grove
Hendon
London, N.W. 4
England

The Regional Directors will also act as reception points for the completed reports, and reports should be sent as soon as possible to the nearest one. From the Director, the reports will be forwarded to the project's master computer at the University of Melbourne for evalution. The Director will also act as a central source for up-to-date orbital, tracking and other information about the satellite.

Tracking reports should include the time the two or ten meter signal is first heard, or aquired on a pass (AOS), and the time it faded out, or was lost (LOS). The exact time of closest approach (TCA), determined by Doppler shift or when the signal reaches peak intensity, would also be very useful in determining the satellite's precise orbit.[7]

Propagation Observations

Telemetry and orbital tracking reports are two important objectives of the AUSTRALIS-OSCAR project. Propagation observations are another equally important objective, and the satellite is ideally suited to carry this out.

All previous OSCAR satellites carried two meter beacon transmitters, but AUSTRALIS-OSCAR 5 will be the first to carry both two and ten meter transmitters. This provides an excellent opportunity to gain new propagation data. The two meter signal will permit further observation of anomalous propagation detected with previous OSCAR satellites, while the ten meter transmitter will allow observations to be made of an h.f. signal source well *above* the ionosphere. These observations may be of particular importance during the present period of relatively high solar activity. The satellite will also permit a comparison to be made between the reception of both signals, in an effort to determine in what bands to place future OSCAR communication satellites.

Thousands of observations made of previous OSCAR two meter signals confirmed that signals appeared and disappeared abruptly, and that the radio range was horizon-limited as propagation theory would indicate.

However, there were a significant number of reports of signals being received initially for several seconds, followed by a quick fadeout, then reappearance of the signal again. Similar anomalous reception was sometimes observed as the satellite disappeared over the horizon at the end of a pass. This unusual reception is believed to have been due to some diffraction process in the atmosphere.

Several observers at high latitudes reported complete blackouts of OSCAR signals during auroral displays, while observers in tropical areas sometime reported echos, rapid fluctuation in signal strength and gradual, rolling fades on OSCAR transmissions.

There were several reports of OSCAR two

[6]Bellair, D. T. and Howard, S. E., "The Tracking and Obtaining of Data From Australis–Oscar 5", *QST*, Aug. 1969.

[7]Norgaard, D., "Eyeball and Eardrum Doppler Tracking", *QST*, April, 1962, p. 44.

See page 110 for New Reader Service

In this close-up view of the satellite, one of the AMSAT members points out where the Command Receiver mounts. The battery pack is in the center.

meter reception considerably beyond the line of sight range, with at least one observer reporting reception when the satellite was 7000 miles away.

While much is known about ten meter ionospheric propagation between stations on the ground, AUSTRALIS-OSCAR 5 will permit observations to be made for the first time of a ten meter signal source above the ionosphere. This opens the door to a new world of experiments. The interaction between the ionosphere and the satellite's ten meter signal is expected to give rise to a considerable number of propagation peculiarities. For example, while a ground-originated ten meter signal is reflected from the lower part of the ionosphere to another area on the earth's surface, the satellite's signal will be shielded from the earth and will be reflected from the upper surface of the ionosphere. While an earth signal might penetrate the ionosphere to be lost in space, the space-originated signal will penetrate the ionosphere to be heard on earth!

Of the strange things that happen to h.f. satellite signals as they pass through the ionosphere, perhaps none is so interesting to observe as the *antipodal reception effect*.[8] This is the sudden reappearance of a signal as the satellite passes above a point approximately at the opposite side of the earth from the receiving station. Antipodal reception is often possible when there is a complete absence of skip at shorter distances. As yet, no fully satisfactory explanation of antipodal reception is available, and the AUSTRALIS-OSCAR 5 satellite may help to provide more clues.

[8]Soifer, R., "Antipodal Reception of OSCAR Signals", *QST*, Nov. 1968, p. 32.

Antipodal listening periods should, of course, be scheduled to center around approximately one-half an orbital period (approximately 57 minutes in the case of the AUSTRALIS-OSCAR 5 satellite), before and after the time of nearest satellite approach to the receiving location.

It is hoped that continuous observations throughout the world can be made of the satellite's transmissions in an effort to detect unusual propagation conditions on ten and two meters. This might be the sort of activity that could best be handled by a radio club. Although it may be impractical to maintain round-the-clock monitoring for the entire period of satellite life (hopefully two months), it should be possible for a club to set up a two or three day watch over a weekend when both transmitters are expected to be in operation.

Not only is it important to record observations of reception, but it is also important to record instances when signals are *not* heard when they should be. Such reports might provide a clue to ionospheric disturbances or auroral or other unusual activity.

A club, or a single-operator station may find it more convenient to conduct long period propagation observations by using a continuous running receiver tuned to one of the satellite's signals, and coupled to a slow-speed tape or ink recorder. The recording would serve as a permanent unattended record of reception, and might turn up instances of unusual propagation conditions.

Propagation observations should be reported on the standard report forms discussed earlier, and should be marked "PROPAGATION STUDY" in the space provided for comments. The report will be entered into the computer, but will also receive special attention for propagation studies that are an important part of the project.

Space QSL

All reports of AUSTRALIS-OSCAR 5 reception, from the simple "I heard it!", to the most advanced measurements and observations will be verified 100% with a distinctive QSL card.

It will not be necessary to request a card. All that will be required to receive one is a report of reception on the standard reporting form. QSL cards will be sent as soon as reports are entered into the computer at the University of Melbourne.

[*Continued on page 98*]

See page 110 for New Reader Service

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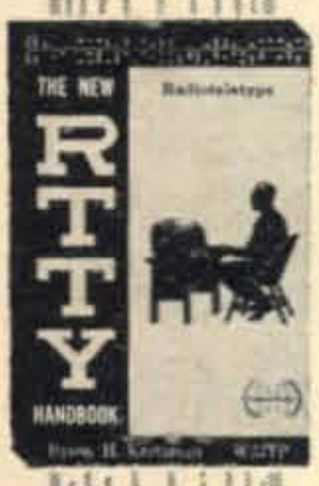

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DX

BY JOHN A. ATTAWAY,* K4IIF

"O lonely night, last forever. You've made me learn to live and love . . . and work DX"

WEST COAST DX BULLETIN

The news from the front speaks of DXpeditions. By the time you read this the monumental effort from Navassa Island by Ernie Hendry, K4CAH, and his gang should be past history. Ernie worked long and hard for this one so we're happy to see him pull it off.

At the time of this writing (June 7), Gus Browning, DX Hall of Fame No. 1, is scheduled to begin a rampage across the Indian Ocean. The old master is eyeing such DXpedition standby's as Des Roches, Farquhar, Aldabra, Juan de Nova, and Chagos. In addition he plans to hit a number of developing countries such as Etoile Cay, Bandeuse Cay, Geyser Reef, Wizard Reef, and Blenheim Reef. Population figures for these countries were thoughtlessly omitted from our Atlas, and we also couldn't locate them on our maps. My best guess is that they are somewhere in Zone 39. One wag was heard to remark over the air that: "Gus will never raise the DXCC countries list to 400 by relying only on sandbars which rise above the water at low tide. He's going to have to take a lot of equipment, build walls around shallow areas of the ocean at 500 mile intervals, pump out the water, and set up on his newly created land." If followed this would add a new dimension to the term "developing country."

Vern Buerg, WB6KBK, advises that he is completing plans for operation from KP6-Palmyra, KB6-Baker, and VR3-Fanning/Christmas Island. Vern's operation may be already started by the time you read this.

Jose, XE1J, is lining up a generator and some antennas for another effort at Revilla Gidego, probably in October.

In October's *CQ* Worldwide DX Phone Contest Jim Walsh and the PJØMM gang will be back on Sint Maarten for another try at the World Multi-op, Multi-transmitter trophy. The call will be PJ8MM. Their goal is 10,000 QSO's in 48 hours, and logistic planning has been going on for months They hope for more worldwide activity on the lower frequencies, particularly 160.

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

De Extra

Don't Write off C.W.: We've heard many discouraged amateurs say: "to heck with c.w., I'm selling my keyer and concentrating on s.s.b. DX, because of the big bite incentive licensing took from the c.w. frequencies. Don't do it. You'll miss too much real DXing.

To begin with I sincerely believe that "this too will pass." The technical proficiency to build and operate c.w. gear is much less than that required for s.s.b. gear, so the very unnatural situation requiring a higher class license for full c.w. privileges than for s.s.b. is bound to be abolished in time.

If you give up c.w. you will miss some of the greatest pleasures of DXing. On nights when 20 is up tight with stateside signals above 14200 you can still tune down into the c.w. band and pick those UA9, UAØ, VU, UL7, AP5, etc. c.w. signals out of the noise and QRM. The average ham in many areas of DX-land is still apt to be running homebrew or converted Command gear with less than 100 watts to a dipole or longwire antenna. You can't work him unless you get down there with him.

Working those weak c.w. stations coming over the pole is DXing in it's purest and natural state. It's the real thing. Well-equipped DXpeditions with strong signals are glamorous and exciting and they stir up the troops, but there's something sort of artificial about it all. For the real thrill of DXing dig out the little guy, the one who lives there. After all, this is the way to enhance international goodwill.

Here and There

Rare Zone Activity:

Zone 19: Reports are sketchy so more data on stations active from 19 would be appreciated. UWØIJ on 14002 and UWØIP on 14049 are mentioned, but no times.

Zone 21: UD6BQ, 14040 kc, 0235 GMT; UF-6DZ, 14010, 0320; AP5CP, 14055, 1545; EP2BQ, 14210, 0230; MP4BBW, 14230, 0245.

Zone 22: VU2AJW, 14261 kc, 1113 GMT; VU2TI, 14025, 1230; 9N1MM, 14235, 1440; VU2DK, 14220, 1230; 4S7PE, 14285, 1630.

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Zone 23: JT1AD, 14032 kc, 1225 GMT; 1400-1437, 1615.

Zone 24: VS6AL, 14210 kc, 1550 GMT; VS6-EK, 14225, 1120; BV2A, 14030, 1500.

Zone 26: XW8AX, 14233 kc, 1540 GMT; XW8CS, 21064, 1330; XW8BP, 14048, 1358.

Zone 28: 9M2FR, 14225 kc, 1520 GMT; 9M-2LN, 21043, 0500; 9M6HM, 14225, 1300; CR8AI, 14200 up, 1100-1530 GMT.

Zone 34: SU1MA, 14202 kc, 0345 GMT; SU1IM, 14017, 0400 GMT.

The above are times and frequencies at which these stations have been heard and worked. There is no guarantee that they will be on those same frequencies at those times again. However, it may help in establishing operating patterns and propagation conditions to various parts of the world. Consult your local DX bulletin for more information.

New and Rare Prefixes:

C21 (?)—This is the new prefix for Nauru Island, ex-VK9. The double figure indicates confusion somewhere.

C3A—C3Z—The new ITU calling allocation to Andorra.

HI4—HI4CYC, 3845 kc, 0245 GMT.

HR4—HR4AS & HR4RB are active on 20 meter s.s.b.

JD1—New prefix for some of the ex-KG6 islands now returned to Japan.

LI2—LI2B is Thor Heyerdahl aboard the reed-boat bound from Europe to South America.

CW—PHONE WAZ

2659.....WA5AUZ
2660.....VE3WB
2661.....W4USQ
2662.....W6DUS/4
2663.....G3ISX
2664.....DJ4VX
2665.....DL7FW
2666.....W9FJX
2667.....WØJMB
2668.....VE4SK
2669.....JA6BEE
2670.....W8TRN
2671.....PAØMRN
2672.....W4RJC
2673.....IT1AQ
2674.....W4YVK
2675.....W6JKR
2676.....SP6AEG
2677.....K8TVO
2678.....WA9OTH
2679.....DJ1SV
2680.....DJ9ON
2681.....WA2CFG
2682.....W3HDZ
2683.....K4MPE
2684.....DL9RC
2685.....OH3MF
2686.....OH3MK
2687.....SM7DQK
2688.....K1UHY

TWO-WAY SSB WAZ

677.....W8GKM
678.....W4AXL
679.....DJ4OQ
680.....I1APC
681.....W8GHN
682.....DL6SI
683.....9M2NF
684.....SM5FC
685.....SM6CWK
686.....SM6DHU
687.....K1IMP

CW WPX

941.....K4OLQ
942.....KØDEQ
943.....SM5DRW
944.....LA9CE
945.....SM5BNX
946.....W9AE
947.....W8ILC
948.....OK3BU
949.....SU1IM
950.....SP1BHX

PHONE WPX

174.....KR6TAB
175.....WA6TAX
176.....DK2BI
177.....F8BC
178.....VK5HW

MIXED WPX

198.....W9AE
199.....WA6TAX
200.....W8ILC
201.....OZ3PO

SSB WPX

420.....DL4FS
421.....WB2YRU
422.....WA6TAX
423.....SM3AF
424.....SM6CMK
425.....K2POA
426.....W8ILC
427.....G3TLV
428.....WA9SUJ
429.....DK2BI
430.....I1AUM
431.....CT1UA
432.....WB2FMK

SPECIAL SSB CONTEST WPX

15.....WAØEMS

WPX Endorsements

SSB: W4OPM-800, W4IC-650, HP1JC-550, YV4UA-450, WØGYM-400, YV4QC-400, W8ILC-300, VE3QD-300, I1AUM-250, K2-POA-250, and SM3AF-250.

CW: LA3UF-450, SM5BNX-450, SM7CRJ-400, SP1BHY-400, WA6ESB-400, W8ILC-400, LA9CE-350, OK3BU-350, and PAØMIB-350.

Mixed: W6KG-650, K4ZCP-600, and W8-ILC-500.

160 Meters: OK3BU

10 Meters: K2POA, and KR6TAB

Asia: W6KG

Europe: DK2BI, OK3BU, SP1BHX, and W9AE.

WPNX

13.....WN3KSQ

VPX—Verified Prefixes

Karel Sokol, OK1-15835.....15 (SSB)
Ing. Blanarovic Juraj, OK3-5292..16 (CW)

OY9—OY9LV, 14240 kc, 1630 GMT.

PK8—PK8YAE, 14040 kc, 1400-1500 GMT.

UZØ—New Russian far east prefix.

VK8—VK8MR and VK8BB have a 20 meter s.s.b. sked on 14155 kc at 1220 GMT.

YB1—YB1BM, 21333 kc, 1535 GMT.

YBØ—YBØAB, 14208 kc, 1535 GMT.

3Z1—3Z9—These prefixes will be used from July 22, 1969 to July 22, 1970 by Polish amateurs to commemorate the 25th anniversary of the liberation of Poland.

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4U7–4U7ITU, 14030 kc, 2145 and 0130 GMT.

9M8–9M8RY, 14248 kc, 1425 GMT.

The DX Award's Program

Interest continues to run very high, with 41 WAZ, 33 WPX, 1 WPNX, and 8 S.S.B. DX Awards for a total of 83, just 1 short of the all time record of 84 was totalled last month.

The Thailand Ban

As all DXers are very aware, contacts with Thailand amateurs are not permitted. The following letter was received from a chap who spent some time in HS-land and apparently has first hand knowledge of the circumstances surrounding this communications ban:

"To give you a better understanding of things I will need to go back several years. In the late 40's the ITU circulated what appeared to be a questionaire, in French, and somewhat vaguely worded. One of it's questions said something to the effect: 'Do you have any objection to your amateurs contacting those of other countries?' It was answered 'Oui.' This and only this is the basis of the whole problem. Many, including both Thai amateurs and GPO officials, feel that this question may have been totally misunderstood. Contrary to popular belief there has never been any letter written by the Thai government requesting that they be put on any ban list, and many of the new generation GPO officials don't really know how they got there in the first place. It is this feeble document of some 20 years ago which is still on file in Geneva today.

"It might be interesting to note that the kingdom of Laos received the same questionaire and answered it in the same way. This document is also said to be still on file in Geneva, and as far as ITU is concerned Laos is every bit as much on the 'ban' list as Thailand. It is my understanding that the FCC has received some documentation via the Laotian embassy in Washington to set their records straight, but it does explain why XW8 remains on the VE ban list. Geneva is not satisfied. So what it boils down to is that there has never been any sort of ban from the Thai side. HS stations can work anyone, anywhere, and if the stateside boys call them they will give them a contact. However, I doubt that anyone in Thailand has ever tried to call a W/K station to initiate a QSO.

"The FCC seems to feel they are bound to their agreement with ITU and must observe what Geneva says. The same holds true for Canada so there we stand. Many are working tooth and nail to set the record straight but this takes time. Bob Daniel, HS1BD, and Fred Laun, HS3AL, (ex-HI8XAL) should be given much credit.

"There are several possible solutions. The most obvious would be a letter from the government of Thailand to the ITU asking

WPX HONOR ROLL

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

MIXED

W4OPM	Joe Hiller	880/950
W8LY	Michael Bakos	733/733
K1SHN	Chuck Banta	685/702
I1SF	Serafino Franchi	657/657
WA6GLD	Jerry Hagen	575/600

SSB

W4OPM	Joe Hiller	746/810
W4NJF	Gay Milius	712/712
DL9OH	Karl Muller	611/611
K1SHN	Chuck Banta	586/601
HP1JC	Juan Chen	552/552
I1AMU	Alfonso Poretta	526/563

CW

W4OPM	Joe Hiller	751/850
W8KPL	William Simpson	725/800
DL1QT	Helmut Baumert	672/672
K1SHN	Chuck Banta	572/671
I1SF	Serafino Franchi	554/554

PHONE

I1SF	Serafino Franchi	526/526

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

Two-Way SSB DX Award

300 Countries

41.....G3HDA
42.....W4IC

200 Countries

173.....ZL3RK
174.....WØYDB

100 Countries

566.....W1PCD
567.....EA4CR
568.....W4RJC
569.....XE1OOL

Complete rules for the *CQ* DX Awards may be found in the DX column of the January, 1969 issue. Reprints may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Florida 33880.

See page 110 for New Reader Service

that they be removed from the ban list. This is not as easy as it appears since decisions regarding radio transmissions are made very carefully by far east governments. Mr Daniel has had several meetings with the heads of GPO and they agreed to write Geneva for information on the ban lists. It was expected that this would take time, but it is believed that ITU has already received correspondence on this subject. If so, things are progressing well.

"Another plan is for the U.S. military to take blanket responsibility for control and policing the licensing of it's amateurs. This would be similar to the situation in Japan or Greece where the U.S. government has regulated its amateur licensing.

"A third alternative is to establish a reciprocal licensing procedure whereby amateurs could operate on either side of the fence. This possibility was advanced by the U.S. embassy, but it made no headway as the Thai government felt the agreement was being sought so that phone patches could be run. This is one of the bitterest subjects that can be broached in Bangkok. I'm sure the Thai officials feel that Thailand will become another Okinawa if such a thing would come to pass. If you have ever listened to ham radio from this area you know what I mean, wall to wall phone patches on all bands all coming from KR6-land. It is not so much the revenue angle as the complete inundation of the bands by a load of traffic which largely serves no purpose.

"The recent decision by the FCC to drop the ban for stations signing their stateside calls portable HS, while being made in good faith to attempt to ease the situation, has actually further confused it. First of all, the DX fraternity stateside cannot understand why U.S. servicemen don't all jump on the bandwagon and start signing new calls. Obviously they can't do this because they haven't been authorized by the Thai government to do so. The FCC hasn't been given any authority to issue call signs to Thailand hams in the past, and it doesn't appear a likely prospect for the future, thus for the present the HS call signs will be used as issued. Moreover, Americans are not willing to leave their hosts, the Thai amateurs, standing in the corner because they were not issued the magic FCC call sign. Most of them feel that until everyone gets a fair shake they will operate as is.

"The recent change to HS was due to the receipt of documentation from WA4PUC/-

Hamfest in Trivandrum, India. L to r, VU2BY, VU-2VK, VU2MSK (better known as W3MSK), VU2-JN and VU2LN. *(Photo courtesy W6VFR).*

HS by the FCC, and not by any special request from the Thai government. In fact, they knew nothing about it until they were informed by the local hams. At that point the biggest damage was done by the military, who saw their ship come in regarding phone patches, and put out a MARS gram to all stations in Thailand to the effect that if MARS frequencies are unusable, and if they have licensed hams in the station, they can move to the ham bands and run traffic. This was apparently based on the fact that WA4-PUC was authorized to handle third party traffic. I might point out here that Don's operation was basically a military approval to operate. Therefore, someone should warn the MARS people in the States before they start something that will have a bad ending. Fortunately there are enough level headed hams in the Thailand MARS stations, who know the true story, that we are not in trouble yet.

"I hope this effort will clear things up a bit for the *CQ* gang."

Amateurs licensed in Ecuador prior to 1953 hold permanent tickets. However, anyone licensed since that time must renew his license in person every year, unless he is incapacitated and unable to appear. The power limit is 1000 watts.

All HC amateurs are required to have an antenna and equipment for 40 meters for national emergency use. Failure to have such equipment will prevent the renewal of a license. A license can also be cancelled by the Minister of Communications for violating the rules or not properly notifying his office that the station is no longer in use.

A.R.E. recommends that HC amateurs QSO non-USA stations outside the U.S.

See page 110 for New Reader Service

160 Meter News

In our eyes the most important idea to be advanced regarding utilization of 160 is the suggestion by W1BB that a DX Window be created on Top Band. Consequently, we are devoting this section of the column to a letter from W2CMS agreeing with this concept and making further suggestions.

de Angelo Lamendola, W2CMS: "W1BB's comment on pg. 67 of April *CQ* regarding the DX-Window at 1825-1830 khz prompts me to express my own feelings about 160. I have been licensed for 21 years, but only got on Top Band 2 years ago after 3 years of patiently preparing a suitable aerial system to fit a limited backyard space. The contacts came through, but no DX due to amateur QRM. I strongly support the suggestion for the DX Window.

"Top Band is a good place for amateurs to study DX communication at the lower frequencies. For example, the ever present problem of propagation to the Orient around or perhaps through the Auroral Oval. Creation of the DX window is a necessary step to clear the air so amateurs can at least hear each other.

"A second important step would be to make available suggestions for construction of a 'radio-meter-type' receiver to enable an amateur to read S1, S2, and S3 signals on 160 in a Q5 manner. I believe that the time has arrived when the serious DX-experimenter should develop the proven technique of 'radiometry' for use on weak signals on Top Band. A microwave radiometer has already been described by Alan Parrish, K1KKP, in his article 'Detecting V.H.F. Signals Too Weak to be Heard' which appeared in *QST* for January, 1968. A somewhat similar technique called a 'phase-lock amplifier' has been used on low frequencies for many years. Parts are easily available for 160 meter design and construction. I, for one, would seriously look forward to assembling and using a 160 meter 'radiometer' if someone would come forth with a *CQ* article on the subject."

QSL Information

WA9VBG has offered his services as QSL manager for a DX station.

CR6IK–Via W8CNL, 120 Collier Ave., Battle Creek, Michigan 49017.
EAØDEC–To EA-Bureau, U.R.E., P.O. Box 220, Madrid, Spain.
FB8ZZ–Via F8US.
FG7EB–c/o VE2AFC, P.O. Box 382, Quebec 4, Canada.
FM7EB–Via VE2AFC.
FM7WQ–c/o W4OPM.
FY7EB–To VE2AFC.
G3OGA–Via C.C. Dumbrille, VP9BK, "Nightwinds", Dunscombe Road, Warwick, Bermuda.
GB3USA–To RSGB, G2MI, Bromley, Kent, England.
GB2UM–c/o G3UVM.
HBØAFM–Via HB9AFM.
HBØGJ–To HB9GJ.
HL9VX–Via W4ZXI.
K4IA/KC4–c/o WA4WIP.
KC6BY–Via WB9ALM.
KC6CT–Via W9VW.
PJ2CQ–To WB4EHX, 4800 Riverwood Ave., Sarasota, Fl. 33581.
PK8YAE–Box 8, Bandung, Indonesia.
PYØBLR–Via PY4BLR, P.O. Box 2590, Belo Horizonte, Minas Gerais, Brazil.
PYØRE–To PY1HX.
SK9WL–c/o SM7CRW, P.O. Box 24, 560 12 WAGGERYD, Sweden.
SM7TV–Via WN4LKC.
TF2WLS–c/o WA5RTB, 3610 30th St. Lubbock, Tx. 79410.
VP1CP–P.O. Box 616, Belize, British Honduras.
VP2GTL–To WA5LES, 2010 McDuffie, Tx. 77019.
VP2LZ–Via W3EVW.
VP2VT–c/o VE2AFC.
VP9BK–Via VE2DCY, 8900 Lacordaire, Montreal 458, Quebec, Canada.
VR1O–To G3NRA, 22 Maldon Road, Goldhanger (near Maldon), Essex, England.
VS6AA–c/o K8UDJ, 2072 Rolfe Road, Rt. 2, Mason, Mich. 48854.
WA6QGW/PX–Via K6VVA, 1634 Creek Drive, San Jose, Calif.
XW8AX–To W6KTE.
ZC4AK–c/o WA2CMV.
ZC4MO–To WB2ZMK.
ZD7AA–P.O. Box 876, St. Helena.
ZF1XX–Via VP9BK (see G3OGA).
ZK1AL–To W8SSR.
3AØII–c/o ON5TO.
4X4, Jerusalem: WB2WOU, 306 Hopper Avenue, Toms River, N.J. 08753 is QSL Manager for all Jerusalem stations. Included are the following stations: 4X4CY, 4X4QL, 4X4SK, 4X4SO, 4X4UL, 4X4VL, 4X4WP, 4Z4AQ, 4Z4HG, and 4Z4NDS.
4X4RQ–c/o VE4AE, 22 Sweetwood Bay, Winnipeg 17, Manitoba, Canada.
5X5SL–*NOT* via W6JZU.
5Z4KL/5X5–To VE4DLC.
6Y5XX–c/o VP9BK (see G3OGA).
9M8RY–Via 9V-Bureau, P.O. Box 777, Singapore.
9U5CR–To ON5TO, Edward de Jansstraat 30, Sint-Andries, Belgium.

73, John, K4IIF

Troubled with TX-I? Read this month's Q & A Column on page 78

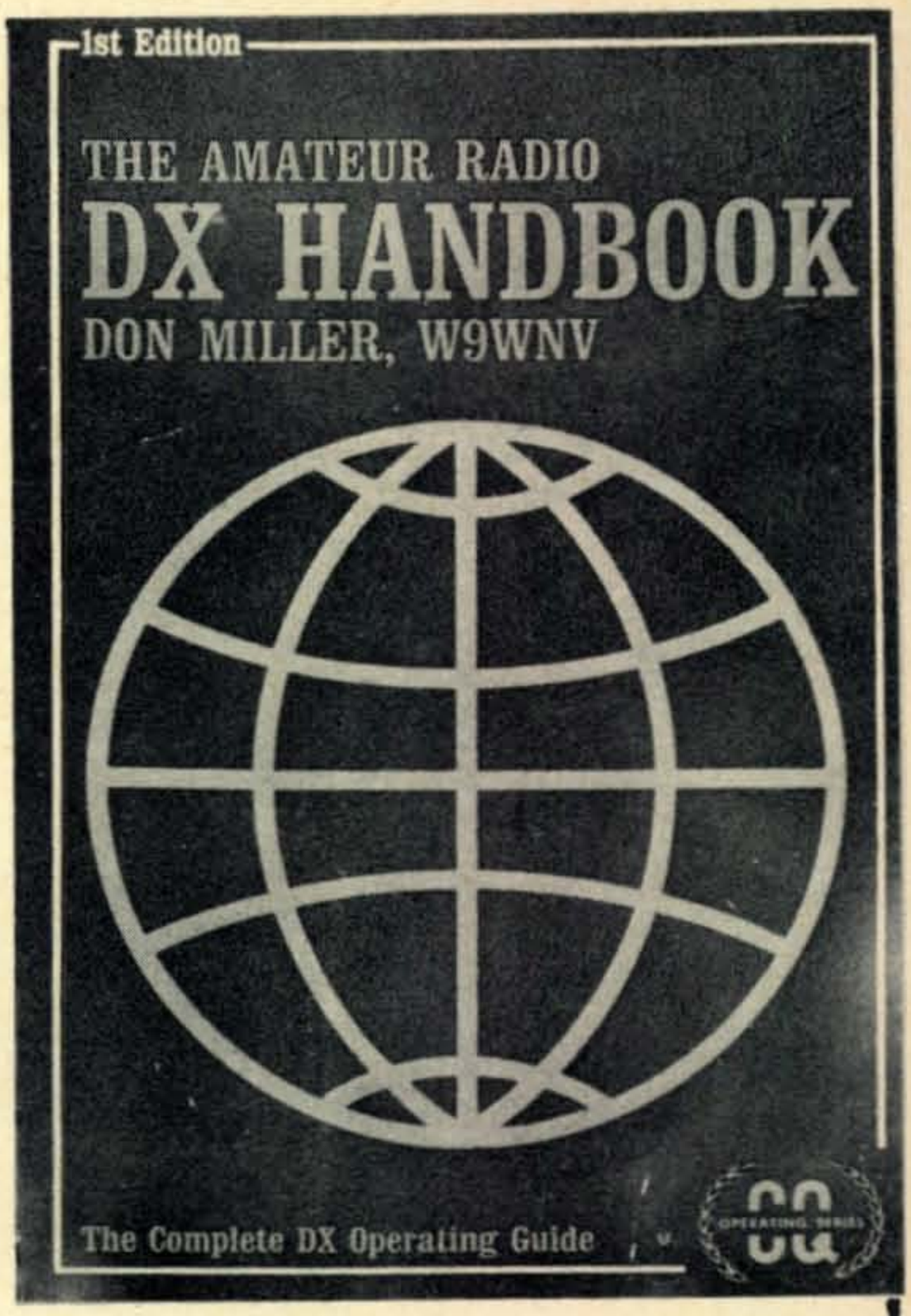
See page 110 for New Reader Service

SOMETHING REALLY NEW

The Amateur Radio DX Handbook is off the presses and on dealers shelves. It is not a compilation of past articles appearing in CQ nor is it a discourse on amateur politics or "who did what to whom." It is in fact a 200 page volume detailing every aspect of working DX and understanding how you did it. It is the difference between occasionally working DX by accident and being a consistently good DXer.

The chapter headings listed below only give a general idea of the type of material covered in great detail throughout the volume. This information is not only vital to American amateurs but is applicable to every active amateur in the world.

Inspect a copy at your local distributor or use the coupon below to order a copy direct.



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Cowan Publishing Corp., 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

THE AMATEUR RADIO DX HANDBOOK, $5.00 each, Postpaid

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Enclosed is $_____

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Q AND A

BY WILFRED M. SCHERER,*
W2AEF

A RELATIVELY new situation that is raising its ugly head, (and one that as time goes on could easily turn out to be a more horrendous monster that t.v.i.), is t.x.i. or radio interference with solid-state appliances such as transistorized radios, TV sets, tape recorders, record players, hi-fi gear, inter-coms, p.a. systems, etc, Believe it or not, we have heard of at least one case where r.f. from a mobile radio transmitter stopped the motor of a vehicle equipped with a transistorized ignition system!

The situation is due mainly to the intrinsic characteristics of the transistors used in such solid-state equipment. Since transistors essentially are back-to-back diodes, they are highly susceptable to producing rectification of even small amounts of r.f. energy, thereby functioning either as an envelope detector or as a non-linear device creating undesired harmonic energy.

These inherent characteristics and the unfavorable impedances often involved not only make remedial measures extremely difficult, but also, where such measures might possibly be effective, the task can be complicated by the fact that solid-state appliances usually are built on printed-circuit boards. Modifications to such equipment cannot be very well undertaken, nor might they be generally acceptable to owners of the affected equipment.

Furthermore, t.x.i. can be caused by transmissions from legally- and properly- operated equipment through no fault of the transmitters themselves. It is not a situation necessarily attributable to harmonics as often is the case with t.v.i. The transistorized gear simply is a sitting duck asking for trouble!

Lest the situation get out of hand and become one as experienced with t.v.i. where such is due to inferior TV-receiver design, it seems to us that pressure should be placed on the manufacturers of solid-state appliances to forestall the possibility of t.x.i. by their investigating, developing and including preventive measures for their products in this respect.

As far as we know, the industry has done nothing toward this end either because of a lack of complaints up to this time, a failure to realize the possible magnitude of the situation or due to indifference.

In order to impress upon the equipment industry the potential seriousness of the situation and to aid in providing solutions, specific case histories will be needed. With this in view, we ask that in cases where the amateur operator has come up against t.x.i., he let us know of the circumstances (including frequencies involved) and of any effective remedial measures taken such as r.f. filtering, bypassing, detuning or swamping of resonant circuitry, complete shielding of the affected device, etc.

This information will be made available not only to industry, but will also be published in the Q & A Column as an aid to fellow radio amateurs. It also would be well for readers to send such data to other radio-amateur journals for assisting other operators. Which magazine is selected is immaterial to us—we're all in the same boat!

In the event the equipment industry fails to respond favorably, we propose that a move be instigated through the efforts of ARRL, EIA,clubs, radio amateurs and others involved in communications, that by Federal law, transistorized products be required to be labeled. "This product is not guaranteed against interference from radio transmitters or other electronic devices." This will protect the public and the radio amateur, as well as other communications services, from undue blame where interference is involved.

We'll be having more data on the subject in future issues in *CQ*. It is our hope that other radio-amateur journals and organizations will also follow through on the matter.

*Technical Director, *CQ*.

Information on R.F. Clipping

QUESTION: I have a TR-3 with a 9 mc i.f. strip and am interested in modifying the unit to incorporate r.f. clipping. Can you supply me with some up-to-date suggestions, schematics or references?

ANSWER: More information then we could

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put into a letter or in the column regarding r.f. clipping may be found in the two following references.

"Speech Clipping for S.S.B." by Squires and Clegg, *QST*, July 1964, p. 11. This describes a setup used at a 9 mc i.f.

"R.F. Clippers for S.S.B. "by Sabin, *QST*, July 1967, p. 13. Also see "Feedback", *QST*, December 1967, p. 81. This describes basic principles (as does the other article) along with an outboard unit with component values for 455 kc and 9 mc.

Crystal Tolerance

QUESTION: I have a 10 mc crystal for which the tolerance is stated as ±.0025%. What are the frequency-tolerance limits for this crystal? I have not had any success in finding literature in which an explanation of how the calibration tolerance is applied in crystal manufacture.

ANSWER: The maximum error for a 10 mc (10,000 kc) crystal having a .0025% tolerance rating would be ±250 c.p.s. when the crystal is working into a *specific* load, such as that stated by the manufacturer.

The deviation is figured this way: 10,000 kc × .0025% = 10,000 × .000025 = .250 kc = 250 c.p.s. Note that × .000025 is used, because × .01 = 1%; therefore, .0025% = × .000025.

Most crystals currently produced are designed to work into a capacitance load of 33 mmf. This is the sum of the circuit capacitances and the capacitance of the tube or transistor section which is shunted across the crystal. By the use of a small trimmer, with which the total capacitance can be varied between some value below and above 33 mmf (or the load specified by the manufacturer), the crystal frequency can be brought in on the nose, since changes in the load will effect the crystal frequency. Typical situations are shown at fig. 3.

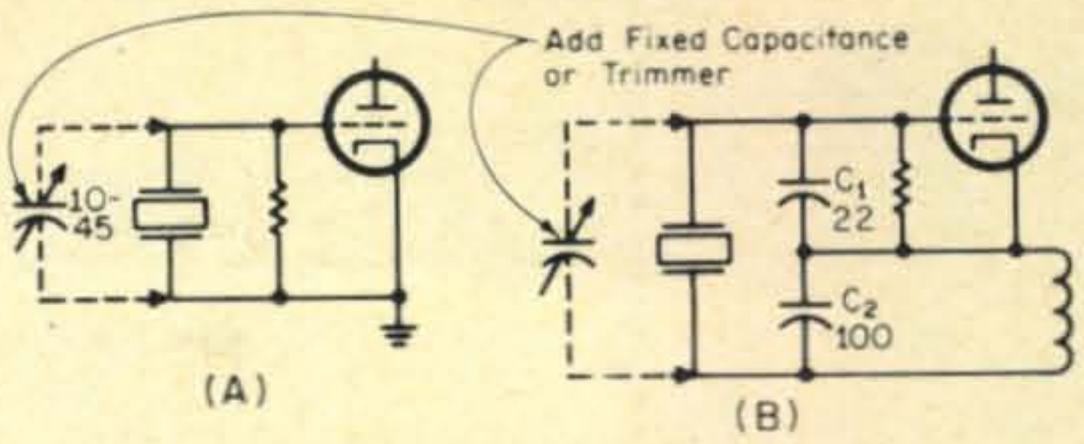

Fig. 3—Two different crystal calibrator grid circuits and suitable methods of adjusting calibrator crystal frequency to precise zero beat with WWV. Total capacitance across crystal must equal capacitance specified by crystal manufacturer, usually 33 mmf. In typical case at (B) C_1 could also be altered so that total capacitance presented to crystal by C_1 and C_2 in series, plus tube input capacitance equals 33 mmf.

Wide-band Preamp with Heath GC-1A Receiver

QUESTION: I recently built the wide-band preamp described in the August and December 1968 issues of *CQ* for use with my Heath GC-1A receiver. It failed to function and the following symptoms were noted on the set:

1—The r.f. stage of the receiver appeared to be disabled. 2—The tuning meter constantly indicated no signal.

The r.f. connections for the preamp were made by breaking the connection at terminal 12 of Deck "D". The original coupling capacitor was left in the set.

What are the possible causes of the trouble?

ANSWER: The reason why the preamp does not function with the GC-1A, as noted above, is incorrect installation. The r.f. amplifier in the GC-1A has a low impedance tap on the r.f. inductor to match the input of the first transistor. The wideband preamp has a high input impedance and must therefore be connected across the entire r.f. inductor for each band.

The procedure is as follows (it is assumed that the preamp has been wired for positive ground):

1—Disconnect C_{10} from terminal 12 of deck "D" on SW_3.

2—Connect C_{10} to pre-amp output.

3—Connect pre-amp input to terminal 6 of deck "D" on SW_3.

4—Readjust the cores in the r.f. inductors for maximum signal.

We wish to thank the questioneer for his thoughtfulness in reporting that due to the above suggestion forwarded earlier to him by mail, the preamp now "works like a charm."

Ferroxcube Cores

QUESTION: Where might I obtain Ferroxcube cores.

ANSWER: In respect to Ferroxcube cores, we suggest you write to Ferroxcube Corporation of America, Saugerties, New York 12477.

Suppliers of other cores are: Tergmag Corp., 88-06 Van Wyck Expressway, Jamaica, N.Y. 11418 (they are distributors for Indiana General Products); Permacor, 9540

[*Continued on page 94*]

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Aug.	2-3	Illinois QSO Party
Aug.	2-3	Maryland/DC QSO Party
Aug.	2-4	Missouri QSO Party
Aug.	2-3	LABRE C.W. DX Contest
Aug.	9-10	DARC WAE C.W. Contest
Aug.	16-17	New Jersey QSO Party
Aug.	16-17	QRP QSO Party
Aug.	16-17	Indiana QSO Party
Aug.	23-24	South Carolina QSO Party
Aug.	30-31	All Asian DX contest
Sept.	6-7	LABRE Phone DX Contest
Sept.	6-7	VU/4S7 Phone DX Contest
Sept.	6-8	Washington St. QSO Party
Sept.	13-14	DARC WAE Phone Contest
Sept.	20-21	VU/4S7 C.W. DX Contest
Sept.	24-26	YL "Howdy Days" Party
Sept.	27-28	VE/W Contest
Oct.	4-6	California QSO Party
Oct.	4-6	CARTG WW RTTY Contest
Oct.	4-5	VK/ZL/Oceania Phone
Oct.	11-12	VK/ZL/Oceania C.W.
Oct.	4-12	Lebanese DX Contest
Oct.	11-12	Floridora QSO Party
Oct.	11-12	RSGB 28 mc Phone Contest
Oct.	15-16	YLAP C.W. Contest
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. Contest
Nov.	5-6	YLAP Phone Contest
Nov.	8-9	RSGB 7 mc Phone Contest
Nov.	8-9	ARRL SS Phone Contest
Nov.	15-16	ARRL SS C.W. Contest
Nov.	**29-30**	**CQ WW DX C.W. Contest**

South Carolina QSO Party

Two Periods:
1800-0300 GMT Sat./Sun. Aug. 23-24
1200-0300 GMT Sun./Mon. Aug. 24-25

This is the third QSO party sponsored by the Low Country A.R.C. of N. Charleston, S.C. Use all bands and modes, the same station may be worked on each band and mode for points.

Exchange: QSO nr., RS/RST and QTH. County for S.C. stations, State, province or country for others.

Scoring: One point per QSO. S.C. use state, provinces and countries for their multiplier, out-of-state use S.C. counties. (Max. of 46)

Frequencies: 1820, 3550, 3950, 7040, 7240, 14250, 21070, 21270.

Awards: Certificates to the first place winners in each state, province and country, and the first 3 winners in So. Carolina.

Mailing deadline Sept. 15th to: Low Country A.R.C., Att: Contest Chairman, P.O. Box 5026, North Charleston, South Carolina 29406

LABRE DX Contest

C.W.—Aug. 2-3 **Phone**—Sept. 6-7
Starts: 0001 GMT Saturday
Ends: 2400 GMT Sunday

We received the above dates from a reliable source. However no rules have been received. It is assumed that they are the same as previous years, and can be found in the August 1968 issue of *CQ*.

Logs go to LABRE Contest Committee, Caixa Postal 2353, ZC-00, Rio de Janeiro, Brazil

All Asian DX Contest

Starts: 1000 GMT Saturday, August 30
Ends: 1600 GMT Sunday, August 31

This is the 10th annual contest sponsored by the JARL and special badges will be presented to all participants in commemoration of this anniversary.

Its the Asians working the non-Asians on all bands, 1.8 thru 28 mc, on c.w. only.

Two classifications, single and all band. Operation limited to single operators only.

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

Scoring: One point per QSO. Asians use non-Asian countries for their multiplier. Non-Asians will count Asian countries as their multiplier. Use the DXCC country list.

Final score: Total QSO points multiplied by the countries worked on that band for single band stations, and by the sum total from all bands for all band stations.

*14 Sherwood Road, Stamford, Conn. 06905.

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Awards: Certificates to the top scorer on each single band in each country, and the three highest scorers on all bands in each country.

In addition, medals will be awarded to the continental leaders on a single band and all bands.

Use a separate log sheet for each band, and include a summary sheet with a band by band breakdown of the score, your name and address in BLOCK LETTERS, and the usual signed declaration that all rules and regulations have been observed.

Entries must be received no later than November 30th and go to: J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan.

VU2/4S7 DX Contest

Phone–Sept. 6-7 **C.W.**–Sept. 20-21
Starts: 0600 GMT Saturday
Ends: 0600 GMT Sunday

This year the rules have been modified so that you are not limited to working VU2/4S7 stations only. Phone and c.w. are separate contests. Use all bands but cross-band operation is not permitted.

Exchange: The conventional five or six figures, RS/RST plus a progressive 3 figure QSO number starting with 001.

Scoring: For DX stations, 2 points for each contact with a VU2/4S7 station on each band, 1 point per contact with other stations.

The ARRL country list will be used, and each call area of W/K, JA, SM, UA, VK and ZL will also count as countries for scoring purposes. (Rules do not specify, but it is assumed that the above will be your multiplier)

Awards: Certificates to top scorers on a single band and on all bands, in each country and above call areas.

Include a summary sheet with the scoring, a signed declaration that rules and regulations have been observed, and your name and address in BLOCK LETTERS.

Mailing deadline is October 15th to: Radio Society of Ceylon, Contest Committee, P.O. Box 907, Colombo, Ceylon.

Washington State QSO Party

Starts: 2300 GMT Saturday, September 6
Ends: 0500 GMT Monday, September 8

This is the fourth annual party sponsored by the Boeing Employees A.R.S. Use all bands and modes, the same station may be worked on each band and mode for QSO points. Wash. may work in-state stations for QSO points.

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

Scoring: Wash. stations score one point for each contact, all others two points for each Wash. QSO. The multiplier for Wash. is states, VE provinces and countries; others total of Wash. counties worked. (Max. of 39)

Frequencies: c.w.–3560, 7060, 14060, 21060, 28100. a.m.–3990, 7260, 14230, 21310, 28600. s.s.b.–3960, 7220, 14290, 21290, 28700. Novices–3735, 7175, 21110.

Awards: Certificates to the highest scoring stations in each state, province, country and Wash. county. The Five BEARS certificate is also available to stations working five club members, during or after the party. Work the club station K7NWS and a gold seal sticker will be attached to either certificate.

Mailing deadline October 4th to: Boeing Employees A.R.S., Att: Contest Chairman K7RSB, 18415–38th Avenue South, Seattle, Wash. 98188

CQ World Wide DX Contest

Phone–Oct. 25-26 **C.W.**–Nov. 29-30
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday in each instance.

Rules will remain the same as previous years and will be given in detail next month. The following brief rundown is for the benefit of our friends in remote areas:

1. All bands may be used. 1.8 thru 28 mc.
2. Exchange, RS/RST plus your Zone.
3. QSO point value: (a) 3 points between stations in different continents. (b) 1 point between stations on the same continent but in different countries. (c) Contacts between stations in the same country are permitted for Zone and/or Country multiplier but have NO QSO point value. (d) Exception: Contacts *between* stations in the North America (WAC) boundries count 2 points. (This applies to stations in North America *only*.)
4. Your multiplier is determined by the number of Zones and Countries worked on each band.
5. Final score: (a) Single band, Zones plus Countries multiplied by QSO points. (b) All band, sum of Zones plus sum of Countries multiplied by the total QSO points.
6. Competition: Three divisions. (a) Single operator, single band or all band. (b)

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Propagation

BY GEORGE JACOBS,* W3ASK

THE present sunspot cycle is still making news!

The Swiss Solar Observatory at Zurich, the world's official keeper of sunspot records for the past two hundred years, reports a monthly mean sunspot number of 120 for May, 1969. This results in the highest smoothed sunspot number yet recorded in the present cycle, 111, centered on November, 1968. This means that peak intensity of the present cycle *did not* occur before November, and it will take several more months to determine when the maximum of the present cycle did take place.

A smoothed sunspot number of 97 is predicted for August, 1969, as solar activity is expected to remain at a moderately high level through the remainder of the year.

Seasonal Propagation Change

A seasonal change in shortwave radio propagation conditions usually begins to take place by mid-August. For a period of about a month, until mid-September, conditions are neither typically summer nor typically fall. For this reason, and to present a more accurate forecast to readers of this column, this month's DX Propagation Charts cover only the *one month* period from August 15 through September 15. Short-Skip Propagation Charts appearing in last month's column are also valid through the month of August.

During this transitional period, fairly good north-south openings are predicted for 10 meters during the daylight hours to such areas as Latin America, Africa and the South Pacific. The first east-west openings should begin by late August, increasing considerably by mid-September.

Excellent DX openings are forecast to almost every corner of the world on 15 meters during the daylight and early evening hours.

*11307 Clark Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Aug. 1, through Sept. 15, 1969

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: 2, 15, 18-19, 24, 27 29. Sept. 1, 14.			B-C	C
Normal: 1, 3, 5-7, 11-12, 14, 16-17, 20-21, 23, 25-26, 28, 30-31. Sept. 2, 4-6, 10,13, 15.	A-B	B-C	C-D	D-E
Below Normal: 4, 8, 10, 13, 22. Sept. 3, 7, 9, 11-12.	C	D	D	E
Disturbed: 9. Sept. 8.	D	E	E	E

HOW TO USE THESE CHARTS

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

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

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

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

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

4—This month's DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

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

6—The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid from August 15, 1969 through September 15, 1969, and are prepared from basic propagation data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

Exceptionally strong signal levels are expected during many of these openings, and 15 meters should be the optimum band for DX openings during most of the daylight hours.

Good-to-excellent world-wide DX propagation conditions are forecast around-the-clock on 20 meters. Conditions are expected

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to peak during the sunrise period and again during the late afternoon and early evening hours. To most southern and tropical areas the band is expected to remain open throughout the hours of darkness as well.

Static levels are expected to begin to decrease steadily after mid-August, and some fairly good DX openings are forecast for 40 meters from the early evening hours, through the hours of darkness and the sunrise period.

Fairly good DX openings to some areas of the world should be possible on 80 meters during the hours of darkness, with conditions peaking just as the sun begins to rise on the "light" side of the path.

It's still a bit too early in the season for 160 meter DX, but an occasional opening should be possible during the hours of darkness and the sunrise period.

V.H.F. Ionospheric Openings

While sporadic-E propagation is expected to begin to taper off by mid-August, some 6 meter openings are likely to occur over distances of approximately 750 and 1300 miles. During periods of intense sporadic-E ionization, two-hop 6 meter openings may also be possible up to distances of about 2600 miles, and 2 meter openings may take place over a range of about 1000 to 1400 miles. While sporadic-E propagation can take place at anytime of the day or night, during the late summer there is a tendency for it to peak between 8 A.M. and noon and again between 5 and 8 P.M. local standard time.

The *Perseids*, a major meteor shower, is expected to take place from August 9-14, with maximum intensity occurring at about 2 A.M. EST on August 12, Other meteor showers are forecast for August 1, 3, 5 and 18. Ionization produced by meteors entering the earth's atmosphere, especially during periods of maximum shower intensity, is expected to make possible numerous meteor-scatter type openings over distances of several hundred miles on 10, 6 and 2 meters.

Trans-equatorial scatter openings on 6 meters should begin to increase during late August and early September. There is a fairly good chance for some openings between the USA and Latin America between 8 and 11 P.M., local standard time at the path midpoint.

Some auroral-scatter openings on 6 and 2 meters are expected during the late summer period, over distances ranging upwards to 1000 miles, or so. These are most likely to occur during periods when h.f. radio conditions are disturbed or below normal. Check the "Last Minute Forecast" appearing at the beginning of this column for the days that are expected to be in these categories during August and early September.

August 15-September 15, 1969

TIME ZONE: EST (24-Hour Time)

EASTERN USA TO:

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

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

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

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

CENTRAL USA TO:

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

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"There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man's lawful prey."

JOHN RUSKIN

CQ's advertising rates are three times greater than those of one competitor and one and a half times greater than those of a second. At the same time, CQ's readership is approximately ten times that of the first competitor and four times larger than the second.

Advertising in CQ is still the best buy in the Ham Radio Market!

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THE award PROGRAM

BY ED HOPPER,* W2GT

FLASH!
Harry R. McNutt, K8KOM
Has qualified for #9
USA-CA-3079 All Counties Plaque!
SEE K8KOM "STORY" JULY 1967 CQ.

FLASH #2
Leo D. Staley, WA5AEB
Has qualified for #10
USA-CA-3079 All Counties Plaque!

THE August, "Story of The Month", about Leo, WA5AEB, after this information. John Sulak, W8UMR, acquired a USA-CA-3000 Award. Bob Smolenski, W2OST, qualified for a USA-CA-2500 Award, endorsed All 14 mc SSB. Howard Perkins, K8EUX, received USA-CA-2500 and 2000 Awards. Henry Freiberger, W5ULN, qualified for USA-CA-2500, 2000, 1500, 1000, and 500 Awards, all endorsed All 14 mc 2×SSB. Duane Ebers, WØAQE, also hit the jack pot by acquiring USA-CA-2500, 2000, 1500, 1000, and 500 Awards, endorsed, All Phone. Wilberta "Willie" Longwell, WA7IRD, added to her collection when she received her USA-CA-2000 endorsement. Bob Holt, GW3-NWV, submitted proof for his USA-CA-1500 Award, endorsed All SSB, and Bob continues to be the only GW to qualify for USA-CA. Don McCarthy, WA9PRE, collected USA-CA-1500, 1000, and 500 Awards All SSB. John Hawkins, K5VTA (Son of W5EHY), and Joe Slattery, W9DRL, both qualified for mixed USA-CA-500 and 100 Awards. Mixed USA-CA-500 Awards went to: Mike Steiniger, K6BFP; Kip Parker, WA3EYL; Ron Conley, K7LTV; John Morris G3ABG (Custodian of a new English Award I hope to tell you about next month); and Paschall Webb, W3MGP. Don Colwell, WØIXM, won a USA-CA-500 Award endorsed All SSB. "Buzz" Longstreth, WA1JTM, qualified for a USA-CA-500 Award endorsed, A-1. I know Paul will excuse me, but I nearly missed mentioning that Paul Hunter, WØPLN did get his mixed USA-CA-2000 Award.

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

Leo D. Staley, WA5AEB

Actually Leo, writes:"Suprise, suprise. Bet you did not expect my 'Story' to also include my application for USA-CA-3079!

"As you will see on the list, the County Hunter regulars, came to the rescue on all but 3 out of the last 42.

"For my story, received General Class license in 1960 and did not go s.s.b. until June, 1964.

"Tuned across the 40 meter County Hunters one day on 7.223 and checked in with Net control, Chas, WØJWD (now WØBL). I was treated with such politeness and courtesy even though Dallas county was not rare, that I volunteered to check into the Net on my California vacation trip the following week

USA-CA HONOR ROLL

3000
W8UMR 20

2500
W2OST 45
K8EUX 46
W5ULN 47
WØAQE 48

2000
K8EUX 63
W5ULN 64
WØAQE 65
WA7IRD 66
WØPLN 67

1500
W5ULN 93
WØAQE 94
GW3NWV 95
WA9PRE 96

1000
K5VTA 155
W5ULN 156
WØAQE 157
W9DRL 158
WA9PRE 159

500
K6BFP 708
WØIXM 709
WA1JTM 710
WA3EYL 711
K7LTV 712
K5VTA 713
W5ULN 714
WØAQE 715
G3ABG 716
W3MGP 717
W9DRL 718
WA9PRE 719

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Due to 40 meter skip conditions, I was only able to give out a few West Texas counties.

"During the next four months, gave out many Oklahoma, Arkansas and Texas counties while mobile. Then in September of 1964, started collecting counties myself.

"Have met and enjoyed visits with many of the County Hunters, including 4 of the 8 with ALL 3079 worked. You will have to look a long time to find the type of comradrie that prevails on the County Hunter Nets. I believe it all started with the group on 40 meters and then expanded to 20 meters when many of the group moved up to work the western counties not available on 40 meter daylight hours.

"You no doubt have heard many many stories about the 40 meter Net. It was a fine group of people and hams. Each would help to pull the other up by their bootstraps for a much needed county.

"Having worked about half of my County Hunting life on each Net. I must say that the 20 meter Net is 10 times the operation of the 40 meter Net. It is hard to believe so many people could get interested in County Hunting. The highest number of contacts in a 'rare' county by myself while mobile on 40 meters, was 28 in Harmon county, Oklahoma. On 20 meters I have heard some mobiles work between 90 and 100 stations in a single county. The number of DX stations County Hunting is also quite amazing.

"Through County Hunting, I have made what I hope to be some lasting friendships, and between planes in some cities I either phone or visit with fellow Hunters. On several occasions I met my Good Buddy, John, W4OHP. at the Dallas Airport, took a 30 hour 'expedition' through Texas and Oklahoma, ending at the airport for his return to Atlanta. A finer DXpedition Buddy you could not find. Yes, I could write a book on the many trips and happenings on trips through Oklahoma, Arkansas, Texas, South Carolina, Georgia and Florida with W4OHP. He was the guy that snapped the picture you published in *CQ*, May 1966. John's picture was also in that issue of *CQ*. Those are memories I will never forget.

"What's next? I honestly do not know. For sure I will continue to give out my counties while mobile, but of one thing I am sure, I WILL NOT START OVER!

Thanks to you Ed. for fanning the interest and writing the prompt letters".

73, Leo, WAB5AE.

Cape Verde Diploma

Our records show that Leo waited until February 1966 and then qualified for USA-CA-500-#547; USA-CA-1000-#94; USA-CA-1500-#45—these all endorsed, Mixed, All 7 mc and All 2×SSB and USA-CA-2000-#26, Mixed. Then in March, 1969 he applied for USA-CA-2500-#42 and USA-CA-3000-#18 and the BIG one—ALL 3079 Counties #10 on May 21, 1969. (*Good Luck, Leo, we will be looking for you MOBILE, on the NET, Ed.*)

Letters

Harry McNutt, K8KOM, writes: "Just a little note to let you know how much I like your column and also to list my last 179 counties.

I sure want to thank *everybody* who has helped me get the 3079! It sure is a great thrill. I am going to try to get on s.s.b., those I now have on c.w. and a.m. Again thanks to ALL!".

Kurt Meyers, W8IBX/2, writes: "If anyone desires a map showing all the counties in the United States, I would recommend the map of Congressional Districts for the 91st Congress. The map is approximately 4 feet by 3

The Jorgensen family L-R Tom, Lois, Jean & Jerry in the rear.

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Morse Net Award

Jorgensen Family Award

feet in size, it is publication: 1968 0-315-190, and can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for 50¢. Not only can they provide a visual county record, they can contribute to one's knowledge of the House of Representatives, as well".

Jean Delancy, K1ZAT/5, writes: "Been having fun checking into the Independent county Hunter Net. We will be operating/5 until October and will be glad to give Tom Green County (Texas) to anyone in need of it. QSL to callbook QTH is OK".

Awards

QRP CLUB-New Award-Chairman is: Hugh Aeiker, WA8CNN, 929 South Park, Charleston, West Virginia 25304.

Hong Kong Firecracker Award: Change of rules due to increase of active VS6 stations. The complete rules and foto of Award in *CQ*, October 1967, sponsored by HKARTS, P.O. Box 541, Hong Kong. For stations located in Zones 18, 19, 23 and 25: 10 contacts needed instead of 8. For stations located in all other Zones: 6 contacts needed instead of 4. These changes effective from 1st January 1970.

Extra Class Award: Sponsored by the St. Louis ARC and described and fotoed in *CQ*, September 1968 *IS AVAILABLE!* Rules information and application blank available for s.a.s.e. from W.J. Bergman, WØAUB, 842 Tuxedo Blvd., Webster Groves, Missouri 63119.

Worked Plymouth County (Mass.)

Diploma Ilha De S. Vicente (DISV): Thi Cape Verde Diploma is sponsored by Cas Do Leao of Mindelo, St. Vicente, Cap Verde Islands. This Award to be permanen and international in its distribution and to b granted to all duly licensed amateur radi stations throughout the world. The DISV wi be granted to all stations that present proof o contacts with 3 CR4 stations of Mindelo S Vincente. All amateur bands may not be use c.w., a.m. or s.s.b. and all contacts after Jan uary 1st, 1968 are valid. A minimum signa report of RST 338 or RS 33 are required Contacts on January 22nd—Dia De S. Vicent —are worth 2 points each. QSLs to CR4 sta tions worked accompanied by 10 IRCs shoul be sent to: Jorge M. S. Barros, CR4AJ, Bo 8, Mindelo Cabo Verde, Cape Verde Islands The Award will be sent by air mail.

Radio Morse Code Network Award Cer tificate: The Western Amateur Radio Mors Code Network was formed in 1968 by ham who have had experience with America Morse. Present membership includes oper ators with Railroad, Commercial, Militar and experimental experience. This certificat is awarded without cost to any operator wh will come up on frequency, 7060 kc at 080 and 3755 kc at 1930 PST, take his turn in th net and show a normal proficiency in the us of American Morse. Most members have con verters which change the audio signal to direc current which then operates a sounder. Pres ently, active members are located in Calif ornia, Utah, Oregon and Michigan. Age o members varies from 25 to 75 years. Th main interest is proficiency and conversatio using the Morse code. For any further infor mation, just break-in on the net or write th "Main Relay", Lloyd Byars, W7MY o "Chief Sounder", Ned Baldwin, W6NI (exWB6QAT).

Worked Plymouth County: This Awar

[*Continued on page 99*]

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WHAT'S NEW?? 550 BIG WATTS!

The New Galaxy Wattmeter/Antenna Selector

The Powerful New Galaxy GT-550 TRANSCEIVER

The Beautiful, Matching Galaxy Speaker Console

30-60-90 DAYS IS THE SAME AS CASH WITH US AND UP TO 3 YEAR-TERMS ARE AVAILABLE AT THE LOWEST RATES...(CASH IS NOT CHEAPER!)

OPEN MONDAY THRU FRIDAY-'TIL 9:00 P.M.—SATURDAY-'TIL 5:00 P.M.

L & S wants to say thanks for the terrific response you Hams have given us...!

We want to continue doing business with you, and we hope you will soon decide to make L & S ELECtronics your headquarters!

Read this flyer through... thoroughly and see what we have to offer. It was designed especially with you in mind.

FREE TOWERS

YES...THAT IS CORRECT! A FREE 40 FT. HAM TOWER WITH THE PURCASE OF ANY FOLLOWING COMBINATION:

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

My subject this month is the TT-30/-AGA-1 tape teleprinter. This is a lightweight, (23 lbs) miniature (9 inches by 14 inches) unit which, I am told, was designed for the White House aircraft shortly after World War II. The unit, fig. 1, was assigned the Teletype number #31, though I can find no indication that there was ever any civilian production. These little machines have been in surplus for several years, and seem to be available in modest quantities today.

The TT-30 came along in the period when the now-standard #28 machines were being designed, and it bears some resemblance to both the #26 and the #28. It uses the older felt friction-clutch, and is not capable of the 100 word per minute speed of the #28, through some of the mechanism was copied on the #28 reperforator.

The standard TT-30 was supplied with a 26 volt d.c. motor-dyna-motor which both drove the unit and provided 250 volt d.c. plate voltage to the associated terminal equipment. Some TT-30's were manufactured with 115 volt universal governed motors, capable of operating on a.c. or d.c. power. They have a switch inside the unit that must be changed to go from a.c. to d.c. (Some of these were marked "26 Volts D.C." on the cover, but the motor itself is clearly marked 115 volts.)

For anyone who would like to operate mobile RTTY, or airborne RTTY, the TT-30 should be an attractive unit. In the more ordinary shack it can provide a compact little monitoring printer that will chunk out the copy on 1/4 inch paper tape rather than pile up expensive page paper copy. It never suffers from a pileup if the carriage return or line feed signal is garbled, either.

In the original system, the TT-30 was hooked up to TT-31 and TT-32 terminal units, the former a duplex transceiver and the latter a receive-only demodulator. The TT-31 was set up for 210 c.p.s. narrow shift, using a 2265 space tone and 2475 mark. The TT-32 used 200 c.p.s. shift, 500 c.p.s. space and 700 c.p.s. mark. Together this constituted the AN/AGA-1 system I have never seen these electronic components, nor a book on the whole AGA-1, and would be most interested in looking at the manual if any of this column's readers have the *NavShips* book. I have the Teletype bulletin number 200 which covers the TT-30 alone.

Most of the TT-30's were sent out with 60 w.p.m. gears, which is fortunate, since parts for the set are no longer made. There were 75 w.p.m. gears available at one time, but they would be of little use now.

The selector in the TT-30 is of the more desirable holding-magnet design, series wired for 20 ma (which saved a little current in the original aircraft design). Since 60 ma is more commonly used as loop current, most users will want to convert the magnets to parallel operation. Fig. 2 shows how this may be done to get the magnets in the proper "aiding" operation. If you hook them up backwards they "buck" each other and will not receive satisfactorily.

One feature which I did not like in the TT-30 was the "unshift on space" provision. There is no simple way of disabling the unshift, as there is in the #15 and #28 machines. I finally took a piece of fine wire and wrapped it around the left end of the #2 (from the top) code bar (fig. 3) and moved

*5716 N. King's Highway, Alexandria, Virginia 22303.

Fig. 1—The TT-30/AGA-1 Teletype Model #31 airborne tape printer, designed to print on standard 1/4 inch paper tape.

See page 110 for New Reader Service

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that bar forward about an eighth of an inch to prevent it from operating. I wrapped the loose end of the wire around a handy projection on the unit. This disables the unshift on space, but allows proper unshift when received in the incoming copy. You do disable as well the suppression of printing on "space" and the unit puts a little square smudge on the tape when "space" is received, but I would rather see that than unwanted downshifts.

Fig. 4 is an overall schematic of the TT-30 as it was supplied with the motor-dynamotor. The speed control section is not included in sets built for 115 volt operation. The red and green "receive" and "transmit" bulbs do not operate from the tape printer, but are merely wired to the rear plug and were lit from circuits in the associated terminal units. The end-of-line light is actuated by a rather intricate set of gears on the left side of the unit which counts only printed characters, not including shifts or blank characters.

The keyboard is directly analogous to the earlier #15 and #26 machines, and will pose no problem to anyone familiar with those old Teletype standbys.

While most of the special Model #31 parts are no longer made, springs, nuts, screws, and several other small components are common to the #14, #15, #28 and even later Teletype units, and may still be ordered from the several individuals who stock Teletype surplus.

There was a later version of the TT-30 made for the Navy, known as the TT-34. This was simply a Model #28 keyboard-send-receive set in a cut-down cabinet. To save weight even steel screws were copied in aluminum, though the printing unit itself was strictly standard #28. The TT-34 used a 26 volt motor-dynamotor setup much the same as the TT-30. For normal operation the d.c. motor and the special wiring and intermediate gear may be discarded and a regular #28 motor and gear substituted.

The *NavShips* book for the TT-30 is N-S 91787 (0280-180-9000 federal stock code).

The current small teleprinter used by the Navy is the UGC-2, a #28 printer, with 3-speed gear shift, in a special small cabinet, equipped with a keyboard from #32 machine. Since the #32 keyboard puts out a *parallel* signal, there is a mechanical sending distributor in the UGC-2 to convert the pulses to the common 7.42 unit serial code.

See page 110 for New Reader Ser

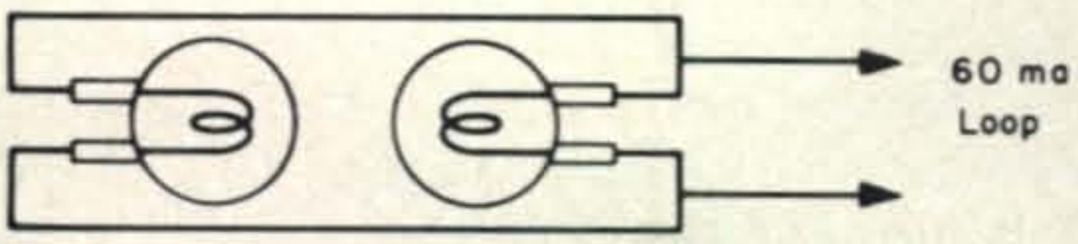

Fig. 2—Conversion of the signal magnets from 20 milliampere operation to the more commonly-used 60 ma configuration. The diagram shows the proper hookup from 60 ma loops.

The UGC-2, in a low-level version which eliminates the husky r.f. noise output of the standard 60 ma machines, is replacing the MITE teleprinters used in Polaris and other submarines, and by the U.S. Marine Corps. The closely-shielded MITE commonly overheated in the field, and it led to r.f. emission troubles on board the *U.S.S. PUEBLO* and elsewhere afloat and submerged.

The TT-30 must have been a bear for r.f. noise. My 115 volt version puts out a good deal of hash, just receiving, and it would have to be shielded if it were to be used on weak-signal work. It helps to keep the cover closed and grounded, but the noise put out by the governor is still excessive. I hope that as it "runs in" it will improve, but like all governed motors it has a certain irreducible amount of brush contact noise.

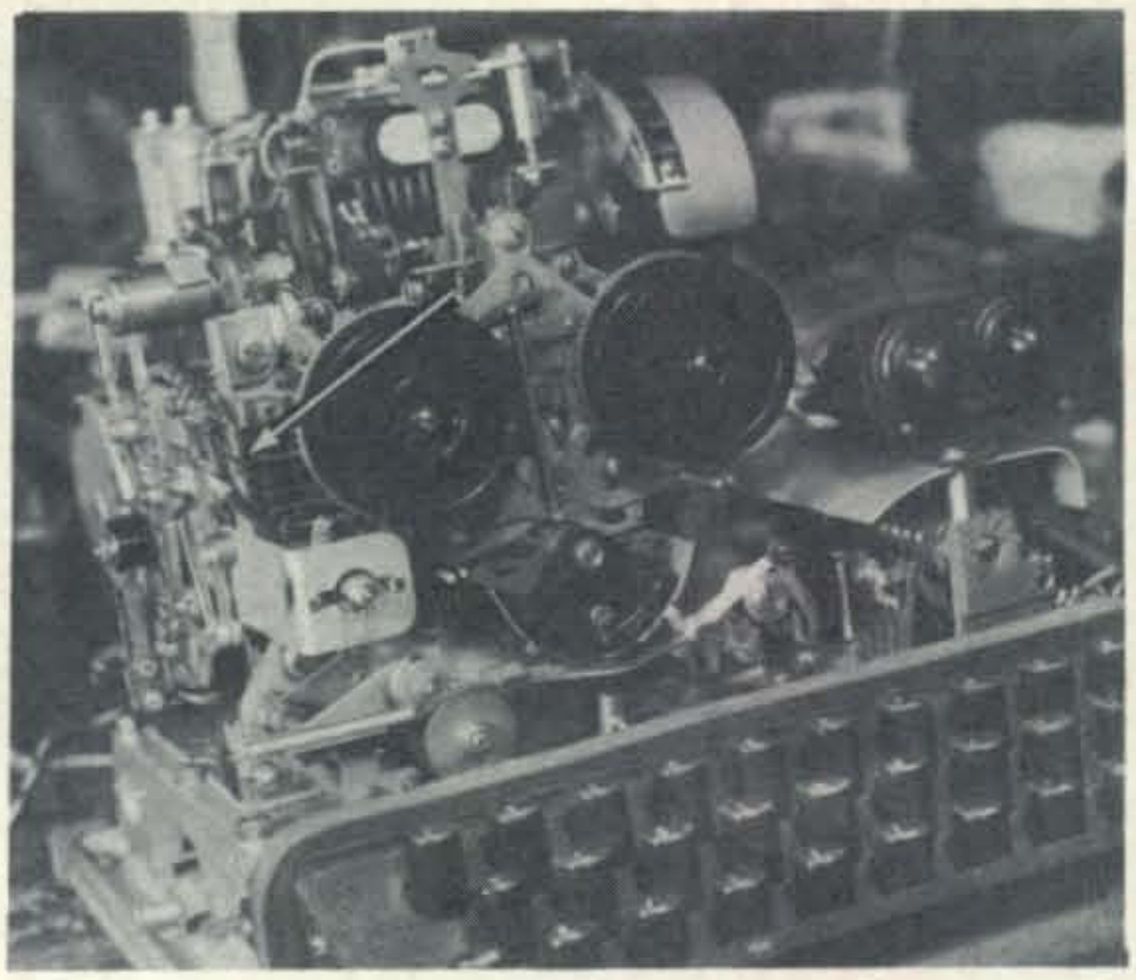

Fig. 3—Method of disabling the "unshift-on-space" feature of the Model 31. (see text)

A couple of other Surplus items have crossed my desk recently: the first is an automatic answerback unit for the #15-19 Teletype machines. This, available from Atlantic Surplus, 300 7th Street, Brooklyn, N.Y. 11215, is a device which, when tripped, will send a pre-coded signal of up to 21 characters. It may be operated from the sending keyboard, or as it was used on a land-line (TELEX) system, was actuated remotely.

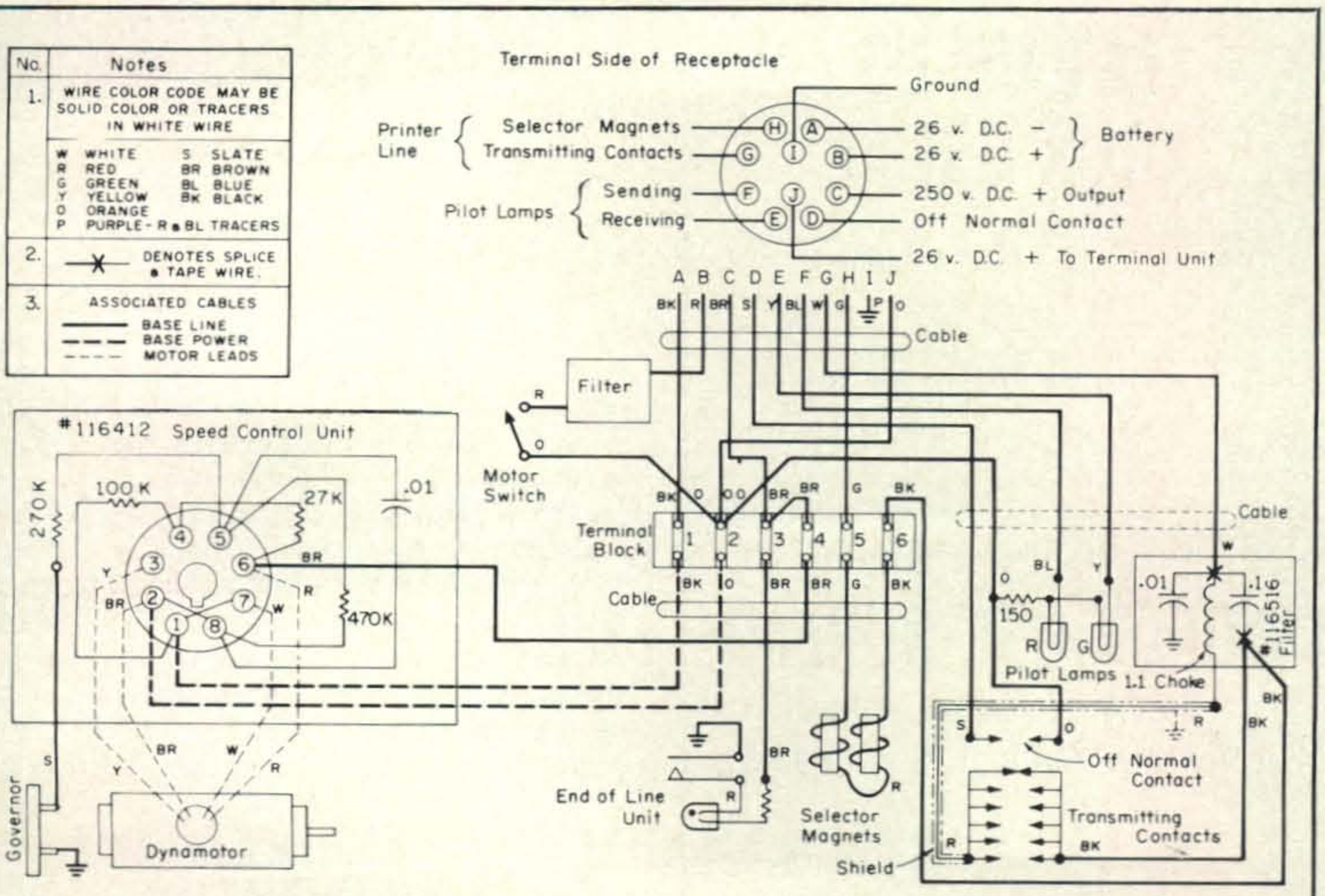

Fig. 4—Overall schematic of the 26 volt d.c. version of the TT-30/AGA-1.

See page 110 for New Reader Service

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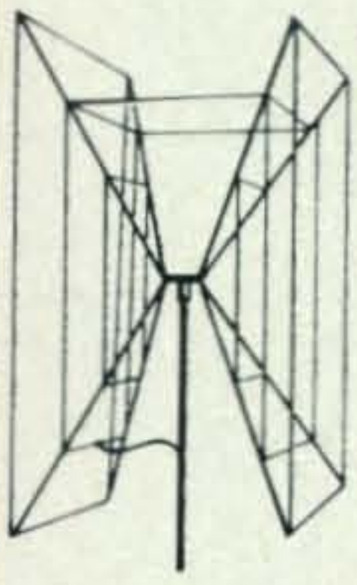

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You could code in your call, name, CQ even, or whatever you desired. Atlantic Surplus has been selling complete #15 keyboards with answerback for $15 each.

Reader Leo Drescher, of Orlando, Florida, advises me that there are a few Stewart-Warner "DATAFAX" transceivers in surplus down his way. These are designed to work on a.m. via a carrier of 2,400, 2,800, 9,500 c.p.s. *etc.*, selected by plug-in filters. The sets are coded to indicate the configuration, *i.e.* "3268" means the machine is set up for 360 scan lines (r.p.m.) per minute on 2,800 c.p.s. carrier. Speeds of 900, 280, or 180 scan lines are also available, depending on the gearing.

Resolution is rather coarse, since the speed of the 30 scan machine allows it to cover an 11 inch page in three minutes, far faster than the standard Navy facsimile units. This is simply the tradeoff of speed versus quality.

For satellite reception of 240-scan transmissions from orbit, the Datafax units would require modification, or the received signal could be recorded on tape at 240 and slowed down or speeded up to accomodate the Datafax unit. ■

Q & A [*from page 79*]

South Tulley Avenue, Oaklawn, Illinois 60453; Ami-Tron Associates, 12033 Otsego Street, No. Hollywood, California 91607.

Radio Astronomy

Some time ago we referred a reader's inquiry about radio astronomy to Andrew Furlong, WA2FGK, of the Amateur Radio Astronomy Club of the Watchung Hills Regional High School. Since then, the club has received many requests from numerous parts of the world for information on the subject.

Andy has now informed us that a pamphlet entitled *Amateur Radio Astronomy* has been printed by members of the club in their own "Arts Graphic Shop." In a copy forwarded to us, we found the text extremely interesting. Included are brief, yet sufficiently informative, discussions on what radio astronomy is all about, its uses, equipment needed, source of strongest celestial signals, problems involved, important discoveries, difference between optical and radio astronomy and most intriguing of all "Signals from Space—Are We Alone?" Also included is a reference on books and periodicals related to the subject.

See page 110 for New Reader Service

The pamphlet is available for the cost of handling only; namely, 25¢. Send your request with remittance to: Amateur Radio Astronomy Club, Watchung Hills Regional High School, Stirling Road, Warren Township, Plainfield, N.J. 07060.

Noise Blanker for SB-301

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You can improve the present setup in the SB-301 by substituting a 6AL5 for the present noise-limiter diodes and changing the noise-limiter resistor from 20K to 500K for s.s.b. and 2 meg for a.m. Also install a .05 or .1 mf capacitor across the resistor.

Correction

In "Product Detector and A.G.C. for the Knight Kit R-100A Receiver," July *CQ*, an error appeared in fig. 4. The polarity of the 4 mf 400 v. electrolytic capacitor should be reversed (negative side should be grounded). Sorry.

73, Bill, W2AEF

Propagation [*from page 84*]

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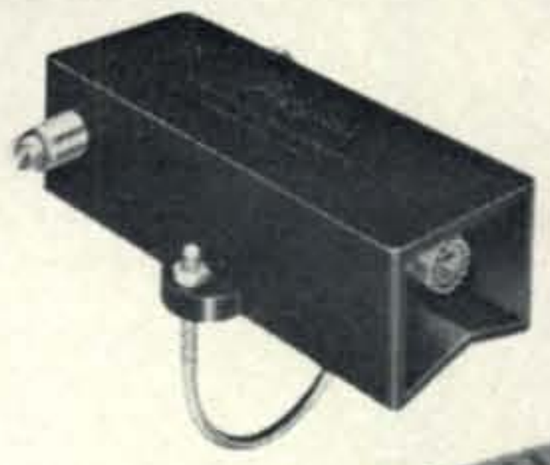

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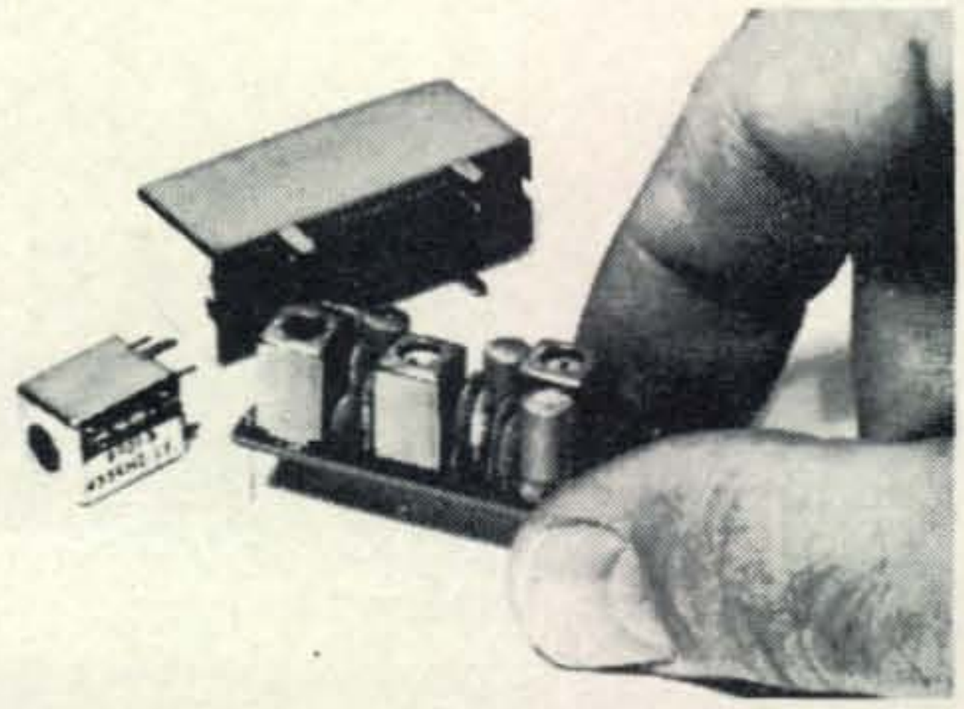

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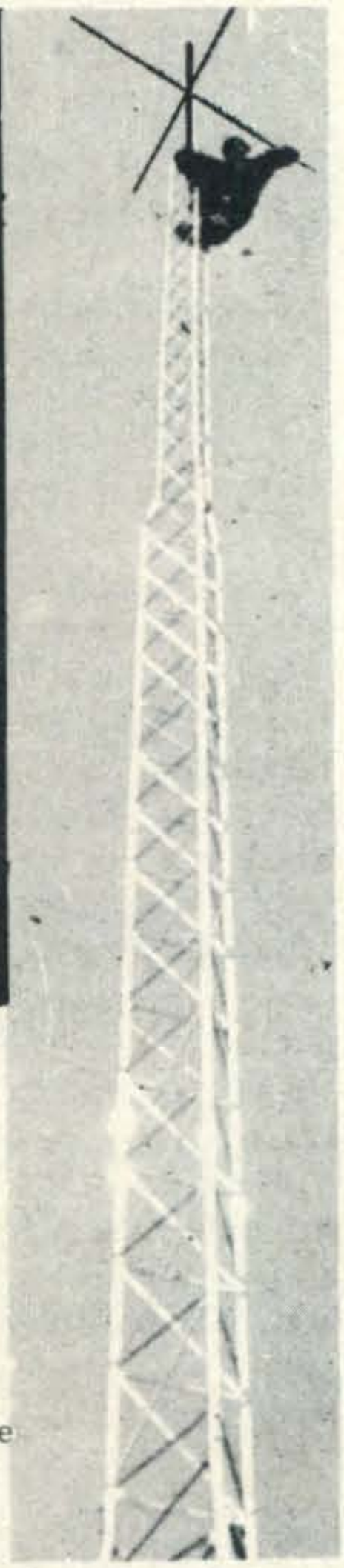

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Far East	14-18 (1)	08-10 (1) 12-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	06-08 (2) 08-10 (4) 10-12 (2) 12-14 (1) 18-20 (1) 20-22 (2) 22-00 (3) 00-03 (2) 03-06 (1)	01-02 (1) 02-07 (2) 07-08 (1) 02-06 (1)◊
South Pacific & New Zealand	11-14 (1)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

See page 110 for New Reader Service

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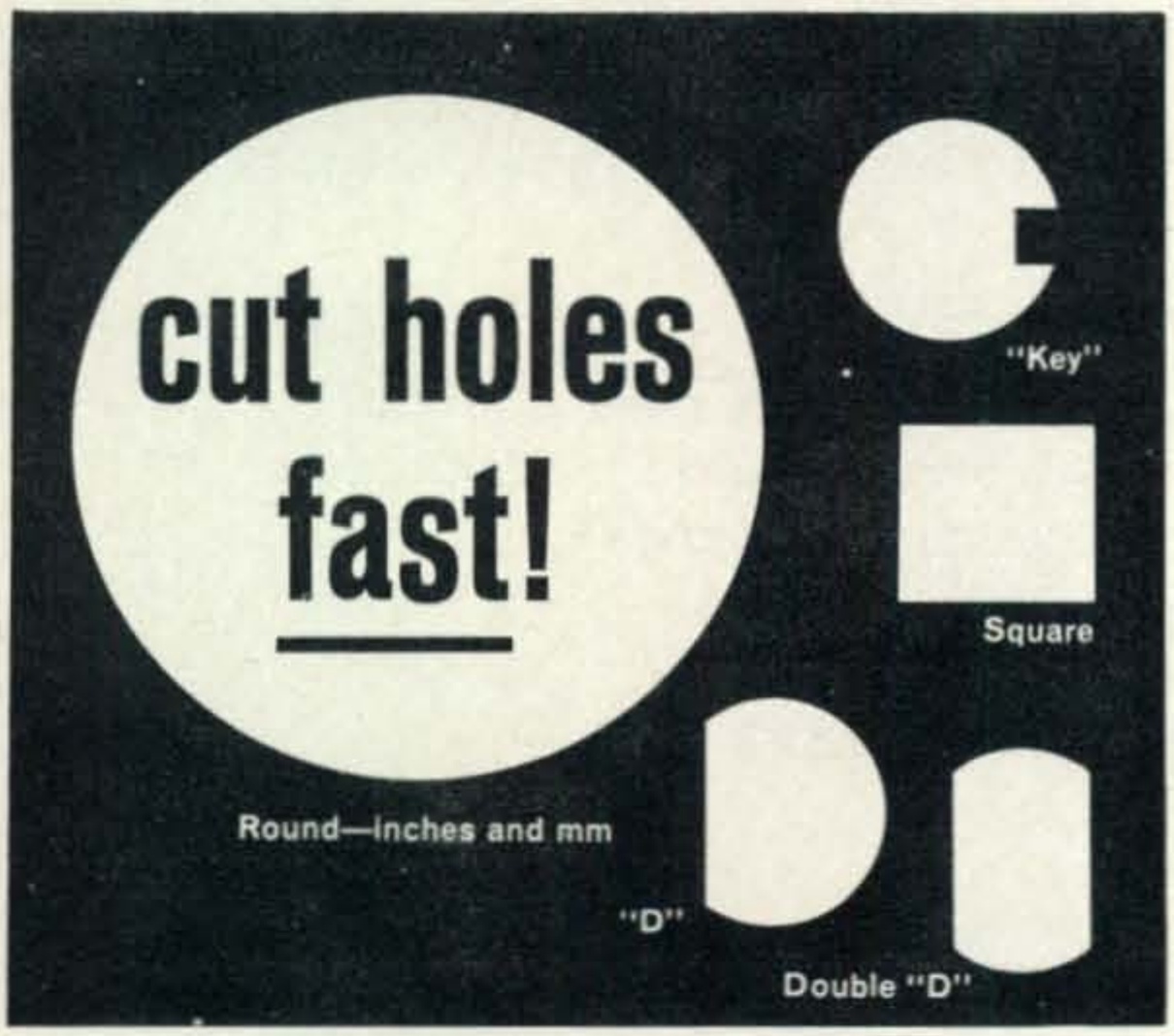

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C. W. Results [*from page 22*]

And so we put another one to bed. This was a real rough one. What with the late arrival of many logs because of the mail embargo, and later an unscheduled stay in the hospital by yours truly (ulcers, aggrevated by this contest business) we were really behind the 8 Ball.

However with the old reliable pitching in a crash program, we made it by the skin of our teeth. Andy Malashuk W1GYE, Bob Entwistle W1MDO, Freddie Caposella W2IWC and a last minute crash assist by John Norback K1ZVU. I would be negligent if I didn't also give credit to Joan of the *CQ* staff, Lucy, Freddie's XYL and my wife Anne who puts up with this "silly contest business" almost every night for six months out of the year.

73 for now, Frank, W1WY

Australis—OSCAR [*from page 68*]

Philosophical Reflection

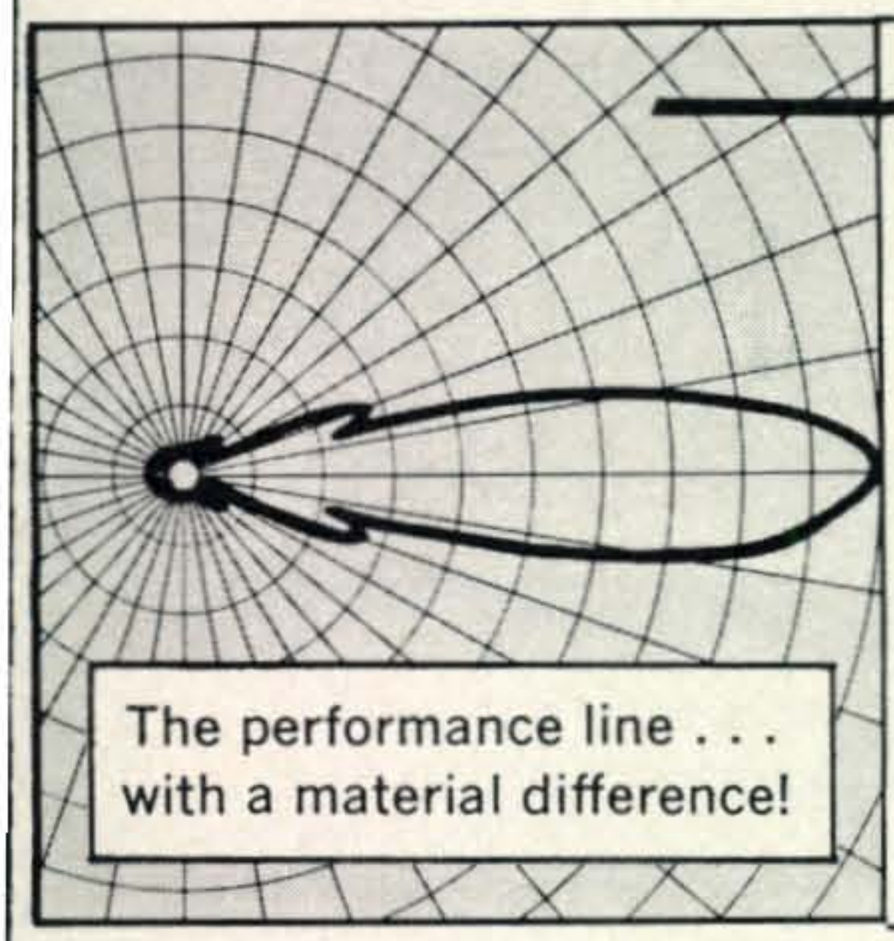
AUSTRALIS-OSCAR 5, as are all OSCAR satellites, is designed as a "free access' satellite. Anyone, anywhere in the world can listen to it, use it, and share in the information derived from it. It will enable radio amateurs, space listeners and amateur space enthusiasts in all countries to cooperate in a voluntary space experimentation program.

It is hoped that the satellite will serve both as a tool and as a catalyst to encourage participation in space experimentation, especially among the younger generation who will be the engineering and scientific leaders of tomorrow. It is gratifying to note that many of the present leaders in this project rose from the ranks of the then younger generation who were attracted to the first OSCAR satellite, launched nearly eight years ago. Self education, exposure and experience in this, one of the most exciting of sciences, is the true sport of amateur radio.

Time is of the essence. Lift-off time is approaching rapidly. To conduct some of the experiments discussed in this article will require some degree of preparation. Get that equipment ready NOW. Plan to participate even if it is only to catch the HI signal on a single pass. Don't miss out on this exciting adventure for amateur radio!

The author wishes to acknowledge the assistance given by Project Australis and AMSAT in the preparation of this article. ■

See page 110 for New Reader Service



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Contest Calendar [*from page 81*]

Multi-operator, single transmitter. (c) Multi-operator, multi transmitter. Multi-operator stations judged on all band *only*.

7. Definition of a multi-operator station: Single transmitter, only *one* signal permitted. Multi Transmitter, only *one signal per band* permitted.

8. Use separate log for each band, 40 contacts to the page. Indicate the zone and country *only* the first time worked.

Official rules including a list of 12 or more Trophies donated by prominent hams and Clubs all over the world will appear in next month's issue. These rules as well as official log forms and summary sheets are now available from *CQ*. Include a large s.a.s.e. with sufficient postage or IRCs to cover your request. NOW is the time to make your request, not the week before the contest. Our address: CQ World Wide DX Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050

Editor's Notes

No comments this month. Hope you are all having a good summer.

73 for now, Frank, W1WY

USA-CA [*from page 88*]

sponsored by the Massasoit Amateur Radio Club of Massachusetts and offered to Amateurs and s.w.l.s for working (or hearing) the required amateur stations in Plymouth county. Stations in the 1st call area must work 7. rest of U.S.A. must work 5 and DX must work 3. NOTE–TWO of these must be members of the Massasoit Amateur Radio Association, Inc. Send GCR list or QSLs and $1.00 to Ernie Guimares, Jr., WA1BFD, 17 West End Ave., Middleboro, Massachusetts 02346. Free to Blind and paralyzed.

Fort Aberchrombie Hamfester's Family Award: This Jorgensen Family Award is available to amateurs and s.w.l.s for working or hearing all FOUR members of the family: Dad is Jerry, WAØVGJ; MOM is Lois, WAØRWM; Jean, 17 is WAØRWK; and Tom, 14 is WAØRWL. Send the 4 QSLs and a dime or IRC to The Jorgensen Family, Box 213, Abercrombie, North Dakota 58001. To our knowledge, this is the only 100% ham family in the state of North Dakota.

Notes

Up to my deadline time, no new foto received from Leo, WA5AEB, so you will have to look in *CQ*, May 1966.

Many thanks for all the wonderful, wonderful and helpful letters received; I repeat, I wish I had a thousand readers like, Bertha, WA4BMC, her letters keep rolling in with much encouragement and helpful suggestions. So–How was your month?

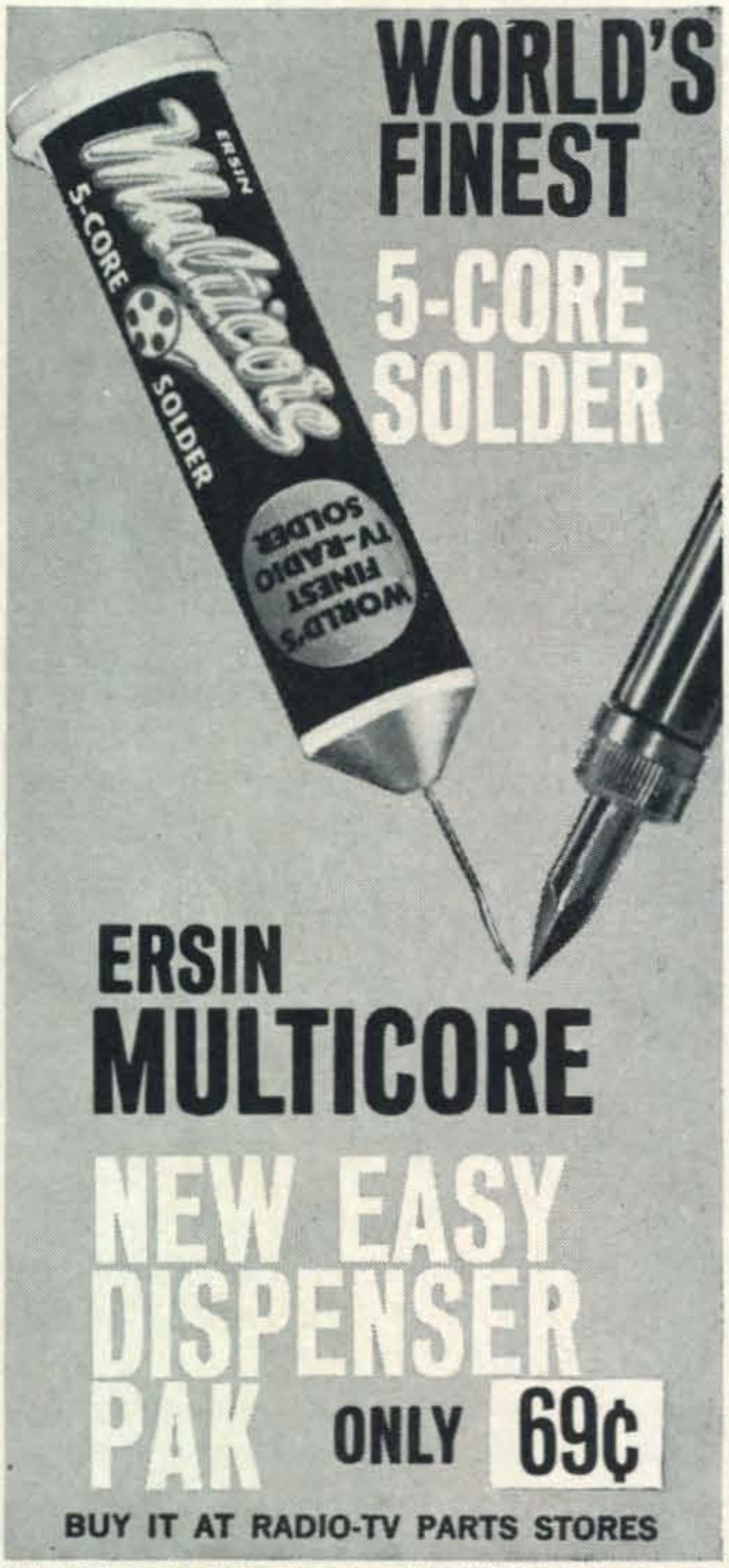
73, Ed., W2GT.

Slow Scan TV [*from page 44*]

the "sliding pulses." They will not be synchronized to 15,750 rate but will march across the c.r.o. screen like little soldiers. Negative going video is applied to the FET at point H. A good test of the sampler operation is to introduce a 1000 cycle sine wave at point H (instead of video) and observe the pattern on the c.r.o. screen at point G. The 1000 cycle sine wave will be boxcarred as shown in fig. 18.

The multivibrator circuit is adjusted by applying fixed voltages at the points specified. Remember to adjust potentiometers P_1 and P_2, white frequency adjust, together to produce a symmetrical square wave as observed on a c.r.o. at the output of Q_{34}.

See page 110 for New Reader Service



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The best method of adjusting the potentiometers is by means of Lissajou figures on a c.r.o. with an audio oscillator connected to the horizontal plates. The adjustments are made to produce a 1/1 circle on the c.r.o. screen for the 1200 cycle sync frequency, 1500 cycle black frequency, and 2300 cycle white frequency.

The voltages measured at each of the arms of the potentiometers is given below.

P_3, SYNC FREQUENCY pot. +4 v.

P_4 BLACK FREQUENCY pot. +.65 v.

The builder may want to have the black control, potentiometer P_4, available as an operator adjustment to compensate for video level and dynamic range of the video. In the final operation, Gain potentiometer, P_5, in fig. 14, should be adjusted to swing the frequency from 1500 cycles to 2300 cycles. (+5 v. to +11 v.). a 5 volt zener is in the collector of Q_{33} for the purpose of preventing video from interfering with sync/signals near ground potential.

Conclusion

The slow scanner now has a variety of cameras from which to choose. Most of us started out with a flying spot scanner similar to the one described by K7YZZ in Oct., 1967 issue of *73*.

The MacDonald camera described in June, July, August 1965 QST is still the best approach when considering the transmission of arrested motion but it may be difficult to focus and uses an above average priced vidicon.

Those of us that can hold still for 8 seconds can build a MacDonald camera with an open shutter using a fast scan 7735A or plumbicon as described by K7YZZ in the Feb., 1969 *73* or build a sampling camera as described in this article.

The results of the sampling camera can be seen in the accompanying photographs. These two pictures compare the output of a normal fast scan monitor to that of the slow scan sampled version. Photography was done with a simple polaroid camera with several close up lenses in tandem therefore limiting the picture quality.

The author wishes to thank the many slow scanners that have had a part in providing circuit ideas and suggestions to make this camera possible. Among the many are WA2FLJ, W4UMF, W7FEN, K7YZZ, VE3EGO, W2PMV, W8SH and Glenn Southworth of Boulder, Colorado. Thanks

See page 110 for New Reader Service

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is also given to W9KVK and WA9MIA who proof read the article and to the XYL (extra class) W9CNW who did the drawings. *Hams should be seen as well as heard.* ■

Announcements [*from page 10*]

Findlay, Ohio

The Findlay Hamfest will be at Riverside Park on Sept. 7. Tickets & information available from Clark Foltz, W8UN, or any Club member. Tickets $1.00 in advance, $1.50 at park. Bring the whole family. No charge for flea market.

Aurora, Illinois

The FRRL Swap n Shop Hamfest will be held August 24 at Phillips Park, Aurora. Free coffee and donuts from 9 to 10 A.M. Fun for the whole family. Homing freq. 145.350 and 3.940 mc's. For additional info contact: Roger Louks, P.O. Box 93, Plano, Ill. 60545.

Chicago, Ill.

The Hamfesters Radio Club would like to invite you to help celebrate their 35th Anniversary Hamfest. It will be held on Sunday, August 10 at Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago.

Troubled with TX-I?
Read this month's
Q & A Column
on page 78

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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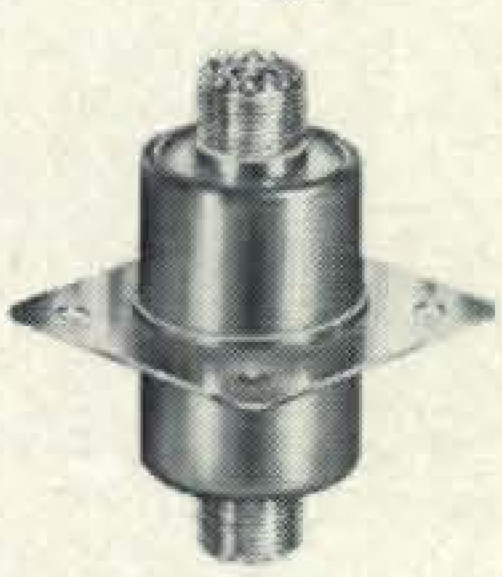

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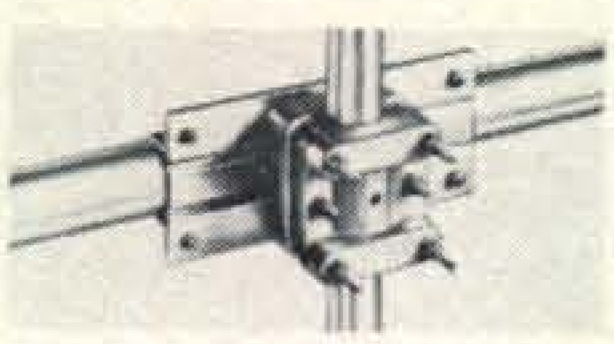

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SELL: 3 el 14 mc beam $60; conv. prop pitch motor, indicator $60; QST de 1946, CQ de 1947 $3 yr; call for; Earp, 518 Dunkirk Rd., Balto., Md. 377-6660.

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WANT: Model Airplane ignition (spark) coil for project. Buy or trade. W4ZUS, Rankin, NAVEODFAC, Indian Head, Md. 20640.

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WANTED: Back issues of 73 magazine, March '67 June & Sept. '66, Dec. '65, June '62, Jan., Feb. & Mar '61 and Oct. & Nov. '60. L. Sharp, VK4NS, 19 Kels Street, Chermside, Queensland, 4032. Australia.

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See page 110 for New Reader Service

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KEEP your equipment in top shape with this Measurements Model 82 signal generator. 29 Hz to 50 mHz. 0-50 volts audio. .1 microvilt to 1.0 volt RF. Cost $895.00 new, best offer over $225.00. takes it. Fred L. Wood, Box 337, RR1, Milan, Ill. 61264.

SELL MARAUDER HX-10 $135., Henry Radio K2 linear $425, Swan 400 transceiver $275., Swan 406B VFO $60., Swantenna $20., DC power supply $65. All equipment clean, excellent condition with manuals. Ship prepaid Continental US upon receipt of money order or certified check. R. Santosuosso, 1302 Alta Vista Drive, Vista, California. 92083.

"HOSS TRADER ED MOORY" says if you don't buy your Ham gear from him, you might pay too much! Shop around for your best price and then call the "HOSS" before you buy! NEW EQUIPMENT: Factory Warranty: Swan 350-C, $3.29.00: Early Model Swan 500C, $399.00: National VX-501 VFO, $119.99: Demo FTDX-400, $489.00: No reasonable offer will be refused on New Galaxy GT-550 and power supply—Try Me! NEW ROHN 50 ft. Foldover Tower prepaid, $188.00: New Mosley Classic 33 and Demo Ham-M Rotoe $209.00. USED EQUIPMENT: HQ-170A, $179.00: Drake 2-A, $139.00: "MINT" 75A-4, $339.00. TR-4, $439.00: T4-XB, $359.00: R4-B, $349.00: Ham-M Rotor, $88.00: Hallicrafters SX-117, HT-44, & supply, $339.00: Swan Cygnet, $369.00: Galaxy GT-550, $369.00: "ED MOORY WHOLESALE RADIO CO. BOX 506 DEWITT, ARKANSAS 72042 Phone (501) 946-2820.

PEORIA HAMFEST—September 15—Peoria, Illinois, same place as last year. For details, see announcements, Sept. issue of CQ, Advance registration: $1.50, write: L. F. Lytle, W9DHE, 419 W. Stonegate Road, Peoria, Illinois. 61614.

LOUISVILLE HAM KENVENTION and Great Lakes Division ARRL convention at Stouffer's Inn on 1-65 in downtown Louisville, Kentucky. The date . . . August 29 and 30. Forums, exhibits, flea market, contests and banquet. Many surprizes, featuring the new Signal/One CX7. Shop the best selection of new used equipment and bring your surplus for the flea market. Make it a family day at the KENVENTION. For information write KENVENTION, 648 South 4th Street, Louisville, Kentucky 40202.

JOB WANTED: Have second telegraph, Merchant Mariner's Document, extra amateur. Will consider employment in or out of U.S. Roger Allen, 271 Peterham Rd., Athol, Mass. 01331.

DRAKE: R4 & T4X with power supply $600.00. TR4 with AC-DC power supply $500.00. GSB, 201 Linear $200.00. Saul Slonim, 2727 Ocean Parkway, Brooklyn, N.Y. 11235.

WANTED: Used crank-up and/or Tiltover Tower in good condition. Heavy duty rotor, Triband or Duoband Fiberglass Quad. State lowest price in first letter. K3JML, C. A. Kollar, Sans Sovei, Mobile HM CT. RO#1, Wilkes-Barre, Pa. 17702.

FOR SALE: G66B rcvr. A.C./12V. DC supply AF67 xmitter. A.C. Supply Want Xcvr, xformer for 813 linear. S.A.S.E. for info. W4VLS, 3832 Moss Rose Dr., Nashville, Tenn. 37216.

COMPLETE set of Popular Elecctronics, first issue through Nov. 1968. $35.00. You pay postage. Paul L. Wenger, 5113 Cavedo Lane, Richmond, Va. 23231.
SWAP—KW power transformers—offers? WA6HYB, 624 First Ave., Chula Vista, Calif. 92010.

WANTED: Galaxy linear—also KW Matchbox—must be in A-1 condition. WA9TLO, Joe Ornatowski, 13 N. Grace, North Aurora, Ill. 60542.

SELL: SX-71 $85; DX60A $65 spare tubes 3 xtals at novice band both $140.00. M.O./certified check u ship. WA2HNX, Suter, 318 So. Goodman Street, Rochester, N.Y. 14607.

HT-41 Linear $125.00., Apache SB $139.00, WRL six, two trans $69.00; Matchbox with SWR $55.00, NC $100.00 W5SYB, 500 Hall, Amarillo, Texas. 79109.

SELL: Heath HW17 2 meter 10 watt output transceiver factory aligned and factory installed Modification No. 1 with manuals and two crystals. $80.00. express collect. G. Countryman, W4JA, 75 E. Bay Street, Charleston, S.C. 29401.

WANTED: Hallicrafters HA-5 VFO and HA-7 Calibrator. Top condition. State price. WA9EXZ, H. A. Draeger, 533 S. Spring Ave., La Grange, Ill. 60525.

WANTED: Valiant, Long Island area WN2JJF, Gary Whitehead, 6 Reynolds, Glen Cove, N.Y. (516) 671-5813.

QUAD FOR SALE: Gotham 2el. tribander. Excellent condition. $25 plus shipping. Dale Hammer, 644 N. Riley, Kendallville, Ind. 46755.

FOR SALE: In excellent condition, Hallicafter SR-160 w/xtal calibrator and PS-150 pwr supply, HTH CW monitor and mike. Make offer. Write J. Adelman, W3CGR, 97 Barre Drive, Lancaseter, Pa. 17601.

TRADE: HX-50 for commercial type linear amplifier. All letters answered. Les Turner, W7BKG, 2213 Sunland Ave., Las Vegas, Nevada. 89106.

CANADIANS: Complete amateur equipment service, fully equipped, gov't lic'd technician. VE6TW, Bob Fransen, Box 197, Sherwood Park, Alberta.

NATIONAL NC-173 excellent condition. For sale; includes speaker. No reasonable offer refused. Jack D. Gollahon, W9TLL, 955 E. Wood Street, Decatur, Ill. 62521.

WANTED: Parks-2 meter converter. (cash). For Sale: Parks 6 meter converter, If 14-18. $30.00. J. Gysan, W1VYB, 53 Lothrop Street, Beveraly, Mass. 01915.

FOR SALE: Wheatstone oiled 15/32" perferator tape for Boehme equipment. P. L. Lemon, 3154 Stony Point Road, Santa Rosa, Calif. 95401.

FOR SALE: Forty MTR mobile CW rig with 12 volt pwr supply $30; VFO see Dec. 67 CQ, $20. 14mc 800 W amp local sale $75. W6BLZ, 528 Colina Street, La Jolla, Calif. 92037.

WANTED: Collins 312B-3 speaker and 500 cycle filter for 75S-1. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Massachusetts. 01056.

TURQUIOSE TAILENDER. Etched "De your call"/ $2.50 ppd. See P. 85, June QST. Add ur cord, base. Bud Frohardt, W9DY, 3620 N. Oleander, Chicago, Ill. 60634.

FOR SALE: Collins 75S3B Rec., 32S3 xmitter; 516 F-2 power supply: SM-1 Mike, $950.00. L. Ahlstrom, 217 Kansas Drive, Portales, N.M. 88130.

WANTED: 4 C.B. rigs. Please give make, model, condition and minimum price. All replies answered. A. M. Fox, Box 895, Greeley, Colo. 80631.

SELL: HX-20 & manual. $135; self-powered VFO, $25; digital 24 hr. clock, $10, K7QAK, 3543 W. Hazelwood, Phoenix, Ariz. 85019.

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RTTY INFORMATION for the Amateur interested in RTTY. F. DeMotte, P.O. Box 6047, Daytona Beach, Florida 32022.

FOR SALE: 100 Khz Crystal. Never used. $4.00. Must sell. Write for details. WB8BEG, 24126 Martha Washington Sfld., Mich. 48075.

HALLICRAFTERS S-120 general coverage receiver, with manual, excellent condx. $45.00. Richard Beatie, WA4ZYU, 1904 11th Ave., Tampa, Fla. 33612.

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.

WANTED: SR-400, HA-20 VFO, and PS-500 AC power supply. Must be in good condition. WB4KQV, 805 Burton Street, Rocky Mount, N.C. 27801.

FOR SALE: HT 37 100 watts HT 41 1000 both $375. Heath SB 300 rcvr. $175. W2FEI, 516-295-5411.

SELL: Heath HX-20 SSB xmtr & HP-20 pwr supply, with instr. manual, $135. J. D. Cox, 3543 W. Hazelwood, Phoenix, Ariz. 85019.

QST Magazines 1960 through 1966 and CQ magazines 1961 through 1966 all at 35¢ per copy—will sell by years only. L. Covey, K1JAR, 238 Jenness St., Lynn, Mass. 01904 or call 745-5464 or 592-1657.

SELL: Q.S.T., C.Q., 73, any amount. Send requirements and offer. E. Guimares, WA1BFD, 17 West End Avenue, Middleboro, Mass. 02346.

WILL BUY WD11 or WD12 tubes, early CW helix, hot wire ammeter or what have you. W6AKM, 1289 Glen Eyrie Ave., San Jose, Calif. 95125.

FOR SALE: Hallicrafters SX-130 with speaker R-50 and Knight Kit Xtal Calibrator. Mint Cndx. First M.O. for $140.00 takes it. BA Rahn, WN9ANQ, 1511 East Main, Little Chute, Wis. 54140.

WANTED: 6 meter Home Brew xmtr 100 watt output. Must be compact, perfect condition, VFO and reasonable. T.O. Easley, 3480 Rosewood Ave., Los Angeles, Calif. 90066.

CANADIANS: Complete amateur equipment service, fully equipped. Gov't lic'd technician, VE6TW, Bob Frensen, Box 197m Sherwood Park, Alberta.

FOR SALE: Honest value new heavy duty power supply factory carton regulated 300 V 180 MA + 6.3 VAC at 10 Amps $20.00. Prepaid. W5HW, 226 Blake Midwest City, Oklahoma. 73130.

FOR SALE: Mosley MA-3 Mobile Antenna 20-15-10, Master HD stainless Spring Base, Uncut 75M coil. All $25. E. L. White, Jr., Box 582, Waynesboro, Va. 22980.

RTTY INFORMATION for the Amateur interested in RTTY. F. DeMotte, P.O. Box 6047, Daytona Beach, Florida 32022.

SELL 2 KVA 115 volt Adjust-A-Volt variac with built-in voltmeter, new condition $15; Robert Ireland, Pleasant Valley, N.Y. 12569.

HW-12, never used. Perfect. Trade for HW-22, HW-32 or what have you. W4YOK, 207 S. Alves Street, Henderson, Ky. 42420.

FOR SALE: SR-42A 2 mtr transceiver exec. shape $115, new HW-100 with pwr. supply $300, sixer $10, also 2 mtr FM, WA5SFA, 1800 College, Jonesboro, Ark.

WANTED: Antique radio tubes made prior to 1923, also spherial DeForest Audion with candelabra screw base. W9LGH, 610 Monroe Ave., River Forest, Ill. 60305.

ATV: Want gear books in good shape. Dealers please send flyers. WA0WDX, 7449 West Shore Dr., Edina, Minn. 55435.

SELL: SX-11, perfect, with manual, $140. Th-4, rotator, guyed 55 ft. crank-up tower: pick up for $165. G. Roget, 300 La Vida Drive, Lodi, Calif. 95240.

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 City, Mich. 48706.

QST's—Most issues from 1954 to 1967 for sale. Bill Bryan, W8LGQ, Lakeshore Dr., R. 1, Hebron, Ohio 43025.

XMTR's-500W. Complete—AM/CW unit in 6 ft. Relay rack. Prestige Item. 20 ft. Tower, sell cheap or trade. W2CE. G. S. Beck, 8604 55th Rd., Elmhurst, L.I., N.Y. 11373. Tel: 212-639-3982.

H.B. 813 G.G. Linear with self-contained power supply. Trade for ? Bill Clearfield, WA0IMY, 2594 So. Colo. Blvd., Denver, Colo.

FOR SALE: KWS-1, all new tubes, all Collins modifications. $695. Can ship. WA8HNM, Leon Beyer, 10 W. 35, Holland, Mich. 49423.

FOR SALE: SR-160 A.C. & D.C., $250. 75S-3-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 Sherbourne Avenue, Portsmouth, N.H. 03801.

FOR SALE: Johnson 275 watt Matchbox with coupler and indicator-Eico 717 keyer-Electrophysics key. R. E. Fritz, Bx. 66, Clifford, N. Dak. 58016.

WANTED: Antique radio tubes made prior to 1920. S. M. La Dage, 431 Oakland Ave., Maple Shade, N.J. 08052.

SEARS EMPLOYEES Net meet Wed. 10 pm. and Fri. 11 pm. E.D.T. 3910 KC or thereabouts—K3YQD, Bill Leggat Net Sec'y.

FOR SALE: Apatche TX-1, needs minor work, best offer over $50. Lafayette HA-230, good cond. $35, or best offer. Consider trade for good oscilloscope. Glenn Anderson, 1100 New Jersey Ave., Pine Beach, N.J. 08741.

COAX RELAYS, 115 VAC, two at $4 each; five 304th @ $20 each; three K8DTS, R. A. Leskovec, 25884 Highland Rd., Richmond Hts., Ohio 44143.

SOUTHERN CALIFORNIA AREA: Collins 75S1, 32S1, 516F2, 312B4, Heath SB 200, $1,080. FOB, W6 RET, Bill Deane, 8831 Sovereign Rd., San Diego, Calif. 92123.

WANTED: Collins 312 B5 PTO console; trade new unpacked Skyline four element fiberglass Quad and difference in cash. George Clark, MD, 1741 La Coronilla Dr., Santa Barbara, Calif. 93105.

FOR SALE: Hallicrafters HT32A, Johnson Thunderbolt linear, Collins 75A4 receiver. Mint condx. $750. W3HQO, 8005 Palmetto Ave., Phila. Pa. 19111.

WANTED: Good Vibrokeyer. Sacrifice perfect Heathkit GR-54 general coverage receiver $85.00. Two yrs. old expert wiring. Stephen G. Hawley, WA4UAZ, Route 3, Box 476-B, Clarksville, Tenn. 37040.

SELL: National NCX-D Mobile Power supply like new $55., wil lship, CE 20A VFO & QT1 Exc. $90. Paul S. Smith, WA5FDT, Mena, Ark. 71953.

WANTED: Manufacturing Co. Electronics large or small that would like to relocate write, H. Sharrard, 438 States Street, Weiser, Id. 73672.

FOR SALE: Heath tunnel dipper, HM-10A, excellent, $19.00. Cal Enix, W8EN, 104½ W. Chicago Rd., Sturgis, Mich. 49091.

FOR SALE: TR44 CDR rotor. Guaranteed perfect. 100' new 9 cond. No. 18 cable incl. $50.00. W6EUF, 2301 Canehill, Long Beach, Calif. 90815.

FOR SALE: 6 & 2 meter trans & Rec Clegg Zeus intercepter with all bander converter. Ed Wagner, WA9SZH, 6307 East Gate Rd., Monona, Wis. 53716.

FOR SALE: Knight R-55 rcvr. $30. Viking 88RMQ, stereo tape recorder. $150. Both excellent. Capt. Tanaka, KH6BTH, 5135 E. Cassino, Fresno, Calif. 93727.

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FOR SALE: Ranger and Courier Amp. Both excel. and with manuals. R. Schweizer, WB2PFC, 240-270 145th Ave., Rosedale, L.I., N.Y.

SX 122 with xtal calibrator $140. WA0TEG, R. R. 23, Box 234, Kansas City, Mo.

WANTED: Collins S line and KWM-2 for best reasonable cash price. State condition SN first letter. LYNCH, 4741 Belwood Green, Arbutus, Md. 21227.

F. M. TRANSCEIVER 12/W PYE on 146.94 MC, W/ control, spkr., manual $50. BC-221 Freq. meter w/book $35. W. J. Davis, 4434 Josie Ave., Lakewood, Calif. 90713.

FOR SALE: CQ Vol 1 No. 1 to date QST Jan. 1924 to date, make offer. D. J. Sullivan, 9607 4th Ave., Inglewood, Calif. 90305.

RTTY 28 ASR & KSR cabinet trade for 28 gear shifts, ASR TD or Reperf base. K0SHK, D.C. Harrington, 1620 Gardenia Ave., N.E., Minneapolis, Minn. 55421.

WANTED: Collins 399C external P.T.O. SELL: Collins MP-1 mobile power supply and 351D-2 mobile mount. Mike Ludkiewicz, 143 Richmond Road, Ludlow, Mass. 01056.

FOR SALE: Collins 75S3B S/N 15885, 32S3 S/N 13596, 516F2 PS, Johnson 250W Match box. $1050. D. Palmquist, P.O. Box 505, Barstow, Calif. 92311.

HALLICRAFTER HA2 transv. w. power. Ex. cond. $130. Joost Koenig, WB6GXT, 5143 Elsinore, Orange, Calif. 92667.

TRADE: Have complete radio control system and very good forty meter receiver. Will trade either or both for walkie-talkie one to five watts or cash. Carey Coggins, 7125 Hunters Branch Drive, Atlanta, Georgia 30328.

FOR SALE: Johnson 250-39 T-R switch. New, never been used—$20. R. C. Kaefer, WN2EWC, Box 24, Cowlesville, N.Y. 14037.

SALE: V.F.O. Heathkit HD-10B, new, $25.00. Crystals for 75S1, as from factory incl. 100kc, upper-tower sb, $20.00., clamp-on am meter for Triplett 310 VOM, new, $6.00 + postage. K6AEZ, 150 Geneive Street, Camarillo, California 93010.

TUBES. New, unused. RK 38, 4D32, 866, 1806, 3E29, 829. Send stamp for bargain prices. K4PNY, 4103 N.W. 15th Street, Gainesville, Fla. 32601.

FOR SALE: Swan 175 $90.00. Hustler MO-2 Mast RM-75 Resonator $15.00. Honeywell W612B DC supply $25.00. K8EKG, 1020 4th Street, SW, Massillon, Ohio 44646.

WANTED: Old battery operated radios of the early 1920's. Need not be in working condition. Also want early wireless gear. D. T. McKenzie, 1200 W. Euclid, Indianola, Iowa, 50125.

FOR SALE: Collins 51J4 with 1,3,6 kc mechanical filters, excellent condition with cabinet. $625. FOB. W7QCN/O. 1610 Shasta Drive, Colorado Springs, Colo. 80910.

SWAP Early HRO, P.S. plus cash for Lafayette HA144 2 meter transceiver W2NX, 29-29 213 Street, Bayside, N.Y. 11360.

FOR SALE: Factory Eico 753, 751. Has been completely stabilized and reworked. Will take first offer. $180. You pay shipping. WA5PPF, Box 5025, Abilene, Texas. 79605.

SELL OR SWAP: Lafayette HE30 5 band receiver. $50 or what have you to swap? J. Wasiewicz, 229 Sarles La., Pleasantville, N.Y. 10570.

SALE OR TRADE: Like new 28 KSR Auto CR-LF with or without 3 speed shift WA0KLC, 315 E. 20, Grand Island N.B.

FOR SALE: Ranger I, $75. SASE for list of basement-cleaning surplus. Al Brogdon, K3KMO, RD 1, Box 390A, State College, Pa. 16801.

WANTED: T. R. Switch, outdoor baluns, mobile rig & HT33B. State terms & condx. J. L. Davis, 904 Haws Ave., Norristown, Pa. 19401.

OMEGA DA KEYER w/p.s. like new, $50.00. p.p. Albert Hale, WA7ERA, Route 2, Boise, Idaho 83702.

FOR SALE: Heath DX60B, HR10B, AM2 S-MTR, Manuals, mint condx, shipped $175. Jay Gardella, 120 Oaktree, No. Kingstown, R.I. 02852.

FOR SALE: Collins 32 S3 and 75 S3 both $750.00. W2VL. M. R. Gutman, 491 Rebecca Lane, Oceanside, N.Y. Phone RO 4-0309.

FOR SALE: Magazines, CQ-QST, PF Reporter, Radio News and IRE Proceedings, 20 years of CQ and QST. Pickup or postage. Best offer S.A.S.E. for list. G. B. Martin, Box 111, Campbell Hall, N.Y. 10916.

HORNET ANTENNA TB 1000-4 for sale very reasonable. Locals only. WA6ZCQ, Ph. 213-663-1581.

SELL: Heath HX20, HP20 & man. $150. Ameco TX 6 & 2 $75. Elmac AF67 $35. Not mobiles. M. Pieper, W9CSV, 26350 W. Edison Rd., So. Bend, Ind. 46628.

TRADE/SELL Mil. model Bird wattmeter $75; few new meters for No. 43 system $15; Components, List SASE. W4API, 1420 S. Randolph Street, Arlington, Va. 22204.

SELL: GR Freq. monitor 1175B new cond. W/cables $120. Trade on HQ180, HQ145, AR88, CR91. WA3BNB, R. Snider, RD No. 2, Lewistown, Pa. 17044.

SELL: Compact Morrow Falcon 10-80 + broadcast receiver with matching AC supply and spkr. $60. W6DJZ, 3748 Floresta Way, L.A., Calif. 90043.

FOR SALE: Heath 10-21 scope, excellent condition, Extras! $37.50. Money order only. William Karl, 24 Mill Street, Cooperstown, N.Y. 13326.

WANTED: Will pay $1.50 a piece for old QST binders. Bro. Gerald Malseed, Calvert Hall College, Towson, Md. 21204.

FOR SALE: ART-13 3 power supplies less SB adapter. Used ARMARS. Best offer. Pickup only. KIGKA, John Welland, 35 Hayward Ave., Lexington, Ma. 02173.

NC 125 Rcvr w/speaker, $75. 1" Millen scope w/ power supply. $20. Both A1 & FOB. K2UQQ, 7 Racoon Dr., Hazlet, N.J. 07730.

HELLO FELLOW HAMS! My three years in Vietnam are now complete. Thank you for your prayers and good wishes. Look on 20 & 40 traffic nets (sidebands). Jerry Murphy, K8YUW.

FOR SALE: B & W 5100 and 51SB combination, Heath Tower, Lafayette HE45B. WA5CMC, 2309 Bullington, Wichita Falls, Tex. 76301.

NEED: April 1916 QST to complete file, A. R. Marcy, W4ID, 461 3rd Ave., Sea Park, Eau Gallie, Fla. 32935.

WORKED W5TIA/4 Jenkins Country, Ga.? An activity of the Georgia Southern Area A.R.C. Qsl via club secretary, W4DQD.

HALL SX-140, HT-40 HA-5VFO Heath AM-2 SWR, Mint condx. $145. Wilson E. Brewster, Mass. 02640.

T150—$30.00, excellent condx., ART13 & Rugged pwr supply—$50.00 or trade for TX62. ART 13 pick up or delivery only. WA3JRY, Bob Huffman, RD No. 1, Dillsburg, Pa. 17019.

WANTED: Manual on Kahn Research Laboratories, Inc. Model RSSB-59-1A SSB receiver, Bob G. Mahrenholz, K4QQK, 307 Old Fort, Tullahoma, Tenn. 37388.

FOR SALE: Cliff-Dweller, 40 & 80 M with Alliance Rotator, coax cable and rotator cable. $100.00. W8EFW, 1340 Ford Rd., Lyndhurst, Ohio 44124.

FOR SALE: Lafayette 45B, 6 meter transceiver $60. Hallicrafters HA-5 UFO, Self-powered, full 80 thru 2 meter coverage, $45.00. Both very good condition. K. N. Massie, 115 Woodlawn Dr., Ironton, Ohio. 45638.

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NOTICE: If UR interested in wireless history, join the wireless Pioneers, a non-profit organization, P.O. Box 530, Santa Clara, Calif. Say Ed Marriner, W6BLZ, Sent U.

MITE KSR $500, Unimat $85, Monitoradio M-160 $75, Bolex P-4, Reg 8 zoom $85. Perera, K2DCY, 410 Riverside Drive, N.Y.C. 10025.

COLLINS 75A4 mech. Filter F455 J60 best offer. All replies answered. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805.

ELMAC A-54H transmitter $28.50, SWR meter $8.50, nuvistors $1.15, sockets. .15¢, 90w. transistors $1.25, cast heat sinks $.75, other parts. Send SASE for list. J. Boer, 449 Hill Street, Boonton, N.J. 07005.

FOR SALE: DX 60 Vy gud $50.00 Mosley Vertical RV-4 complete with Roof Mounting $20.00 Three brand new 12JB6 finals for TR3 $2.50 each Eico Grid Dip Meter $20.00. Call 212-TW 1-3714 or write WB2NDS, 16 Fane Court, Brooklyn, N.Y. 11229.

WANTED: Dauco DR-30 or DR 50 receiver, transistorized transmitter. SELL: 75 A 2 w/Prod Det, Cal, Spkr, $195. WA3BGN, 6117 Smithfield Street, Harrisburg, Pa. 17112.

WANTED: Electric train, standard gauge, 2⅛" wide track or larger in trade for ham equipment or parts. Send QSL with make and model for reply—will consider purchase. H. C. Deacon, 872 Santa Rita Ave., Los Altos, Calif.

INFINITY TRANSMITTER, phone patch & other surveillance plans $4.20. 12 VDC/120 VAC 150 W. transistor inverter $14. G. Denman, Rt3, Box 164, Grapeland, Texas 75844.

SELL OR SWAP: Mohawk recv $100—Polaroid #250 $80 PH 600A-35. Want KWS1 Chas. Barker, Bloomfield 52537, Ph. 515-459-3800.

FOR SALE: Collins 62S-1, KWM-2. SELL OR TRADE: RTTY CV-89A/URA converter; Model 19 & T.D., TDA-2 distortion Analizer; TS-2B/TG Test set. LM Freq meter; TS-323/UR freq. meter. Gonset G-150; RCA 12v, 60 watt CMV-3E1, Low band, Crystalled on 52,525 MHz; G.E. Pre-Prog. Type ES-12-A, 12v, 60 watt High Band, Crystalled on 146.94 MHz. K5RTI. 1301 Clearfield Drive, Austin, Texas. 78758.

COLLEGE BOUND: EICO 720 $40, EICO 730 $30, SX-99 (as-is) $50, Misc. Magazines CQ, QST, 73's Oct. 1960 on. 50¢ at except certain rare issues. R. Haidak, WA3JDT, 4 Homer Street, Greenville, Pa. 16125.

COLLINS R-388 $375.00. Hy-Gain Hy-Tower vertical 80 through 10—$75.00. Much more, stamp for list. WANT: Waters Codax Keyer. J. Shank, 21 Terrace Lane, Elizabethtown, Pa. 17022.

JACKSONVILLE AREA Amateur Radio Club—Hamfest July 6, 1969. 4-H building, Morgan Co. Fairground, Jacksonville, Ill.

Heath HW22 40 meter SSB transceiver FB condition. $70. Hustler Mobile antenna mount plus 20 and 40 meter resonators. $15. Art Johnson, K2POA, 29 Boone Street, Bethpage, New York 11714. Phone: 516-931-3374.

SELL: Health Pawnee 2 meter TX-RX, I-177 tube tester, Ham-M rotator, Homebrew KW PP 813 final W2RUZ, 33-45 172 Street, Flushing, New York 11358.

SELL: Hallicrafters HT-37 transmitter—$200. Hammarlund HQ-110 with spkr. $129. Both in excellent condition. Lee Hagan, K40ZQ, 9312 Habersham Drive, Louisville, Ky. 40222.

SALE: 41000A w/sckt, chmy $75, TS-186/4 $275, TS-323/4 $200, CU-57/URA $100, ME-30/u $40. B. Neilson, 3226 Louisville Rd., Augusta, Ga. 30906.

WILL SWAP English ham mags. or stamps for "QST's" pre-April 1922, "Radio" July 1935. "R/9" No's 40-49 (1932-33). A Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England.

FOR SALE: Wheatstone oiled 15/32" perferator tape for Boehme heads. P. Lemon, 3154 Stony Point Road, Santa Rosa, Cal. 95401.

FOR SALE: National SW3 and FB7X. Also Hallicrafters SX146 never used. Won at SAROC hamfest. Erv Rasmussen, 164 Lowell Street, Redwood City, California 94062.

WANTED: Elevating base, B-42, and original cabinet for SX-42, also 500 kc xtal for BC 221. John Wagner, 662 W. Lincoln, Caro, Michigan 48723.

WANTED: Early battery receiver and wireless gear, need not be in working condition. State your price. McKenzie, 1200 Weuclid, Indianola, Iowa 50125.

BALUN KIT for 500 W. ratios 1:1 or 4:1 includes Toroid form and wire, you furnish connectors and mounting $2.00 P.P. Toroids, Urbana, Ohio 43078.

ANTIQUE SPEAKER vintage 1927 for use with RCA Radiola 17. Also QST—1 or 2 issues of same period. R. Mendelson, 27 Somerset Pl., Murray Hill, N. J. 07971.

FOR SALE: New, factory packaged, regulated power supplies. 250-300 MDC, 105 bias and 6.3 at 10 amps. $20.00 prepaid. Contact W5HW, 226 Blake Drive, Midwest City, Oklahoma 73130.

WANTED: Hallicrafters HA-10 low freq. conv. and HA-26 VFO, WB4BSH 1305 Fiske Blvd., Cocoa, Fla. 32922.

DRAKE R-4A. Brand new. Bought it, checked it out then moved. Warantee card, manual. original carton. $295. cert. check plus shipping. A. Stadler, W9KHD, 525 Kinkaid Ct., Des Plaines, Ill. 60016.

PLATE XFORMER Stancor. 3600 volts. 2500 WV at 1.7 amps 115-230 primary. For bridge rectifier. Aprox 11"x10"x7". 1251 lbs. Best acceptable offer. A Stadler, W9KHD, 525 Kinkaid Ct., Des Plaines, Illinois 60016.

WANTED: Am interested in mint 200V with 160 meters, state details, E. F. Erickson, W2CVW, 13 Robert Circle, So. Amboy, N.J.

WANTED: Surplus ideas for "Surplus Sidelight;" sell: 4 volumn Test Equipment Directory, 1500 pages of military, commercial test gear, $5.50 postpaid, also other surplus, fax, RTTY stuff, list free. G. White, 5716 N. Kings Highway, Alexanderia, Va. 22303.

Hallicrafters receiver SX 101A MK 111 excellent condition $150.00 W2UI 427 Oakland Ave., Maple Shade, N.J. 08052.

FOR SALE: Send SASE for list of amateur crystals for sale all bands 160 thru 2 mtrs in ft-243 also many novice frequencies available. K8LJQ, 351 Mower Road, Pinckney Mich. 48169.

TRADE National NC155 rcvr with original carton and Heath Cheyenne am xmtr. (both with manuals in as/is condx) for HW32A. Would consider sale as package or separate; make offer. VE2AUL, 6140 Shirley, Halifax, N.S.

WANTED: Instruction book for Heath DX100 xmtr. Ed. Rittenhouse, W3PVY, 226 Fourth Street, Weatherly, Pa. 18255.

NCL-2000 in excellent shape—$360.00, Gonset GSB-201 $190.—WA5DAJ, 4305 Windsor Drive, Garland, Texas 75040.

KEYBOARD—Answer-Back for identification for model 15,1200. Send for Teletype free catalog. Atlantic Surplus Sales, 300 7th Street, Brooklyn, N.Y. 11215.

FOR SALE: Heath GR-54 SWL receiver. Ony 2 months old. Prof. alligned. $70. ppd. Dave Naatz, Rt. 5, Box 237, Austin, Minn. 55912.

TAPETONE SKYSWEEP 345 6 mtr. rcvr. conv. $75., Matching xc-144 2 mtr. conv. $25. Ted Craven, W6CVQ, 841 Sevely Drive, Mtn. View, Ca. 94040.

WANTED: Copy of "Radio Reminiscences: A Half Century" by Dr. Taylor. M. Gauthier, 10425 San Jose Ave., South Gate, Ca. 90280.

See page 110 for New Reader Service

SWAP FPR? Conversion kit, convert TA33 beam to include 40 meters—Gud condx. WA6HYB. 624 First Ave., Chula Vista, Calif. 92010.

SB-34 in excellent condition with Mic, manual prepaid for $225.00—also sell Galaxy AC supply VOX, and calibrator. Len Malone, 4305 Windsor Dr., Garland, Texas 75040.

SIERRA HAMFEST Bowers Mansion August 23, 1969 bring the children, fenced playground and swimming area. QSP, QSL for details NARA, Box 2534, Reno, Neveda.

RTTY Model 14 and TD @ $40.00, Model 15 KSR @ $60.00. Both Syne motors and 60WPM. Dale R. Lee, W3JRM, 1228 Shelbourne Dr., Bethlehem, Pa. 18018.

112 New Control xfmrs 3 windings 230-230-115V. 60 50VA. Net at $9.40 ea. Sell all or part at $1.50 ea. D. Platsis, WA6DBR, 2161 Menzel Place, Santa Clara, Calif. 95050.

HAVE CABLES FOR TCS; Xfmrs many kinds, BC22TT; Little Giant 20-40 meter antenna: TV Test equipment. What do you need? L. Basham, 735 Caves Hwy, Cave Junction, Ore. 97523.

SELL: Swan 350 (late model) 117XC supply, 410 VFO, 22-B adaptor, swr. A-1 condition, w/books. 1st certified check for $425. takes all. Al Povol, 3538 Centerview Ave., Wantagh, N.Y. 11793.

WANTED: Tents, camping gear, Ampex or equal Hi-Fi Stereo Tape Equipment, Large 121/2-16" Cassagerian Telescope. Will buy or swap for electronic equipment such as listed in our new flyer 969J2—free. Denson Electronic Corp., P.O. Box 85, Rockville, Conn. 06066.

FOR SALE: QST 1930 to date a few missing. Also have CQ, Radio and books. Write your needs and make offer. A. C. Gifford, Union Springs, N.Y. 13160.

FOR SALE: EICO CW Trans. 720 + VFO 722, $50. Johnson Kw match box 250-30 $30.00. Heath UT-1 P.S $10. Exc. cond. J. Tryniski, 613 So. 1st Street, Fulton, N.Y. 13069.

WANTED: Correspondence with experimenters in sleep learning. M. Hoshiko, W9CJW, 707 S. James, Carbondale, Ill. 62901.

FOR SALE: Pair NEW Arvin 9 transistor CB walkie talkies, Chan. 13, Model 97R59, $32.50 PP Receipt money order or trade for Ham gear. WA4NED, Box 468, Gainesville, Ga. 30501.

NEED: WD-11 and WD-12 tubes W6AKM, 1289 Glen Eyrie, San Jose, Calif. 95125.

HT-37 and HQ 170C for sale. Both in FB condx. Best offer takes both. Ron Clement, K7MJX, 125 Norwood, Shreveport, La. 71105.

WANTED: SB-72, General Radiotelephone Co. SSB/AM citizen band rig at realistic price, good operating condition, State price 1st letter. Bob McGwier, Box 565, Grove Hill, Ala. 36451.

G31DG would like to add ham call license plates from KH6, KL7, KP4 & KZ5 to those already on his shack wall. A. Herridge, 96 George Street, Basingston, Hants., England.

BARGAIN 75-A1, manual, 100kc. crystal calibrator, perfect shape, C.O.D. $130. Rafael Estevez, WA4ZZG, P.O. Box 2442, Hialeah, Fla. 33012.

EICO 753 needs work but intact. $50. Vibroplex champion bug $9. 80-10 mtr. preselector excint cond. $10. write K3FOD, 925 Coleridge Rd., Baltimore, Md. 21229.

EICO 753 w/751 AC supple. Very stable. $165.00 cash. Viking II w/VFO best offer. ART-13 best offer. Johnson 250-20 low pass filter. $12. K5ZUV, 911 S. Liberty Ave., Okmulgee, Oklahoma 74447.

WANTED: Joystick Antenna and Joymatch and 20 meter hustler. Also Eico 752 mobile DC supply. P. Ludwig, 600 Hylan Blvd., Staten Island, N.Y. 10305.

BLANK CHASSIS 13x17x4 alum—$3.50; Blank Chassis 11x17x2 steel—$2.00; Rack Panel 19x14 steel, $3.00. E. Tischler, 58 Carey Ave., Wilkes, Barre, Pa. 18702.

SELL ARRL Handbooks 1937-38 39-41-43-44-45-46-47-49-50-51-55-67—$3.00 each P. P. K4JK, 2804 Broadview Drive, Huntsville, Ala. 35810.

FOR SALE: Like new—Viking Valient II $175.00. T. G. Soukup, WA1AWX, RFD 3, Bob Hill Road, Ridgefield, Conn. 06877.

FOR SALE: WE 417A, $3.00 Ea, Simpson 230 VOM w/leather case, $17.50; Heath Balun Coils, $4.50; Heath GP-11 6, 12V PS $6.00—WA2IEU, 72 4th Street, Woodridge, N.J. 0705.

CAMERA: Retina 3C f:z lens w/exp mtr. Sell $75.00 or swap with ham SW rcvr. M. Bae, Box 9 Kingston, N.J. 08528.

FOR SALE: 75A4, s/n 4745, immaculate condition. 0.5 and 3.1 filters. S. J. Chmell, 2943 73 Ave., Elmwood Park, Ill. 60635.

SELL: SB-200 — $175, TR4-$450, RV3-$50, Galaxy MKII w/AC $300, NCL-2000—$400. Wanted Drake or Galaxy. K5TGJ, 2817 Lakewood Dr., Garland, Texas 75040.

ZENITH 1938 receiver console 1.8-18mc ($40) Kodak automatic 35 camera and flash ($45) sell or swap for hame gear. Tom Dornback, 19W167 21st Place, Lombard, Illinois.

FOR SALE: NC-98 gen. cov. rcvr just aligned. 100% functioning $50. Novice xtals $75. All plus postage. WB6ZQQ, 3592 Valencia Hill, Riverside, Calif. 92507.

SELL: Heath DX60b, HR10B, Xtal cal, SWR, 11 novice xtals, manuals, mint condx. Guaranteed. Ship for $175 or separate. WA1JFG, 120 Oaktree, No. Kingstown, R.I. 02852.

SWAP OR SELL: for $30 unused, clean 725A magnetron made in Canada. Need schematic and operating manual of Precision Radiation Instruments, Model 106C, "Lucky Strike" Geiger Counter. George Kapsokavadis, 13 Kolokotroni Street, Corfu, Greece.

FOR SALE: Late Serial Number, Exc. cond. Collins 75S3B 32S3 516F2 312B-4 Complete 30% off current list. WA0GUN, 291 So. Jasmine, Denver, Colo. 80222.

VACUUM CAPACITOR 5-30 mmf. 10,000 Voet Jennings, ECS-30, FB for VHF, amplifier $15.00 prepaid. G. Lay, 109 No. 32 Ave., Yakima, Wh. 98902.

FOR SALE: Apatche TX-1, needs minor work, best offer over $50. Lafayette HA-230 good condx. $35 or best offer. Consider trade for good oscilloscope. Glenn Anderson, 1100 New Jersey Ave., Pine Beach, N.J. 08741.

G3IDG, a student of early amateur radio, would appreciate offer of a complete set of "Spark Gap Times". A. Herridge, 96 George Street, Basingstoke, Hants., England.

ENGLISH amateur radio historian requires "Who's Who in Amateur Radio" (c. 1934) & Calling CQ" (De Soto, 1941). A. Herridge, G3IDG, 96 George St., Basingstoke, Hants., England.

R390. very good, with manuals. $600. Will ship U.S. or Alaska. Al Hershberger, Box 280, Soldatna, Alaska 99669.

NEEDED: Drake DC-4 power supply. Trade: Hallicrafters SX-110 General coverage Receiver. WB4ESE, Box 211, Lewisburg, Tenn. 37091.

TOROIDS 88mhy. 5/$2.00 postpaid. 32KSR good condition. $200. New Clegg 66er $160. NCX5 & NCXA $400. Drake 2B & 2BQ $175. B&W 51SB adaptor $50. Facimile xcvr. $20. Stamp for list. Van W2DLT, 302X Passaic Striling, N.J. 07980.

SELL: Heath Apache $100. HT-37 w/Galaxy comp. & mike. $225. Heath Mohawk receiver needs new tubes $225. All with manuals. W8UGD, George Eastman, R No. 1, Box 420, Ossinerg, Mich. 49766.

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CORRECTION: Sierra Hamfest, Bowers Mansion will be held on Saturday 30 August 1969. QSP QSL for details. NARA, Box 2534, Reno, Nevada.

WANTED: Swan 405X Mars VFO and 22 adapter. Have BL22IT, EICO Signal Generator, Sweep Generator, Multimeters, tubes, etc. or what do you want? Basham, W7TCT, Cave Junction, Ore. 97523.

FOR SALE: Mobile mts & DC supply for SR-400, list $249 sell $120, same for SR-150 list $149 sell $65, Nat. NC-198 with 100kc calib. Q-mult and field effects pre-amp. spkr $90. W9JNI, 330 N. Buffalo Street, Warsaw. Ind. 46580.

EICO 722 VFO FOR SALE: Factory wired used very little; like new, $32.00. Registered check or money order. I'll pay shipping. W1B Cartwright, WA8PZJ, Chillicothe, Ohio. 45601.

EICO 753 SSB transceiver w/power supply $100.00; Gonset 6 mtr. 12 v. converter $25. WA3IAX, 8802 Church Field Lane, Laurel, Md. 20810.

FOR SALE: HyGain 6 mtr; 6 element beam with AR22 rotor-wire—$39.95. Good condition. Geffner, 48 Park Avenue East, Merrick, L. I., N. Y.

WANTED: TG 34A keyer with tapes or Instructograph, Swan 14-117 D.C. power supply (for 350) Cassette recorder with AM/FM or just FM HAM-M Rotator & Control. Please quote lowest price. H.F. Cushing, WB6CQG, 5224 Bobbie Ave., San Jose, Calif. 95130.

TRADE: 6 and 2 SR-34AC Hallicrafters transceiver—good working order. Henry Wroblewski, WA9AAQ, 3747 S. Harvey Ave., Berwyn, Ill. 60402.

WEST COAST ONLY—4 el. Tri Band Hornet antenna for sale, reasonable. WA6ZCQ.

ANTIQUE TUBE 226 or 326 with good filament. Prefer light bulb shaped glass. Need 3 for Antique radio. R. Mendelson, 27 Sommerset Place, Murray Hill, N.J.

FOR SALE: KWM-2 #15750 516F-2 (both latest series), $895. 75S3B#16895, $475; 399C-1 VFO, $165, Comdel CSP-11 (new) $95. James Craig, W1FBG, 29 Sherbourne Ave., Portsmouth, N.H. 03801.

WANTED: Old style CDR AR22 rotor. Will pay $15.00. You ship. Write before shipping. Judson Snyder, K2-CBA, Babcock Lake Road, Petersburg, N.Y. 12138.

SELL: DX-60A, HG-10 VFO. SASE for price and details L. B. Cebik, W4RNL, 245 Morning View Drive, Athens, Georgia. 30601.

The NEW TYMETER©

"Time at a Glance"

Made in U.S.A.

#100-24H¼

$15

24 HOUR CLOCK

Walnut or ebony plastic case. H4", W7¾", D4". 3 lbs. 110V 60 cy. A.C. Guaranteed 1 year.

Made in U.S.A.

At Your Dealer, or WRITE TO

TYMETER ELECTRONICS
PENNWOOD NUMECHRON CO.
7249 FRANKSTOWN AVE., PITTSBURGH 8, PA.

WANTED: Old Hallicrafters Model SX-9 Made in 1936 (not SX-99) J. Y. Wilfong, Rt. 1, Box 334, Newton, N.C. 28658.

FOR SALE OR TRADE: CE-20a Utica 650-A VFO BC-639 WA0KLC, 315 E. 20 Grand Island, Nebr.

WANTED: Mite TTY equipment for amateur use. E. A. Wille, KH6EVX/W9EKU, Page Comm. Engrs. c/o Adv. Tm. #18, APO SF 96258.

SALE: Collins 75S3 S/N-13526, like new. $390 or best offer. Dan Liebreht, WA2CRD, 3950 Blackstone, Bronx, N.Y. 10471.

INTERNATIONAL CLUB for disabled hams solicits your used postage stamps for funds. All countries & any quantity. A. Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England.

DIGI-KEY as advertised in QST $11.00. PP. W3MSN, 5400 Boulder, Oxon Hill, Md. 20021.

SELL almost new Drake 2 NT xmtr much below cost. Aero. Center ARC, Inc., Postal Station 18, Oklahoma City, Oklahoma. 73169.

SELL CENTRONIX, INC., Model ATA-1 multi-channel amplifier with power supply for $50. Carl C. Drumeller, 5824 N.W. 58th Street, Oklahoma City, Okla.. 73122.

GENERATOR, Honda-300, used 6 hours like new. 120 volt, 115 volt-12 volt-6 volt. Best offer over $100. R. J. Dowling, W1LPO, 37 Rancocos, Warwick, R.I. 02888.

SWAN POWER SUPPLY new model 14, 117 delivered $120.00. with guarantee cards. W4ALG, M. Johnston, 2625 University Blvd. Tuscaloosa, Ala. 35401.

FOR SALE: Globe Chief 90A-$20; Knight T-150-$55; Novice Xtals 3701, 3711, 3714, 3716, 3735, 7059, 7155-$1.25 each. W0JCK Box 323, New Linderwood, S.D. 57761.

HEATHKITS HW32, HP13, DX40, VF-1; Hustler 20m. car tape player with tapes, FM stereo car radio. Dick Kesler, K9RTU, R4 Olney, Ill. 62450.

SCHOOL COSTS are rising. Willy accept any reasonable offer. Hallicrafters SR-160 triband transceiver. Tom Frenaye, 617 Purdue, Claremont, Calif. 91711.

FOR SALE: Hustler 4-BTV four band trap vertical near new. WA6DET, 27031 Graylake Rd., Palos Verdes, Calif. 90274.

WANTED: antique transmitting and receiving tubes made prior to 1920. W2EZM, 431 Oakland Maple Shade, N.J. 08052.

DRAKE TR3-RV3-AC3 $420. Need 4-1000A. Ray Clark, 126 Slosson Ave., S.I., N.Y. 10314.

"WON ONE, ALREADY HAD ONE, sell one new Gonset GSB-201 Mark III Linear, 2000 PEP. $275. cash. Larry Hook, 11921 E. 1st Street, Tulsa, Okla.

DEAD RANGER AT YOUR QTH? Sell me that meter to keep my Ranger alive. Please! WA7IUQ, 4543 N. 30th Ave., Phoenix, Arizona. 85017.

FOR SALE: Master Mobile K-73, 500 watt Linear Amplifier, 10-80 meters, $125. W1KWP, M. Sanborn, 128 Davis Ave., Brookline, Mass. 02146.

Troubled with TX-I? Read this month's Q & A Column on page 78

See page 110 for New Reader Service

A GREAT BUY FROM ARROW —

THE GALAXY GT-550 TRANSCEIVER

TRANSMITTER: 550 watts PEP–SSB, 360 watts CW. Manual keying for SSB/CW, or VOX operation with accessory installed. Also, break-in CW with accessory VOX installed. Built-in audio side-tone for CW monitoring through speaker or headphones. Selectible sideband without 2 kHz jump when changing sidebands. Shifted carrier CW to prevent "leap-frogging" with another transceiver. Stable, —45DB carrier suppression. Unwanted sideband suppressed over —55DB. Sharp, 2.1 kHz filter with better than 1.8:1 shape factor. ALC circuitry automatically reduces gain level to prevent "flat-topping." High impedance microphone circuit (use —50/60 DB microphones) with PTT control circuit. Audio Response @ —6DB points approximately 300 and 2400 Hz. Adjustable Pi-Network antenna matching for resonant 40/100 Ohm loads.

RECEIVING: Nominal 50 Ohm input with relay control for antenna switching. Preselection coupled to exciter tuning. Sensitivity better than ½ uv for 10 DB S+N/N ratio. Selectivity 2.1 kHz with same, outstanding 1.8:1 shape factor for SSB/CW, or 300 Hz sharp selectivity with optional plug-in CW filter. Full AGC on receive modes with fast attack and slow release characteristic. Nominal 1 watt audio output with —6 DB points @ 300/2400 Hz. External 8 Ohm speaker required.

FREQUENCY COVERAGE: Crystals supplied for 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 28.0-29.0 mHz. Optional crystals may be installed for other 10 meter coverage. A solid-state VFO operates, without switching, in the range of 5.0-5.5 mHz at all times. Double regulation and temperature compensation makes this VFO extremely stable. An illuminated dial with over 12 inches of linear bandspread. Primary dial calibration marks of 5 kHz. Smooth vernier dial provides 72:1 vernier tuning for ease of operation.

BACK PANEL CONTROLS: Bias Adjust. "S" meter zero.

BACK PANEL JACKS: Antenna • CW Filter (three jacks) • PTT • External VFO (Power) • External VFO (RF in) • ALC (Input) • EXT. (For Linear keying) • Microphone • Power Plug (From AC-400 or G1000DC) • Key (For CW operation) • Speaker.

SIDE ACCESS CONTROLS: VOX Gain • VOX Hold Time • Anti VOX.

FINISH: Cabinet in mar-resistant black crackle finish. Front panel in two-tone brushed aluminum.

SIZE: 6" x 11¼" x 12½" (HWD)

WEIGHT: 17 pounds.

$475.00

R.F. CONSOLE RF550

The RF550 contains a precision wattmeter with a high degree of accuracy in the range of 3.5/30.0 mHz. Calibrated scales are 400 and 4,000 watts full scale, switch selected for forward or reflected power. Also contains a switch to select 5 antennas plus a dummy load (not supplied), and all unused connections are grounded. SO239 coax-connectors. Approx. 7x7¼x 6½" (HWD). Weight 5½ pounds.

$69.00

SPEAKER CONSOLE SC550

A matching speaker with headphone jack for the transceiver, complete with cable. AC400 power supply will mount inside the console. Size — approximately 6x10x9½", weight 6 lbs.

$ 25.00

REMOTE VFO RV550

A solid-state VFO like that in the transceiver, complete with simple plug-in cables. Function switch selects the remote unit to control Receive - Transceive - Transmit frequency independently. Gives about the same flexibility as a separate transmitter and a receiver with the GT-550. Approx. 7x7¼x6½". (HWD) Weight 4 lbs.

$75.00

ARROW ELECTRONICS, INC.

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- 18 Isaac St., Norwalk, Conn. 203 - 838-4877
- 225 Rte. 46, Totowa, N.J. 201 - 256-8555

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August, 1969

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Advertiser's Index

See page 110 for New Reader Service

THINKING TOWERS?

The Herbert W. Gordon Company can now make available any of the fine and complete line of Heights Towers. This line is so complete we're absolutely positive that we have the tower with the specifications to meet your exact need, whatever they may be.

Hams across the country are raving about the weld aluminum structed towers by Heights that require no maintenance whatever. These towers are designed to accommodate every conventional antenna wind-load from 2 square feet to as much as 26 square feet in heights ranging from 32 feet up to 120 feet, with or without hinged base and available with a hinge up the tower if so desired.

Tower sections are made in 8 ft. lengths and through a unique combination of straight sections, junction sections and top sections permit the expansion of one tower design to a larger higher tower as you can afford it.

Heights Towers are self supporting in winds up to 80 mph. At 80 mph each square foot of antenna projection area creates a wind-load of 20 lbs. You can obtain the wind-load or square footage of antenna projection area from the specification of your antenna. If your location is such as to bear the brunt of higher wind velocities you should select a progressively stronger tower combination. A 100 mph rating takes 30 lbs; a 115 mph takes 40 lbs. and a 130 mph takes 50 lbs.

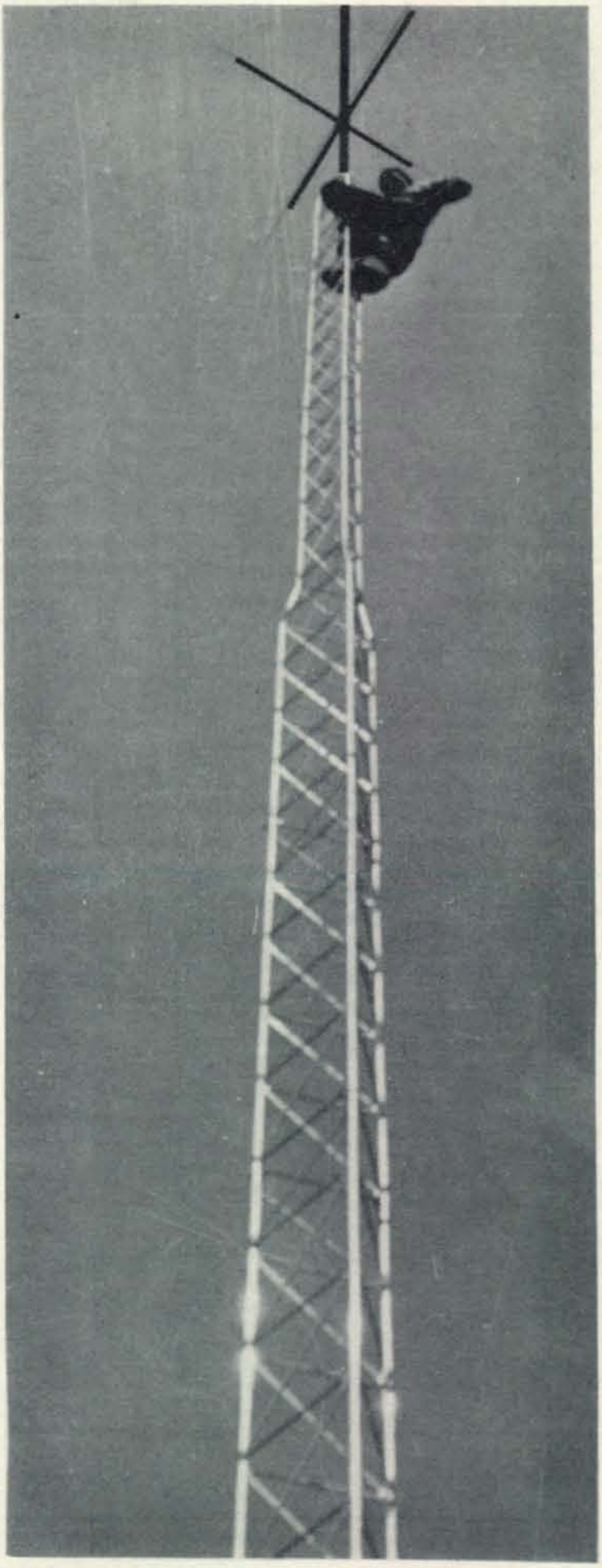
Heights Towers are very, very strong and yet very, very light. The A40, for example, is only 67 lbs. while the popular A72 rating for 18 sq/ft weighs only 240 lbs.

These towers are welded by men with certified ratings and reflect the best quality of materials available. Remember, no guy wires, no wall mounts and no climbing is necessary if you select the right combination of fold over crank-up tower. A comprehensive variety of accessories in all categories are carried.

We unhesitatingly endorse this fine product; additional literature of which is available upon request.

We have available for immediate delivery to you a complete chart of the entire Heights Tower line including prices and information to help you select the exact tower you need at the price you want to pay.

Write or phone today for this—the most impressive tower listing ever compiled. Herbert W. Gordon Company, Harvard, Massachusetts 01451. Telephone (617) 456-3548. Americas largest exclusive Ham Distributor.



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Woodchuck Hill, Harvard, Mass. 01451
Telephone 617-456-3548

See page 110 for New Reader Service

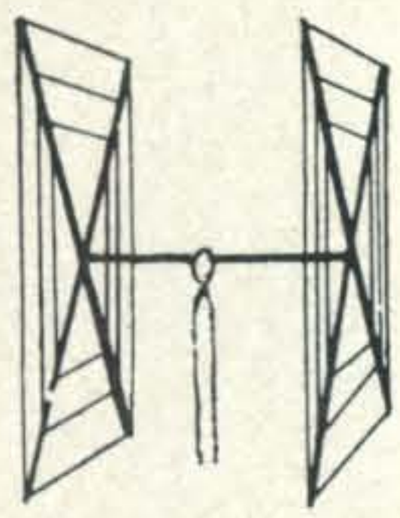
AHA! YOU THOUGHT GOTHAM

had a 47 story factory with 16 beautiful receptionists and 87 research technicians.

No! No! No! Gotham is 2 brothers making thousands of antennas in a 15' x 35' store.

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:

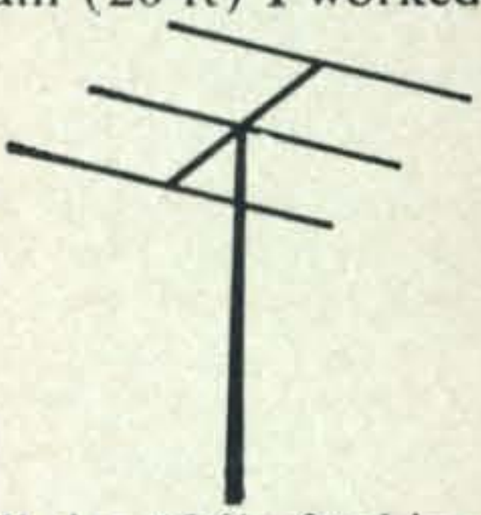
10-15-20 CUBICAL QUAD	$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00

(all use single coax feedline)

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

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history! Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.



2 EL 20	$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, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

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

HOW TO ORDER: Send money order. We ship immediately by REA Express, charges collect. Gotham ham and CB antennas are available for pick-up in: Rockford, Ill.; Orange, Calif.; Cleveland, Ohio; Daytona Beach, Fla.; Calgary, Canada; Hannibal, Mo.; Indianapolis, Ind.; South Bend, Ind.; Oklahoma City, Okla.; and in the Benelux Countries and Australia. *Write for* name and address of franchised distributor. Other cities open.

See page 110 for New Reader Service

ry World travel...first class!

Sit down to one of the new GT-550s...switch on that tremendous power...and pick up one of your favorite DX contacts. You'll swear you're talking to the guy next door!

This is *the* rig. The one they all want. And now you understand why. Makes you want to go home and throw rocks at your own outfit.

The price kinda surprises a guy, too. Doesn't cost as much as you figured to own the best. You can add those great matched accessories one at a time until you have everything a ham could want.

Wonder what you can get on a trade-in? Ask your dealer.

See the Galaxy line at your Dealer's. If he doesn't have it, write us for one near you who does.

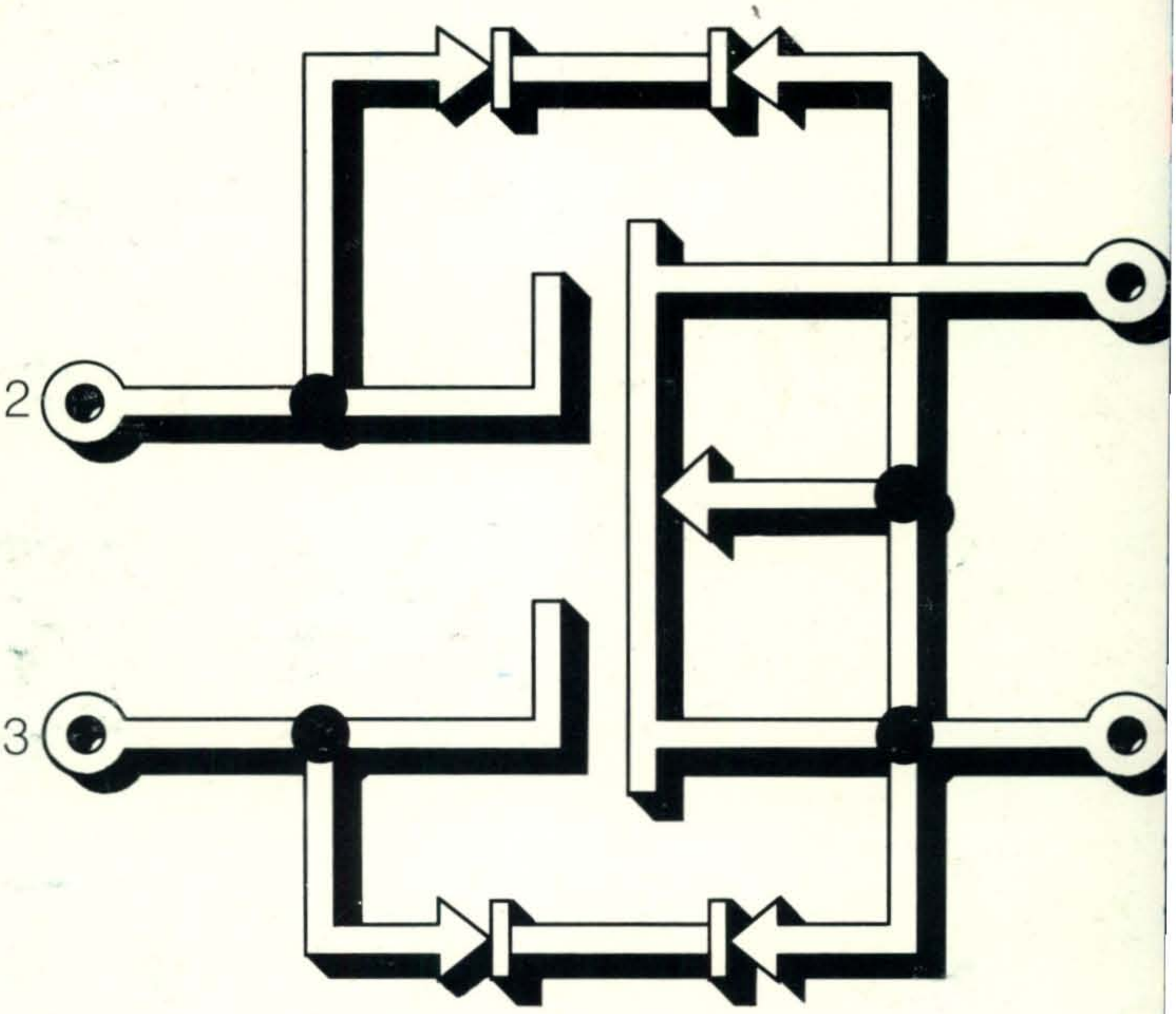
GALAXY ELECTRONICS

"Pacesetter in Amateur/Commercial Equipment Design"

10 South 34th Street • Dept. CQ-CC44 • Council Bluffs, Iowa 51501

Solid-State Projects for the shack.

Use RCA-40673 MOSFET with the Transient Trappers



RCA-40673 MOSFET with built-in Transient Trappers —20 dB (typ.) gain at 200 MHz in RF applications.

The Transient Trappers are in the RCA-40673, the industry's FIRST dual-gate MOSFET with INTEGRATED PROTECTION-CIRCUITRY.

Back-to-back diodes, diffused within the same silicon pellet as the MOS Field-Effect Transistor, guard each gate against:

- static discharge during handling operations prior to circuit installation without the need for external shorting mechanisms.
- in-circuit transients.

These back-to-back diodes — as shown in the schematic — are electrically dormant during wide excursions of large signal swings, but have very effective protective-clamping action in the presence of excessive transient voltages.

Ask your RCA Distributor for the full story, or write RCA Electronic Components, Commercial Engineering, Section XXXX, Harrison, N. J. 07029.

RCA