CQ

March 1973
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SY1MA
DXpedition to MT. ATHOS

.....p.34

The Radio Amateur's Journal

08240

N. TRAVIS '73

More power to you, with

Power to get you to the pole — Heathkit SB-220 2 kW Linear... 369.95*

The SB-220 uses a pair of conservatively rated Eimac 3-500Z's in grounded grid circuitry to provide up to 2000 watts PEP SSB input. And it can be loaded to a full 1 kW input on both CW and RTTY. A broadband pre-tuned pi-input delivers maximum efficiency with low distortion over 80 thru 10 meters. Requires only 100 watts drive. Built-in solid-state power supply can be wired for either 120 or 240 VAC. Built-in circuit-breaker protection. Zener diode regulated operating bias reduces idling current for cooler running, extended tube life. A large quiet fan is another plus feature. Other features include ALC to the driving unit to prevent overdriving; front panel switch-selected monitoring of grid current, relative power and high voltage; easy, enjoyable 20 hour assembly. **Kit SB-220,** 69 lbs.

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

Power up with 1200 watts SSB, 1 kW CW — Heathkit SB-200... 229.95*

Provides 1200 W PEP SSB input, 1000 W CW. Built-in solid-state power supply with circuit breaker protection. Metering for SWR grid current, plate current, relative power, plate voltage. ALC output. Shielded, fan-cooled amplifier compartment. Pre-tuned cathode input circuit for maximum efficiency and low distortion.

The sturdy, yet lightweight construction of the SB-200 is achieved through the use of a heavy-gauge one-piece aluminum chassis that is partitioned for extra strength and isolation of components and circuitry. This clean, open layout makes assembly extra easy, too. **Kit SB-200,** 50 lbs.

SB-200 SPECIFICATIONS — Band coverage: 80, 40, 20, 15 and 10 meters. **Maximum power input:** 1200 W P.E.P. SSB, 1000 W CW. **Driving power required:** 100 W. **Duty cycle:** SSB, continuous voice modulation; CW, 50% (key down time not to exceed 5 min.). **Third order distortion:** 30 dB or better at 1000 W P.E.P. **Output impedance:** 50-75 ohm unbalanced; variable pi-output circuit. SWR not to exceed 2:1. **Input impedance:** 52 ohm unbalanced; broad-band pretuned input circuit requires no tuning. **Meter functions:** 0-100 mA grid current, 0-1000 mA plate current, 0-1000 relative power, 1:1-3:1 SWR, 1500-3000 volts high voltage. **Front panel controls:** Load; Tune; Band; Relative Power Sensitivity; Meter Switch, Grid-Plate-Rel. Power-SWR-HV; and Power Switch, on/off. **Tube complement:** Two 572B/T-160-L (in parallel). **Power requirements:** 120 VAC @ 16 A (max.), 240 VAC @ 8 A (max.). **Cabinet size:** 6⅝" H x 14⅞" W x 13⅜" D.

Heathkit "Cantenna" Transmitter Dummy Load... 10.95*

Provides 50 ohm non-inductive load with SWR less than 1.5:1 for frequencies of 1.5-300 MHz. Coax fitting to transmitter line, & phone jack for relative power measurements. One gallon coolant oil capacity (oil not included) permits power up to 1 kw. **Kit HN-31,** 3 lbs.

Heathkit Wattmeter/ SWR Bridge... 29.95*

Two switch-selected ranges measure RF output from 10-200 and 100-2000 W... built-in SWR capability for proper tune-up, transmission line to antenna Z matching. Negligible loss for permanent insertion into 50 ohm line. Remote detector permits placement of meter in any convenient location. (6 ft. of cable supplied.) **Kit HM-102,** 4 lbs.

HM-102 SPECIFICATIONS — Frequency range: 1.8 to 30 MHz. **Wattmeter accuracy:** ±10% of full-scale reading. **Power capability:** 10 to 2000 watts. **Impedance:** 50 ohm nominal. **Connectors:** UHF type SO-239. **Dimensions:** 5 1/16" H x 5¼" W x 6½" D.

Heathkit® SSB, CW & NEW FM amps

NEW Heathkit
2-Meter Amplifier for cleaner
FM copy on the fringe... 69.95*

40 watts nominal out for 10 watts in — *requires only 12 VDC supply.*

Fully automatic operation — *with any 2-meter exciter delivering 5-15 watts drive.*

Solid-state design — *all components mount on single board for fast, easy assembly.*

If you're regularly working from a fringe area, the new Heathkit HA-202 can boost your mobile output to 40 watts (nominal), while pulling a meager 7 amps from your car's 12-volt battery.

Install it anywhere...in the trunk, under the hood or dashboard. Use it with any 2-meter exciter delivering 5-15 watts drive. Features fully automatic operation. An internal relay automatically switches the antenna from transmit to receiver mode when you release the mike button.

All solid-state design features rugged, emitter-ballasted transistors, combined with a highly efficient heat sink, permitting high VSWR loads. Tuned input-output circuits offer low spurious output to cover the 1.5 MHz segment of the 2-meter band without periodic readjustment. All components mount on a single printed circuit board for easy, 4-hour assembly. Manual shows exact alignment procedures using either a VOM or VTVM. And installation is just as simple.

Kit includes transceiver connecting cable, antenna connector. Operates from any 12 VDC system — additional power supplies are not required. Add HA-202 power to your mobile 2-meter rig, and boom out of the fringe. **Kit HA-202,** 3 lbs.

HA-202 SPECIFICATIONS — Frequency range: 143-149 MHz. **Power output:** 20W @ 5 W in, 30W @ 7.5W in, 40W @ 10 W in, 50W @ 15 W in. **Power input (rf drive):** 5 to 15W. **Input/output impedance:** 50 ohms, nominal. **Input VSWR:** 1.5:1 max. **Load VSWR:** 3:1 max. **Power supply requirements:** 12 to 16 VDC, 7 amps max. **Operating temperature range:** −30° F. to +140° F. **Dimensions:** 3" H x 4¼" W x 5½" D.

New Heathkit VHF Wattmeter/SWR Bridge... 29.95*

Perfect tune-up tool for your 2-meter gear. Tests transmitter output in power ranges of 1 to 25 watts and 10 to 250 watts ±10% of full scale. 50 ohm nominal impedance permits placement in transmission line permanently with little or no loss. Built-in SWR bridge for tuning 2-meter antenna for proper match, has less than 10-watt sensitivity. **Kit HM-2102,** 4 lbs.

HM-2102 SPECIFICATIONS — Frequency range: 50 MHz to 160 MHz. **Wattmeter accuracy:** ±10% of full-scale reading.* **Power capability:** To 250 W. **SWR sensitivity:** less than 10 W. **Impedance:** 50 ohms nominal. **SWR bridge:** Continuous to 250 W. **Connectors:** UHF type SO-239. **Dimensions:** 5¼" W, 5⅛" H and 6½" D, assembled as one unit.
*Using a 50 Ω noninductive load.

See them at your Heathkit Electronic Center — or fill out coupon for FREE Heathkit catalog

HEATHKIT ELECTRONIC CENTERS

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New FPM-300, a low-priced, versatile, compact SSB/CW transceiver with latest high performance FET and integrated circuits plus extended coverage.

This new radio, with built-in AC-DC power supply, is compactly designed with modular construction techniques for effective and reliable service in fixed, portable and mobile use for amateur, Civil Defense, CAP, MARS, RACES and other utility HF Communications Services.

The new transceiver has premium type glass epoxy printed circuit board construction for greater reliability, routine maintenance and features the latest state-of-the-art solid state devices throughout. The All-American made radio, priced at only $595, is also equipped with a unique integrated circuit speech compressor design for extended "talk power" plus many other built-in features—all good reasons why you should be talking with a Hallicrafters.

For additional data see your Hallicrafters distributor or write or phone:

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You should be talking with a Hallicrafters.

MARCH, 1973 VOL. 29, NO. 3

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Phillipsburg, N.J. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. Allow six weeks for change of address. Printed in the United States of America.

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Telrex Labs are design engineers, innovators and manufacturers of the world's finest ¾ to 160 meter communication systems and accessories priced from $25 to $25,000.

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OTHER MULTI-BAND ARRAYS AVAILABLE

Elements shortened to show details.

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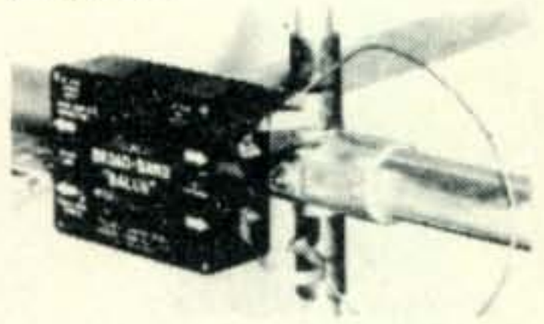

TRAP

TYPICAL TELREX MONOBAND ANTENNAS

Mod. 15M317-	15 mtr. 3 el. rotary, 10 DB gain, 4 KWP pow. rat., 2½" O.D. x 17' boom		$175.0(
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Mod. 2M609-	2 mtr. 6 el. array, 14 DB gain, 300 W pow. rat., 1" x 9' boom		39.95
Mod. 2M814C-	2 mtr. 8 el. array, 16.5 DB gain, 300 W pow. rat., 1.375" x 14' boom		59.00
Mod. 6M516-	6 mtr. 5 el. array, 13 DB gain, 400 W pow. rat., 1.5" x 16' boom		63.95

Communications and TV Antennas

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ZERO BIAS

Ten meters is deader than a doornail these nights. Your buddy 10-miles away would be hard pressed to hear your barefoot Heathkit without a decent rotary beam at each end of the circuit. Two-meter f.m. simplex would probably do better. But while ten lies dormant, neighboring 11-meters jumps with the short range garbage "communications" which are the essence of hobby-type CB operation.

Now, many CBers may seem ignorant, but few are really stupid. It doesn't take too much reasoning power to discover that 10-meters is next door to 11-meters, and 10 is too dead for the hams to be using, and most of the simple CB transceivers just need a few crystals and a little re-peaking to put them on 10, and most CB antennas will work—sort of—on 10-meters, and nobody's going to hear them if they slide up to 10 because nobody's listening. So, putting 2 and 2 together and coming up with something between 3 and 5, the CBers have discovered 10-meters.

As is we didn't have troubles enough with foreign BC and commercial interlopers, we're now faced with a head-to-head battle with the worst criminal element of the Citizen's Band for the occupancy of 10-meters.

In the underworld vernacular of this criminal element, they're known as "Sliders." I'd call them thieves.

There aren't many of them yet, but I'll guarantee that if you sit on your duff for very long and ignore them you'll find yourself vying with "Canary Man" and "Big Momma" for the DX when 10 starts to pick up in a few years.

What to do? A campaign to occupy a dead 10-meter band would get about as much support as Prohibition, but it couldn't hurt to try. A more realistic approach, though, would be to spend an hour or so scanning that dead 10-meter band for these thieves, and immediately notifying the nearest FCC monitoring station when you land one.

With FCC monitoring personnel in such short supply the immediate "crackdown" effect can't be anything but slight, but it's just possible that the word might get back down to the 11-meter criminals that 10-meters is a nice place to visit but you would not want to stay because the natives are downright inhospitable.

In all fairness it must be mentioned that amateurs have unwittingly or thoughtlessly contributed to the existance of Sliders. While some of these CB thieves have in fact converted 11-meter gear to 10 meters, many more are using obsolete amateur a.m. equipment purchased from local hams or from the used equipment shelves of amateur equipment dealers. There isn't too much that can be done to curb the sale to CBers this obsolete gear by dealers except to urge them to play policemen. However, the private sale of amateur equipment to CBers or any non-ham can and must be stopped. There's no excuse for the ham who sells to the CBer. He can't claim that he didn't know – he just didn't care. And his not caring will bring grief to his fellow amateurs and ultimately to him. The few dollars that most obsolete a.m. gear will bring in an illicit sale to a CBer is the dirtiest of money. With the recent FCC permission for Novices to use 10-meters, and to use v.f.o.'s, there's an enormous new market for that older gear right here in amateur radio. There's no need to sell it to the CBer. For that matter, I would sooner see the ham give his old gear to a Novice or ship it overseas to a DX station for his local newcomers. But to sell it to a man who's going to use it against you is like selling a gun to a mugger for him to hold you up with.

Think about it. In the time it took to write this I've monitored NINE Sliders in round table QSO's from 28.0 to 28.5 mHz!

516 883-6223

That's the telephone number to dial for the newest service to be offered by *CQ*. Right now you can dial day or night for the most up to date short-term propagation forecasts available to amateurs anywhere in the world. The new special telephone number carries a pre-recorded message giving propagation conditions for a one-week period – Monday through Sunday – advising of unusual propagation conditions and expected band conditions from 160 through 2-meters. This service will supplement the Propagation Column appearing each month in *CQ*, which still remains the most accurate and informative source of detailed propagation information.

The new Dial-A-Prop information will be supplied by *CQ's* Propagation Editor George Jacobs, W3ASK, internationally acclaimed expert in the prediction of radio propagation conditions.

73, Dick, K2MGA

From the World's Number One Manufacturer of Amplifiers

The biggest, broadest, finest line of amateur power amplifiers

2K-4 . . . THE "WORKHORSE"

The 2K-4 linear amplifier offers engineering, construction and features second to none, and at a price that makes it the best amplifier value ever offered to the amateur. Constructed with a ruggedness guaranteed to provide a long life of reliable service, its heavy duty components allow it to loaf along even at full legal power. If you want to put that strong clear signal on the air that you've probably heard from other 2K users, now is the time. Move up to the 2K-4. Floor console or desk model . . . $845.00

2K-ULTRA . . . THE "ULTIMATE"

There has never been an amateur linear amplifier like the new 2K-ULTRA. Small and lightweight, yet rugged and reliable . . . all that the name implies. The ULTRA loafs along at full legal power without even the sound of a blower. Its anode heat is silently and efficiently conducted to a heat sink through the use of a pair of Eimac 8873 tubes. In fact, all of its components are the very best obtainable. The price . . . $845.00

TEMPO/2001

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full kilowatt of power for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. $545.00

TEMPO/6N2

The Tempo 6N2 combines most of the fine features of the 2001 for 6 and 2 meter amateur operation. The amplifier uses the same small cabinet, the same modern tubes, the same inherent quality for 2000 watts PEP input on SSB or 1000 watts input on FM or CW. The rig is completely wired in one small package with an internal solid-state power supply, built-in blower, and RF relative power indicator. $595.00

3K-A COMMERCIAL/MILITARY AMPLIFIER

A high quality linear amplifier designed for commercial and military uses. The 3K-A employs two rugged Eimac 3-500Z grounded grid triodes for superior linearity and provides a conservative three kilowatts PEP input on SSB with efficiencies in the range of 60%. This results in PEP output in excess of 2000 watts. In addition, the 3K-A provides a heavy duty power supply capable of furnishing 2000 watts of continuous duty input for either RTTY or CW with 1200 watts output. Price . . . $1080.00

Prices subject to change without notice.

Henry Radio

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"World's Largest Distributor of Amateur Radio Equipment"

OUR READERS SAY

RTTY on 20m. C.W.

Editor, *CQ:*

My concern about conditions on 20 meters prompts me to worry about the future of c.w. operation. 20 is our most dependable band for DX and as matters stand at the present, I wonder how long it will remain so.

I am of the opinion that c.w. is the life blood of amateur radio; I think it should always remain so. All of us that agree with this will have to do something to save c.w. and we will have to do that something soon.

The threat to our last remaining 100 kHz is the monstrous signals emitted by RTTY. These stations are slowly taking over. The chattering gibberish that they send out is impossible to copy through.

My contention is that RTTY is not ham radio. This type of signal should not be allowed in the c.w. portion of any band. RTTY and TV should be assigned an area of their own.

A strong case should be made to the FCC against this intolerable method of transmission. My feeling is that those who use it must have little feeling for ham radio or much concern for the chaos they create.

John Rogers
Elmont, NY

Nicaraguan Quake

Editor, *CQ:*

The International Mission Radio Association wishes to thank all the hundreds of hams who handled traffic on and off the IMRA net, during the Nicaraguan earthquake emergency. This net was designated by General Somoza and Gen'l. Roger Bermudez, YN1RB, as the official outlet for traffic from all parts of Nicaragua to the north. IMRA was activated for duty on Dec. 23, and operated seven days a week, from dawn to dusk and later if band condition permitted. Over 1500 messages or phone-patches were handled during the crisis. Particular tribute should be paid to Frank Savat, W5YOI, of Louisiana, the vice president of IMRA, who spent almost full time as net control. Frank was ably assisted by the alternate net controls, who also kept the traffic moving smoothly. They included WA2BPV, WA2FLI, WA2IPM, WB2PSS, W4BOZ, W4DAV, W4IKS, W4KKB, WB6IXC, WA7LUB, WB9CCB, and W9LII. HR1MM took care of the Central America traffic and VE5BO handled the Canadian messages which were later put on the Canadian Coast to Coast net. I have, undoubtedly omitted some calls, but please excuse this as things were pretty hectic at W1MD during this period, If your call did not appear, please accept my profound apologies.

The participation of US, Latin American and Canadian stations on this net would be most appreciated. The net meets on 14,280 kHz, at 1900Z to 2000Z, and evenings from 0100 to 0200 GMT, band conditions permitting. The purpose of the net is to promote good will and handle written or phone-patch calls and messages from the mission fields, deployed personel and any one who needs assistance. The IMRA is non-denominational and it's motto is "People Helping People."

Sylvester Connolly
President IMRA

Getting the Edge on C.W.

Editor, *CQ:*

You have two excellent articles about c.w. in the August and December editions. I got the article about "the edge in the Amateur Extra examination" just one day before the test and it helped me to pass it.

I have some difficulties in finding an old edition of the Candler System. Al D'Onofrio thinks that still some systems are around and should be available. If you know any way to get one, I would appreciate it.

Paul Krug, WB2IXY
Hempstead, NY

[Continued on page 99]

Announcements

Muskegon, Michigan

The 1973 ARRL Great Lakes Division Convention will be held March 23-24 in Muskegon, Michigan. Wouf Hong ceremony and ham hospitality Friday at the Ramada Inn; tech sessions, swap & shop and exhibits Saturday at Muskegon Community College; dinner and dancing Saturday evening at Ramada Inn. Registration $2.25. For info contact Convention Coordinator WA8GVK.

Baltimore, Maryland

Greater Baltimore Hamboree, Sunday April 8 at 10 A.M. Calvert Hall College, Goucher Blvd. and LaSalle Road, Towson, Maryland 21204. (1 mile south of Exit 28 Beltway-Interstate 695) Food service, prizes, flea market. Registration $2. No table charge or percentage. Contact W3WVC at above address.

Midland, Texas

The Midland Amateur Radio Club will hold their annual Saint Patricks Day Swapfest on Sun-

[Continued on page 99]

Q AND A

BY CHARLES J. SCHAUERS, W63QLV*

BECAUSE technologies are changing so fast, there is an information explosion. Even the largest computer cannot handle all of the new information generated yearly in the various engineering disciplines.

Even if a computer large enough existed today to handle say all amateur radio equipment produced during the last 25 years, it would take a great deal of time to get the information concerning these sets into the computing system so that it could be retrieved quickly.

The problem of storing information in computing systems is a large one. It still takes a large number of people to feed modern day computers with changing data and keep this up-to-date, especially if the information must be paraphrased.

As far as I know, there is no computing system in being which has been filled with amateur radio troubleshooting information etc., so obtaining information is not always an easy matter.

I takes time to answer questions properly. So during this transition period of Q & A Editors please be patient. We do not know it all and there are questions we cannot answer—but we try.

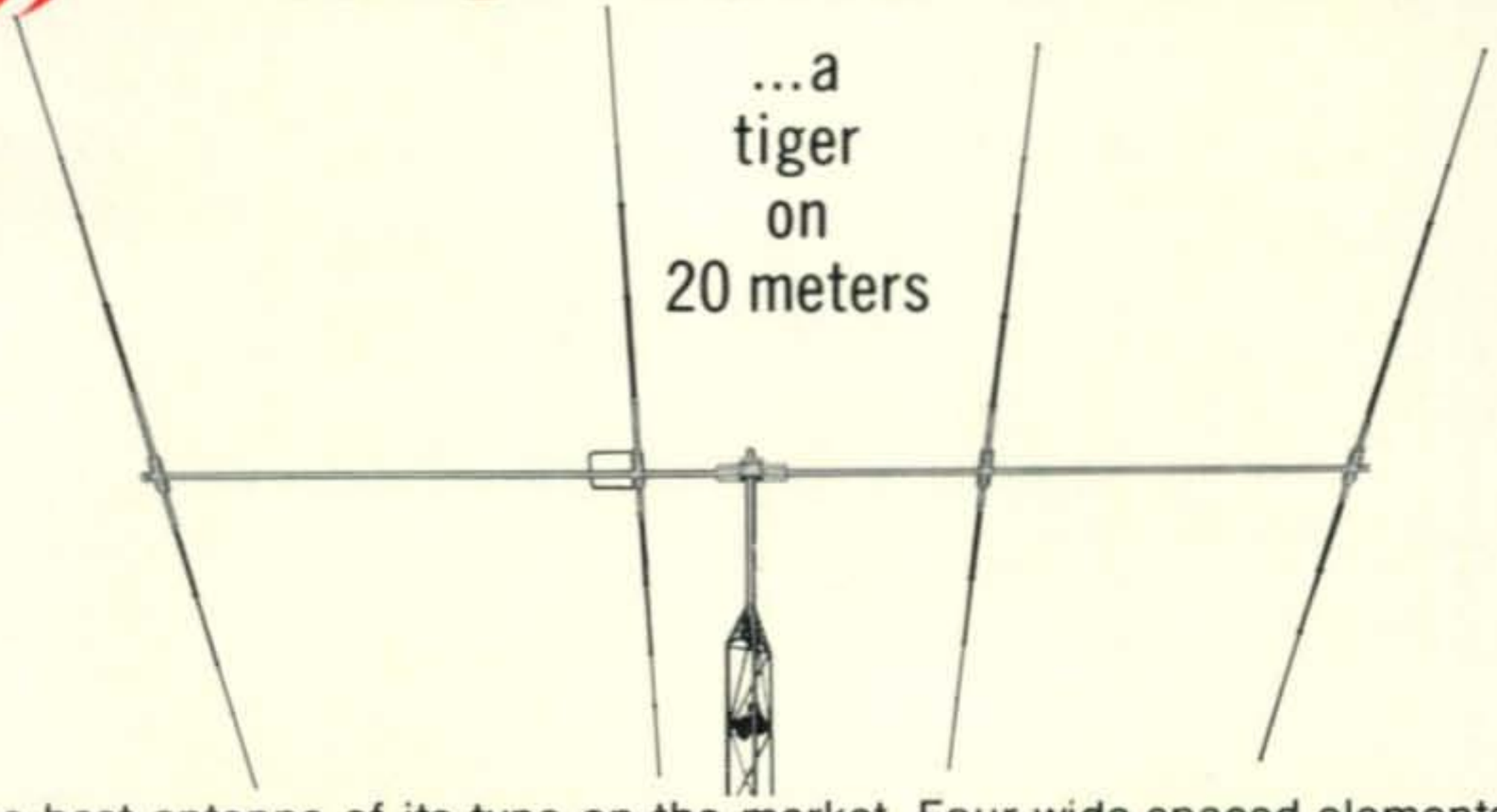
Q & A is a free technical assistance program offered by **CQ** to its readers. We ask your cooperation to enable us to assist as many amateurs each month as possible. Always include a self-addressed stamped envelope with your question. Only one question per letter, please. Before writing to ask where a published article appeared, try to find it yourself by consulting the annual indexes of the various amateur magazines. Mail questions to: **CQ** Q & A, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

Tempo One Transceiver Operation on 75 Meters

There is *no* transceiver made that is perfect, and I personally will argue with any engineer extant! Some transceivers are better than others (in many ways) but yet when

for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters).....**$149.95**
Model 203BA (3-element, 20 meters).....**$139.95**
Model 153BA (3-element, 15 meters).....**$ 69.95**
Model 103BA (3-element, 10 meters).....**$ 54.95**

FERRITE BALUN MODEL BN-86

Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

HY-GAIN ELECTRONICS CORPORATION

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

you get down to "brass tacks" *all* have some component or design faults—in other words, the transceiver could be made better—but *never* perfect. For perfection implies that heaven has finally "landed" on earth! This will never happen.

A "problem" (easily cured as described below) has appeared with the Tempo One transceiver. It has been noted that that the maximum power output does not always occur simultaneously with the dip as indicated on the plate meter when operating on 75 meters. This would lead one to believe that there is a neutralizing problem. If the set appears to be in neutralization on 10 and 15 meters, the 75 meter problem is one of an improper L/C ratio in the pi-network, rather than neutralization. Please refer to the Q & A COLUMN of *CQ* for October 1972 which generated *this* additional information (including this solution) which was supplied by Walt Henry of Henry Radio.

Solution: (1) Remove all cable connections from the back of the set. (2) Remove Tempo One from its cabinet. (3) Locate the capacitor, C_{60}, which can be reached from the bottom of the chassis at the last wafer of the bandswitch. (4) Change C_{60} from a 1000 pf capacitor to a 250 pf silver mica rated at 1000 v.d.c. (5) Put the set back together. That's all there is to it. Thanks Walt!

32S-3A From 32S3 (Collins)

"Last month you published information on the KWM-2 conversion to a '2A. Any information on the transmitter 32S-3 to a 32S-3A?"

Yes. Ask for Service Bulletin No. 7 which tells you how to convert this set into a 32S-3A, general coverage. Also ask for the 32S-3 Service Bulletin Revision 1, which gives you additional information. Address your request for this to Collins Radio, Publications Engineering Department, Cedar Rapids, Iowa 52406 or the address given in last month's column.

S.W.R. Meter

"I bought a popular foreign made s.w.r. meter. It has two meters on it, and the reason I did buy it was because it cost so little. But I'm having problems. I use 1 kw p.e.p. When I load up on c.w. position everything seems fine, but when I switch to s.s.b. the meters are eratic. They bounce (the needles) all 'over the place.' What's cooking? I know the needles should move as I talk (excitation ap-

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Dick Cowan, WA2LRO
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plied) but these things 'wander' all over."

Difficult question. I *had* one of the meters that you mention. I found a bad diode. I changed this and everything was ok. But there could be other causes too. Poor connections of coax, intermittent ground, etc., etc. could cause erratic operation. If the meter is operating properly on s.s.b. the reflected power meter needle should be practically stationary and the other meter go to the *limit* you set on c.w. Check your *whole* antenna system before you do a thing. You could have some bad coax, corrosion of connections at the beam proper or *another* defect within the meter itself.

Dynamic Stability

"What does dynamic stability mean as applied to power supplies that power s.s.b. sets?"

I assume you mean transmitters. Well, it means that the power supply has enough *reserve* power to assure linearity as well as power demands required by the amount of excitation used. This is a simple explanation.

Thermal Noise

"What is thermal noise?"

Electromagnetic noise omitted by a hot body . . . It's often called Johnson Noise. (The 'body' is not human but electronic as applied to communications (for example).

Equipment Evaluations

"Really now, do you believe the information relative to ham equipment evaluations one reads in all ham magazines?"

If they are made by Bill, W2AEF, I do. He does the evaluations for CQ . . . without advertising in mind. But remember one thing, when he tests and evaluates, his environment is *different* than yours, and if he states a parameter that just doesn't seem to be present when you obtain equipment, don't blame him.

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HW-100 Hum

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[*Continued on Page 90*]

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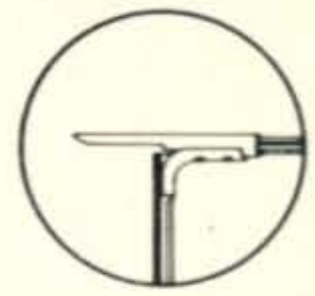

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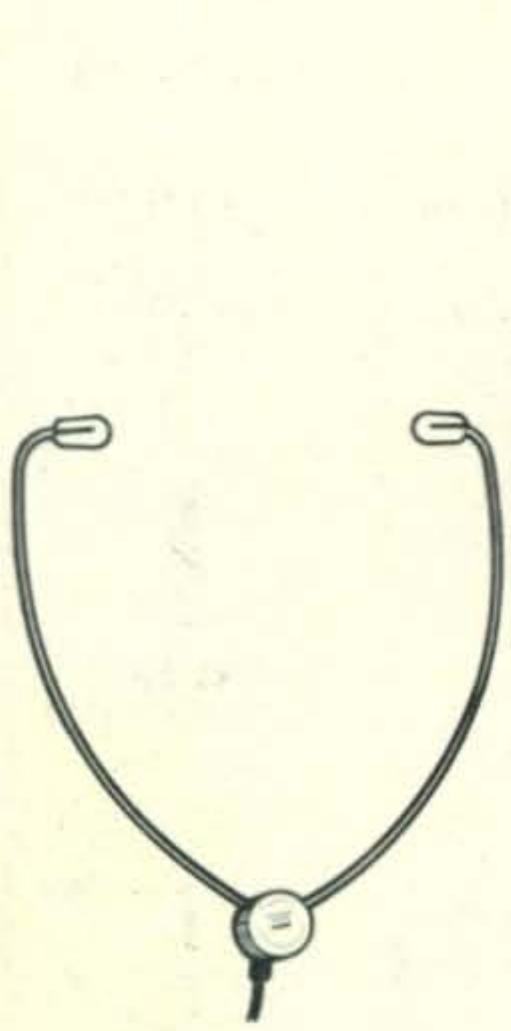

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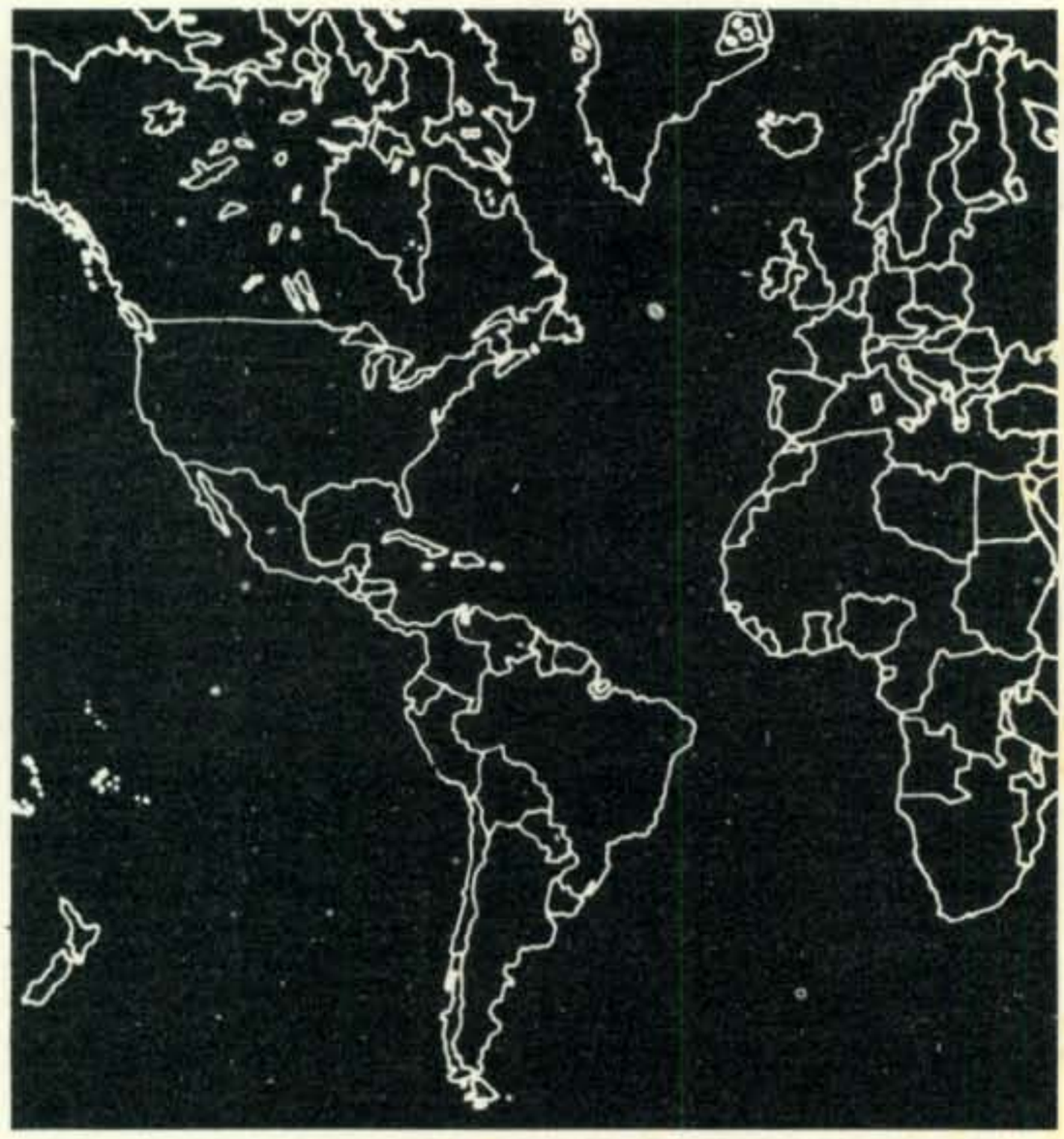

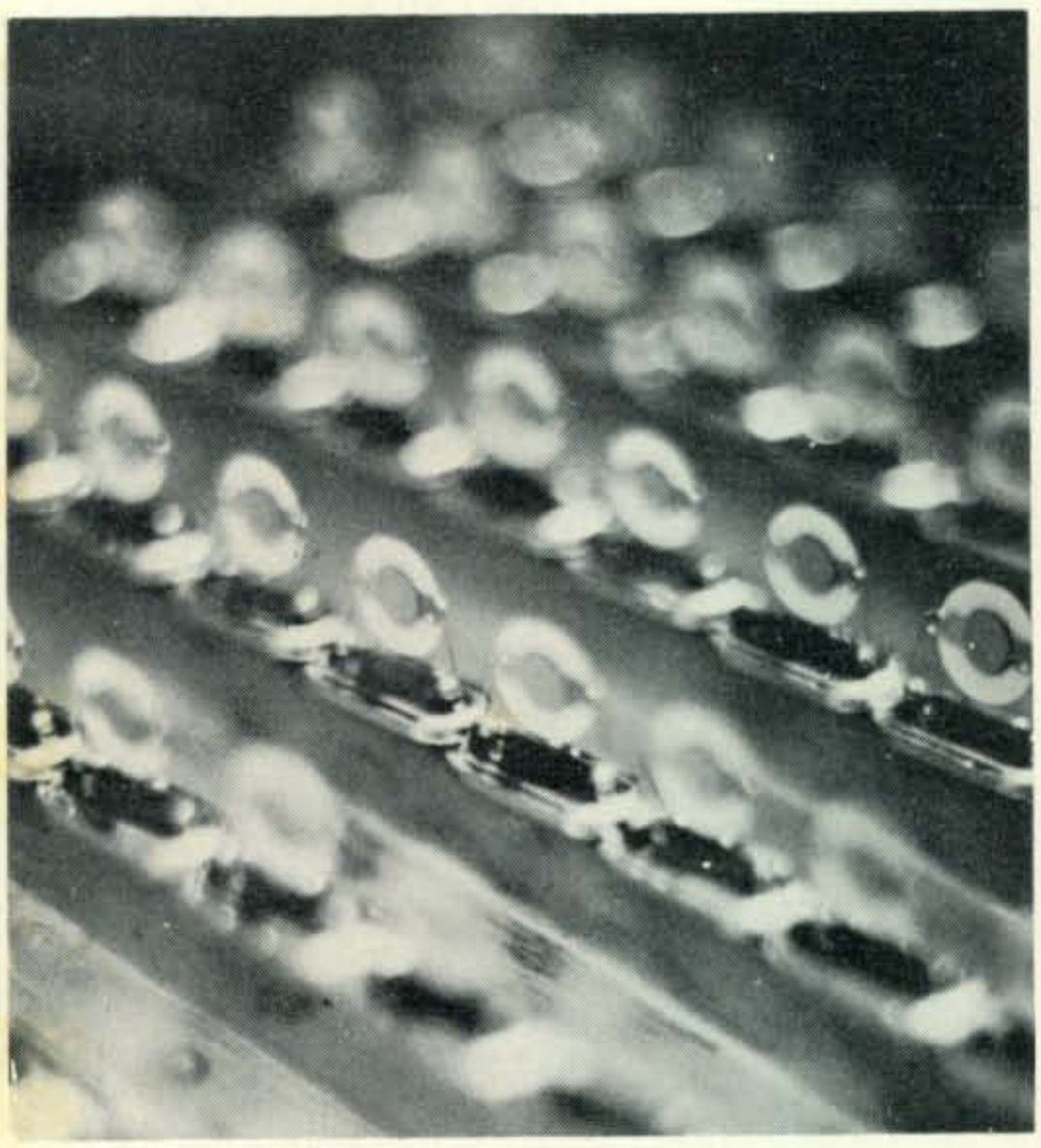

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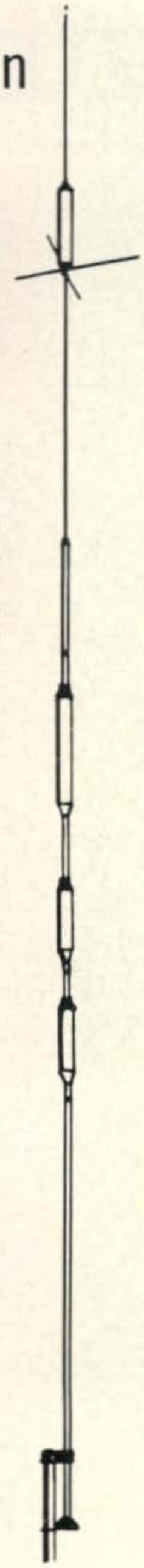

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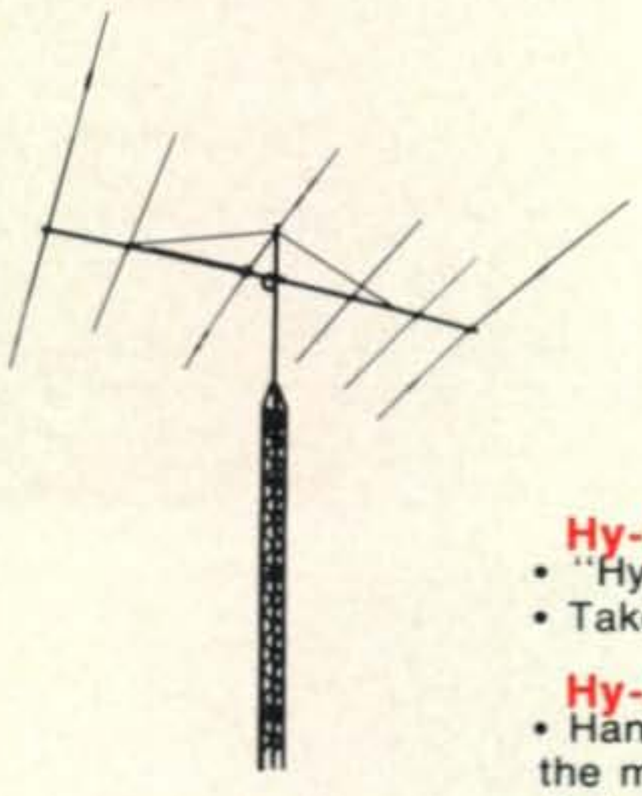

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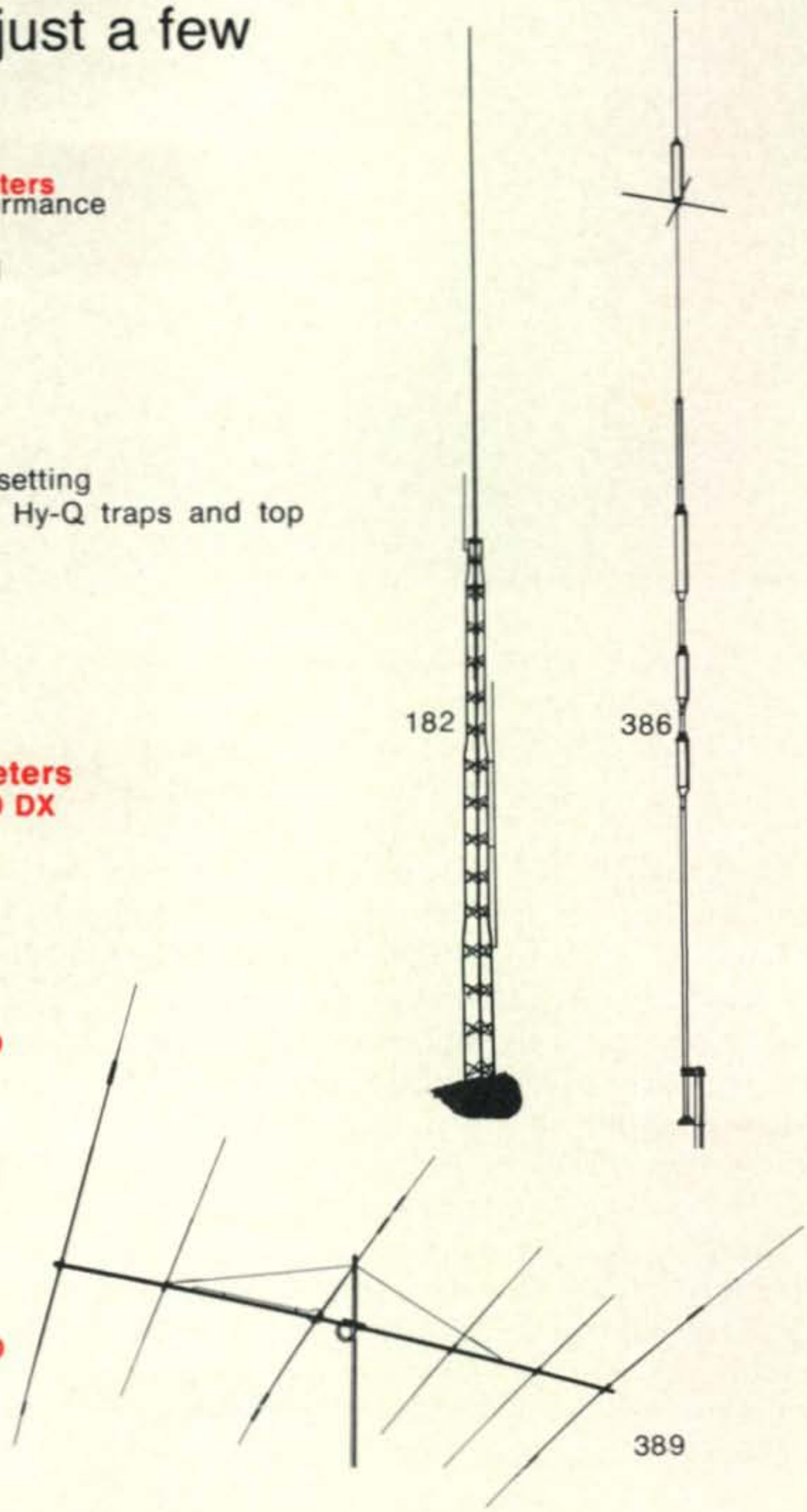

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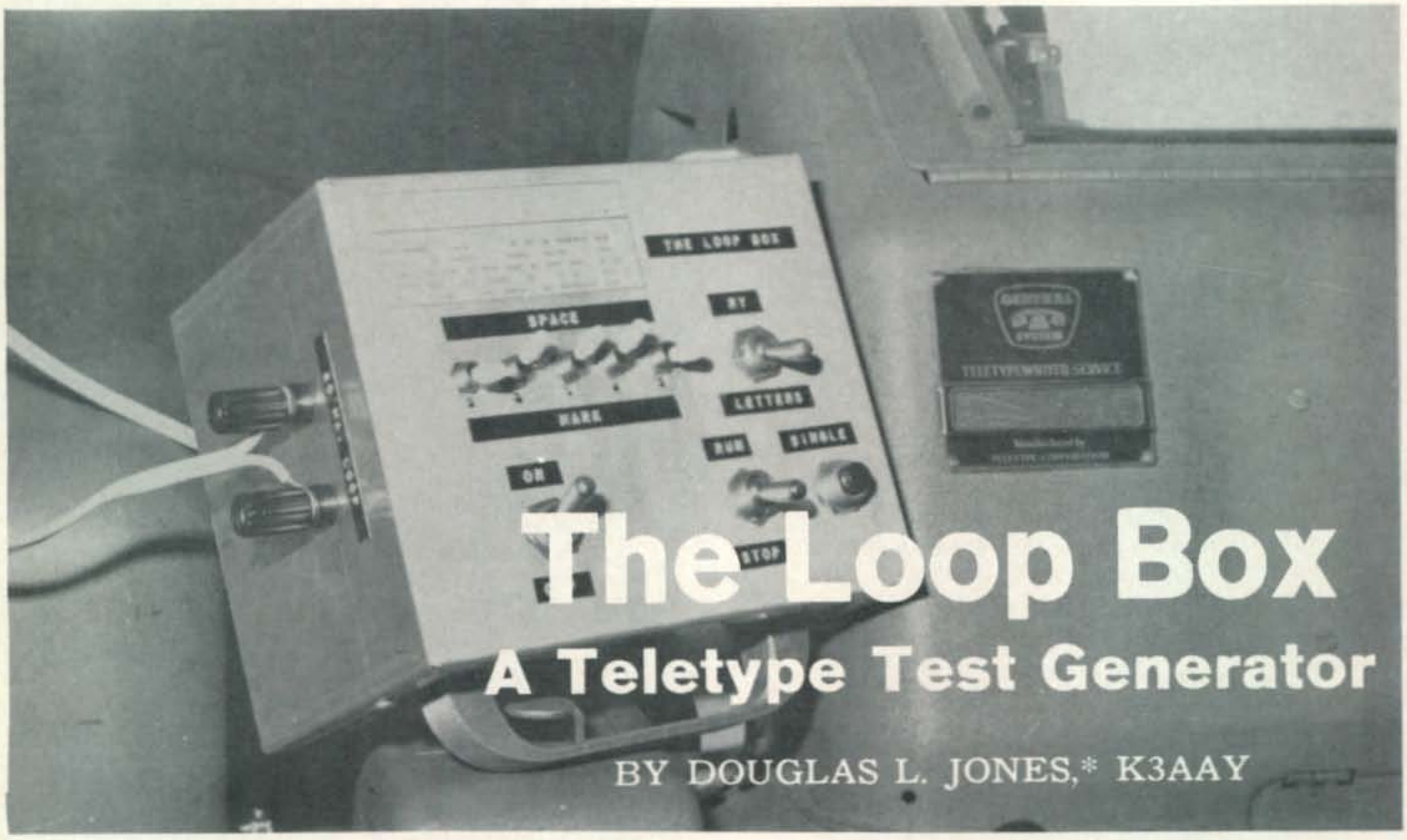


The Loop Box

A Teletype Test Generator

BY DOUGLAS L. JONES,* K3AAY

THE idea for the Loop Box was not really born of necessity; rather, it was kind of a by-product of one of those wistful thoughts of "I wish I had a gadget that . . ." Less than a week later the breadboard version had proved successful. By the end of the second week, this test generator had undergone modifications, a face lifting from discrete components to integrated circuits, and was buttoned up tight in its own aluminum box.

The features of this little teletype test generator include battery operation, loop switching regardless of polarity, and complete semi-conductor operation with not even a switching relay. The user can generate any single letter or RY's, one at a time or continuous. Add to that the fact that it can cover any of the popular teletype speed ranges and with proven zero percentage distortion. Perhaps best of all it is downright fun to use.

Look through the circuit descriptions. If you're an RTTYer you will probably want to build one. There is plenty of room for modifications or substitutions, so sharpen up your Boolean algebra and get out your old computer board parts.

Block Diagram

A study of fig. 1 will give you some insight into what is happening in the Loop Box. The basic clock circuit is fed into a set of flip flops which is the divide-by-8 circuit. The output is fed to the matrix where it is added with switch selected levels T_1 through T_5. It is at this point that panel selection of the exact letter you want to generate can be made. A quick look at the front view photo will show the five panel switches T_1 through T_5.

The output of the matrix goes to the loop switching circuit. This circuit is placed in series with an existing teletype loop, one that contains its own source of loop current. The polarity of the connection is unimportant.

Whatever letter was previously set up by the program switches T_1 through T_5 can now be sent out two different ways. By means of a SINGLE LETTER push button, the letter can be sent out one at a time each time the button is pushed. If the RUN/STOP switch is thrown to RUN, the letter will be continuously transmitted until the switch is returned to STOP.

The total transitions of RY can be made quite easily. The RY generator is switched into the matrix; they too can be sent singly or continuously.

*2271 North Mill Rd., North East, Pa. 16428.

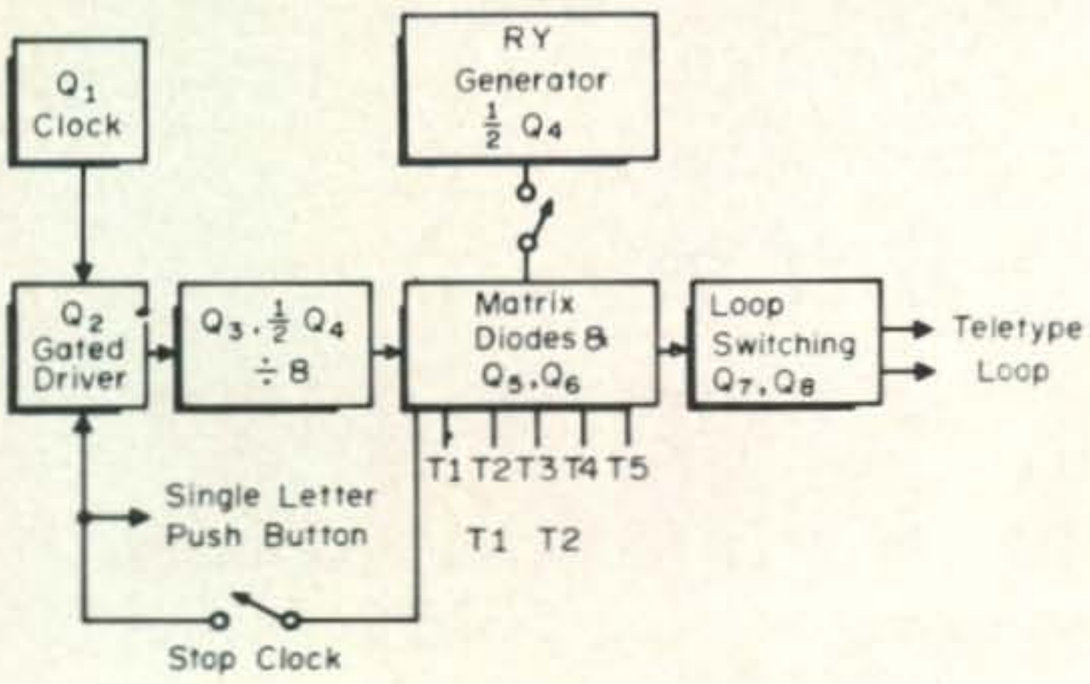


Fig. 1—Block diagram of the Loop Box.

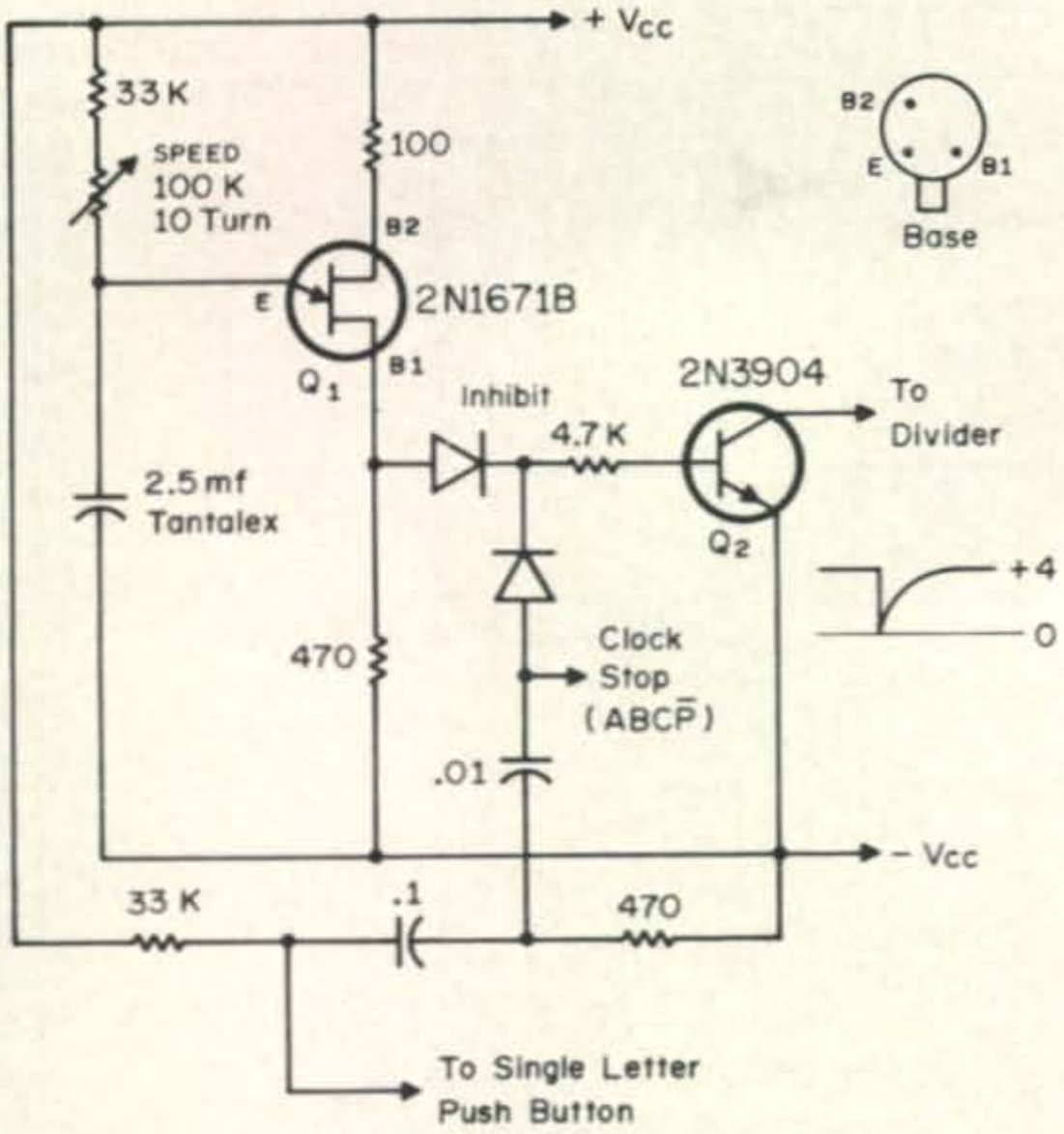


Fig. 2—Circuit of clock and gated driver, including inhibit circuit for single letter operation.

The Clock Circuit

Figure 2 shows the unijunction clock circuit used to drive the Loop Box. The emitter of the UJT is biased by two resistors, a 33K and a 100K pot. If a 10-turn potentiometer is used in this circuit, it will allow easy adjustment of circuit speed. As Table I shows, the unit will cover a speed range of from 60 to 100 w.p.m.

The output of the UJT while of constant speed and amplitude, was the wrong polarity for the Motorola flip flops chosen in the divide-by-8 circuit. The gated driver shown *in fig.* 2 serves two functions. First, it provides polarity inversion to allow the succeeding circuits to work on a down-clock transition. Secondly, it is a good place to inhibit the operation of the circuit by the stop-clock pulse. The stop-clock pulse ($ABC\overline{P}$) which is derived from the matrix is used to stop any further generation of another letter. It does by necessity allow completion of what ever letter it is presently generating. When the stop-clock goes high, this saturates the driver transistor and inhibits any more clock pulses

Speed	Time (ms)	Baud
60	22	45.45
75	17.57	56.88
100	13.47	74.2

Table I—Pulse spacing necessary for setting up Loop Box clock pulse rate for desired operating speed. A calibrated oscilloscope will be needed for these settings.

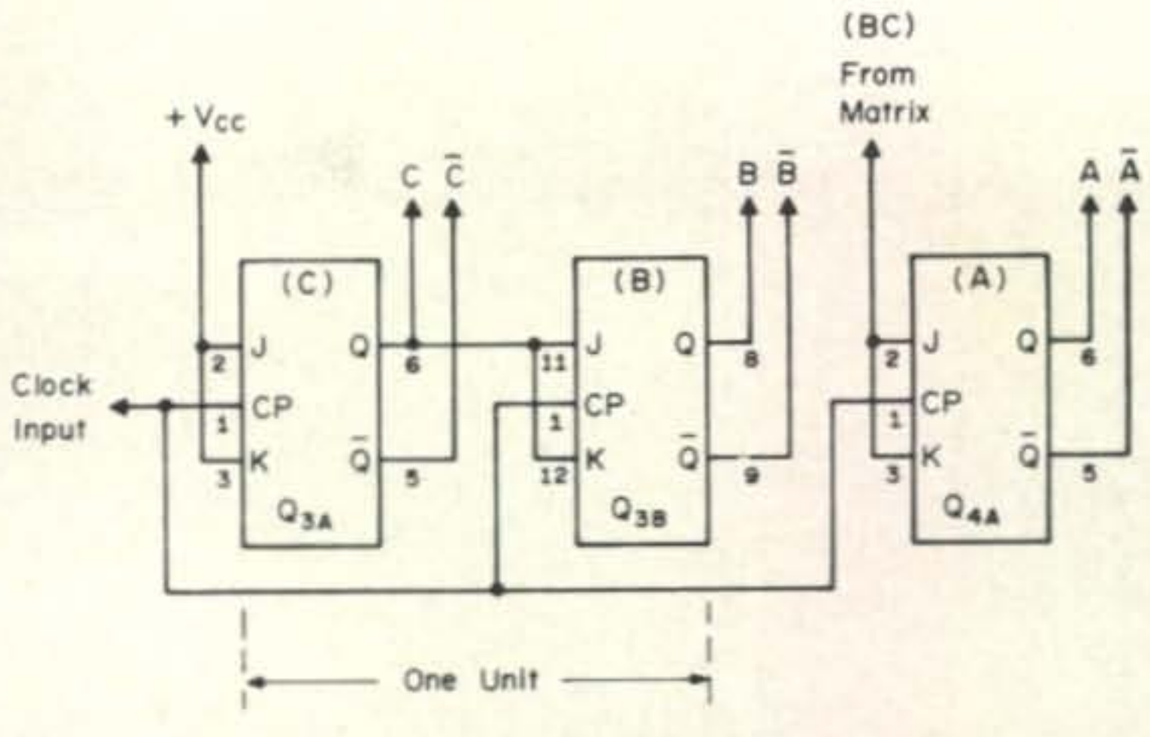


Fig. 3—Eight to one frequency divider circuit uses 1½ Motorola C1052P dual JK flip flops. Letter designations for connections correspond to others in matrix diagram.

from getting through unless one of two things happen: either the stop-clock is removed by the RUN/STOP switch or the push button is activated to allow one negative pulse to start the generation of one letter.

The Divider Circuit

Motorola C1052P dual JK flip flops are used in a parallel connected divider circuit. This parallel connection was necessitated due to the fact that the clock input is common to both flops in one of the dual units. There are actually two of the dual units used. The divider circuit utilizes three of the flops, the fourth is used in the RY generator.

As fig. 3 shows, the majority of the outputs from the divider circuit go to the matrix. One connection (BC) comes from the matrix and is used as the priming input for the third JK. Table II shows the 8 transitions the divider circuit goes through; this truth table is only for an A, B, or C lead as it goes high. All six leads must be fed on to the next circuit for matrixing.

The Matrix Circuit

The matrix is a cost-wise consideration of discrete components and integrated circuits,

ABC	Pulse	
000	Stop	Start Clock
001	Start	RY Flip
010	#1	
011	#2	
100	#3	
101	#4	
110	#5	
111	Stop	Stop Clock

Table II—Truth table showing the 8 transitions the divider circuit (fig. 3) goes through.

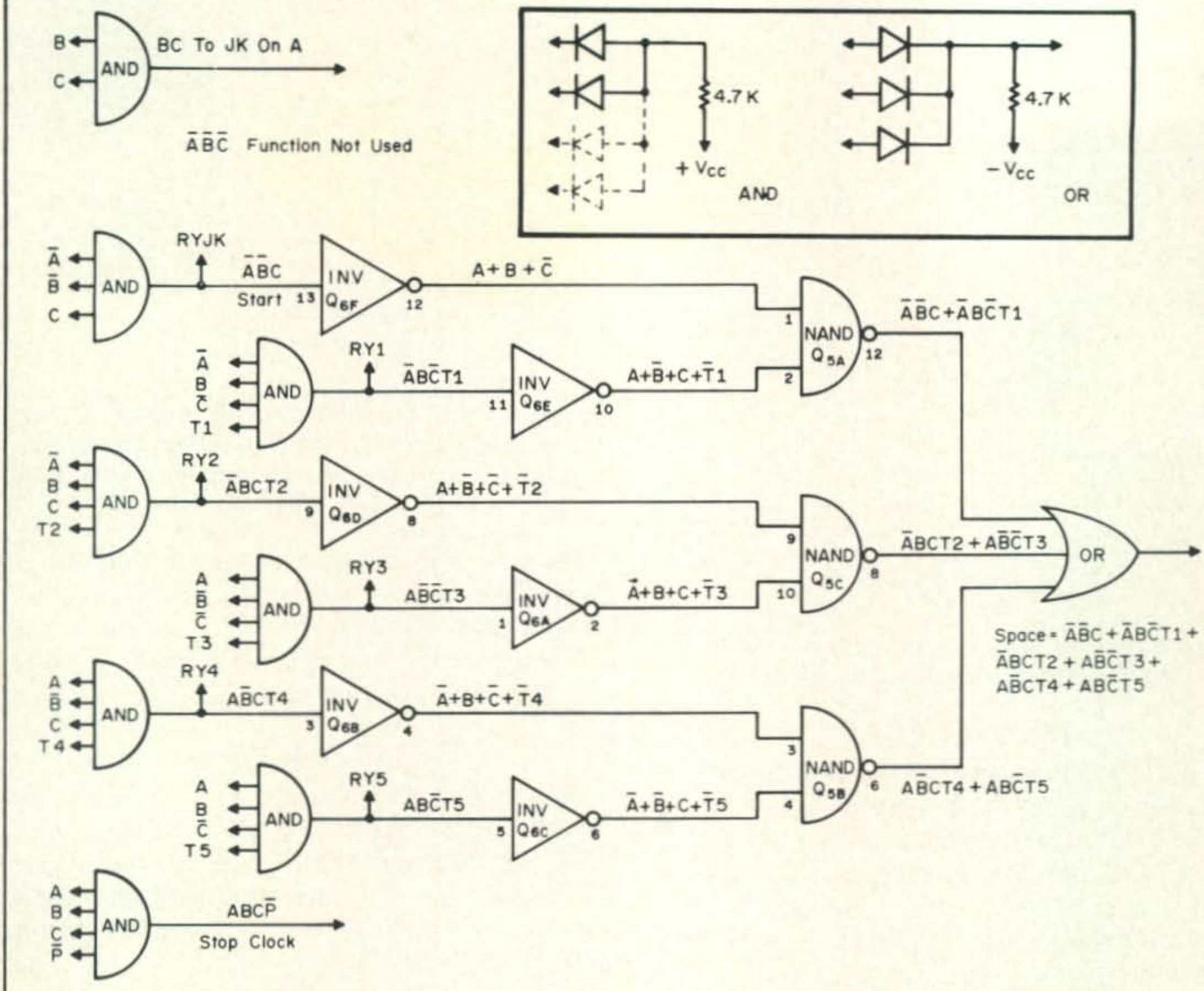


Fig. 4—Matrix for Loop Box. AND or OR gates are constructed of discrete components as shown in inset. Inverters are a Motorola C1036P hex inverter chip; NAND gates are a Motorola MC862P triple 3-input NAND chip. See fig. 9 for basing.

and a mathematical complexity of AND, NOT, NAND, and, OR logic circuitry. In short, it was the most economical method using existing junk-box parts to accomplish the end.

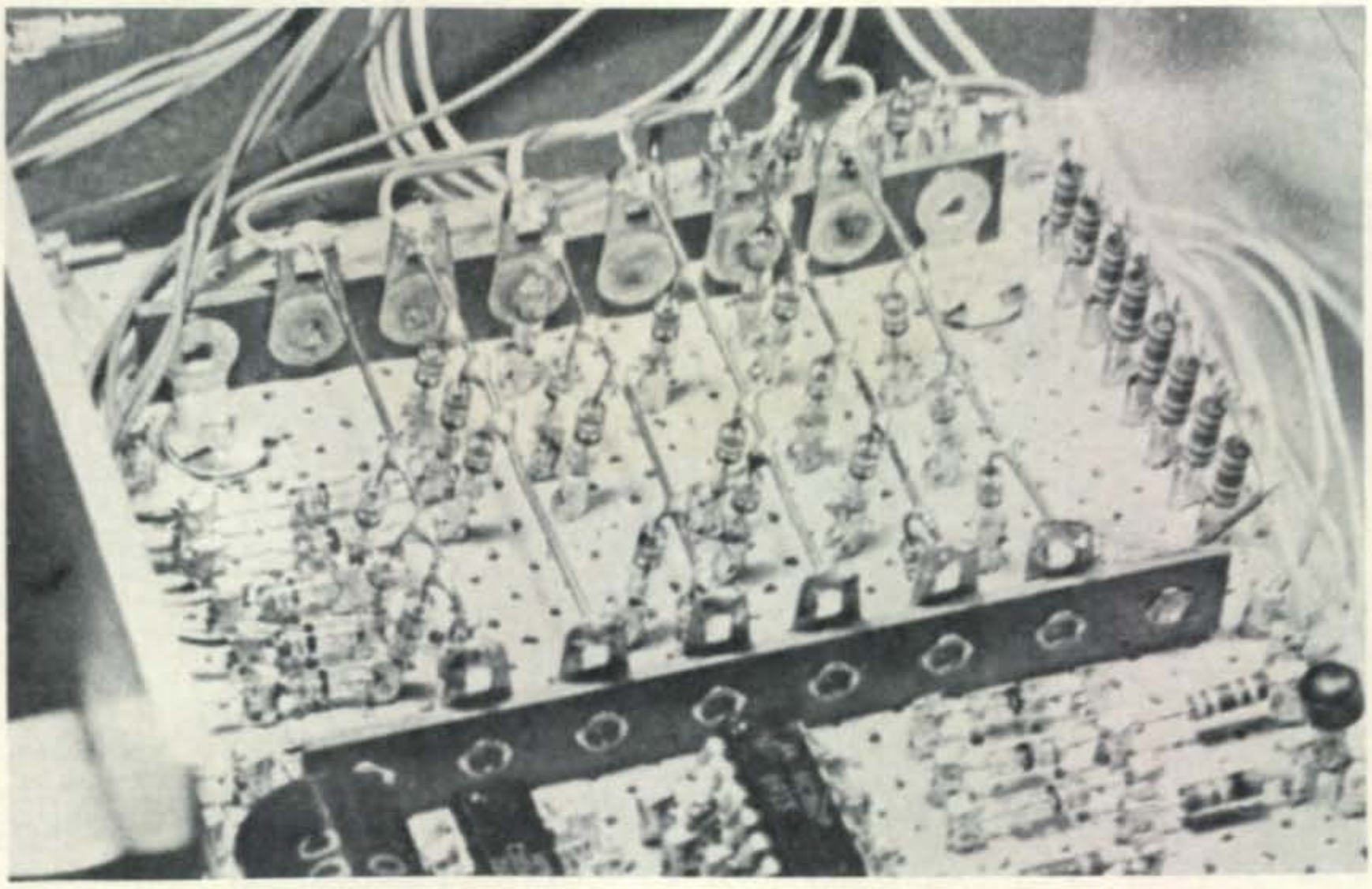
If you are unfamiliar with Boolean algebra, the output equation of the matrix simply says that a space will occur if $\bar{A}\bar{B}C$ (001) or if the T_1 or T_2 . . . or T_5 switches are thrown. If any of the switches are not thrown, there will be no space produced during that time slot; thus the time period would be marking.

A teletype signal as you will recall, is actually made up of 7 pulses; a start pulse (space), followed by 5 mark or space pulses depending upon the particular letter selected, and a stop pulse (marking) that is about 1.41 times as long as any one of the others. Actually, the stop pulse is stated to be a minimum of 1.41 times as long as any other pulse. In the Loop Box, the stop pulse is defined as being 2 units long.

Starting with pulse 001, it is a start pulse. The next 5 pulses will exist in a time domain but their presence is optional depending upon the programming of the 5 letter selecting switchs. Pulses 000 and 111 serve as the stop pulses. Further investigation of this same table will also show the start- and stop-clock pulses, which are dependent upon the setting of the RUN/STOP switch. One teletype stop pulse is allowed through at start-clock to allow the circuit to settle down before the first teletype start pulse. The same start pulse will also be used in the RY generator to cause the letter transition.

The AND and OR gates use discrete components while the INVERTERS and NAND gates are I.C. chips. The numbers refer to pin connections on the 14 lead devices. The algebraic equations show the development of the final space equation.

The first AND gate, BC, is actually a funda-



Close-up view of the matrix showing diodes wired between bridging heavy-gauge wires and flea clips in perf board. Other matrix interconnections are made between flea clips on reverse of board.

mental part of the divide-by-8 circuit. Since it utilizes two of the many inputs, it was built in the same complex.

The START pulse gate is next, followed by 5 gates whose output depends upon the coincidence of the timing pulses with the arrival of the switched levels, T_1 through T_5. If the appropriate swtich is thrown, then this gate will yield an output towards the general space equation.

Notice that there are really two outputs from most of the AND gates. One goes on in the matrix to the INVERTER stages. The other is fed to the RY generator (fig. 5).

The RUN/STOP switch has an output labeled $\overline{P}$. This is anded with pulses from the divider and is fed back to inhibit the operation of the clock should the stop-clock level occur.

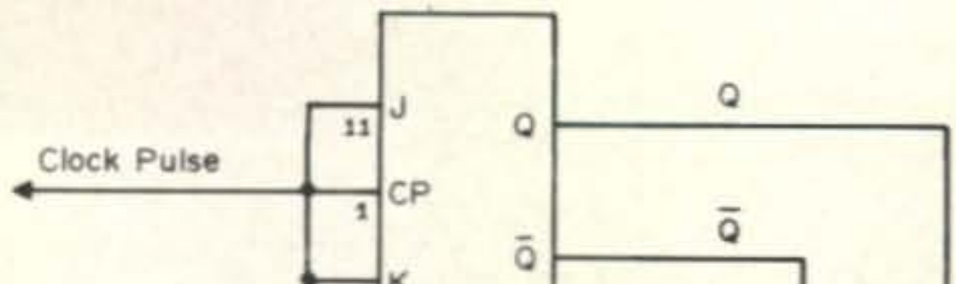


Fig. 5—RY generator uses half of a Motorola C1052P Dual JK Flip Flop. To generate RY, T1 through T5 must be on SPACE.

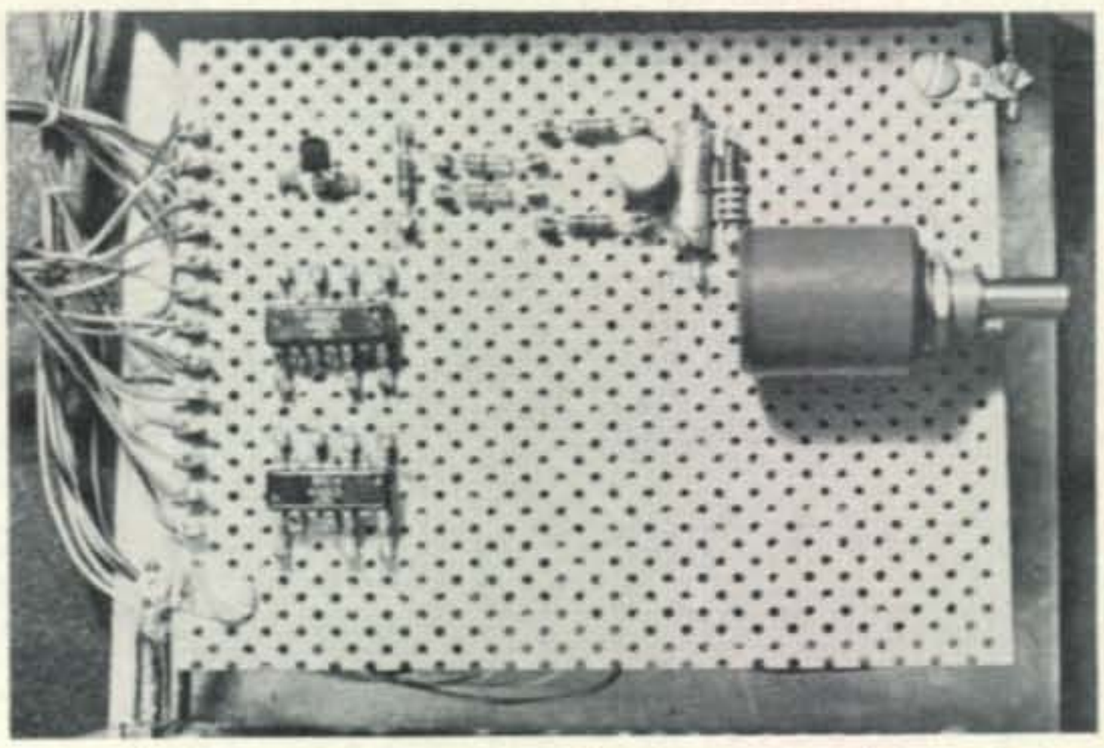
RY Generator

With every occurrence of the START pulse, RYJK is developed at the same AND gate. It is fed to the RY generator (fig. 5) and is used as the priming source for the RY flop.

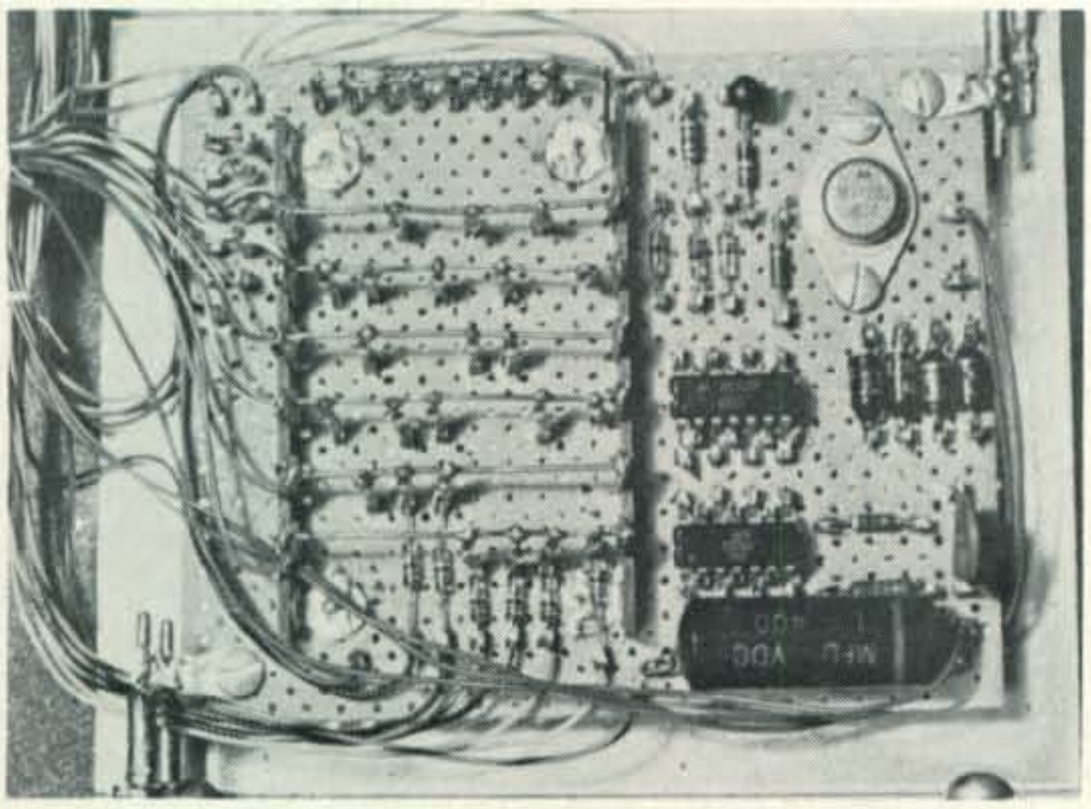
One output of the RY flop is fed to the AND gates of T levels 1, 3, and 5; the other output is then fed to T levels 2 and 4. When the RY/LETTERS switch is thrown to RY, the flop will alternately ground first the outputs of the three gates, then after the next start pulse which would be the start of the next letter, it would ground the outputs of two of the gates. Thus, the generation of the letters R and Y.

Loop Switching Network

The output from the matrix goes to d.c. coupled amplifiers in the loop switching network (fig. 6). No collector supply or load is needed for the output transistor as the teletype loop supplies both the operating current



The clock circuitry is at the upper right with its speed setting 10-turn pot below. To the upper left is the gated driver, with the two dual JK flip flop IC's below.



The matrix and loop driver are a second board. The loop driver transistor is at the upper right, with the matrix at the left.

and load. The diode bridge circuit will allow either polarity connection of the teletype loop as the bridge will provide a unidirectional current routed to the transistor.

A bit more care is needed in choice of these output components. The diodes chosen must handle the loop current of 60 ma. The output transistor must have a high enough V_{CEBO} breakdown rating to sustain any inductive voltage spikes created at the beginning of a space period.

Panel Switches

Figure 7 shows the connections of the operating switches as well as the power supply. Four C cells will easily power the unit; the total current drain is approximately 55 ma. A conservative estimate would give ten hours of continuous operation before needing new cells. A lot of letters can be sent out during a ten hour period.

The C cells, in addition to supplying power to the unit also provide the two logic levels of 0 and 1 for the programming switches T_1 through T_5 and for the RUN/STOP switch. The SINGLE LETTER push button picks up a ground connection at this point. Finally, the

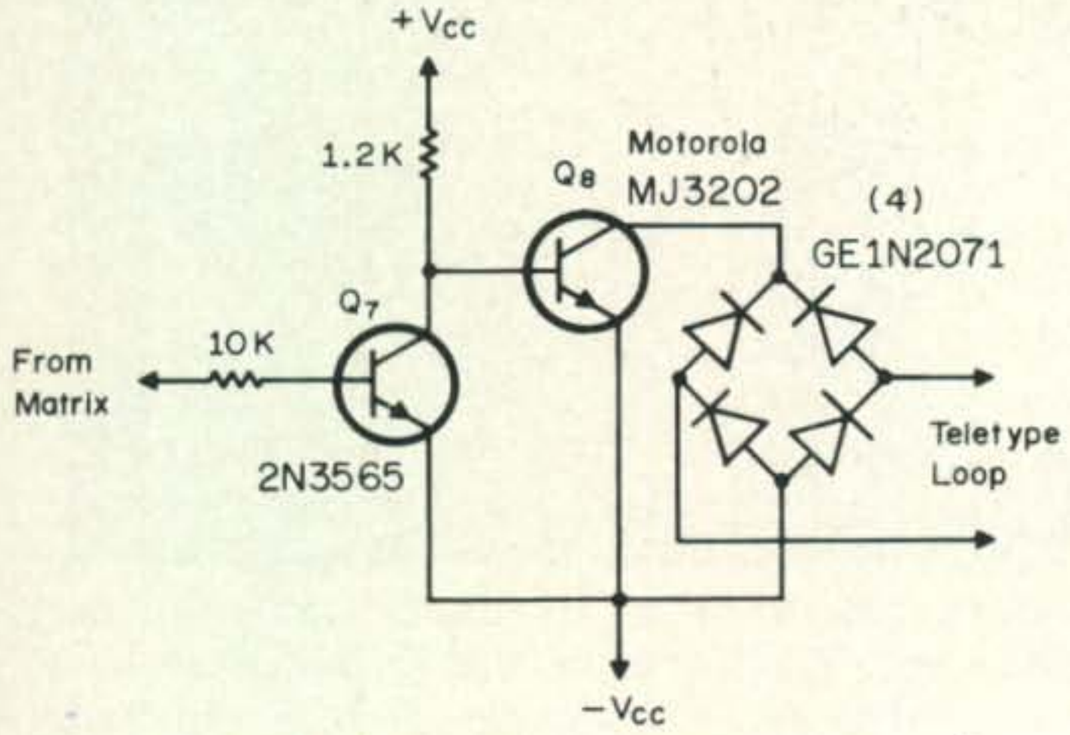


Fig. 6—Teletype loop switching network.

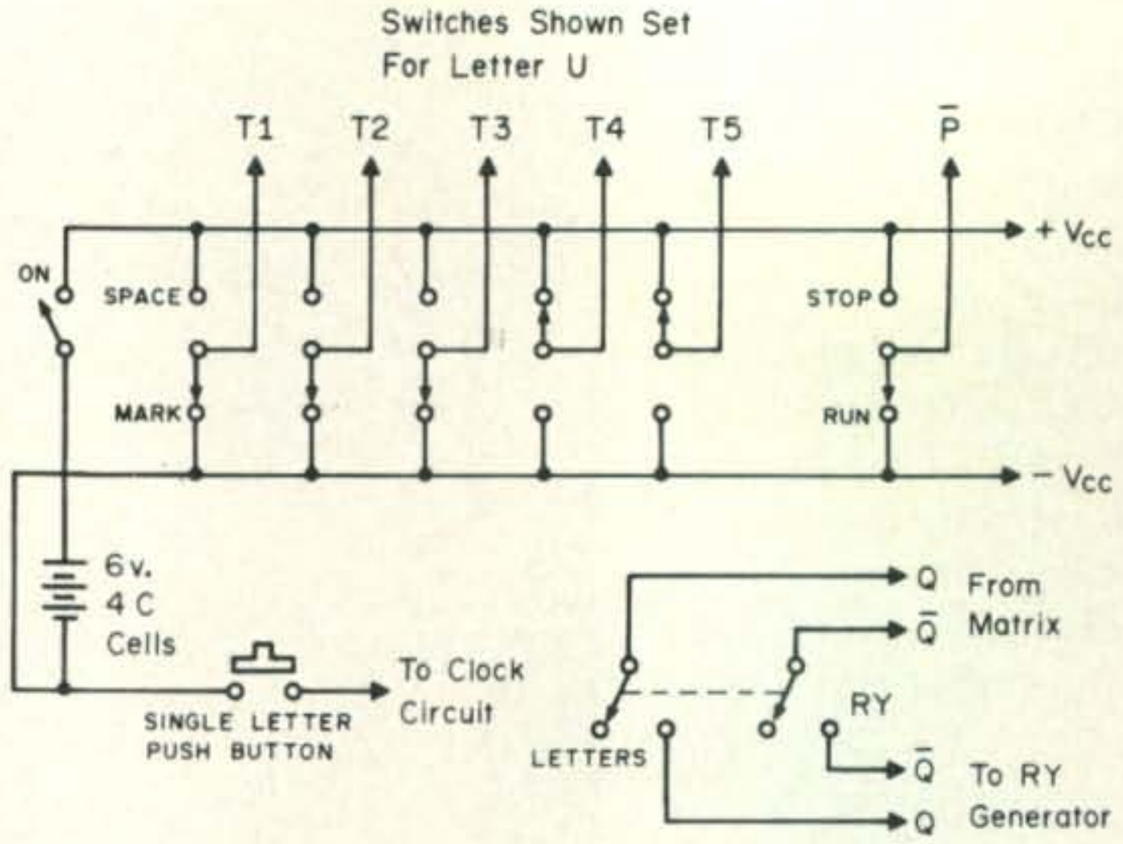


Fig. 7—Panel switch wiring for Loop Box. T1 to T5 switches are shown set for letter U.

RY/LETTERS switch is a double-pole single throw switch, taking outputs from the matrix and combining them with outputs from the RY generator.

Waveshapes

Figure 8 is a timing chart of all critical waveshapes throughout the unit. All levels

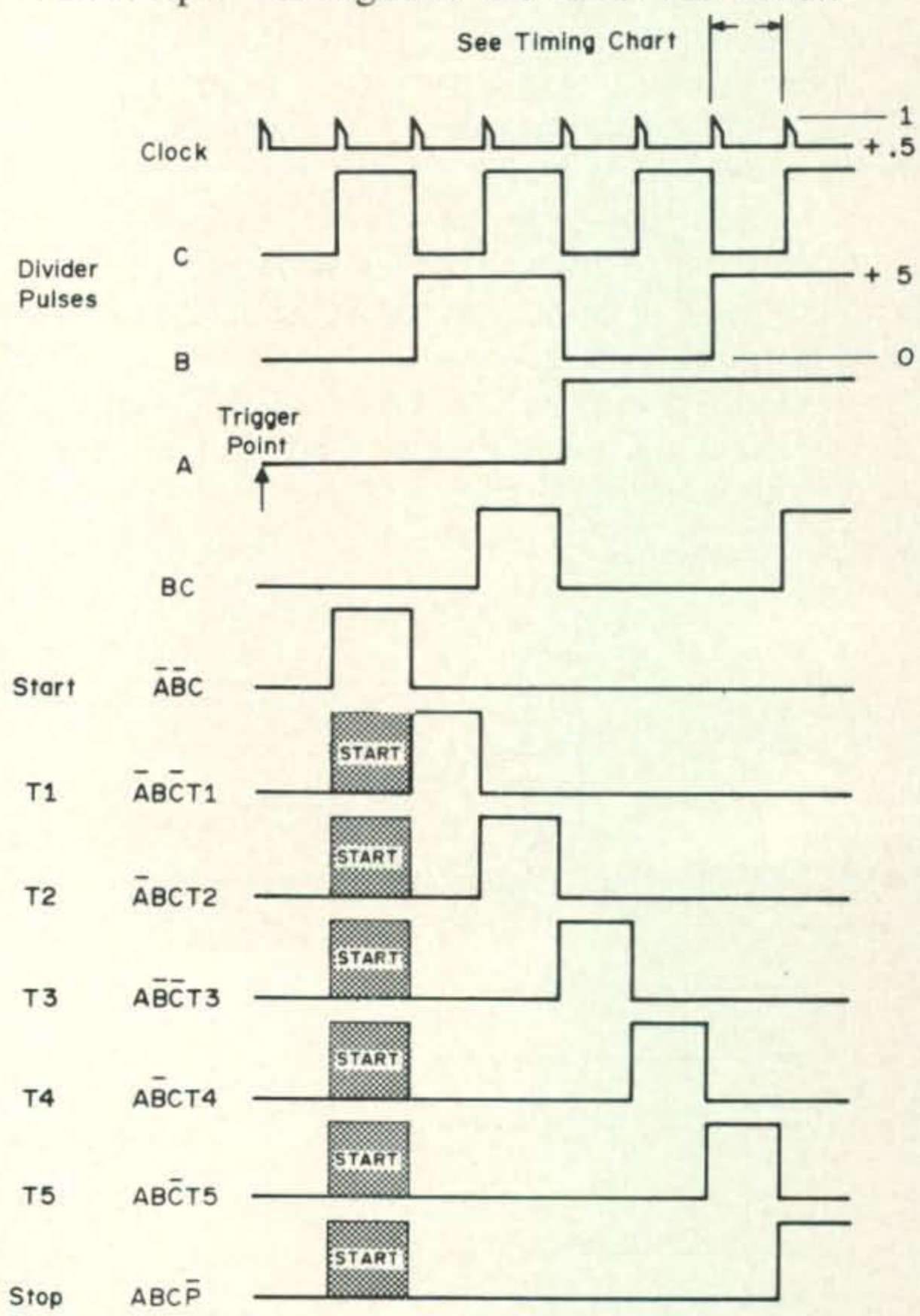


Fig. 8—Waveshapes found at designated points in the divider and at the matrix output when each T-switch is thrown to mark, with RY/LETTERS switch at LETTERS, and SINGLE LETTERS button pressed.

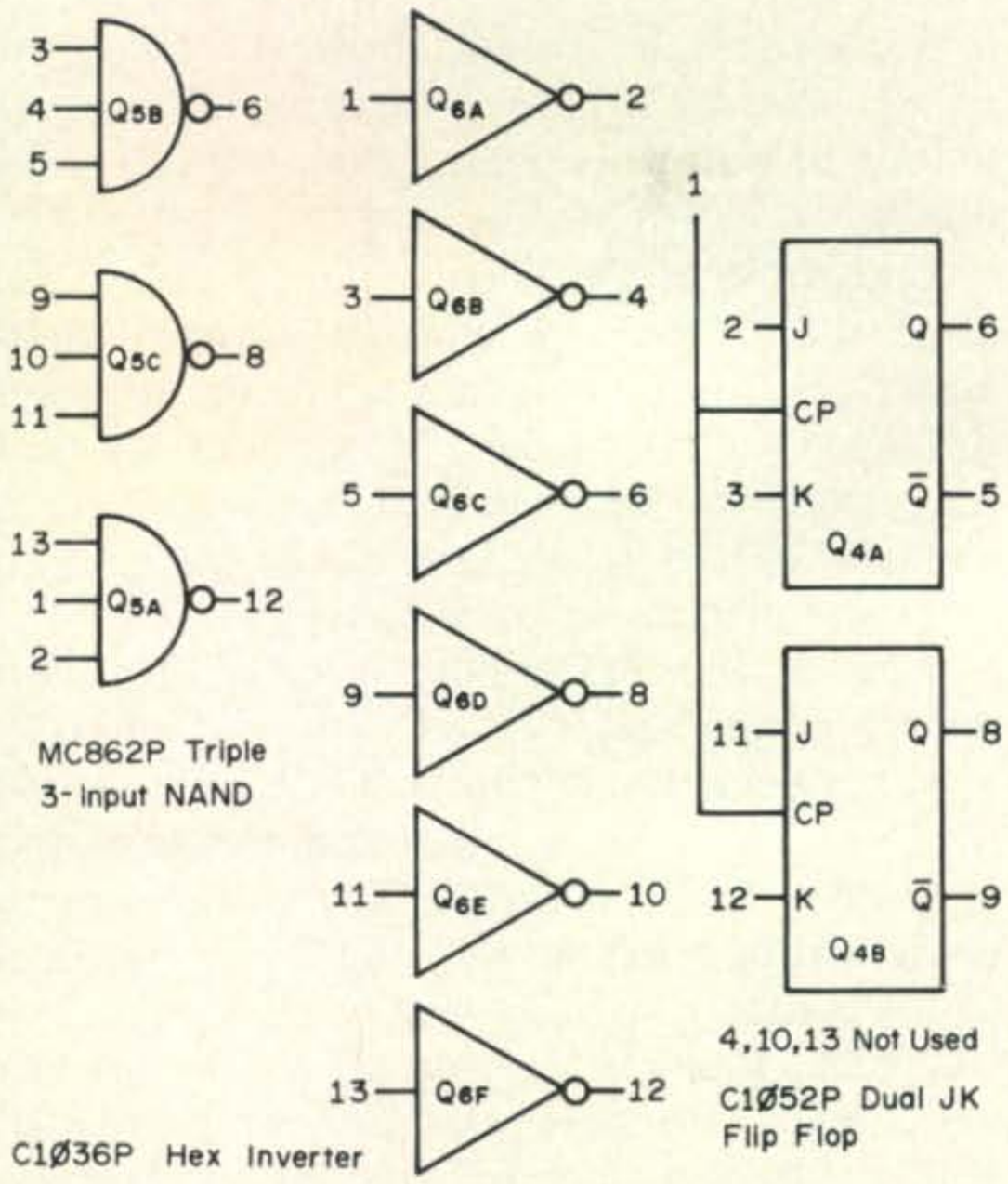


Fig. 9—Circuit connections for Motorola DTL logic devices used in the Loop Box.

are 0 to 5 volts with exception of the clock which is .5 to 1 volt.

Timing of the clock pulse will be dependent upon the setting of the potentiometer. By use of a calibrated oscilloscope, timing for the desired output speed can be made at this point. Table 1 shows the pulse spacing necessary for various speeds.

The divider pulses can most easily be picked up on the bus leads running through the matrix. The C pulse will go through eight transitions for every four that B goes through. Next check for A. It is entirely possible to have C and B correct but not to have A. This is due possibly to not generating the BC feedback correctly in the matrix; it too is shown on the timing chart.

Having found C, B, and A correct, use the down-clock pulse of A as an external trigger sourse for the oscilloscope in seeing the generation of the rest of the pulses. The RUN/STOP switch must be in the run position. The first thing you will see at the output of the matrix is the START pulse $\bar{A}\bar{B}C$. If any one of the programming switches is thrown, you should see the appropriate T pulse along with the START pulse (example is shown on timing chart for T_3).

The only pulse you should not be able to see is the STOP pulse. If it is there and working, it should stop the clock by the time it goes high. The Boolean equations have been included on the matrix diagram to help you chase down any pulse that might become elusive.

Construction

Basing diagrams for the Motorola logic devices are included in fig. 9. The AND and OR circuits use discrete components, these circuits are shown as an inset in fig. 4.

No specifications are given on the signal diodes. They are small glass signal diodes and they truly were taken from old computer boards. A considerable savings here as you are using a total of about forty diodes. Watch it! Diodes that shorted due to a little too much soldering iron were fairly easy to find. The real 'gem' was the one that was marked backwards.

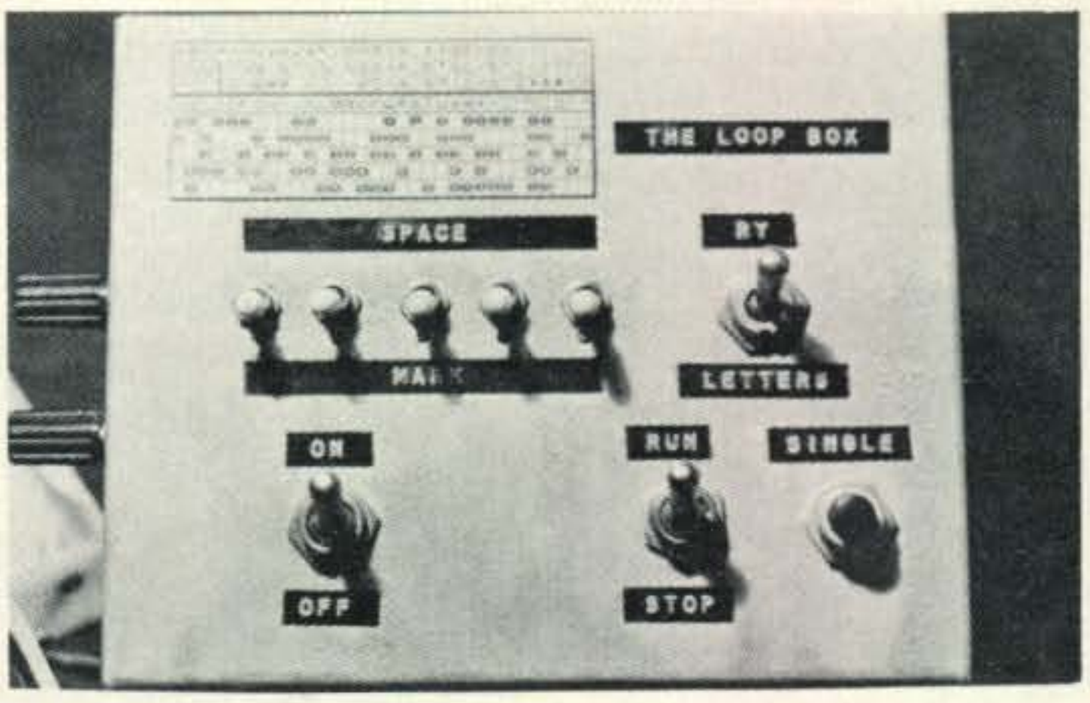
The resistors can be quarter-watt units. Do use a good quality potentiometer in the clock circuit; the ten turns make it a pleasure to adjust the speed.

Construction was done on Vector board with component mounting on flea clips. The photos show possible layouts of the two boards and interconnecting cable. Sorry, no printed circuits with this one, regular point to point wiring is used, although it does get touchy around the small pins of the integrated circuit.

Of note is the matrix, actually about the best part of the construction layout. How to get all those diodes and signal busses in a neat and manageable pattern? It actually ended up a three dimensional matrix.

At the opposite ends of the matrix, six-lug terminal strips were placed. The six signal

[*Continued on page 94*]



Front view of the Loop Box showing the five "T" switches used to perfectly synthesize any RTTY character for testing RTTY equipment. The Single Letter push button located at the lower right is pressed each time the letter is to be generated, or the Run/Stop switch may be placed at Run, allowing a continuous string of any character to be sent. The RY/Letters switch permits RY to be sent automatically, as needed.

C.W.: The Second Time Around

BY AL D'ONOFRIO,* W2PRO

THE north wind cut like a scalpel, slicing blasts of icy snow into the frozen-pinched faces of Friday's home-bound commuters. From atop snow encrusted aluminum poles, piercing arc lights painted an eerie silhouette of humanity on the move along Third Ave., all in search of refuge from New York's traditionally unpredictable March snow storms. Bundled in foul-weather clothing, dumpy shadows shuffled, stumbled, and bumped as they headed for buses and trains in the Grand Central area.

Two of those shadows belonged to Alf and Pete, friends and co-workers for the past twenty years at nearby Edco Publications. These two dumpy little shadows, like most of us, were creatures of habit, too. Having cashed their paychecks at the First National City Bank in their office building, they would then unerringly pay a visit, enroute to Grand Central Station, at a Third Avenue cultural-exchange and mind-expanding center to unwind from the cares of the week.

They pushed their way into the busy establishment, festooned in Kelly-green paper chains and shamrocks, stamped and shook the wind-packed snow from their coats, and took their customary places atop two bent-wood barstools at the far end of the bar. Emblazoned across the blue-tinted bar mirror was free-hand lettered "Erin go bragh," in iridescent green; next to the chromium-plate cash register sat a plastic leprechaun toasting the patrons with a mug of suds, his right eye intermittently lighting everytime someone rang up the cash register. St. Patrick's Day was a week away, but no one seemed to mind; with all the ice and snow, the prospects of St. Patrick's Day and an early spring helped to warm the heart, if not the shivering bones.

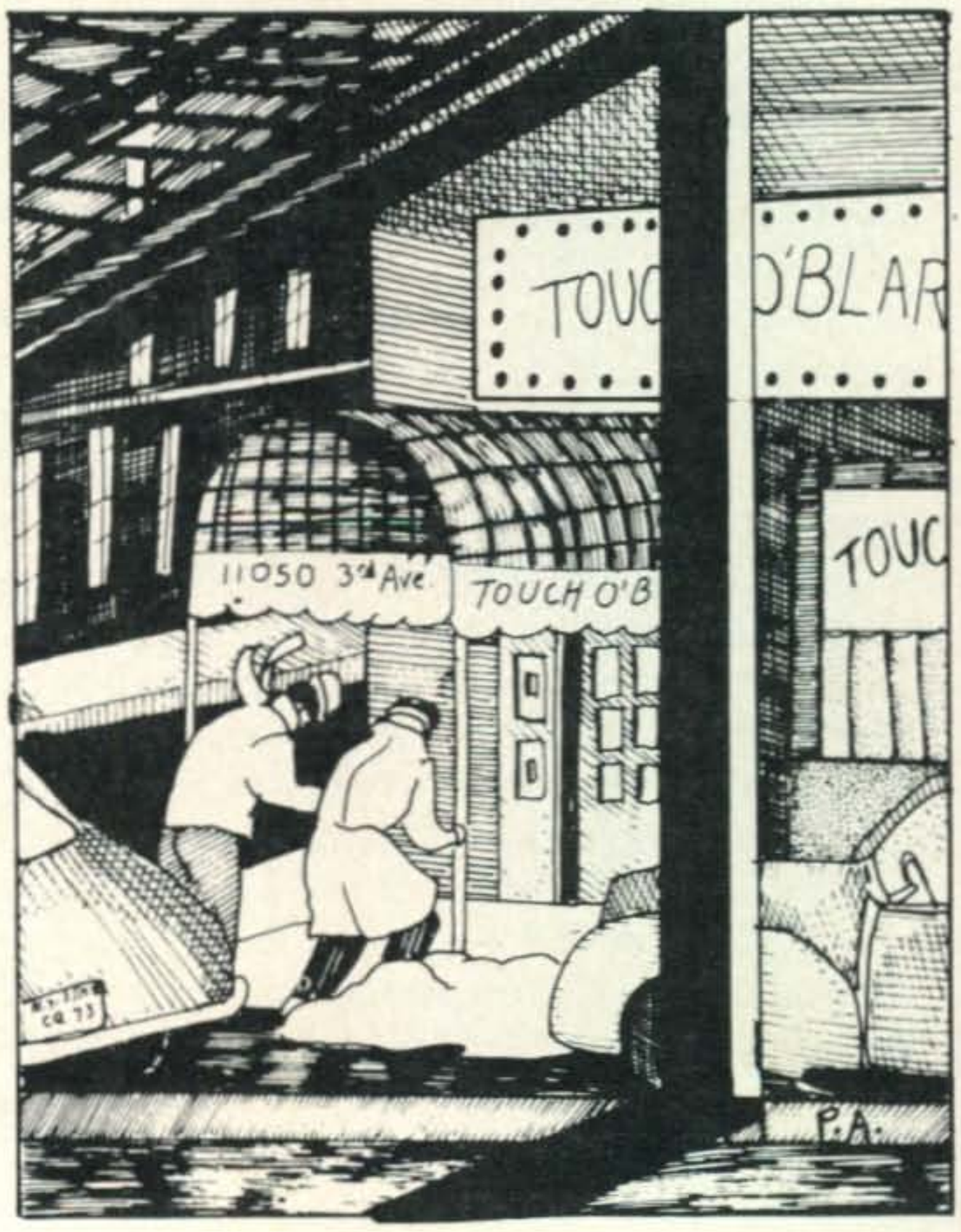
Like most of the Third Avenue bars in the area, the "Touch O' Blarney" was a blue-collar operation that catered to the nine-to-five white-collar worker. You might say that the place was decorated in early American cheap—and to the delight of the patrons, so were the prices.

Angelo the bartender, greeted his two thirsty guests and twirled a pair of circular green coasters before them. The two returned the greeting with a nod and a smile and ordered a brace of large-sized Lowenbraus, each placing a brand new one-dollar bill next to his coaster.

"What weather . . . cold as a witches left ear lobe," said Pete, slapping his hands together. "Pass the pretzels over here," motioning with a nod to a yellow bowl to Alf's left.

Alf agreed and slid the bowl of pretzels to his companion; then in mild reproof: "Hay, I thought you were going to try that low carborydrate diet again—that *dunking man's* diet?"

"Please . . . the modified *airman's diet*," he corrected, scratching off several salt particles from his pretzel and removing it in one measured chomp. "For your edification, sir, I've lost almost one full pound since this time last Friday."



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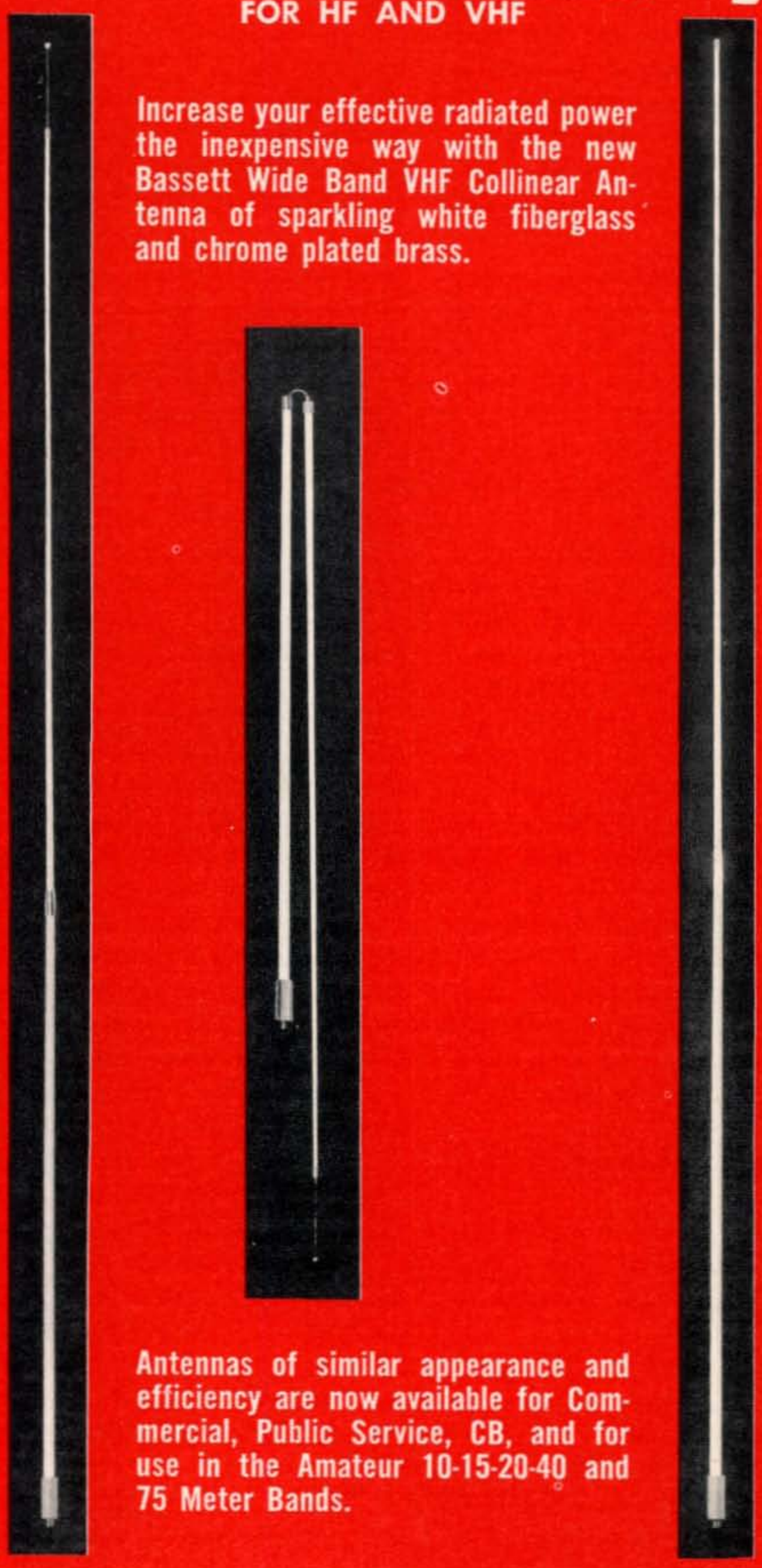

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"Well, now," said Alf, arching away and measuring Pete's corpulent frame: "yes, yes; your clothes are just hanging; why, you're practically skin and bones."

"Do you realize that if I continue on this ascetic way of life that I shall have lost more than fifty pounds by the end of the *first* year alone? one hundred by the end of the *second* year. I'll be so weak that you'll have to lift the glass for me."

"I could never live with that on my conscience; here, take another pretzel; you look a little faint."

Angelo smacked down two wide-mouth mugs of frosty brew before them: "Good health, Gents," and removed a dollar. They lifted their beers and drank long and deep, wiping up with the backs of their hands.

"It's not just beer," said Pete; it's more like a health food, and Angelo is the dietitian."

"Meant to tell you, Alf, that removing a few pounds from the middle was only the first of my epochal, slightly belated, New Year's resolutions; the second one is this," reaching into his jacket and slowly withdrawing that universally recognized little booklet, the *License Manual*. "Going for that extra ticket; got the theory nailed down already . . . I think. But there's that other damned thing . . . that twenty-words-per-minute code test, you know?"

"Yes, I know . . . I went down that street six or seven years ago, remember?"

"Right. Now, you've been a strictly c.w. man all of your life, while I've been a strictly phone man. As a matter of fact, I haven't had a bona fide c.w. contact since the war.

"Which one?"

"There, you see how long it's been . . . War Two, that's which one."

"Yes, indeed; you're in big trouble all right. That Extra code exam certainly does a fine job of separating the boys from their more worthy brethren."

"To tell you the truth," Pete continued, lowering his voice, "I attempted a c.w. contact last Saturday afternoon, but . . . well."

"But what?"

"I sent a *terrific* CQ, a bit slow, but well sent . . . and stood by for a reply. Then this, this person, zeros on my frequency and sends, very slowly so I shouldn't miss anything . . . L . . . I . . . D; it was humiliating." He turned to his companion: "stop smiling, damn you; this is serious . . . I need help, not smirking ridicule."

"I'm not smirking or ridiculing anyone," said Alf, carefully avoiding any eye-to-eye contact. "But so what's the big deal; one obviously demented and uncharitable guy calls you a lid, and you . . ."

"But he was right, Alf; I am a lid—L . . . I . . . D—lid. If I ever expect to pass that Extra, I'm going to need some help some advice and pointers, like from a c.w. man," looking into Alf's eyes. "Drink up and let me get the next round," motioning with his right hand to Angelo. The hollow *beau geste* made Alf smile, for it had been Pete's time to reciprocate anyway; however, the intention of Pete's *buttering* was as understanding as it was transparent.

"You've got to keep in mind that the code test has two equally important parts, receiving at twenty *and* sending at twenty—bomb out on one and you can plan on catching an early train home," said Alf, a trace of superiority in his voice, as though someone should be chiseling his words in a block of stone.

"Sure, sure; I know all that," said Pete, impatient with Alf's usual pedagogical wind-up.

Alf sipped slowly, smacking his lips and returning the big mug to the bar: "Let's talk about receiving first. Since you managed to pass a 13 w.p.m. once upon a time, you've merely gotten a little rusty; code is a little like bicycle riding, too. You need to get back on that bike and ride, and ride, and keeping right on riding. In other words, you need lots and lots of plain old-fashioned code practice —and that's the only prescription that'll enable you to copy a healthy twenty."

"So, give me a few pointers on filling that prescription, Doctor."

"You've got to establish a plan for getting into shape for that exam—like a fighter trains for the big event. You need to train everyday in small practice sessions—in the beginning, not any longer than 30 minutes of receiving per session. Longer sessions are just too tiring and aren't all that beneficial. So plan on at least one session a day, a second session when you feel refreshed enough for it, like on a week-end."

"That's easy enough to do," said Pete, "a c.w. QSO should take about thirty minutes . . ."

"Not so fast there. C.w. QSO's are not part of the package. QSO's are fun sessions, not carefully structured and executed training sessions. You don't count QSO's in the training program."

"I don't get you," said Pete, feeling somewhat insecure now and wishing Angelo hadn't removed that bowl of pretzels.

"While in training, you've got to be steeped every day in only the very best c.w.—the kind of clean c.w. you'll be hearing on the exam. Ideally, there should be absolutely no difference in the code you're copying everyday and that you'll be copying on the day of the exam." He raised his glass and sipped contentedly, eyeing with some inward pleasure the somewhat pained expression on Pete's face. Pete acknowledged silently.

Alf was enjoying himself: "To the serious student aspiring to pass that code test, only two reasonable approaches exist: using those W1AW code practice runs, or equivalent; or using some sort of tape machine at home. I favor the tape machine for the long haul, mainly because it offers you a variety of plain texts and speeds, anytime you feel like practicing. And the code will be QRM free—just the way you'll be hearing it on the big day. You follow me up to now?"

"Of course, I follow," said Pete petulantly, "do you think I'm really that dense?"

"That was a rhetorical question, old friend, was it not?" playfully peering over the top rim of his eyeglasses, slowly stroking his chin. (His portly sidekick quickly bantered a reply, an American idiom best left unsaid.) The two laughed and lifted their glasses.

Alf once more grew serious: "You continue practicing this way seven days a week, always striving to keep your copying speed slightly ahead of your comfortable, solid copying speed. In other words, if your solid copying speed is about 13 w.p.m., then you should be trying to copy, let's say, 15 w.p.m.—you're continually reaching for that next higher plateau."

"Okay," nodded Pete, "that makes sense."

"Of course it makes sense; building up your code speed is just a matter of common sense combined with a regimen of steady practice, seven days a week.

"Now, when you find yourself copying fairly well at, say 15 w.p.m., spend about 20 percent of your copying session just *listening* to the code spill over, without putting any of it down on paper. In the beginning, use your index finger instead of a pencil. Let your finger rest lightly on the paper while you're listening to the code. This technique is sometimes referred to as phantom writing—for want of a better name. It's a sort of psychological transistional step that I found helpful to increase my copying speed. In any event, give it a whirl; see what happens."

"What's it suppose to do—this phantom writing?"

"It weans you away from that baby-step letter-for-letter way of copying and graduates you into seeing several letters, even words *en bloc* in your mind's eye. Once you've gotten the knack of this phantom writing, you'll discover that visualizing and holding the letters, even for just a second, will help you to copy better and faster the old on-the-edge way of copying."

Angelo smacked down two fresh beers on the bar and rapped his knuckles on the mahogany to signify a round on the house.

"Now, for sending code," continued Alf, watching the head of beer trickle down the sides of his glass.

"Yeah, sending the stuff," said Pete, with a long face. "I actually flunked out on my first trip to the FCC office; both my fist and I have never fully recovered. When I finally did pass, I think it was because the guy felt a little sorry, you know. And now with that touch of arthritis in my fingers, I don't know if I can master that straight key well enough to send at twenty."

"Look, Pete; let's do it right this second time around. Why bother with the straight key if it won't cooperate? Switch over to a keyer."

[*Continued on page 96*]

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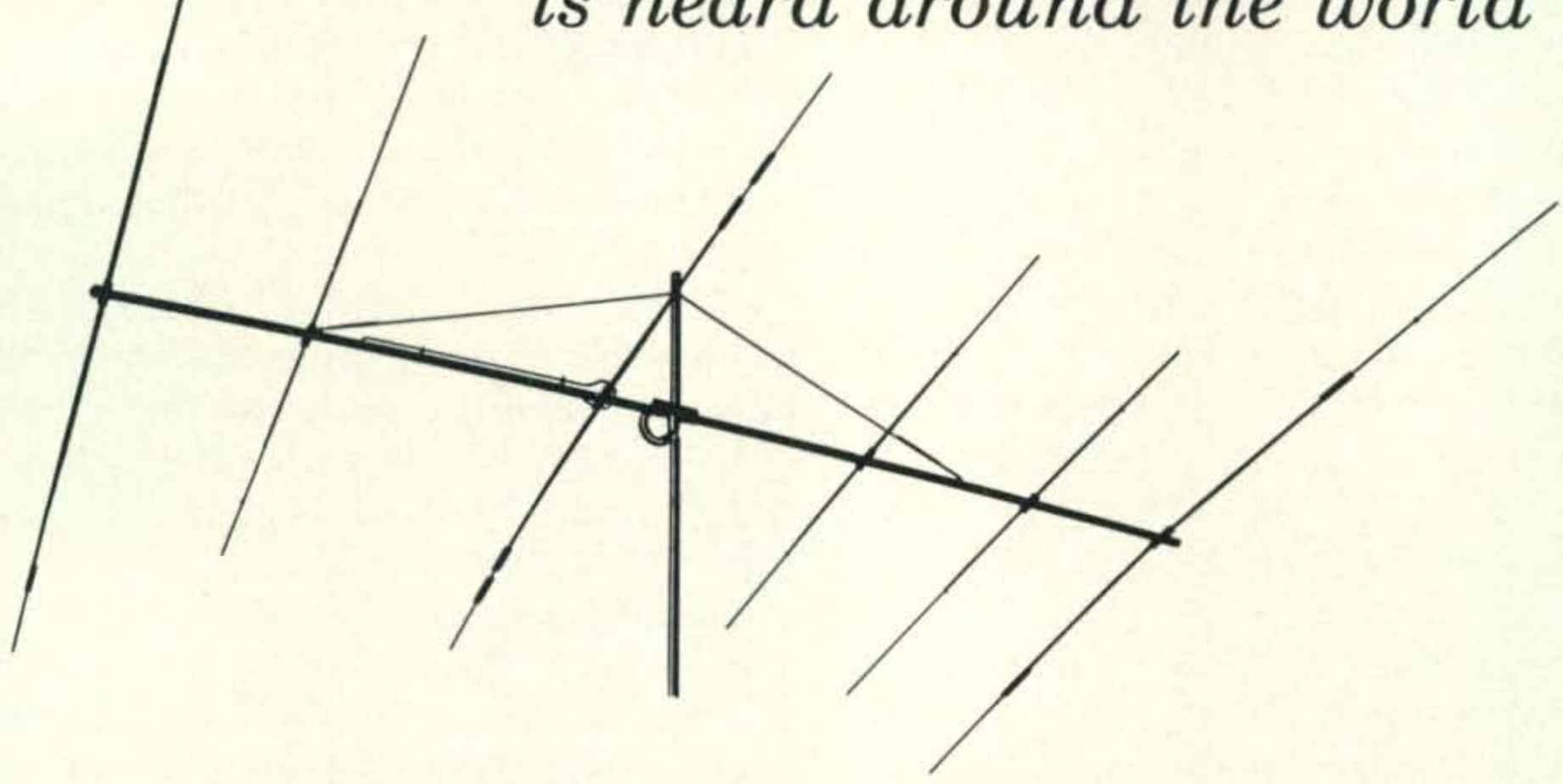

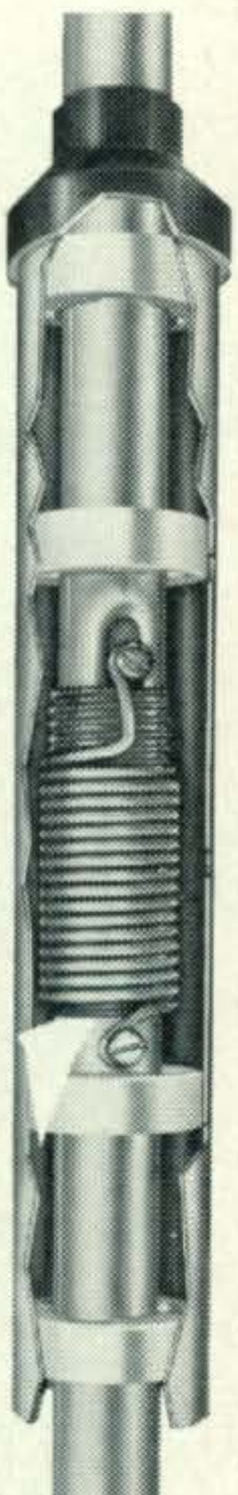

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- **Thunderbird's "Hy-Q" traps** provide separate traps for each band. "Hy-Q" traps are electronically tuned at the factory to perform better at any frequency in the band—either phone or CW. **And** you can tune the antenna, using charts supplied in the manual, to **substantially** outperform any other antennas made.
- **Thunderbird's superior construction** includes a new, cast aluminum, tilt-head universal boom-to-mast bracket that accommodates masts from 1¼" x 2½". Allows easy tilting for installation, maintenance and tuning and provides mast feed-thru for beam stacking.

  Taper swaged, slotted tubing on all elements allows easy adjustment and readjustment. Taper swaged to permit larger diameter tubing where it counts! And less wind loading. Full circumference compression clamps are mechanically and electrically superior to self-tapping metal screws.
- **Thunderbird's exclusive Beta Match** achieves balanced input, optimum matching on all 3 bands and provides DC ground to eliminate precipitation static.
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- SWR less than 1.5 to 1 on all bands.
- 24-foot boom...none longer in the industry.
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- Interlaced, optimum spaced elements for higher gain and better pattern control.
- 3 active elements on 20 and 15 meters. 4 active elements on 10 meters.

New 6-Element Super Thunderbird
Model 389
Suggested retail price, **$179.95**

Improved 3-Element Thunderbird
Model 388
Suggested retail price, **$144.95**

Fabulous 3-Element Thunderbird, Jr.
Model 221
Suggested retail price, **$99.95**

Popular 2-Element Thunderbird
Model 390
Suggested retail price, **$99.95**

Hi Hobby Industry

Write or call AL McMILLAN—WØJJK for service MASTER-CHARGE & BANK-AMERICARD credit Tues.-Sat.: Noon/5PM (712) 323-0142 telephone, BOX 864 (1530 Ave. "G") Council Bluffs, IA.—51501.

Zener Diode Cathode Bias

BY JOHN J. NAGLE,* K4KJ

In designing power amplifiers it is often convenient to obtain operating bias from a cathode resistor. However, the variation in the d.c. component in class AB_1, AB_2, or B amplifiers causes changes in the bias which generates distortion and is undesirable in high performance systems.

This distortion may be eliminated by using a Zener diode in the cathode lead to supply bias as shown in fig. 1. In this case the bias is constant as long as the cathode current does not go below the minimum current for good Zener action or above the current that would damage the Zener diode. With this arrangement, however, the Zener diode must handle the total cathode current which may be substantial and would require a large and expensive Zener diode.

The current that flows through the diode can be reduced by shunting the Zener diode with a by-pass resistor. See fig. 2. If the resistor is properly proportioned in relation to the bias voltage and cathode current, most of the d.c. component of cathode current will flow through the resistor with just enough flowing through the Zener diode to "keep it alive."

The Zener diode will hold the bias voltage constant; the current through the resistor therefore will also be constant and any increase in the current, such as caused by a signal, will pass through the Zener diode. Since the diode internal impedance is relatively low, variations in the bias will be small.

*12330 Lawyers Road, Herndon, Va. 22070.

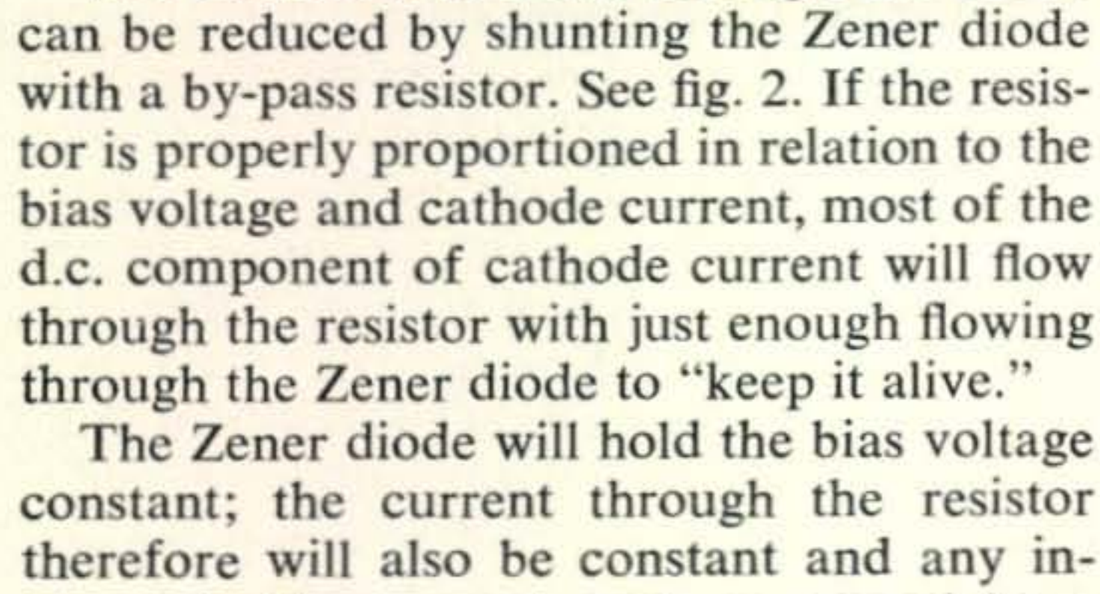


Fig. 1—Basic circuit for Zener diode cathode bias.

The value of resistor needed is:

$$R = \frac{E_c}{I_{min} - I_{z\ min}}$$

where:

R = Value of by-pass resistor.
E_c = Desired bias.
I_{min} = Minimum value of cathode or source current.
$I_{z\ min}$ = Minimum value of Zener diode current.

The peak power dissipated by the diode is

$$P_d = E_c (I_{z\ min} + \triangle I)$$

where:

$\triangle I$ = the signal-to-no-signal change in cathode current and the other symbols are as above.

The actual power rating required of the diode will depend on the peak-to-r.m.s. current ratio for the type of signal being transmitted and may be considerably less than that indicated above, especially where the signal consists of speech.

The saving in diode power dissipation due to the resistor is equal to the power dissipated by the resistor and is

$$P_r = E_c (I_{min} - I_{z\ min})$$

It as apparent that the advantage of a by-pass resistor will be greater in situations with a large d.c. component and a small variable component, such as Calss AB_1 amplifiers, and less where the reverse is true, such as Class B amplifiers.

[*Continued on page 94*]

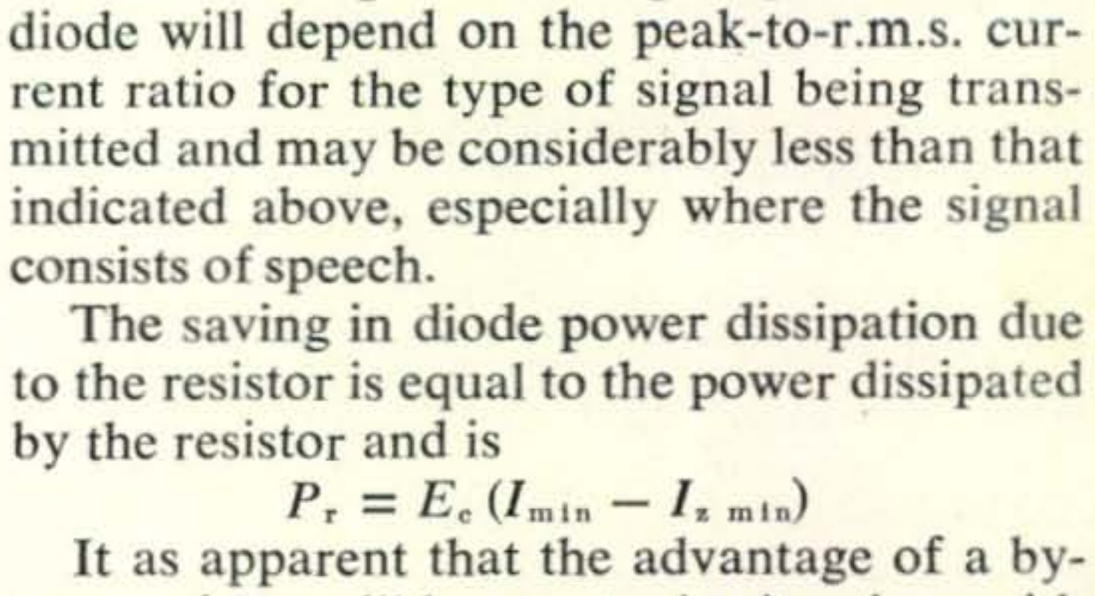


Fig. 2—Use of resistor and capacitor to bypass the Zener diode.

SY1MA: Mt. Athos DXpedition

BY VINCENT S. DANIELS,* WB4USR/SVØWJJ

As is usual with anything I do, the trip got off to a late start from Athens on the night of October 12, 1972, on our way to the first amateur radio operation from Mount Athos. Mount Athos has been recognized as a new amateur country, and is probably the last one that will be found in Europe. After catching a couple of hours of sleep in the Greek city of Salonica, we set out over the twisty road to coastal village Uranopolis, a small village port which provides the only route to Mount Athos. Our arrival at the village, behind schedule of course, occurred just as the small boat to Mount Athos was about to leave. With all haste we loaded the 1500 watt Honda generator, the Yaesu FT 101, antennas and all the other paraphernalia onto the skiff and jumped aboard.

Our first sight of the monks of Mount Athos came to us on board this small shuttle-boat. Bearded, dressed in black robes and with ages of wisdom written on their faces, the monks cast a majestic image. The little boat wound its way along the coast, stopping at each monastery along the way to pick up or discharge passengers, food, mail, or whatever.

After docking in Dafni, the port village of Mount Athos, we passed under the wary eye of the customs official and made our way to the 1950, (give or take a few years), Mercedes 4-wheel-drive diesel bus which is the only mechanized public transportation in the country. It resembled a left over WW II armored personnel carrier. We should have known right then that to turn back would be the smart thing, but I was never one for letting evil omens bother me. For instance, the fact that the DXpedition started operating on Friday the 13th had no effect on my morale whatsoever. After some amount of discussion we loaded the gear aboard the bus and started our trip over the mountain ridge to the administrative center of Mount Athos, the monastic village of Karyes. The "road" was no more than a wide donkey trail, gutted by rain and always precariously close to the edge of a cliff, which dropped directly into the sea. Din, SV1DB, got seasick—on the bus—not on the boat, but we held on and made it over the mountain, and finally descended into the village of Karyes.

Upon exiting the bus, we entered the Middle Ages. Modern times do not exist in Mount Athos. There are practically no vehicles, no motors, no noise, no electricity. All cooking is done on large wood burning stoves, such as the one in the inn in which we stayed. Oil lamps supply light during the night time hours, and everyone is usually sound asleep by 8 P.M.

One other very noticeable item is lacking from Mount Athos: females! The country is a mans' world and females are not allowed to enter its boundaries. The rule is not limited

*2210 Edwards Rd., Fort Pierce, Fla. 33450.

Mount Athos, The Holy Mountain

Mount Athos is a small religious country which occupies a peninsula on the northern coast of Greece. Since the time of the Byzantine empire in the 10th Century, Mount Athos has enjoyed self government and the area is administered by a Greek Orthodox monastic council, and this autonomous form of rule has been officially recognized by the Greek government since 1926. The population of Mount Athos is composed almost entirely of monks and religious hermits, of whom most live in the 20 monasteries and 12 hermitages which grace the coastline and mountains of Mount Athos.

The weather was bad as we welcomed Bill to Mount Athos. It would get worse.

We went searching the mountain for a suitable QTH. Notice the FB weather.

Bill and Din pause at the new SY1MA QTH high in the clouds of Mount Athos.

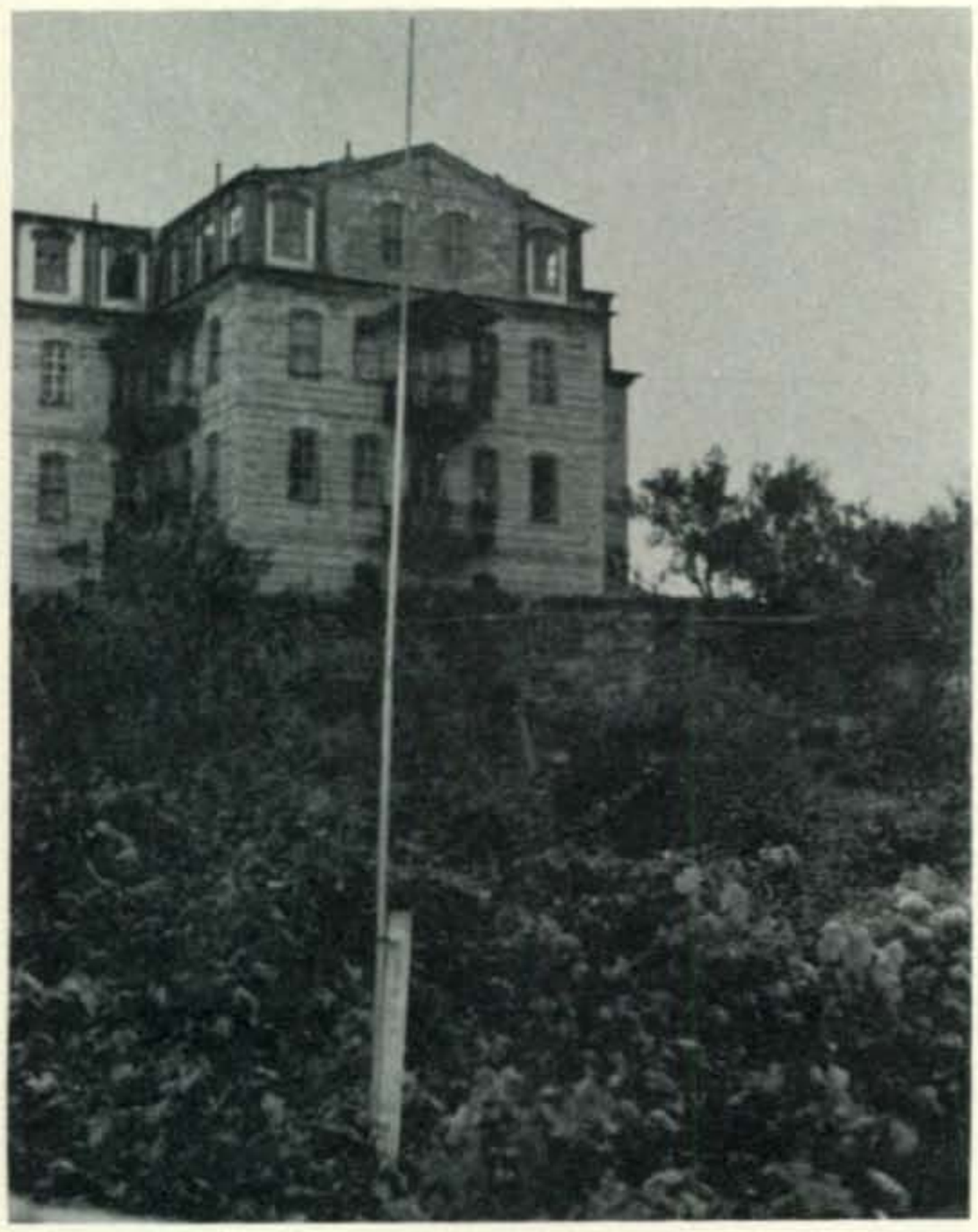
Our first attempt at a tent, with Din hammering, did not fare so well through the thunder storms.

The generator gave problems, but thanks to SV1DB and SV0WJJ things were soon back in order.

Dampened in body, but not in spirit, Vince and Bill operate SY1MA from within their plastic tent.

Roads were washed out; mule train was the only way out over the mountains.

After 1500 QSO's opening up a new DX CC country, the DXpeditioners depart from Dafni.



Our first antenna location was too low to be very good, and the generator and QSO noise disturbed the very rigid living conditions of the monks. The building in the background is one of the many monasteries in Karyes.

to the human species—no female animals are permitted to enter into the male sanctuary of Mount Athos. So do not count on a contact from here for the YL-DXCC.

After settling in the local inn, we took care of the administrative chores and got right to setting up the generator. We converted the inn to our operation center, and installed our antennas—three verticals—in the back yard garden. We rented two beds upstairs, prepared everything, turned on the generator and went to work on 20 m. The pileup was great and JAs and locals were pounding in. We took turns working and even managed a few Ws before the band went dead at about 2000 hours. We felt defeated. Either propagation or our QTH was miserable. We went to bed with hopes of a better day in the morning. One of the problems did improve the next day—propagation was better. But then another problem came up, and at about 1200 hours we were told we would have to shut down because we were disturbing the very strict regimen of the monks with our QSO, and generator. By this time Bill, SW0WII/WA6BWB, had arrived with a second FT-101, and we were ready for the pileups, but we needed a new QTH far from the monasteries.

The weather the next morning was terrible: cold and verging on rain, but this couldn't deter us because we're hard core DX'ers. We took the 8 A.M. bus up the mountain as high as it went and then hoofed it to the top of the ridge. We walked through the clouds on the way up, but we did manage to find a fantastic location on the edge of a cliff, with a tree right there to facilitate the building of a tent. (You may be asking yourself right now where we managed to come up with tent material. Simple! We brought a 15 meter roll of 1½ meter wide, double ply, heavy duty plastic.) We started construction of a plastic tent strung over the branches. Bill, an ex-Boy Scout called it a "faceria," meaning, "it ain't gonna work," and we saw just how true this statement was when, two minutes later, we were hit with a ferocious thunder storm. Our plastic tent became an above ground pool, then collapsed, getting us soaked to the skin, but fortunately the equipment was dry. Under Bill's expert guidance we started anew. By suspending a large branch between two trees, and draping the plastic over this support, a secure tent was completed. Folding the plastic on the uphill side back around under us for a floor, we managed to construct a good sized, sturdy, and reasonably dry tent. The rain continued, but we couldn't get any wetter so we continued to work installing antennas, positioning the generator, and improving on the usability of our temporary home.

At noon we were back on the air, soaking wet, freezing cold and nearly starving. Din and I hung our clothes on wires inside the tent to dry, but Bill just kept his clothes on. As usual his Boy Scout know-how prevailed, and when his clothes had dried from his body heat, ours were still wet and cold, so finally we followed suit, and suited up. We operated for twelve solid hours on the 15th until finally the band went dead, and we weren't too far from that state ourselves. Breaking down whatever gear was inside the tent, we packed it in plastic bags, but left the antennas and the generator outside. At 11:30 P.M. we started down the side of the ridge for the town. Try to imagine walking on a donkey path down a mountain, with only two cheap flashlights, in the middle of a fog and with rain falling all around you, and add to all this the fact that the place you are looking for has no lights to guide you in, and you will have some idea of our discomfort when we realized we were lost.

[*Continued on page 97*]

Modifying The Allied Radio Shack Series 190 Receivers

BY BRUCE L. MACKEY,*

For those who may have purchased the Allied Radio Shack 190 receivers after reading the excellent evaluation of these units by Bill Scherer, W2AEF, in the May 1972 issue of *CQ*, here are some simple modifications which will resolve most of the difficulties encountered, particularly regarding reception of single sideband signals.

The S meter movement is excessively fast for an accurate determination of signal strength on sideband signals and this can be remedied by placing a 500 mf 6 volt electrolytic across the meter movement. A convenient location for this capacitor is on the underside of the i.f. board with the positive lead tied to tie point #18 and the negative lead soldered to the ground cluster located just about one inch from tie point #18 toward the inside of the board.

The fast release of the a.g.c. on sideband can be cured simply by removing R_{66} (1K) and replacing the resistor with a wire jumper. The release time will now be one second. The attack time will be lengthened slightly, but is still adequately fast for s.s.b. reception.

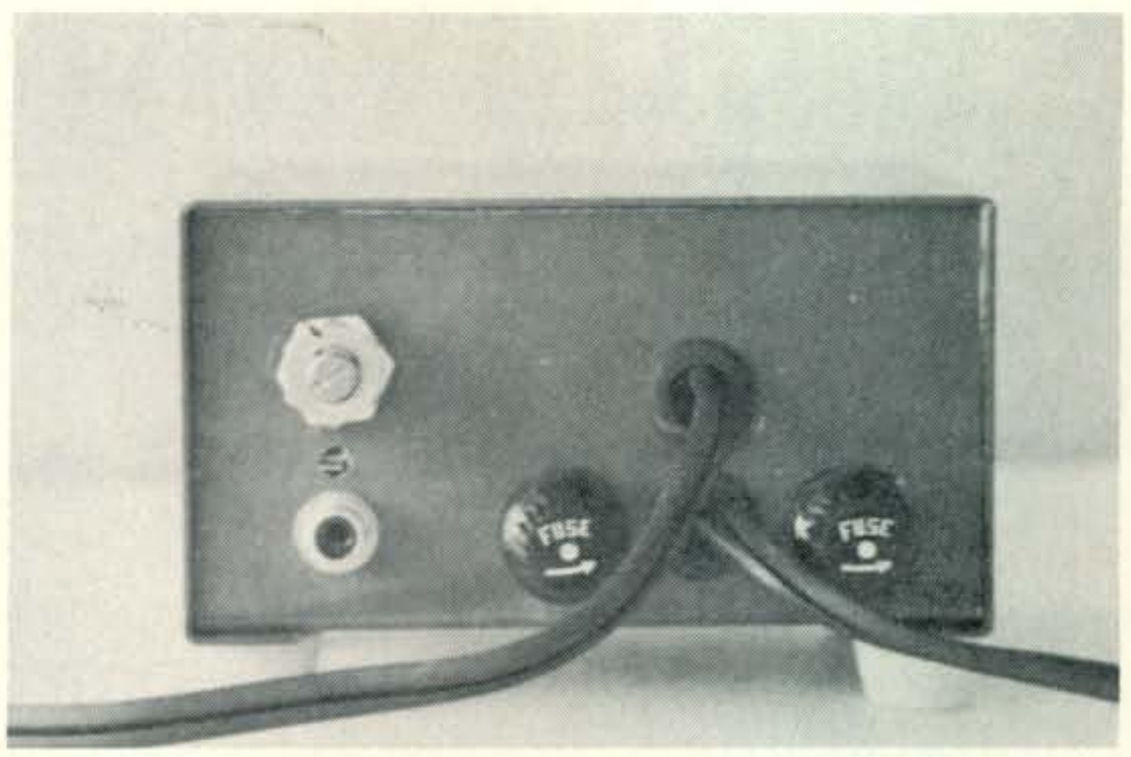
*Chief Engineer, WKRT Radio, 44 Owego St., Cortland, N.Y. 13045.

The audio selectivity of the Allied 190 receivers can be improved by removing C_{97} (350pf) on the audio board, and the replacement of C_{98} (.001mf) with .01mf. This will result in considerably flatter frequency response which begins to roll off at 3 kHz instead of the rising characteristic with which the receiver is supplied. Since C_{98} is the a.c. feedback capacitor for the audio output stage, the hum and distortion of the amplifier will also be reduced by the increase in its value.

To provide a better signal to b.f.o. ratio at the product detector, replace C_{72} (20 pf) with a 4.7 pf. The b.f.o. output transformer should also be retuned as follows: There are two slugs in the b.f.o. output transformer (T_{12}). Remove the top slug by backing it out of the top of the coil. There is a slug at the bottom of the transformer which has been screwed all the way down, (it is not used for tuning in the factory procedure), and this slug should now be brought up toward the top of the transformer. Tune in the crystal calibrator in the u.s.b. mode. As the slug is brought up toward the top of the transform-

[*Continued on page 94*]

The Allied AX-190 communications receiver.



Front and rear views of the simple r.f. power meter for mobile use with the author's 2-meter f.m. transceiver. The phono jack on the rear panel connects to the r.f. sensing unit at the trunk-mounted amplifier. Note the shaft lock used on the calibration control to prevent accidentally changing its setting. The cabinet is an LMB 342, 3 × 4¼ × 2⅜".

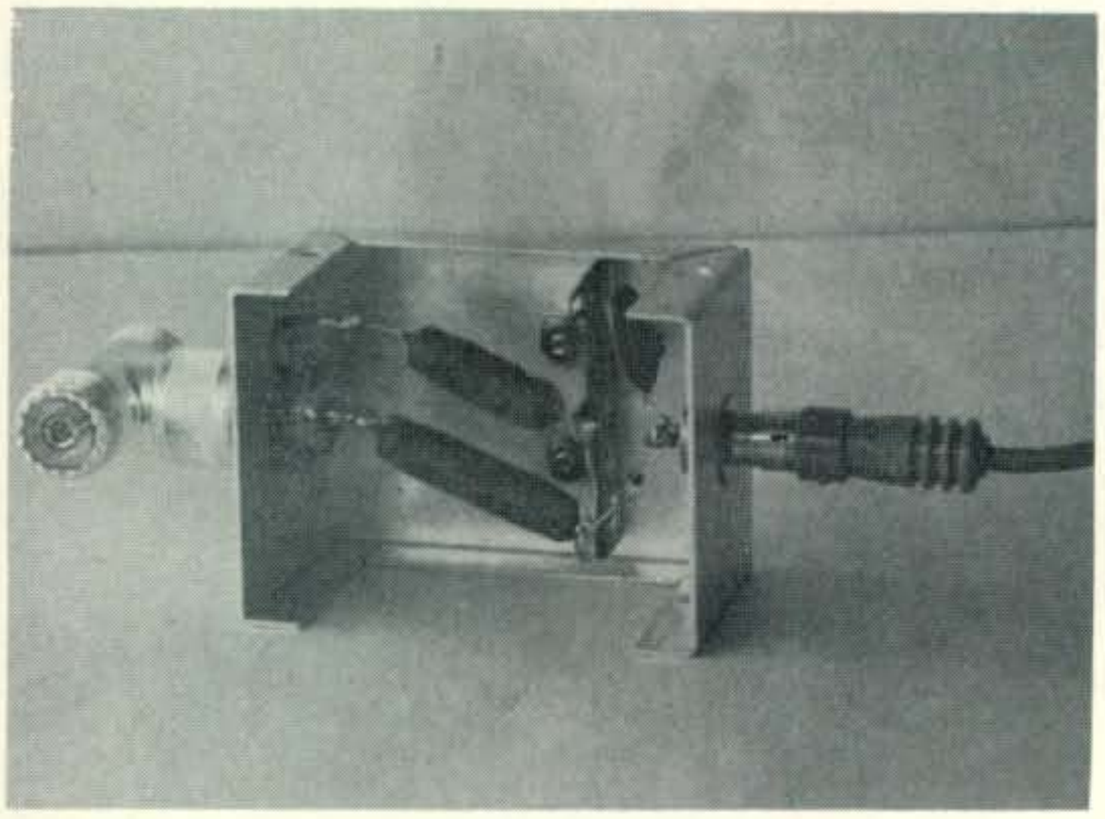
Simple R. F. Output Metering

BY WALTER J. STILES,* W7NYO

THE 2-meter f.m. mobile activities at W7NYO employ a Regency HR-2A transceiver for local work, with a trunk-mounted Regency AR-2 amplifier for cross-country trips. The power switch for the AR-2 is mounted on the amplifier itself necessitating raising the trunk lid when higher power operation is desired. Experience has shown that about 50% of the time the XYL forgets to turn on the amplifier, and with the HR-2A's output feeding straight through to the antenna, her oversight is not normally discovered until the signal drops out prematurely some 30 miles down the road.

The mobile r.f. output meter shown in the photo eliminates this problem while also accurately indicating relative output of the transceiver and amplifier, the condition of the transmission line and antenna, and the condition of the car's battery. In addition, the

*Suite 1621, Tucson House, Tucson, Arizona 85705.



The r.f. sensing unit consists simply of two non-inductive resistors in a voltage divider and a diode. R.f. connections are made through an assembly of standard coax connectors.

meter can supply some interesting testimony as to the flatness of the rig's overall broadbanding by merely switching, for example, from 146.16 to 146.70 to 146.94 and comparing the relative r.f. outputs.

The circuit for the two-unit mobile r.f. output meter is shown in fig. 1. The r.f. pickup unit is self supported on the AR-2 amplifier output connector by an Amphenol 83-877 plug-to-plug and an 83-IT T connector. This unit contains a high-impedance voltage divider from the hot lead of the coax connector to ground. A 1N34A diode rectifies a small sample of r.f. to d.c. to operate a dash-mounted meter. The 11,000 ohm divider has no effect on s.w.r. and consumes no significant amount of r.f. The author used standard Workman non-inductive ceramic resistors, available at almost any TV parts house. While relatively high wattage resistors were used, any 1-watt, or higher non-inductive resistors will work, as will conventional 2-watt garden variety carbon resistors. The resistor lead from the center conductor of the coax connector should be as short as possible. The r.f. pickup unit shown is built in a 1⅝" × 2⅛" × 2¾" mini box. A conventional 20' hi-fi cable with molded male phono connectors is used to connect to the meter.

The meter box contains a calibration control (bypassed for r.f.) and a Calectro D1-920 0-15 v.d.c. meter with its internal 15K multiplier resistor removed. Save the resistor for use later. The meter movement is 1 ma. The special scale shown in fig. 2 may be copied photographically and pasted in place over the original scale. Calibration has proven to be satisfactory as long as the antenna presents a 50 ohm non-inductive load.

Calibration is made easy by using a 50 ohm dummy load and a calibrated wattmeter. Connect the transmitter through the r.f. pick-up unit and wattmeter to the dummy load. Adjust R_3 until the meter reading corresponds to the reading of the wattmeter. When adjusted at or near the high end of the scale, readings should be within a few percent of full scale over the entire range.

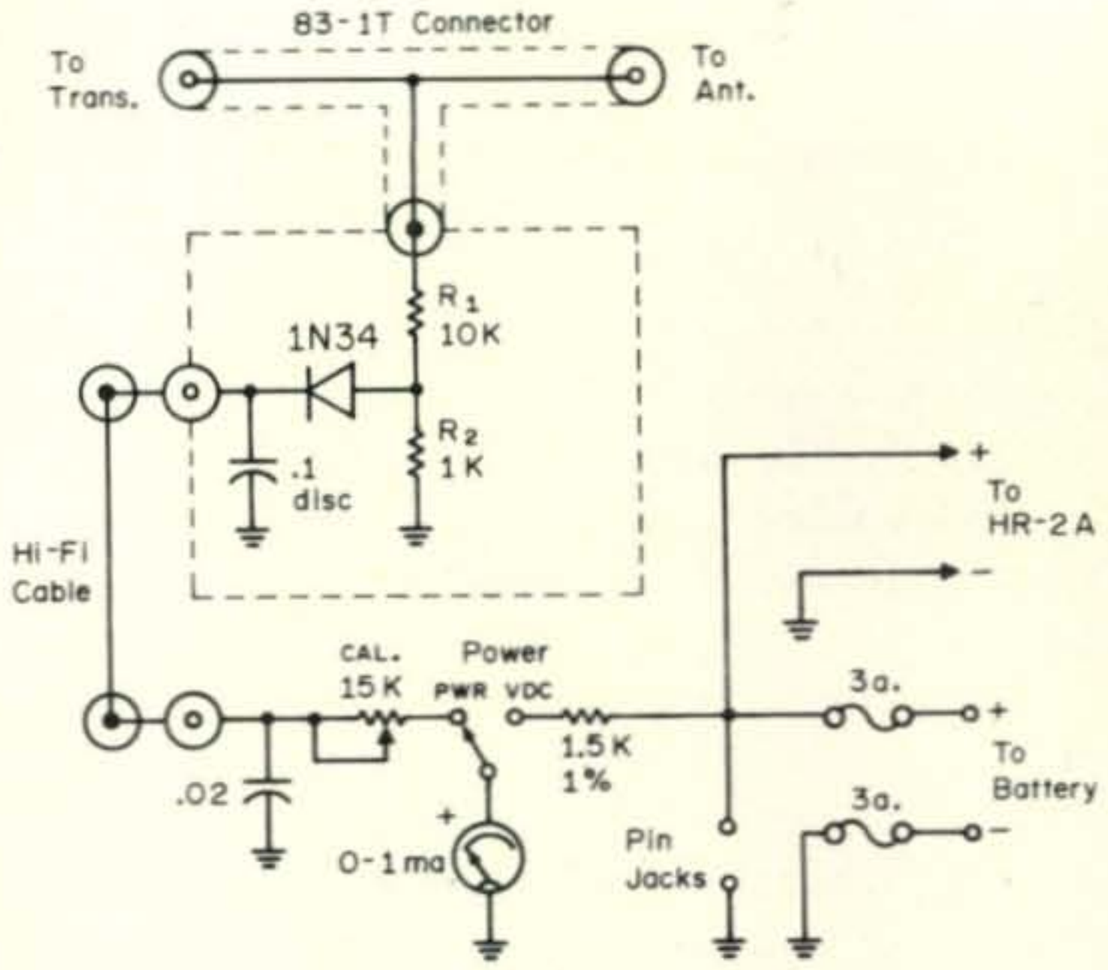
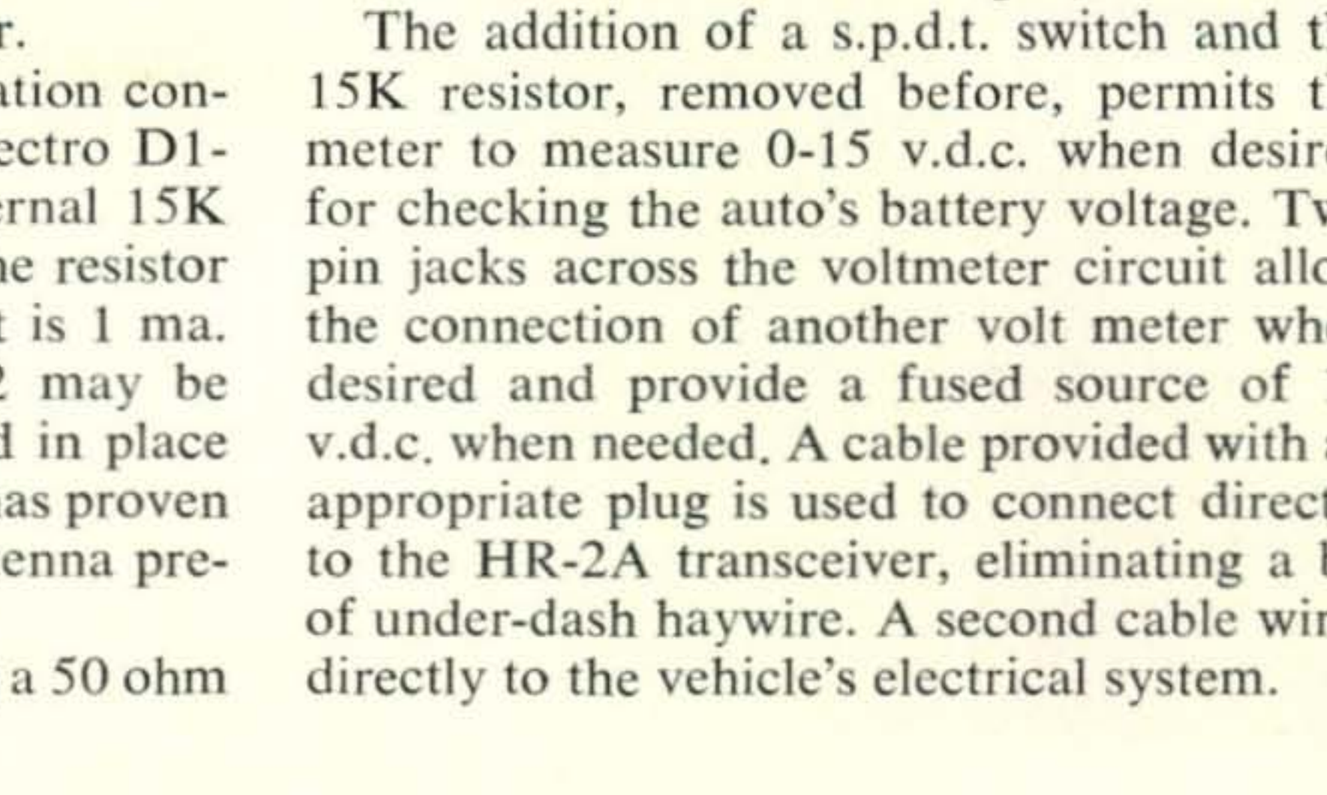


Fig. 1—Circuit of the simple r.f. power meter.

The addition of a s.p.d.t. switch and the 15K resistor, removed before, permits the meter to measure 0-15 v.d.c. when desired for checking the auto's battery voltage. Two pin jacks across the voltmeter circuit allow the connection of another volt meter when desired and provide a fused source of 12 v.d.c. when needed. A cable provided with an appropriate plug is used to connect directly to the HR-2A transceiver, eliminating a bit of under-dash haywire. A second cable wires directly to the vehicle's electrical system. ■

Fig. 2—Full-size drawing of the new meter scale.



New Products Unveiled At SAROC

As is usually the case, the annual SAROC convention at Las Vegas during the first weekend of January was a big hit. More than 1,500 licensed hams registered, and from outward appearances, a good time was had by all.

We were quite impressed with many new products for the amateur which were displayed at SAROC for the first time, some in the v.h.f. area, others for the h.f. bands. Time and space doesn't permit listing all the new goodies here, but we'll squeeze in as many as possible.

One of the most interesting innovations at the show was an adaptation of the Modar marine v.h.f. f.m. transceiver, being offered exclusively by Topeka FM. Basically, the boys at Topeka have redesigned this excellent marine transceiver for two meter use. The rig takes receive crystals only, allowing for transmit either on simplex, 600 kHz high or 600 kHz low. It can run either 10 or 25 watts, and a variety of accessories and options are available. Modar is a subsidiary of Motorola. For further information get in touch with Doug Flair at Topeka FM Engineering, 3501 Croco Rd., Topeka, KS 66605.

Another bunch of shiny new v.h.f. desirables were displayed by ICOM, the new national distributor for the well-known Inoue line. Among other things catching our eye were the IC-200, a synthesized two meter rig, a brand new package for 220, and, of course, the popular IC-21. We think v.h.f.ers will want a copy of the new Inoue catalog. Drop a note to Bob Brunkow, ICOM West, 1251 170th N.E., Bellevue, WN 98008.

More v.h.f. goodies by Clegg included the FM-27B synthesized two meter transceiver, a brand new 220 rig, and some new power supplies. Drop a note to Phil Theiss for more info at Clegg Div. of International Signal & Control Corp., Litell Rd., East Hanover, NJ 07936.

More v.h.f. by Midland. A brand new transceiver for 220, another for two meters, and a hand-held job also for two. These rigs are moderately priced, and should make Midland's entry into the ham market quite exciting. Send for catalog to Don Saxon, Midland Electronic Corp., 1909 Vernon St., North Kansas City, MO 64116.

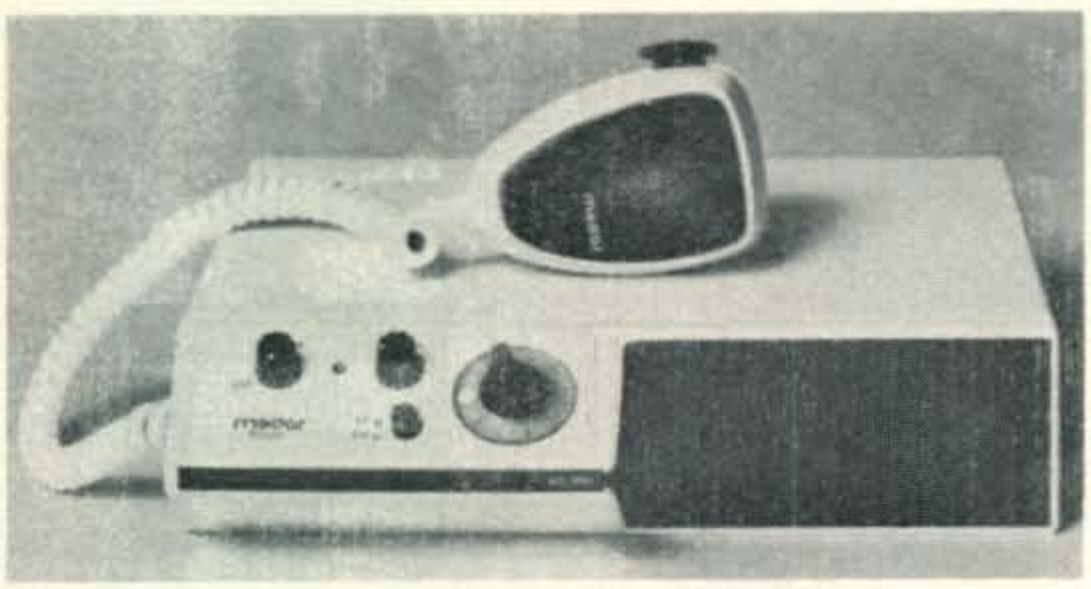
From Henry Radio there's a new Tempo 220 mHz f.m. transceiver. A note to Mary Silva at Henry will bring full details.

Both Standard Communications and Dycomm got lots of interest at their booth with v.h.f. repeaters. If you're interested in repeaters drop a line to Fred Deeg at Standard Communications Corp., 636 North Marine Ave., Wilmington, CA 90744, or Jim Penney at Dycomm, P.O. Box 10116, Riviera Beach, FL 33404. They'll both be glad to hear from you.

Getting away from v.h.f. for just a bit, it was a pleasure to see the new Swan all solid state transceiver line at the show, and from the crowds at the Swan booth, it would seem that there's a lot of interest in these new offerings. They come in various power ranges, and the styling is exciting. Why not get in touch with "Whit" Whitley, Swan sales Manager for more details? Address is Swan Electronics, Div. of Cubic Corp., 9233 Balboa Ave., San Diego, CA 92123.

Other new equipment coming very soon from our friends at R. L. Drake. We can't let the cat out of the bag this early, but suggest you drop a note to Doug Horner, Drake sales Manager and tell him you'd like to be put on the mailing list to receive any new product announcements that they might be sending out in the next month or so. We think you'll be pleasantly surprised. Address is R. L. Drake Co., 540 Richard St., Miamisburg, OH 45342.

That's about all we have room for. Don't forget, when writing for additional info, to mention you saw it in *CQ*. ■



The 2-meter f.m. version of the Modar marine v.h.f. f.m. transceiver offered by Topeka FM.

The Song of The Flea

49 countries worked in a month. So what, you say?
Did I mention that the power here is 3 watts or less?

BY MORT WATERS,* W2NZ

RUN of the mill DX QSOs are so easy to come by in these days of beams and kilowatts, that many hams run and hide from the pack who jump in at the end of every contact. Who needs another dozen rubber stamp QSOs? A far cry indeed from the days when every DX contact was a thrilling triumph.

But I found an ultra simple way to get back all of the old excitement and sense of accomplishment—QRP. As a major bonus, those stereotyped QSOs are now a thing of the past. Every time I say the magic words "power here QRP 3 watts output" they start firing questions at me and a real QSO develops. Perhaps an even better indicator of the high level of interest QRP generates is the mail I now get so often from hams I've worked with one or two or three watts. They seem to believe I've uncovered a magical formula they want me to share.

My purpose in writing this is to do exactly that, to share with you the excitement I've mentioned and to get you interested enough to try it yourself. The big news is that you can do it too, without building new gear or spending a cent on new equipment. Working with QRP is something anyone with a modern exciter can do in two minutes from *now*.

The idea is so ridiculously simple it should have occurred to me years ago, but somehow it never did. Judging from the QSOs I've had, I'd say it hasn't occurred to too many others either. To end the suspense, tune your rig for minimum output instead of doing what you always do—squeezing every last bit of r.f. out of it.

If you have a modern exciter, as mentioned above, just tune it normally. Then reduce power by cutting back on the drive or gain control, whichever yours happens to be called. My rig, a conventional exciter with a pair of 6146's, cuts down to ½ watt output this way. You can even guesstimate the output from your rig with your s.w.r. bridge.

In order to make this measurement you should start with the maximum output you get from your rig. If you don't know how much it is, estimate it at half the input you read on the plate meter. There's time to be more accurate later on, but for now just follow these simple tuning instructions:

1. Tune up normally for maximum output.
2. Set s.w.r. bridge to read *forward* power. Adjust sensitivity to get a full scale reading.
3. Reduce transmitter drive until bridge meter falls to an indicated s.w.r. (as if you were reading s.w.r.) of 3:1. Your output now is about 25% of the original amount. If your exciter is capable of putting out 100 watts maximum, you now have about 25 watts.
4. Without disturbing drive setting, readjust bridge sensitivity so that the needle goes full scale again.
5. Reduce transmitter drive further (this adjustment may be critical) until the bridge again reads "3:1." You've now reduced your output to about 6 watts. Instant QRP! If you repeat this procedure a third time, you'll be down to about 1½ watts.

It's worth noting that even if your original estimate of full power is way off, the final result of the above tuning process will not vary materially. For example, if full power is really 70 watts, three steps down will cut you to about 1.1 watts. If however your power was 120 watts, the same three steps will bring it down about 1.9 watts—a swing of only .8 watts from a starting difference of 50. And even though this represents nearly 3 db difference, in practice it will hardly matter at these ultra low levels.

Please don't bother to write long technical explanations of how inaccurate all this is. Believe me, I know. But it is good enough to get you into the game and at least know which ball park you're playing in. Later, if you want more precise data, measure the r.f. voltage into your dummy load and apply the formula *Power = (R.F. volts²) ÷ (Load resistance)*. That'll tell you, right on the button.

---

*82 Boston Ave., Massapequa, N.Y. 11758.

Or take the easy way out and use a very low range wattmeter. The Heathkit HM-102 is excellent for this. Many owners don't realize it can measure 0-20 watts of r.f., in addition to the 200 and 2000 watt calibration on the meter face. Read the manual. It tells how.

Well, now that you've got QRP available, what's next? If there's a rub, this is where it comes in. Given reasonable propagation, power and antenna, DX is easy. Reduce power and it's a bit harder. Use a crummy antenna and it really becomes hard. On the other hand, the more your antenna is upgraded, the easier it is. In my case, working DX has been so routine that it hasn't turned me on in years, except for the few occasions when something really exotic shows up. I can almost hear you muttering about my stacked six-element monobanders. Not so! My station is no different than thousands of others. The antenna is a Hygain TH6DXX at 56 feet. I suppose I may have been taking this beam for granted. I knew it was good, but not until I went QRP did I fully appreciate it. However, I'm sure most if not all directional antennas will work well too. You'll soon find out how good yours is.

This is not to say that you cannot work DX without a beam, but as tough as it is with higher power, it's even more of a struggle with QRP. To sum up, then, you can work DX on a wire antenna with QRP—but it won't be easy.

With up to 3 watts and my beam, signal reports here are astonishing. They have been so consistently good that it wasn't long before I began to doubt the evidence of my own eyes. Was I really running a couple of watts, or was I kidding myself? Finally, to settle my mental reservations, I again measured the voltage into the dummy load, only to have my original figures confirmed exactly.

The funny thing about QRP is the general air of disbelief which, for me, even infected my own thinking. Quite often, when in QSO with a DX station, I have the distinct feeling he doesn't believe that I'm running a few watts. Only recently did I decide what to do about it. Now, whenever I sense that "oh, yeah" attitude, I turn up the drive, punch the linear switch and zap him with a kilowatt. That usually converts him! But I suppose it's to be expected that a guy on the other side of the world who reports your signals at RST 569 should be doubtful when you tell him you have 3 watts. Probably the most comical of all was the time I answered a G's CQ. His very first words to me were "With a signal like yours, you must be running a full gallon. RST 599." Imagine his reaction when I told him I was feeding the TH6DXX with one puny watt.

Operating with QRP puts you in another world. Whatever your present operating style is, you can be sure you'll have to change your ways. For one thing, you have to learn to outsmart the competition. The tricks you'll soon develop will be of great value later when chasing some real DX in earnest, with every ounce of power you can muster. Here are some of the techniques that work for me.

First of all, don't waste your time calling CQ DX, unless you happen to own an exotic prefix. It's usually wasted effort when you run normal power; with QRP the waste is total. If you insist on CQ's or if all else fails, you might try a variation of: "CQ CQ CQ DE QRP QRP W2NZ W2NZ W2NZ 3 WATTS K." This sometimes stirs up some action. Always send slowly; it's easier to copy a weak signal at 12 w.p.m. than 30. If you happen to live in a rare state or country, let it be known when you call CQ or call someone else. As a lowly W2, I'm sorry to say, I don't have anything going for me. Even my county is common.

Tail-ending is a technique dear to every DXer. But unless you know exactly what you're doing, don't try it with 3 watts. You won't be heard. The trick is to move off the frequency the DX is listening to, just far enough to put a little distance between your signal and his, but not so much that you're outside the passband of the DX's receiver. It takes practice to get the feel of it.

The above technique will serve you well, QRP or QRO, but here's one I've restricted to QRP. It sometimes works for me. Its chief ingredient is known as "chutzpah," freely translated as brass, gall, nerve, cheek, etc. Wait until the moment when the lucky local begins bidding the DX a fond farewell. When he goes into that "73, GD DX, HPE BCNU" routine, you step in as big as life with your mighty 3 watts a couple of hundred cycles off his frequency and say "AC3DX QRP QRP W2NZ W2NZ PSE K." If AC3DX hears you and has a touch of pity (!) in his heart, you'll nail him. It's fun.

Another tack I've tried is to simply jump into the pileup, cross my fingers, and send "QRP" a few times. Once in a wihle the DX will call "QRZ QRP only"—and you're in.

[*Continued on page 94*]

CQ Reviews:
The Regency AR-2 Two Meter Amplifier

BY GLEN E. ZOOK, *K95TH/5

REGENCY Electronics recently began marketing a medium power amplifier as a companion for their 2-meter f.m. transceivers. This amplifier, the AR-2, is an 80 watt (maximum) output unit designed and styled after the Regency HR-2/HR-2A series of equipment. The AR-2 is U.S. built, using a BET (balanced emitter transistor) amplifier design. Included with the amplifier is a d.c. power cable and mounting bracket. Front panel controls consist of an off-on switch and a transmit indicator light. Rear panel connections are d.c. power input, r.f. input, and r.f. output.

Technical Details

The Regency AR-2 is a fully solid-state amplifier constructed on a large heat-sinked copper chassis. Switching and r.f. sampling circuitry is built on a single glass epoxy circuit board. The final itself is a pair of BET silicons in a push-pull circuit using strip-line techniques. This circuit is quite conventional using tuned input and tuned output circuits (strip lines). The sampling circuit which operates the change-over relay consists of a pair of bi-polar transistors with diode rectifiers to provide d.c. for activation of the relay circuit. To operate the amplifier, the unit is placed in the "on" condition by the front-panel switch and then the exciter is keyed to provide r.f. drive. This r.f. from the exciter is sampled by the switching circuitry which in turn energizes a 3 pole relay. One set of contacts switches the input r.f. from the exciter to the base circuit of the amplifier. A second set of contacts switches the antenna to the output circuit of the amplifier. The third set of contacts apply 12 v.d.c. to the amplifier. When returning to receive the relay drops out, removing the d.c. from the final stages and switching the antenna to the exciter for receiving purposes.

Specifications & Performance

The Regency AR-2 was put through its paces under controlled circumstances using varying input power. Factory specifications call for 25 watts output with 10 watts drive and 80 watts output with 25 watts drive. The unit was checked with varying power levels from 5 watts through 25 watts. At the 5 watt level a Motorola H33FFN-1141C was used as the exciter and at 10, 15, 20, and 25 watt levels a Motorola U43HHT-1130B was used for an exciter. In both cases a Bird 43 wattmeter with appropriate shunt element was inserted in the line between the exciter and

[*Continued on page 97*]

*FM Editor, *CQ*.

Regency AR-2

GENERAL SPECIFICATIONS:
Size: 2⅝" x 6½" x 9½"
Power requirements: 13.6 v.d.c., 9 a. max. (80 watts output)

OPERATION:

Drive Level	*Claimed Output*	*Achieved Output*
10 watts	32 watts	35 watts
15 watts	48 watts	55 watts
20 watts	64 watts	68 watts
25 watts	80 watts	85 watts

The Regency AR-2 is a solid-state amplifier designed for the amateur 2-meter band. Output ranges from 30 to 80 watts depending on drive.

Protective Circuits For Transistor Power Supplies

BY R. PHELPS, JR.* W4KXV

SOME time ago the author embarked on a project to build a twenty-five watt, all solid-state, transmitter for the eighty and forty-meter bands. He now understands why a rig of that description has not thus far appeared in amateur literature. He also recognizes a likeness between that type of project and that of putting up a radio tower. In both cases one first must do some preliminary work—building the foundation. In the case of putting up the tower, one must first dig a hole and, if one encounters rock, he has to deal with that, too. Well, the corresponding operation in building a high-power, solid-state rig is building the power supply, and the "rock" is in providing the overload protection for the transistor in the rig. The transistors in a regulated power supply may also need protection.

The purpose of this article is to present some solutions to the problems of power-supply design for the relatively higher-powered h.f. solid-state transmitters—the term relatively higher-powered being defined as power levels between 15 to 25 watts. The newcomer to this subject should investigate the cost of transistors capable of higher powers and higher frequencies. He will then understand our interest in these power levels.

The design of solid-state rigs up to the five-watt level is well covered in the amateur literature[1]. For higher-power levels, the author has found guidance in material of more limited distribution. The transistor manufacturers' literature is the best source he has found. A particularly well written and readily available source of information on both transistor h.f. power amplifier and regulated power supplies is RCA's *Silicon Power Circuits Manual*. Other manufacturers books and technical data sheets are just as useful, but the RCA book is available over the counter at many parts distributors.

After studying this material and gaining a bit of first hand experience, one realizes the truth that transistors are quite different from tubes, and for one whose experience has been with tubes, the introduction to transistors can be quite a shock—no pun intended. The most apparent difference of course is that transistors are low-impedance, low-voltage, high-current devices in contrast to vacuum tubes. A less apparent (but related) differ-

*2313 Hunter Mill Road, Vienna, Va. 22180.

[1]All references referred to in this article are listed by author or publisher at the end of the text.

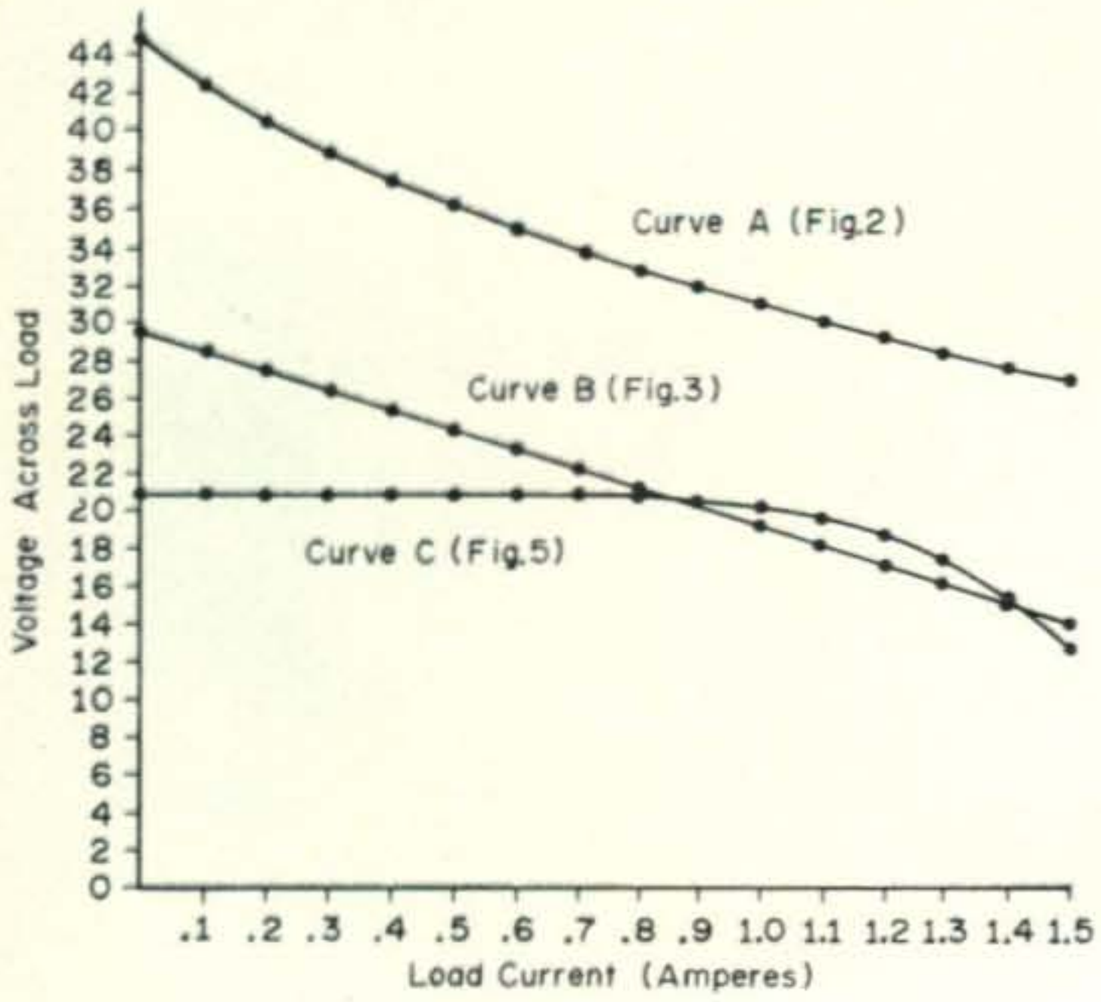


Fig. 1—Power supply regulation curves.

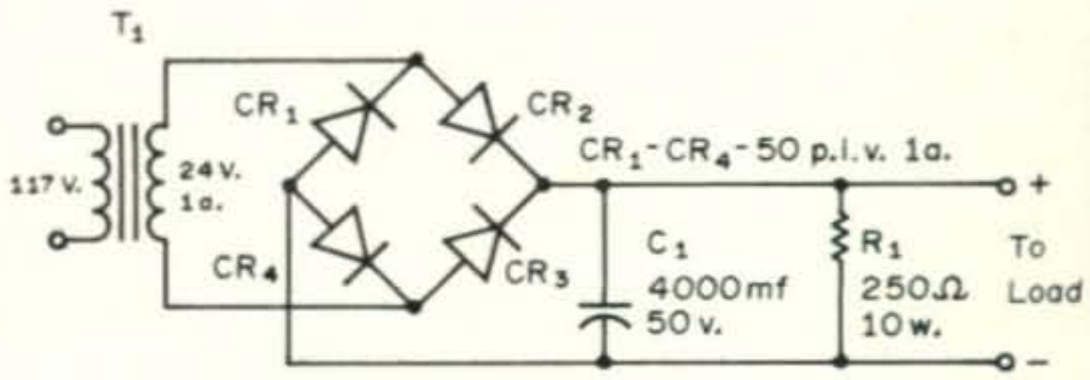


Fig. 2—Basic low voltage power supply.

ence is that transistors have much higher input and output capacities—at least in the circuit configurations most comparable to vacuum tube circuits. But their most challenging characteristic, differences as far as the design of power supplies to be used with transistor transmitters are concerned, are their wide variations in input and output capacitances with applied voltage, their high-current requirements for appreciable output power, and their "secondary breakdown" effects.

Their capacitance variations result in tune up difficulties and high harmonic content of the output wave, the effects of which can lead to serious misinterpretation of test data. For example, s.w.r. measurements can be very inaccurate if the harmonic content is high. These drawbacks can be minimized through the use of regulated power supplies and through the design of the tuned circuits in the transmitter. (The latter subject will be treated in a later article.) Secondary breakdown results from current concentration at critical points within the transistor. This condition causes increased temperature at the point of current concentration, which, in turn, causes increased currents—a runaway regenerative condition that leads to the rapid destruction of the transistor. This harmful effect is minimized by the design and structure of the transistor, but it is one of the reasons why transistors are far less forgiving of overload conditions than are vacuum tubes. While a momentary off resonance condition of a vacuum tube amplifier may result in some extra illumination from the tube's white hot plate, the tube will probably not be permanently damaged. Also, the fuse or circuit breaker (if the rig has one) will open before the tube is ruined. (This statement does not apply to certain commercially manufactured rigs now on the market that employ TV sweep tubes in their finals. These tubes are being operated so close to their design ratings that any overload can be disastrous.) Not so, however, with transistors. Even very brief overload conditions can result in their demise.

The tendency of the overload current in a transistor to concentrate at one point means that the resulting heat is concentrated at a small point and that the temperature, therefore, at that point will rise very rapidly past the danger point. The result is a shorted transistor—another "dead soldier" to add to your collection. The associated power supply can be subjected to a severe overload, and damaged, as well. Fuses and circuit breakers are no protection—not even the fast-action instrument type. Small as the fuse wire may seem, it is large in comparison to the point of current concentration in the transistor. Consequently, the temperature in the transistor rises more quickly than the temperature in the fuse. This situation, combined with the lower rate of heat transfer within the transistor and the lower temperature danger point inside the transistor, results in the transistor failing before the fuse opens.

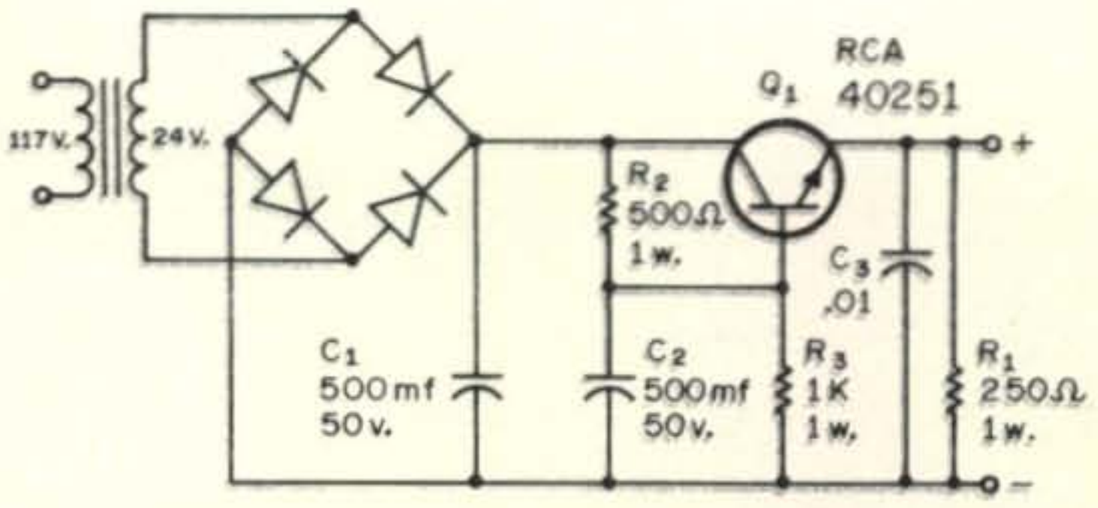


Fig. 3—Basic power supply with transistorized ripple filter.

What is the solution to this problem? The answer is electronic protection circuits that reduce the output of the power supply very rapidly once a critical, or cut-off current, is reached or exceeded. Circuits of this capability have been described by several authors. The first type, described in the RCA silicon manual and the ARRL *Handbook* use a rectifier type diode to nullify the voltage regulation capability of the series control transistor in a series-type of regulated power supply. Above the critical current value, the output voltage falls to a very low value with any further increase in current. The output current, however, remains high. The second type of protective circuit, described in both Gottlieb's and Lytel's books, and by Nelson in *ham radio*, uses a silicon-controlled rectifier (SCR) to place a heavy load across the rectifiers ahead of the regulator circuit whenever the load current exceeds the preset critical value; this condition then causes a protective fuse to open. Since the SCR acts very rapidly, the circuit is capable of protecting the transistors in both the regulator and in the

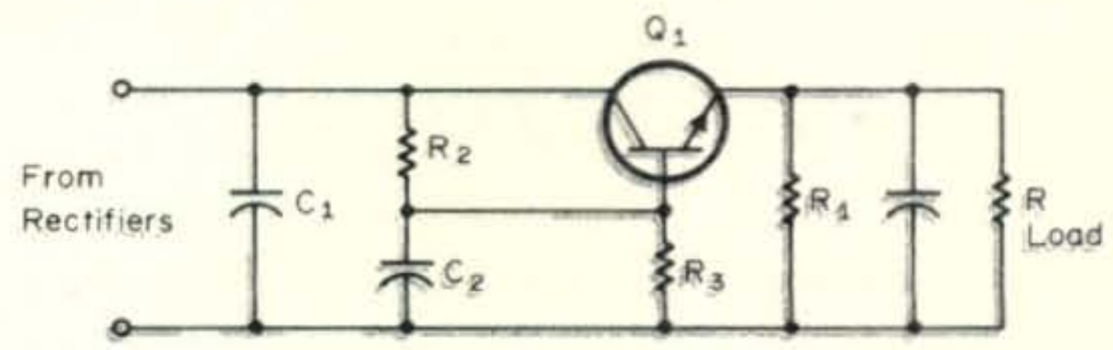


Fig. 4—Transistor filter of fig. 3 redrawn as emitter follower.

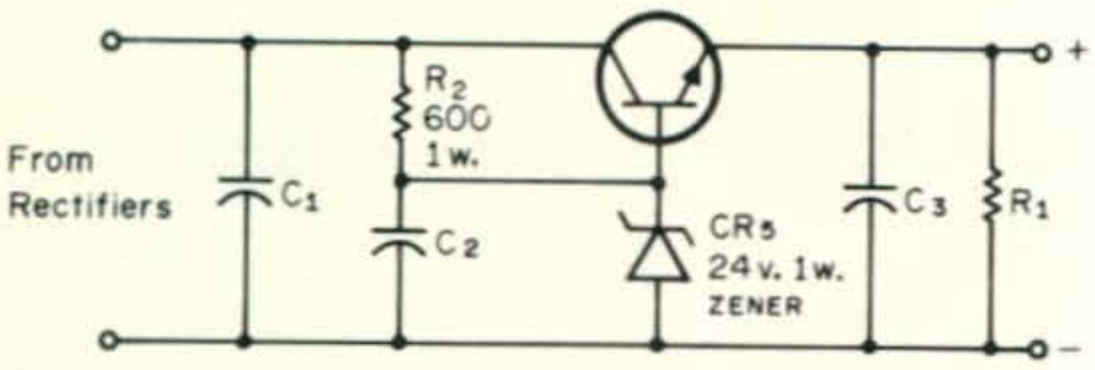


Fig. 5—Circuit of fig. 3 with Zener diode replacing R_3.

load from damage while the fuse is acting. This type of circuit removes all voltage and current from the regulator and load when it acts.

The author prefers a third type of circuit which results from combining the features of the first two types of protective circuits just described. The author's preference stems from the fact that this circuit reduces the load current and voltage to very low values and holds them there until the circuit is reset, but does not involve blowing a fuse. In order to explain fully the action of this circuit, we must briefly review the design of low voltage-high current power supplies for use with transistors.

The regulation characteristic of a power supply describes its ability to maintain the output voltage under increasing load. Figure 1 shows regulation data on various types of power supplies. What may be considered the *basic* type of power supply for this application is shown in fig. 2. It shows a full-wave bridge rectifier made up of four diodes, CR_1 to CR_4, following the step down transformer T_1, followed by the lareg capacitor C_1, and the bleeder resistor R_1.

The use of a half wave rectifier type supply is eliminated from consideration, because of its very poor regulation. Capacitor C_1 under no load conditions is charged to very nearly the peak value of the transformer's output voltage. Under increasing load, the charge steadily decreases, as shown in curve A, and the ripple output voltage increases. The use of a choke or resistor to improve the filtering and regulation is impractical, because of the heavy currents and low initial source voltages involved. The transformer must be capable of providing the needed current under load and have a low effective resistance in order to provide adequate regulation.

The performance of the basic power supply, fig. 2, can be improved by the addition of a series transistor, Q_1, and associated components R_2, R_3, and C_2, as shown in fig. 3. While it is not a true voltage regulator, its use does result in better regulation and less ripple than obtainable by adding just more capacity across C_1, even several times as large as C_1. For this reason, this circuit is sometimes called a "capacitor multiplier." The regulation performance of the circuit in fig. 3 is shown by curve B in fig. 1. Provisions for the dissipation of Q_1's heat must be made. Ordinarily, mounting Q_1 on the power-supply chassis with an insulating washer should be sufficient.

The filtering action of the Q_1 circuit is easy to visualize when the circuit is redrawn, as in fig. 4. This is an emitter-follower circuit with the R_2-R_3 network setting the base bias of Q_1 and the charge on C_2. At ripple frequencies—60 and 120 cycles—the time constant of C_2-R_2 is much longer than the period of the ripple frequency, so that the voltage across C_2 may be considered constant. Consequently, the ripple voltage which adds to the collector-to-base voltage has no effect on the base-to-ground voltage and, therefore, the ripple has very little effect on the output current, which is determined by the base-to-emitter voltage.

The action of the circuit shown in fig. 3 as a voltage regulator is less effective than that as a filter, because the voltage across C_2 can change over longer periods. It does have some regulating effect, however, and does partly reduce the effects of changes in load. If R_L is decreased, the base to emitter voltage increases, which results in increased current through the transistor from collector-to-emitter. The increased current then tends to raise the voltage across the load and to effect some regulation.

The addition of zener diode CR_5 in fig. 5, in place of R_3, results in better regulation of the circuit. The voltage drop across the load differs from the voltage across the zener diode by only the base-to-emitter voltage of transistor Q_1. An increase in input voltage to the regulator will not change the voltage across the load, because the base-to-ground voltage of Q_1 is set by zener diode CR_1. The current through CR_1 will increase, of course.

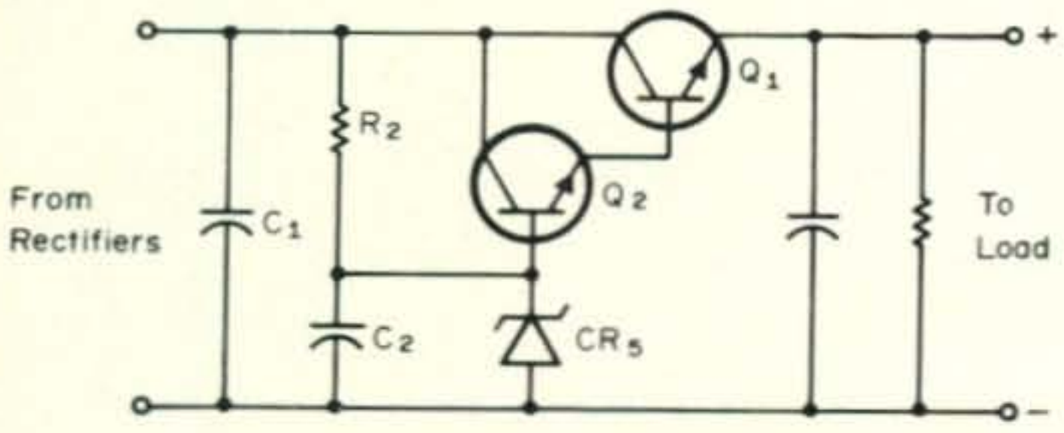


Fig. 6—Circuit of fig. 5 with current amplifier added to increase sensitivity.

A change in load is also compensated by the action of Q_1 and CR_1. Any increase in load resistance will increase the voltage across the load and, therefore, reduce the base-to-emitter voltage of Q_1. The current flowing out of the emitter into the load is consequently reduced, and as a result, the voltage across the load returns to its original value. In a similar manner, a decrease in load resistance momentarily reduces the emitter-to-ground voltage. Since the collector-to-ground voltage is fixed by zener CR_1, the base-to-emitter voltage is increased, resulting in greater current being delivered to the load and the voltage across the load is then restored to its original value. The performance characteristics of this regulator are shown in curve C of fig. 1.

The addition of a second transistor, Q_2, to the series regulator circuit, shown in fig. 6, results in further improvement in the performance of the regulator. The output voltage across the load is held constant within a small fraction of a volt and would appear as a nearly straight horizontal line were it plotted in fig. 1. The scale employed in fig. 1 is such that the thickness of a line on the graph represents a greater voltage than the drop encountered from no-load to full-load. Q_2 adds little to the cost and complexity of the circuit. Q_2 can have a much lower power rating than Q_1, and therefore needs no special mounting precautions. The action of Q_2 may be considered to be that of a current amplifier that amplifies the sensitivity of the regulator circuit.

Further improvement in the action of this type of series regulator circuit—such as making the output voltage variable—can be achieved with additional components. Examples can be found in the references. One advantage gained includes the reduction in the effect of temperature on the circuit regulating performance. For the author's purpose —that of powering a 25 watt rig—the level of performance reached by the circuit shown in fig. 5 is quite adequate. The regulation it provides is enough to eliminate the effect of changing supply voltage on the tuning of the transmitter transistor circuit, and the very low ripple in the output voltage of the supply produced a pure d.c. note from the rig.

The circuit of fig. 5 does have two disadvantages. The first is that should the transistor in the rig suffer secondary breakdown, or overload from any other cause, such as from mistuning or loss of load (antenna), the regulator "fights" to maintain the voltage and current to the load, and that action doesn't do the transistor any good. The second disadvantage is that such an overload in the transmitter, or a short-circuit condition across the output of the power supply, will put the full power-supply voltage and current across Q_1. These conditions can quickly ruin Q_1 if its ratings are exceeded.

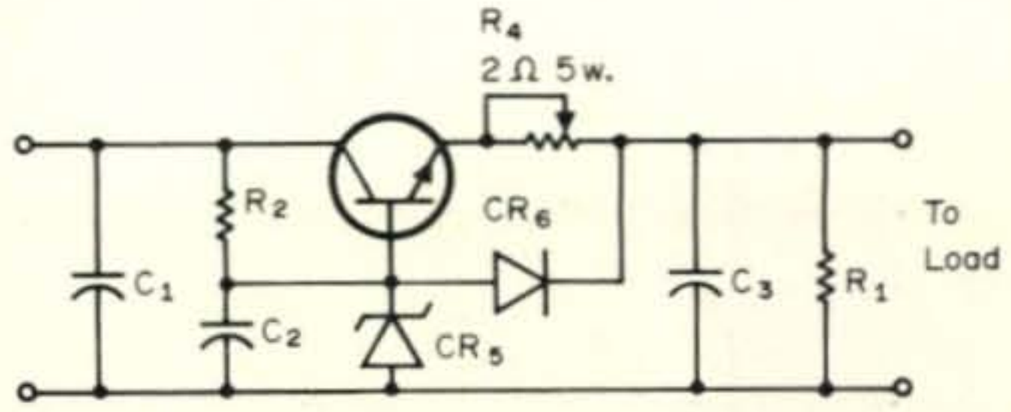


Fig. 7—Circuit of fig. 5 with current limiting capability added. CR_6 is one or more rectifier diodes in series to achieve desired current regulation.

The discussion now leads us to consider the protective circuits needed to protect the transistors in the power supply and transmitter against the hazards just described. The first circuit to be considered is shown in fig. 7, and its action is shown by curve A of fig. 8. The circuit is similar to that of fig. 5, except current sensing resistor R_4 and shunt diode CR_6 have been added to provide the desired protection. CR_6 is connected in its forward direction. At low-load currents, the voltage across R_4 and the base to emitter voltage are too low to cause it to conduct appreciably. Once these voltage drops are sufficient to cause CR_6 to reach its maximum forward voltage, the base-to-emitter current is prevented from increasing further. The collector-to-base current is but a small fraction of

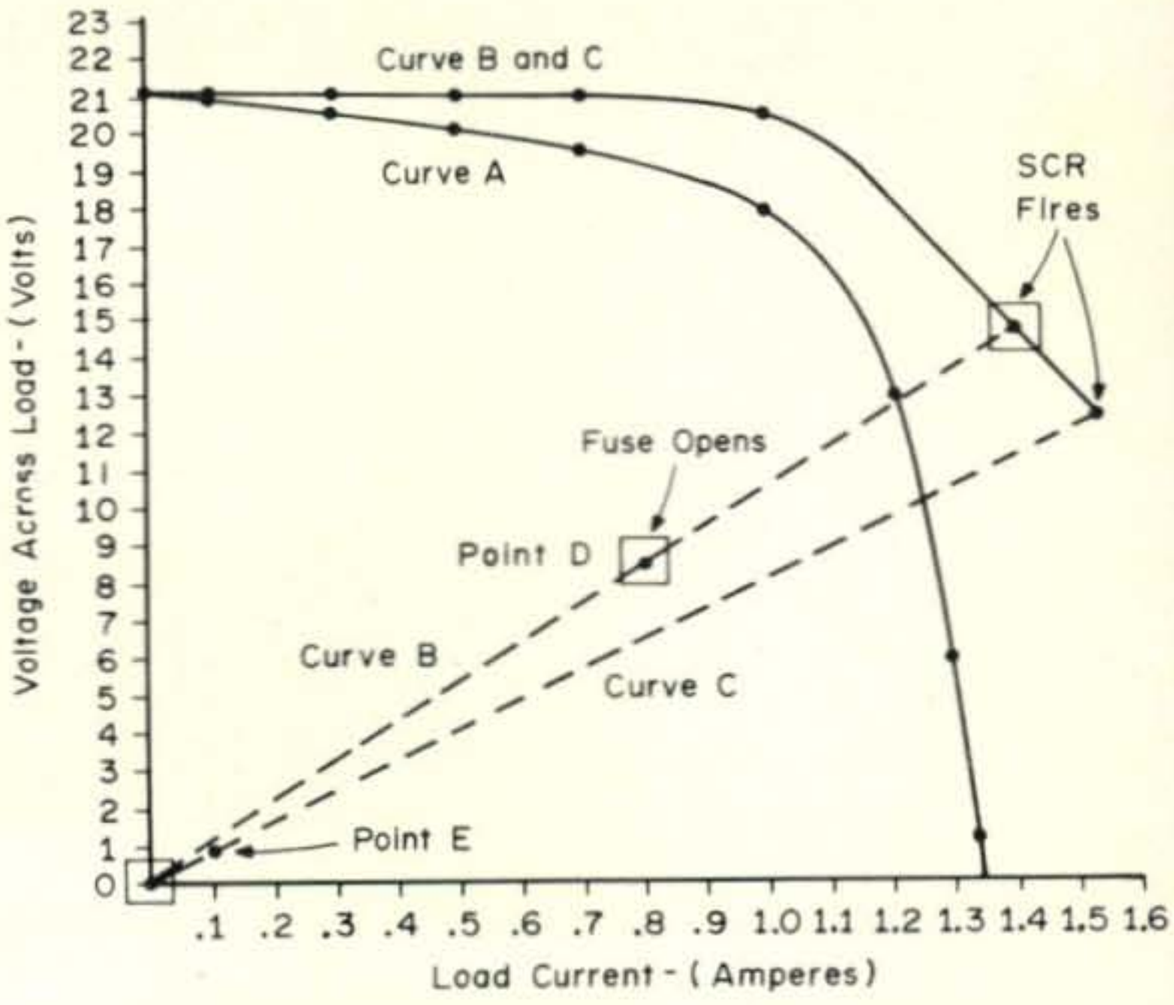


Fig. 8—Protective-circuit performance curves.

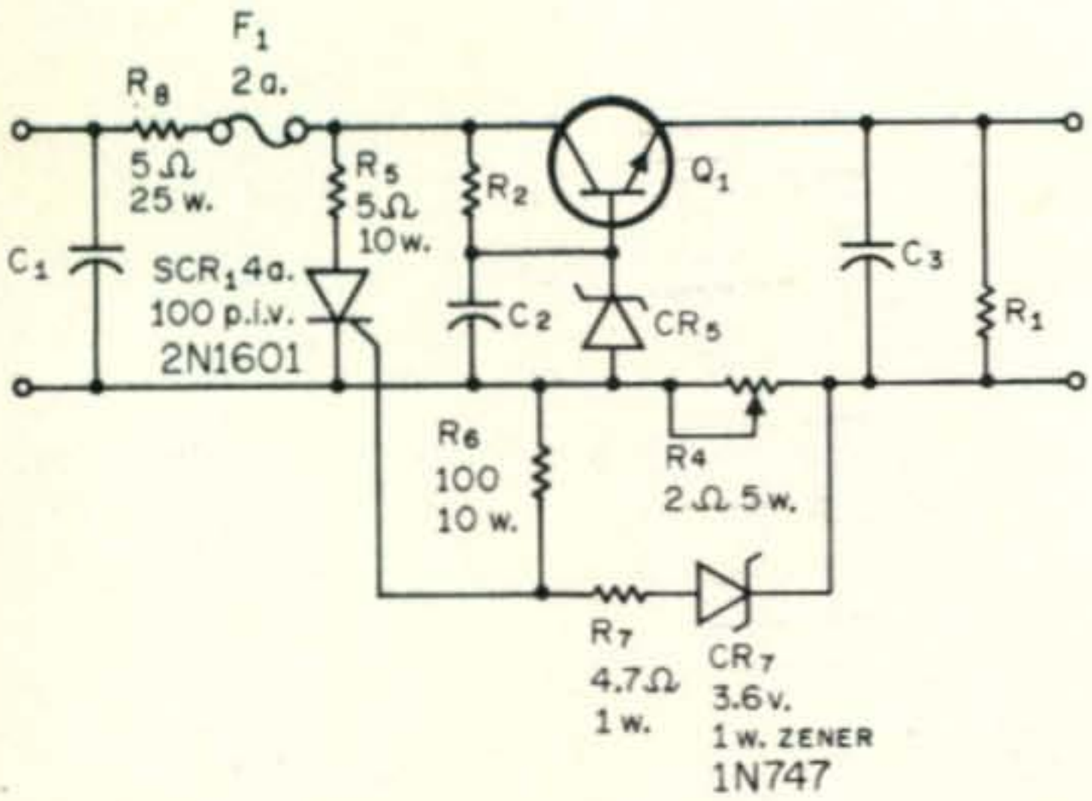


Fig. 9—SCR and fuse type of protective circuit added to circuit of fig. 5.

the collector-to-emitter current. Resistor R_1 permits only a few milliamperes to flow through it. The result is that the collector-to-base voltage drop must increase. Any further increase in load current causes the output voltage of the regulator to follow curve A of fig. 8. The upper current limit is set by R_4 and CR_6. The full source voltage is applied across Q_1 at full current.

The rating capability of the transistor used at Q_1 should be such that it can withstand that condition. The full current is delivered to the load. This circuit acts very fast—fast enough to protect the series transistor in the power supply. This circuit also protects the transistor in the rig if the transistor can absorb the limiting value of current without harm. The degrading effect of the protective circuit on the regulation of the power supply is slight.

The second type of protective circuit is shown by fig. 9. Its action is shown by curve B in fig. 8. The protective circuit is made up of fuse F_1, silicon controlled rectifier SCR_1, zener diode CR_7, and resistors R_4, R_5, R_6, R_7, and R_8. The action of this circuit is very fast—in microseconds—and it therefore can protect both the voltage regulator and transmitter transistors. The current level at which action of this circuit is initiated is set by R_4. When the IR drop across R_4 exceeds the zener breakdown voltage of CR_7, current flows through R_7 into the gate of SCR_1 to cause SCR_1 to change quickly to its conducting state. This action places R_5 across the output of the rectifiers and fuse F_1. Resistor R_5 is of such value that it pulls the voltage way down to protect the transistors (point D on curve B). R_5 and CR_1 draw more than sufficient current to cause F_1 to blow, but not enough current to damage the rectifiers or transformer.

Resistor R_8 is needed only if the internal resistances of the rectifiers and transformer are not enough to reduce the voltage into the regulator to the desired value. This circuit does not reduce the power-supply output voltage or current to zero during the time period from when SCR_1 is switched to the conducting state until fuse F_1 opens, as shown by curve B of fig. 8. The protection offered the load (i.e., the transistor in the transmitter amplifier) is therefore somewhat limited, because secondary breakdown may have proceeded so far that the reduced current may be still sufficient to cause its complete destruction.

A circuit that combines the features of the protective systems just described is shown in fig. 10. Its performance is presented by curve C of fig. 8. Here the same current sensing and switching arrangement is used as was used in the circuit of fig. 9. However, the anode of SCR_1 has been shifted to the base of the series losser transistor Q_1. Until the load current exceeds the preset critical value, SCR_1 has no effect on the performance of Q_1 and CR_5, and the voltage regulating action is just as it was in the circuits of figures 5, 6, and 7.

When the critical current is exceeded, and SCR_1 is switched to the conducting state, the base to ground voltage of Q_1 is reduced to the voltage across SCR_1. Very little current can then flow through the base-to-emitter circuit and load so that Q_1 is effectively cut off. The voltage across the load and the current through the load are therefore quickly

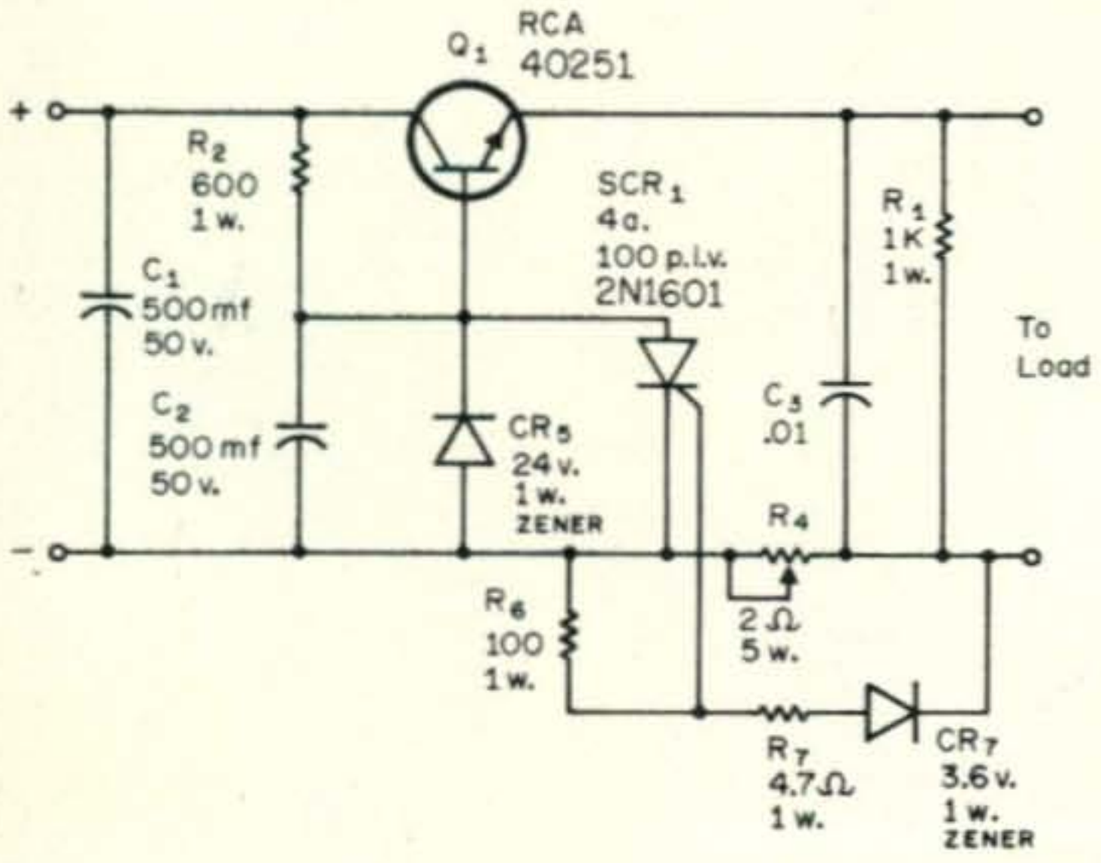


Fig. 10—Combined type of protective circuit added to circuit of fig. 5.

[*Continued on page 92*]

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F. M.

BY GLEN E. ZOOK,* K9STH/5

THE old saying "Old soldiers never die, they just fade away" can be applied to the world of f.m. Things are changing, quite rapidly, towards the elimination of experimentation on 2 meter f.m. For eaxmple, it is no longer necessary to modify or build to get a rig going for v.h.f. f.m. Repeaters, once a project for a hardy bunch of experimenters, are rapidly becoming available as an off-the-shelf item. Antenna experimentation was curtailed by the Report and Order on Docket 18803. Auto patches have come under fire, eliminating another area of experimentation. As a result, some of the pioneers in v.h.f. f.m. feel that they are no longer needed, and are beginning to fade from the scene. With virtually everything concerned with v.h.f. f.m. available from commercial sources the challenges are no longer there. Thus, the pioneers are beginning to drift away.

Will they stay gone long? I doubt it! The drive and temperament required to get f.m. off-the-ground is still there. Just because the need for cut-and-try on 2 meters is gone, there is still a need for experimenters on the higher frequencies. Sure, the pressure for Class E Citizens Radio Service may produce many commercial rigs for 220 mHz, and even 450 mHz has some ready-to-go amateur units. But, the higher frequencies are still in need of population. Ten years ago no one would predict the growth of f.m. on two meters. The commercials are already using 960 mHz for control links and data transmissions, and mobile and portable units are just around the corner. This has been caused by over-population of the lower frequencies. The same thing is becoming true of the amateur bands. If Class E CB becomes a reality (and sources within the EIA say that it is just around the corner—money talks!) the availability of 220 mHz equipment will make for a crowded amateur band within a very short time. 450 mHz is already crowded with control links as well as simplex and duplex activity. Only 50 mHz has relatively little activity. This is not due to a lack of equipment, but due to TVI and lack of interest. Even this band could become crowded in a short time.

What does this mean? We need our pioneers to clear the way to those "useless" UHF frequencies. Just as they cleared the way for 2 meters, these same persons and persons like them can clear the way to even higher frequencies. So, don't let them fade away, but encourage these experimenters, and keep them working. If a few hardy individuals don't show us the way up, things will be much harder on the masses. These fellows need room to work and frequencies for experimentation. Give them all the help they need, for if we don't, we all lose!

Technical Talk

A number of readers have asked how to build their own scanning receivers. Thus, the subject of the month will be a scanning circuit that can be applied to just about any receiver channel switching scheme. The father of this brain-child is Bob Pace, WA5CJG, of Houston, Texas, and the circuit was originally printed in the Spring, 1971, edition of the *Newsletter of the Texas VHF FM Society*. Bob has graciously granted permission to reprint the circuit herein.

Not every f.m. operator will be happy with a scanning receiver. Scanners are quite handy in areas with several frequencies but light to moderate activity. In these cases a scanner will allow one to know what is going on without need for constant manual channel switching. Amateurs in areas of high activity who like continuous reception will also like a scanner. But, those amateurs in areas of high activity who like the squelch to close once in a while should stay away from scanners, for they never shut up (or at least it seems so).

Bob's circuit was originally designed for use with tube-type receivers, but can be easily adapted to solid state receivers using a grounding function to turn on the oscillator. Also, although not mentioned by WA5CJG, the unit can probably be adapted to diode switching of crystals to form the basis of a 10 frequency receive deck. The scanning circuitry will scan 10 frequencies before returning to start. If less than 10 frequencies are to be scanned, the outputs can be paralleled so that there is no lost time scanning

*410 Lawndale Drive, Richardson, Texas 75080.

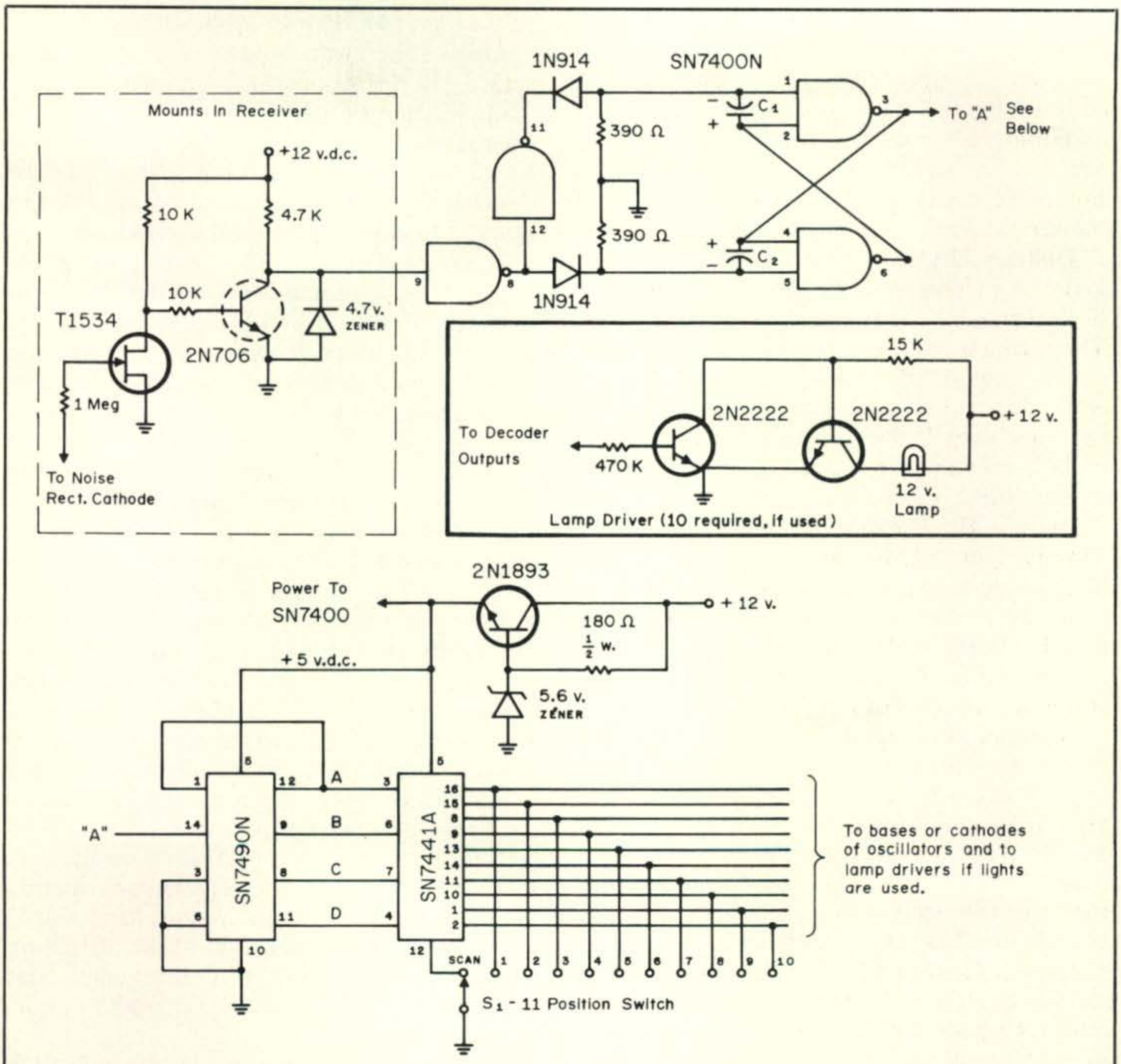

Fig. 1—A receiver channel scan module. It was originally designed for tube circuits but can be used with solid-state receivers. C_1 and C_2 should be adjusted for desired scan speed (about 100mf).

positions that will not be used. Specific channels can be locked out by placing a switch in the line which activates that channel. By opening the switch the channel will not be activated when the unit reaches that position in the scanning mode.

The scanning function stops whenever the squelch of the receiver opens. At that point the circuit locks onto the channel and remains there until the squelch closes. If continuous monitoring is desired or if a QSO is to be made on a specific channel, that channel can be activated by the frequency/scan selector switch. In this position the scanning function is disabled and the desired channel can be selected with the switch. Although not absolutely necessary, provision is made for a pilot lamp circuit to indicate which frequency is being scanned or received at any particular moment. The rate of scanning can be varied by proper choice of timing capacitors. For most operations the values given in the schematic should suffice. Also, semi-conductor devices are not evxtremely critical and equivalents from the Motorola HEP line should work as well as the devices indicated.

Again thanks to Bob Pace, WA5CJG, for his help and for the use of this scanning circuit.

Have You Heard?

It seems that every repeater in the country has at least one, and sometimes more, users that strain relations from time-to-time. Al-

though a few users deliberately cause problems, most really cause problems either from ignorance or absent-mindedness. How many of these fellows show up on your repeater?

Timmy Timeout: Timmy forgets that he is not on 75 meter sideband where timeout timers do not exist. He repeatedly times out the repeater with long-winded transmissions.

Delbert DX'er: Delbert would probably love 20 meters and the challenges of DX. Unfortunately, Delbert cannot operate there. Thus, whenever a station outside the normal service area of the repeater appears, he must work that station no matter who else is using the repeater. Delbert forgets that 146.520 mHz is now the recognized simplex/DX frequency for 2 meter f.m.

Ronnie Ragchewer: Ronnie is related to Timmy Timeout, but exercises his functions in tying up a heavily used repeater talking to a buddy a mile or two away. Ronnie hates any breakers and sometimes ignores even emergency traffic. Ronnie doesn't know that simplex transmissions work on f.m.

Norman No-offend: Norman is a likeable fellow who doesn't like to hurt anyone's feelings. Thus, whenever asked for a signal report he gives only the best. That is, everyone has the best signal Norman has ever heard, even if the signal is three times too wide for the repeater receiver, has 90% a.c. hum, and sounds like Mr. Duck with a bad cold.

Gerald Goodbuddy: Gerald always jumps on top a station that has given one of his buddies a poor signal report or quality report. Gerald never has any trouble with any buddies and likes to hear the same from them. Sometimes wonder if Gerald knows what a good signal sounds like.

And finally:

Percy Policeman: Percy is the local expert on regulations, procedure, and general information. He takes great pain in telling newcomers just what they should do and what not to do. Percy takes great pain in interpreting FCC regulations. Unfortunately, Percy's worst faults are just what he tells everyone else not to do!

Hmmmm. Some of these characters sound just like someone we know. In fact, there is hardly an f.m.'er who has not worn the shoes of Timmy, Ronnie, Delbert, or any of the others. All of us slip from time-to-time. The idea is to keep alert, treat our fellow f.m.'ers fairly, and to avoid becoming part of the problem rather than contributing to the solution.

For Newcomers Only

One of the most important facets of amateur f.m. operations is frequency stability. This is due to the channelized nature of operations. Since f.m. signals range from 10 to 15 kHz wide (±5 kHz and ±7.5 kHz deviation) in most amateur 2 meter f.m. work, channels have been agreed upon 30 kHz apart. This is in line with commercial regulations. However, the commercials are starting to go to ±15 kHz channel spacings, and, if f.m. keeps growing, 15 kHz channel spacings may be seen on the amateur bands. Because of the wider nature of f.m. signals, the bandpass filters used in f.m. receivers must necessarily be much wider than those used in s.s.b. receivers. Thus, adjacent channel interference is possible if the receiver filter is too wide. In commercial f.m. equipment which was either designed for or modified for narrowband (±5 kHz) this bandpass is usually in the neighborhood of 15 kHz (6 db points). Allowing for a 10 kHz wide signal centered in the receiver passband, there is only 2.5 kHz to the 6 db point on the filter. At that point, especially with a weak signal, distortion of the recovered audio usually results. Commercial standards call for a frequency stability in the transmitter of 0.0005% or about 750 Hz at two meters. Many amateur transmitters call for 0.001% or 1500 Hz. This means that once the transmitter is zero'd to the correct frequency it can move only 750 Hz or 1500 Hz under operating conditions.

In the f.m. rig there are at least two crystals involved in any two-way exchange, one in the transmitter and one in the receiver. In a worst-case condition each crystal could drift as much as 750 Hz (0.0005%) or 1500 Hz (0.001%) resulting in a difference of 1500 Hz or 3000 Hz between the receiver passband center and the transmit signal. Thus, many units built for the amateur markets have filters a bit wider than the commercial units, usually in the neighborhood of 20 to 30 kHz wide at the 6 db points. This tends to make adjacent channel interference more possible than with the narrower commercial filters. But, when signals stay put, there is usually not too many problems except in major metropolitan centers. Even these problems can be reduced, but they require replacement of the receiver filter with one of a narrower bandpass. Because of these wider filters, some amateurs have been using crystals with a 0.0025% frequency tolerance, and getting

away with it when both stations are using similar equipment. A 0.0025% crystal can drift up to 3.75 kHz, or a total system under worst-case drift of 7.5 kHz! This often places the transmitter outside the passband of a repeater receiver using commercial equipment with narrowband filters. The result is a distorted signal on the repeater output, if the repeater is keyed at all.

Why do amateurs use these 0.0025% crystals? The answer is simple: First of all these crystals are cheaper than the more stable 0.001% or, preferably 0.0005% types, often costing only 50% as much. Secondly, the wider receiver filters allow the use of these crystals with few problems when working simplex. But, as activity increases in any locale problems begin to arise because of the wider filters and drifting equipment. The cure for adjacent channel interference is narrower filters, but these cannot be brought into play until the transmitters can stay within the passband. A vicious circle. The cure is simple, use the stability crystals recommended by the manufacturer: 0.001% in most amateur f.m. equipment and 0.0005% in commercial equipment. Since the equipment will meet up-to-date frequency stability, why degrade performance to save a few bucks in the short run. In the long-run things can get much more expensive or adjacent channel interference can make use of the f.m. rig a very unpleasant situation.

Q & A

Q. Why do commercial f.m. radios have locks on them?

A. The obvious answer to this question would be that locks are to prevent theft. However, that is only incidental to the real reason: To prevent unauthorized adjustments. Each commercial transmitter must be certified by a person holding at least a second class radiotelephone operators license. Because of this certification, some protection must be given to prevent someone without federal qualifications from changing the frequency, deviation, or making any other changes to the transmitter operations. Some of the earlier commercial equipment even had provisions for a wire and lead seal for the frequency and deviation adjustments! If this seal were broken the certification was void. By the way, any radio thief worth his salt has keys to all major radio equipment.

Q. Can you guarantee that if I put up (brand X) antenna that I will be able to hit the (repeater 75 miles away) station?

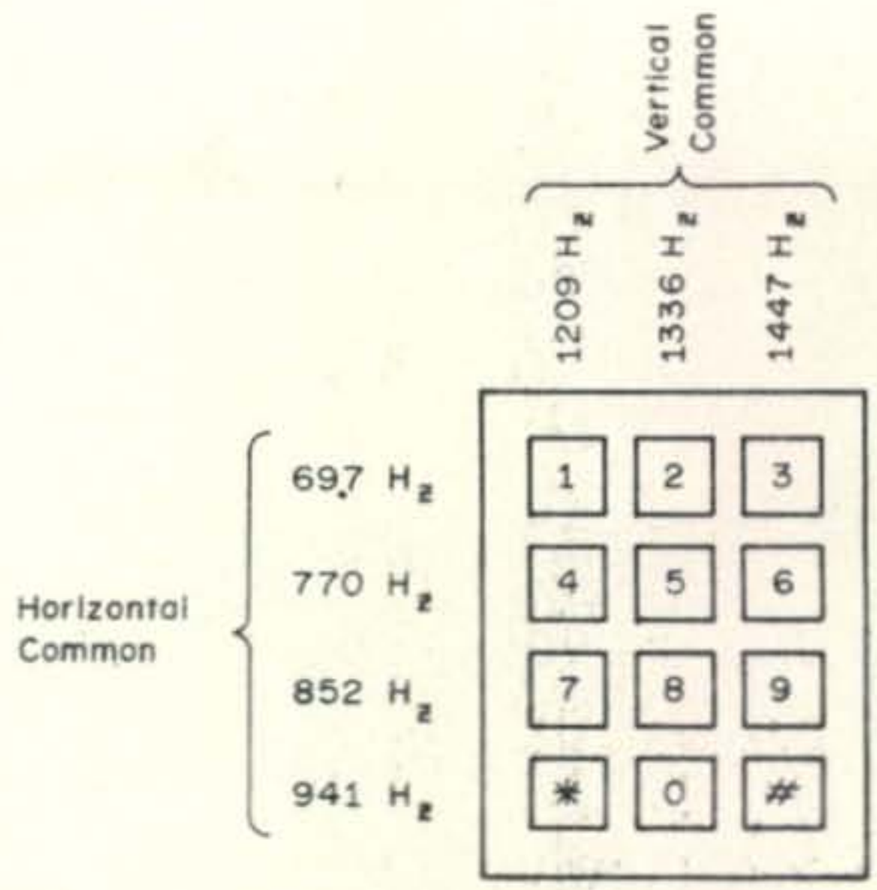

Fig. 2—"Touch Tone" encoder frequencies. See Q&A this column.

A. There are too many variances which are unknown to be able to say that you will be able to hit any given repeater under all circumstances. With above average power (60 watts output or so) and a very good antenna such as the Cush-Craft stacked 11 element beams, or yagis by Hy-gain, or other manufacturers, up at least 50 feet and fed by ½" heliax or similar transmission line, the chances are very good. If the location of the repeater is very high in relation to the surrounding area or if the station location is very high, lower power or less antenna may work. There is just no way to tell without trying.

Q. What are the frequencies used in "Touch-tone" encoders?

A. See Figure 2. This is for the common 12 button pad. 16 button and 20 button pads have other frequencies, but are used in amateur work normally only for repeater control circuitry.

Finale

Plans are under way for a mailing of reply cards for the 1973 repeater directory. Things will be handled just about as last year. However, many repeater groups are not on the mailing list, so if a card is not received, please drop me a line either asking for a card or giving full details on the local machine. If your repeater is not mentioned in the directory you have only yourself to blame.

News has been at an all time low. We need news of repeater activities, suggestions, construction projects, what-have-you, are always in demand. Remember, this column needs the support of f.m. operators to be of greatest value. See you next month.

73, Glen, K9STH/5

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An RTTY Repeater

Part III—The U.H.F. Control Station

BY BYRON H. KRETZMAN,* W2JTP

PART I of this three part article about a radioteletype (RTTY) f.m. repeater described the repeating system and the terminal unit (TU), the device that detects the a.f.s.k. RTTY signal and which makes it key an a.f.s.k. oscillator, "regenerating" the signal. Part II described the logic control equipment at the repeater site itself, and that end of a u.h.f. control link that permits complete radio remote control of the RTTY repeater. This third and last part describes the Control Station.

*431 Woodbury Road, Huntington, N.Y. 11743

Figure 12 is a photograph of the Control Station. From the top down, there is the Control Unit, the low-band 52.60 mHz Sensicon Motorola PA8633 monitor receiver (from an —80D), the TU204 u.h.f. Motorola u.h.f. transmitter (from a T44); and, on the bottom, the a.c. power supply. Note the addition of a "non-stock" (surplus) blower, mounted at an angle, on the u.h.f. transmitter strip.

Fig. 12—Control station for the RTTY repeater, mounted in an open table-top rack. The Control Unit is at the top (with dust cover removed). Next is the 52.60 mHz low-band monitor receiver; next is the T44 u.h.f. transmitter. The a.c. power supply for the receiver and the transmitter is at the bottom.

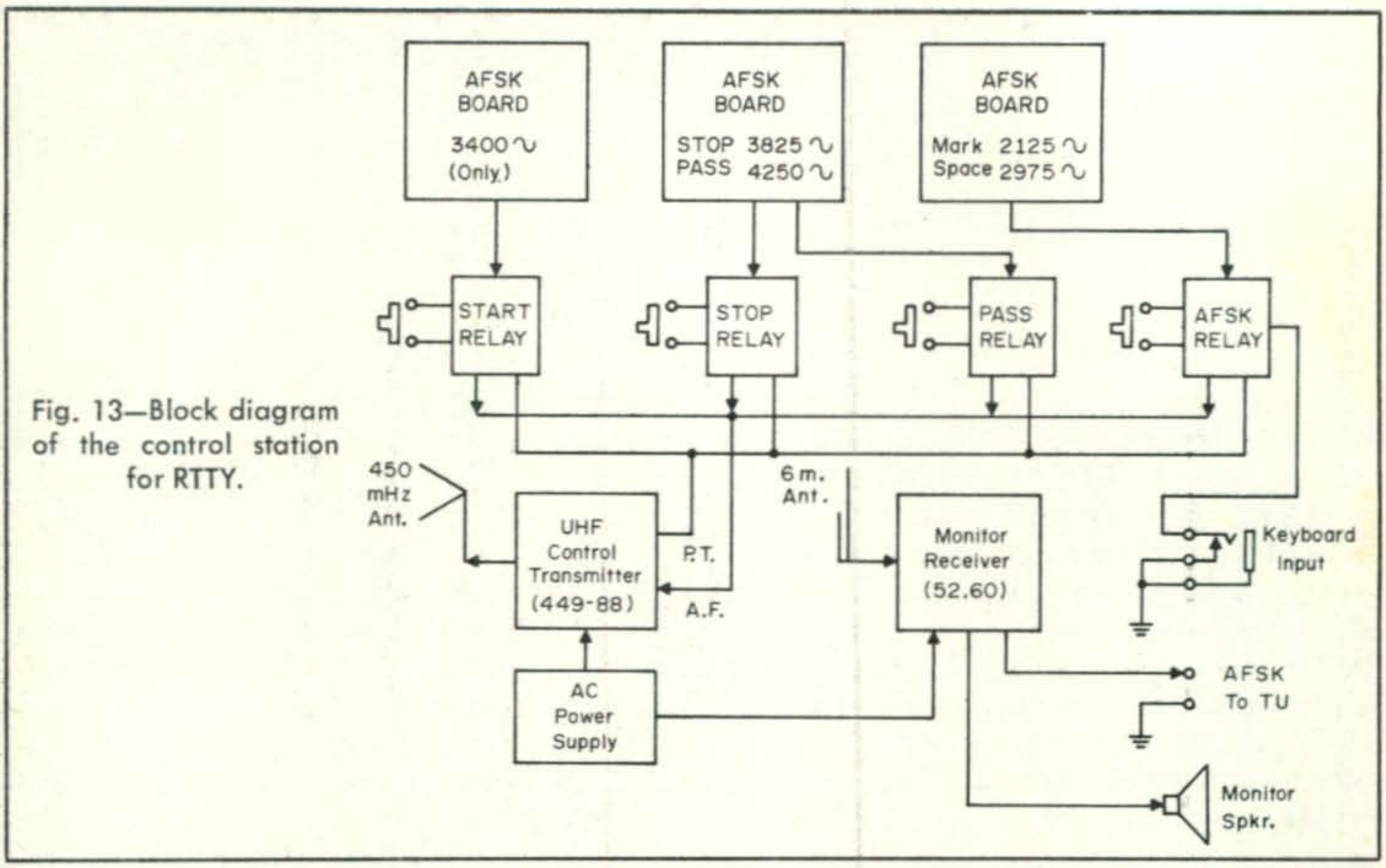

Fig. 13—Block diagram of the control station for RTTY.

This is essential if the u.h.f. transmitter is to be run at or near rated output (20 watts) for the normal long transmissions of RTTY. Naturally, if the u.h.f. path is short and good enough to allow operation with only a few watts, the u.h.f. transmitter can then be run in the TUNE position, and without the blower.

Figure 13 is a block diagram of the Control Station. The solid-state control tone oscillators are built on plug-in printed circuit boards. The first is used for the START tone, only; the second for the STOP tone and the PASS tone; and the third is used as a standard a.f.s.k. generator. The START function turns on the repeater a.c. supply, if it was shut down for any reason. The STOP function shuts down the repeater by turning off the repeater a.c. supply, and the PASS function permits bypassing the time clock at the repeater site so that it may be tested or used for a special purpose during the normal time clock "off" period.

The a.f.s.k. board, resting on *mark* (2125 Hz), can be used to key-on, via the u.h.f. control link, the repeater transmitter with a steady *mark* for testing. It should be remembered that, because of the carrier operated relay (COR) on the u.h.f. receiver at the repeater site, *any* operation of the u.h.f. control link locks out the v.h.f. (146.70) repeater receiver. A closed-circuit jack, KBD IN, on the Control Unit panel, is the means for connecting the a.f.s.k. oscillator directly to the keyboard of a Teletype machine or to the contacts of a transmitter-distributor (TD) for feeding the repeater RTTY over the priority u.h.f. link.

The low-band receiver, on 52.60 mHz, monitors the output of the repeater, as required by FCC Rules, and can also be used to feed an external TU at the Control Station for machine copy. If the TU at the Control Station is equipped for autostart, unattended machine copy of the repeater traffic for logging purposes, is therefore possible. A monitor speaker, hidden behind the Control Unit, enables anyone at the Control Station to *listen* to the repeater output channel.

The Control Unit

The two control tone generators, and the a.f.s.k. RTTY generator, are built on the a.f.s.k. circuit boards[11] developed by W2JAV for RTTY. Normally built for frequency-shift keying, the first is used only for the START tone of 3400 Hz. The second is used for either the STOP tone of 3825 Hz or is frequency-shifted to provide the PASS tone of 4250 Hz. The third board is used as a straight a.f.s.k. generator, as it was designed, with 2125 Hz for *mark* and 2975 Hz for *space*. It is this a.f.s.k., when keyed by a machine, (and carried up-link by the u.h.f. radio control circuit) which then transmits RTTY via the repeater.

[11]Kretzman, B. H., "RTTY," *CQ*, March 1962, page 91.

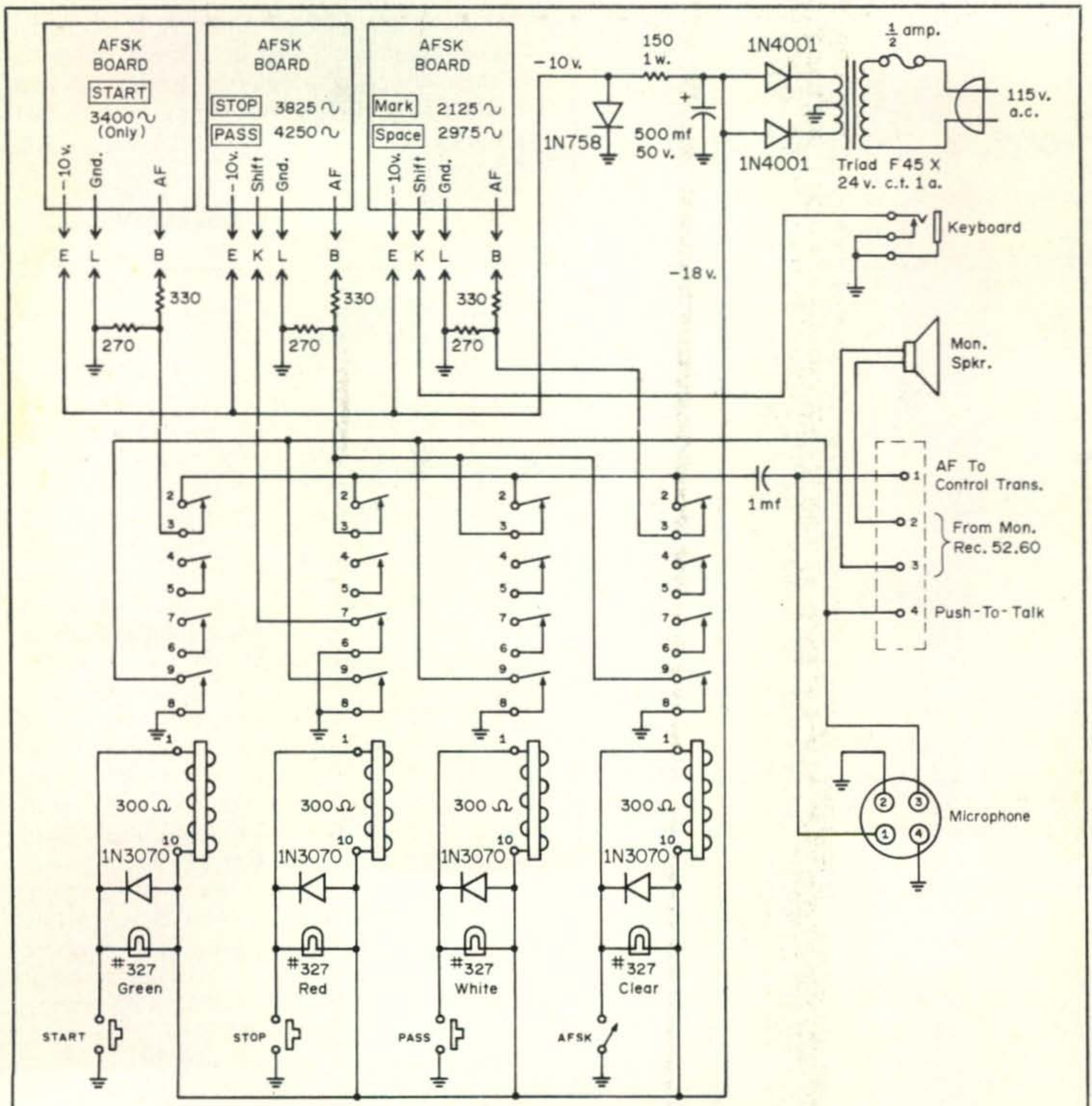

Fig. 14—Control unit schematic diagram.

Contained within the Control Unit is a small d.c. power supply to provide —18 volts d.c. for the control relays and pilot lights, and —10 volts d.c. for the control tone oscillator boards. The —10 volt bus is regulated by a 1N758 Zener diode.

Each control function has its own relay which performs the frequency selection, feeds that frequency to the u.h.f. control transmitter and keys it on. The relays are surplus hermetically sealed relays, available commercially as C. P. Clare part number RP3716-G169. It has a single 300 ohm winding. Of course any low-current relay which will operate on 18 to 28 volts d.c. may be substituted. A minimum of two sets of form A (normally open) contacts are required. Contact rating need be only 1 ampere.

A green pilot light indicates actuation of the START relay, red the STOP relay, and white the PASS relay. Push-buttons are provided for these functions, and whichever one is pressed must be held down for at least 10 seconds. This is because of the time delay built-in at the other end of the u.h.f. control link. A clear pilot light indicates actuation of the AFSK relay. A s.p.s.t. switch, instead of a push-button, is used to set up the control link for RTTY operation, or simply to turn on the 52.60 mHz repeater transmitter by sending

up-link a steady *mark* tone. A front panel closed-circuit jack, KBD IN, permits patching to the contacts of a Teletype keyboard or to a TD. This is also a convenient point to insert a square-wave keyer[12] to check on overall telegraph bias.

Other Equipment

The power supply at the bottom of the rack assembly is similar to that for an —80D except that higher plate voltage is provided for the u.h.f. transmitter strip; and the receiver, in this case the 52.60 mHz receiver, is not muted when the u.h.f. transmitter is on. Antennas are simple. A square-corner-reflector type of antenna is used on u.h.f., and a "J" antenna[13] is connected to the 52.60 mHz repeater monitor receiver.

Final

As a last comment: *fuse everything!* Do not omit any fuse shown in the schematic diagrams for the power supplies. Unattended operation *requires* this kind of protection. It can be awfully embarrassing if part of the RTTY repeater system goes up in smoke, not to mention the damage to the equipment. Fuse values should not exceed those indicated. For example: a ¾ ampere fuse should be used in the Logic Control Unit power supply, fig. 7, Part II. If you had a 15 ampere fuse in this position, a 6.3 volt a.c. heater line short circuit would not blow the 15 ampere fuse, or the house 15 ampere branch fuse (or breaker), but the 6.3 volt heater wiring would burn up; with lots of smoke.

If a fuse blows, find out *why* it blew; just don't replace it with a fuse having a higher current rating! ■

[12]Kretzman, B. H., "RTTY," *CQ*, Dec. 1962, p. 69 (ground collector of Q_1).

[13]Kretzman, B. H., "The J-antenna on 6-Meters," *CQ*, Dec. 1967, p. 29.

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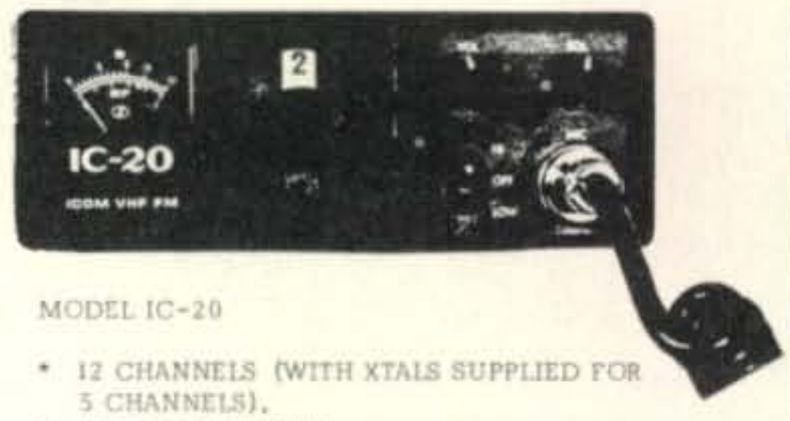

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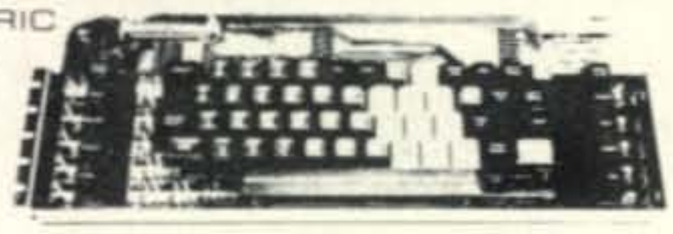

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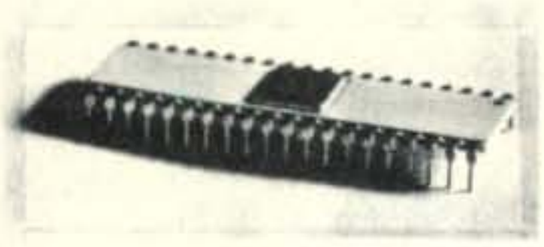

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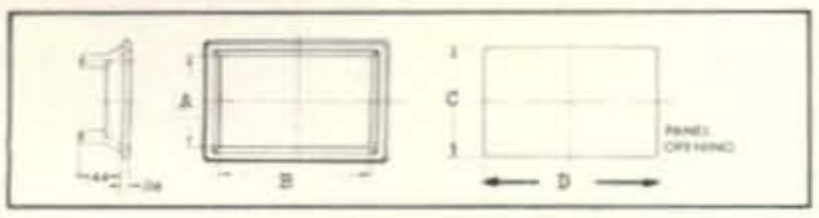

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915-XX	.80	3.00	1.172	3.37	2.40	2.21	2.04
920-XX	.80	4.00	1.172	4.37	2.45	2.25	2.08
930-XX	1.38	5.00	1.750	5.37	2.75	2.53	2.33
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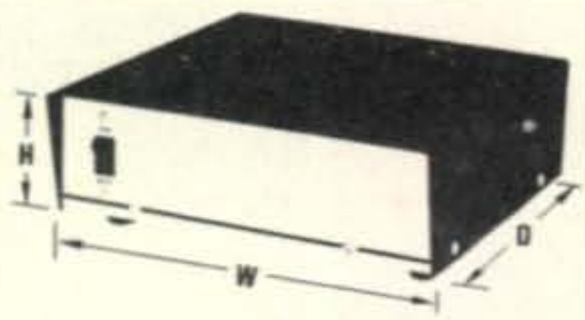

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Slow Scan TV

BY COPTHORNE MACDONALD,* W1GNQ/ϕ

"Exploration"

We could call it the "Exploration Net," but everyone has his or her idea about what a net is or should be, and this is bound to be a bit different. Perhaps it's best just to call it "Exploration," or the "Exploration Group." Whatever we call it, the thing I have in mind starts with a group of slow-scanners getting together on the air. The evening belongs, in a sense, to one of the group. He has spent long hours during the preceding weeks preparing for this evening. He has chosen something to "explore" and has gotten together the pictures and sounds that will let us explore it with him.

It might be partly biographical. The story of an episode in his life, or an activity he's into, or digging into a subject he feels strongly about. Making silver jewelry, a sailing trip to the Bahamas, the problems of Nutley, New Jersey, growing organic vegetables, life as a rancher, survival in New York City, or one of a thousand other possibilities. Perhaps he has taken his camera out to tell the story of what a friend or group in his community is doing. Perhaps it's an SSTV interview with some local sage or personality.

The presentation might run 20 to 40 minutes. I.s.b. simultaneous SSTV/voice would be the mode—for maximum effectiveness. (If you didn't have a second receiver or an i.s.b. adapter, you'd invite a ham friend over and ask him to bring his receiver. Stereo tapes with SSTV in one track and voice in the other could be prepared by hams not having i.s.b. transmitting gear, and aired by some other ham who does have the gear.) The presentation would be followed by questions, comments, and general discussion by the group.

How about it? Could we talk Don Miller, W9NTP, into giving us a tour of the archeological museum in his home, or into sharing the slides/story of his church building trips into the jungles of Haiti? And ancient taboos and personal politics aside, wouldn't it be an evening to remember if we could talk Barry Goldwater into sharing his feelings about whats' right and wrong in America today—and get involved in the discussion with him afterwards.

These two guys are on SSTV. Hundreds more with bits of their lives and thoughts to share are on SSTV too. If this appeals, and you want to help get things going, please drop me a line with your ideas; including times, bands, and the date you'll have a program ready for the first one of *your* evenings!

*P.O. Box 483, Rochester, Minn. 55901.

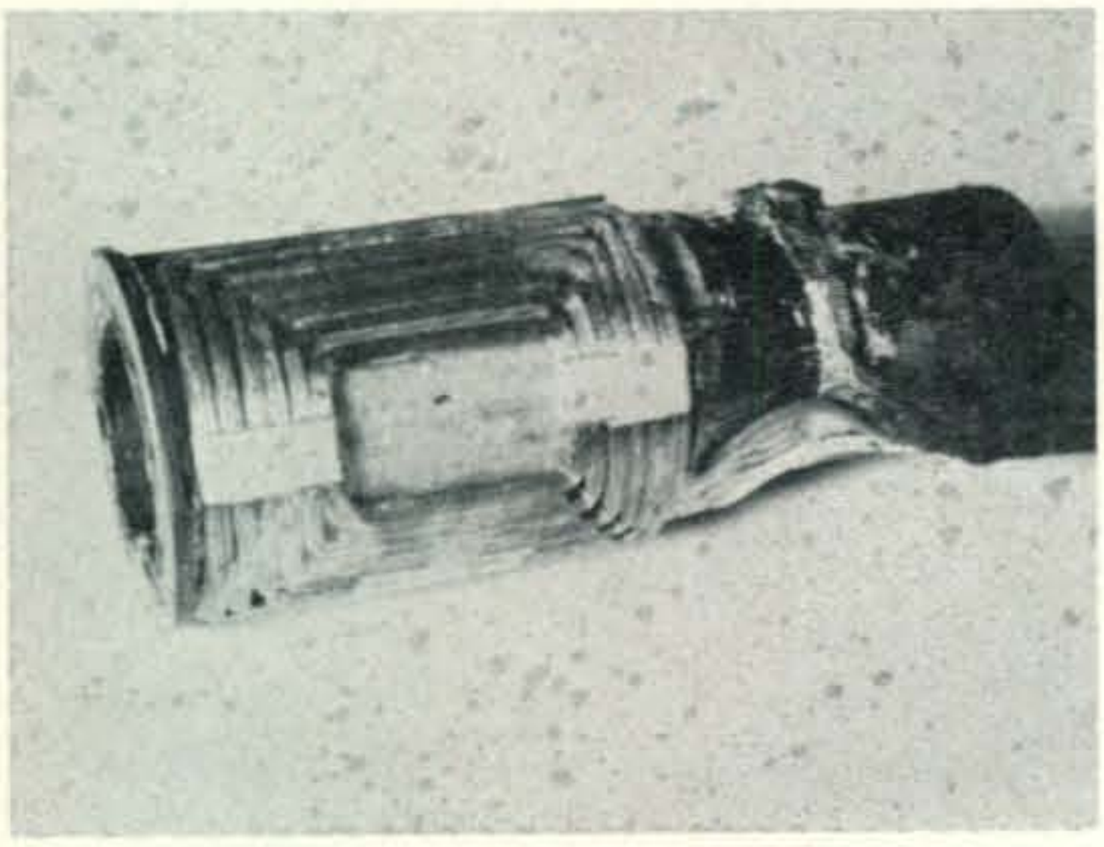

Fig. 1—Yoke with iron wrap removed to show one of the two coils that make up the 50 mh winding.

Vidicon Deflection

Now into hardware talk, and the continuing saga of the vidicon. All commonly available vidicons are magnetically focussed and deflected. Generating the magnetic fields that move the electron beam precisely where we want it to move is the mixture of art and science that we'll explore next.

The science part starts with the fact that we can generate a magnetic field by passing a current through a coil of wire. The strength of the field is proportional to both the current and the number of turns. The first bit of art comes in making that coil the right size and shape. The fact that we must slip a solenoidal focus coil over the deflection yoke means

that the deflection windings must be compact and dimensionally accurate. The horizontal windings must be oriented at precisely 90 degrees to the vertical windings, at the optimum location along the length of the tube. Figure 1 shows one of the four windings in a commercial vidicon yoke.

Several years ago *CQ-TV*, the journal of the British Amateur Television Club (93 Fleetside, West Molesey, Surrey, England) published directions for winding your own coils. Mel Shadbolt of ATV Research (130 N. Broadway, Dakota City, Nebraska 68731) sells kits for winding both fast scan and slow-scan yokes and focus coils. I have had mixed reports on the success of following the *CQ-TV* instructions, and reports of generally good results with Mel's Kit. Most commercially manufactured yokes and focus coils have all of the little niceties that are hard to come by with homebrew construction: electrostatic shielding of the yoke, iron wire wrap over the yoke windings, Mumetal shield over the focus coil, and a molded target connector support. Brand new assemblies are available in the U.S. from Cleveland Electronics, Inc., (17877 St. Clair Ave., Cleveland, Ohio 44110). Used cameras, even if not operational, are a source of yokes, focus coils, lens mounts, cases, etc. Two companies dealing in used video equipment are Denson Electronics (P.O. Box 85, Rockville, Conn. 06066), and CCTV Center (400 Route 46, Lodi, N.J. 07644). If anyone knows of a source of Japanese made coils I would be happy to pass the word along.

The form of the windings must be just so in order to produce a deflection field that has low geometric distortion, and doesn't disturb the normal happenings in the triode section of the electron gun, or near the target. Once that form is determined, however, the yoke manufacturer has lots of latitude in choosing the number of turns for each winding. Figure 3 summarizes the characteristics of some

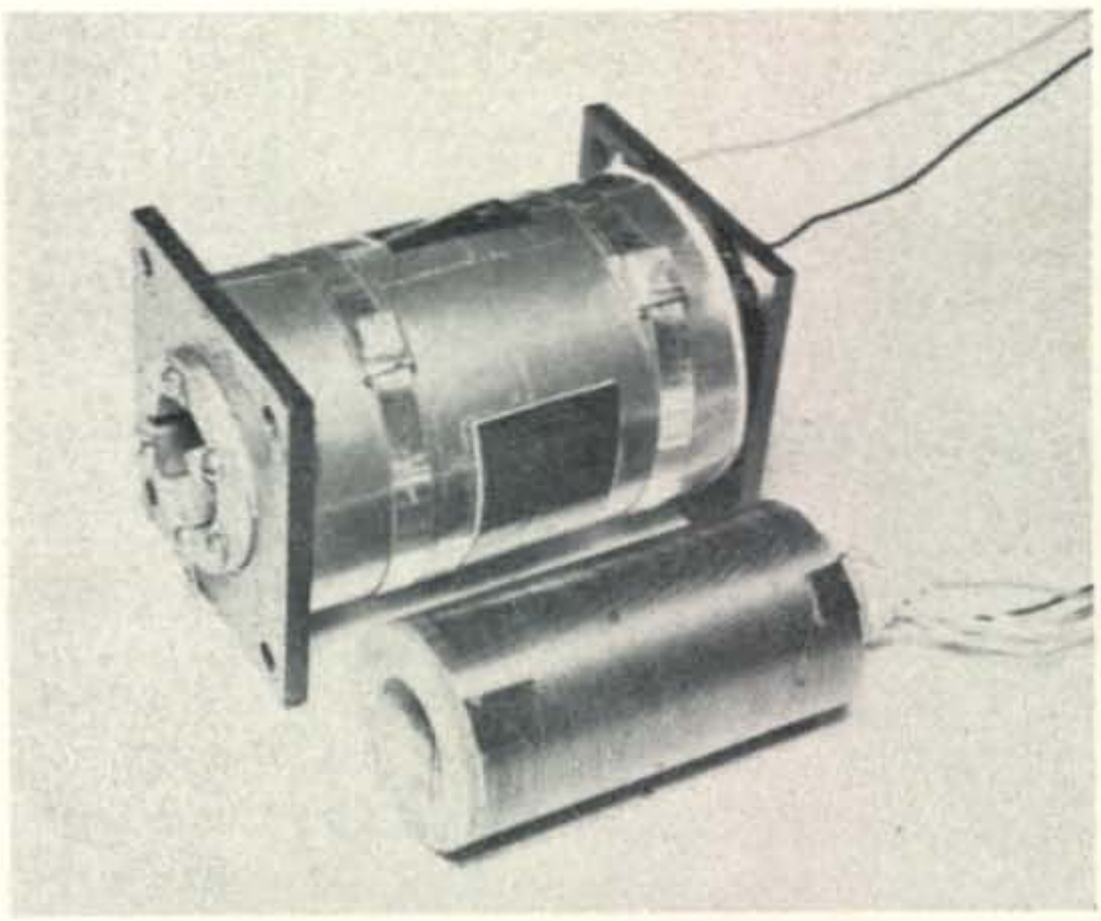

Fig. 2—Commercially made yoke and focus coil for a miniature Vidicon.

common yoke and focus coil windings. 1 mh and 4 mh yoke windings are commonly used for the horizonal rate sweep in fast scan cameras. 50 mh is the most popular value for the vertical rate.

Which winding inductances can be used at which rates? The limitation at the high frequency end is the stray capacitance of the winding itself. At fast scan rates it is desirable to complete the horizontal retrace in about 6 microseconds. If the self resonant frequency is lower than 100 kHz or so, it won't be possible to get a retrace this fast with a simple sweep circuit. This makes it difficult to use 50 mh windings at 15750 kHz. No problem in using windings in the 1 to 4 mh range, however.

At slower rates *any* winding can be used. If that is true why make special slow-scan yokes? As you see in fig. 3 the sweep current requirement drops markedly as the inductance goes up. (The sweep current is actually proportional to the square root of the winding inductance.) A slow-scan yoke is simply one with two high impedance windings, permitting the use of low drive current in both horizontal and vertical axes.

Yoke Winding Characteristics				Focus Coil Characteristics		
Induct. (mh)	D.C. Resist. (ohms)	Approx. p-p Drive Ma Normal Scan	Overscan	D.C. Resist. (ohms)	Ma for 40 Gauss Field	Ma/Gauss
1	1	150	200	385	40	1
4	8	75	100	110	70	1.75
50	185	22	27			

Fig. 3—Electrical characteristics of common 1" Vidicon yoke and focus coil windings. Yoke drive currents are shown assuming focus field of 40 Gauss.

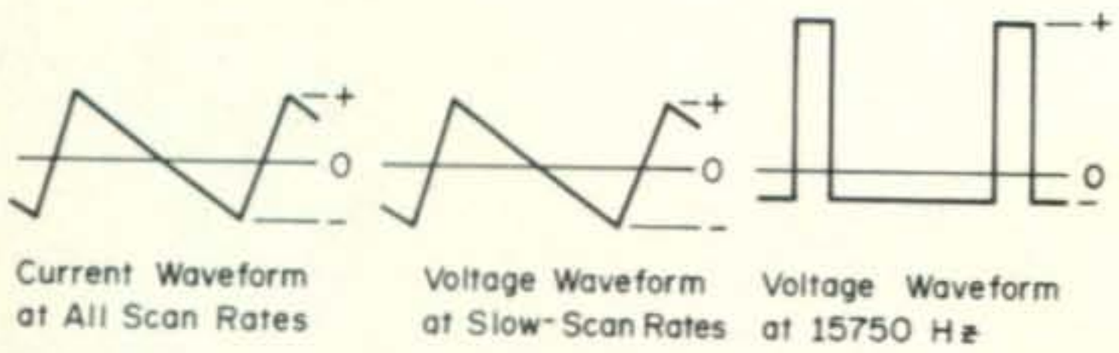

Fig. 4—Deflection yoke voltage and current waveforms.

Sweep Waveforms

The object at all scan rates is to generate a sawtooth *current* waveform through the yoke winding. As shown in fig. 4, the waveform starts with a current flowing in one direction through the yoke. The current drops in value as the sweep advances, reaching zero at the center. It then reverses polarity and increases in magnitude negatively until the end of the scan is reached. The sweep then quickly retraces to the starting condition. At slow-scan rates the windings are essentially resistive. A current sawtooth is obtained simply by applying a voltage sawtooth of proper amplitude and d.c. bias to the winding. We can obtain a sweep current of 22 ma through a 50 mh, 185 ohm winding, for example, by applying a voltage sawtooth of 4.07 volts p-p across the winding.

$$\frac{\text{4.07 volts p-p}}{\text{185 ohms}} = \text{22 ma p-p}$$

At fast-scan horizontal rates we have a different situation. Now the winding looks like a fairly high Q inductor. Let's take a close look at the situation with a 4 mh, 8 ohm winding at 15,750 Hz. The inductive reactance is close to 400 ohms, while the series resistance is only 8 ohms, so the load will be predominately inductive. The voltage across an inductor is related to the rate of change of current through it: $E = L\ (di/dt)$. At 15,750 Hz the total period is 63.5 μsec with about 6 μsec retrace time and 57.5 μsec active sweep time. From fig. 3 we see that the desired peak-to-peak sweep current is 75 ma. Since with a linear sweep, di/dt is constant, the voltage across the coil will be constant. Its value will be:

$$E\text{scan} = \frac{4 \times 10^{-3} \times 75 \times 10^{-3}}{57.5 \times 10^{-6}} = 5.2 \text{ volts.}$$

During retrace the voltage will be of the opposite polarity and much higher.

$$E\text{retrace} = \frac{4 \times 10^{-3} \times 75 \times 10^{-3}}{6 \times 10^{-6}} = 50 \text{ volts}$$

Figure 5 shows the type of simple sweep circuit that could provide such a waveform. The transistor would be switched between saturation and cutoff by the horizontal drive waveform. The collector load inductor would normally be a high Q inductor of 5 to 20 times the yoke inductance. The collector load resistor controls the current through the inductor and thus the sweep amplitude. The positive going, high voltage kick dictates the use of transistor with a V_{CEO} rating of several times the expected pulse amplitude. The diode/capacitor circuit damps out the tendency of the yoke to ring or oscillate. (The

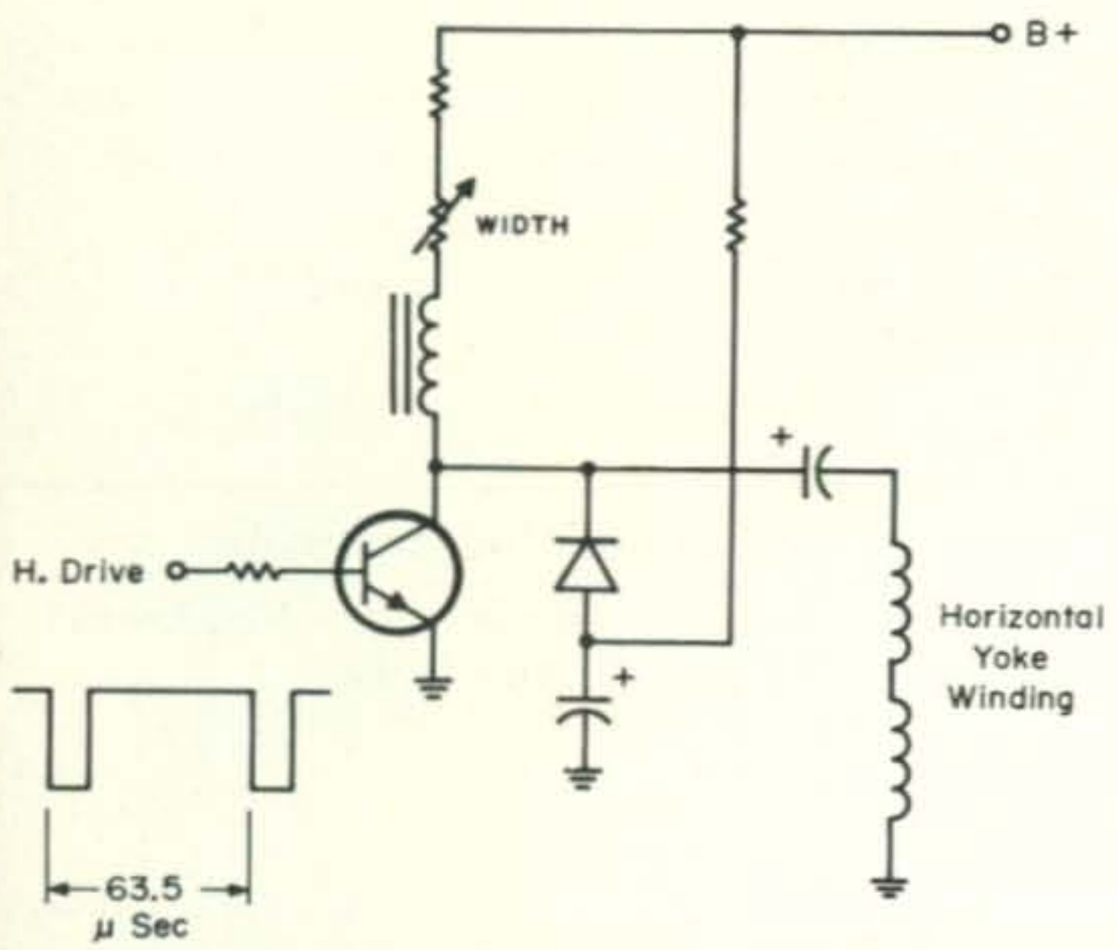

Fig. 5—Typical fast-scan horizontal yoke driver circuit.

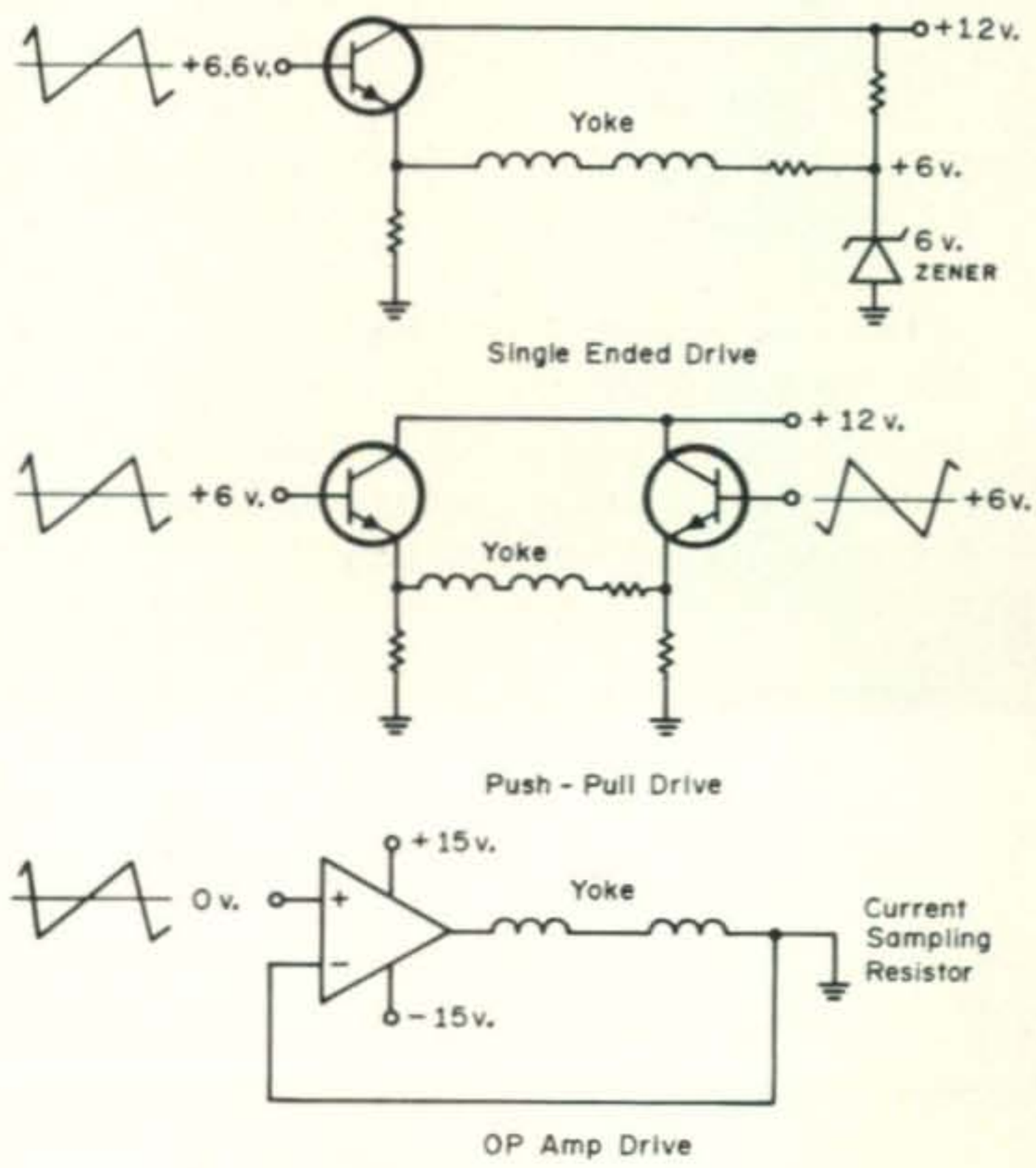

Fig. 6—Slow scan yoke drive schemes.

yoke is, of course, not a pure *L*, but *L* shunted by *C*.) Linearity is often improved in more expensive cameras by adding a small sawtooth component to the transistor base drive waveform. The fact that the yoke is a.c. coupled insures that the sweep is fairly well centered on the tube face. (There is no provision for adjusting centering in a simple circuit like this.)

Slow-Scan Drive

At the slow-scan frame rate, capacitive coupling becomes impractical because of the large values of *C* required. The need to reverse the current direction in the middle of the scan still exists, however, and this can be accomplished in one of several ways. Figure 6 is almost self explanatory. Sweep amplitude can be controlled by either adjusting the sawtooth voltage amplitude or varying a resistor in series with the yoke winding; centering by changing the average d.c. value of the input sawtooth to the driver.

Checking Linearity

At 60 Hz and slower scan rates a simple way to check the linearity of the current waveform is to put a low value resistor (10 to 100 ohms typically) in series with the yoke winding and check the waveform developed across the resistor with a d.c. coupled scope. At higher frequencies like 15,750 Hz the problem is a little tougher because of the low yoke *R*; make the resistor small compared to the yoke winding resistance.

Enough for now. Vy 73, Cop

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

WE have just received the new *1973 JAN Crystal Catalog* and are always pleasantly surprised to read this publication. Any amateur using crystals owes it to himself to write for a copy. In the new catalog are a host of popular HC6/U hermetically sealed units for $1.75 each, 3 for $5, that are perfect for f.m. enthusiasts, converter builders, etc., as the frequency range is from about 2 mHz to 10 mHz for fundamental units, and 11 mHz to 44 mHz for 3rd and 5th overtone units. There are even some special 75¢ "rocks" (3 for $2.00).

We are also quite happy, in these days of rising costs, to see that the old faithful FT-243 units are still available for the nominal price of $1.50 each, 4 for $5.00. You can choose any amateur frequency and JAN will supply ± 1 kHz crystals for the above price and ± .OO5% units for only $2.00 each. You can get a copy of the *1973 JAN Catalog #16* by writing to them at 2400 Crystal Drive, Ft. Meyers, Florida, 33901 and mentioning *CQ*.

Another interesting company is Frank Electronics, 407 Ritter Road, Harrisburg, Penna. 17109. These people carry interesting surplus items at even more interesting prices. As an example: 3/8" yellow RTTY tape is only $1 for 10 rolls; a Potter Brumfield 115 v.a.c. 60 Hz relay with s.p.d.t. and s.p.s.t. contacts of the highest quality industrial plug in variety is only $1 and a Motorola FMTRU-5V 6 volt 7 watt (easily converted to 2 meter f.m.) police motorcycle transceiver is only $14.95. We ordered one of these and even got the antenna as well as 4 crystals. Drop a line to Frank and ask him to quote your needs.

This month I would like to discuss a fairly new IC that we have just received detailed information on. This is the Fairchild Semi-Conductor Corp., 313 Fairchild Drive, Mountain View, California, μA 706 Audio amplifier. Supplied in a modified DIP package as shown in figure 1, the μA 706 can deliver 5 watts of audio (RMS) into a 4 ohm load with only 25 millivolts of signal input. The chip is designed to operate from a 6-14 volt positive source so that it is a natural for mobile work. Full power is only obtained in a 12 volt auto system, however. Total harmonic distortion at full output can go as high as 3% but at 2 watts or below, distortion is only 0.5% or less. Figure 2 is a schematic of the recommended hookup for the μA 706. The speaker is 4 ohms as stated, but for modulator work, it can be replaced with a 4 ohm step-up transformer winding. It should be pointed out that the chip should be heat sunk by means of the heat sink bracket supplied. Once you see one, it becomes obvious how to mount it. We have personally tried

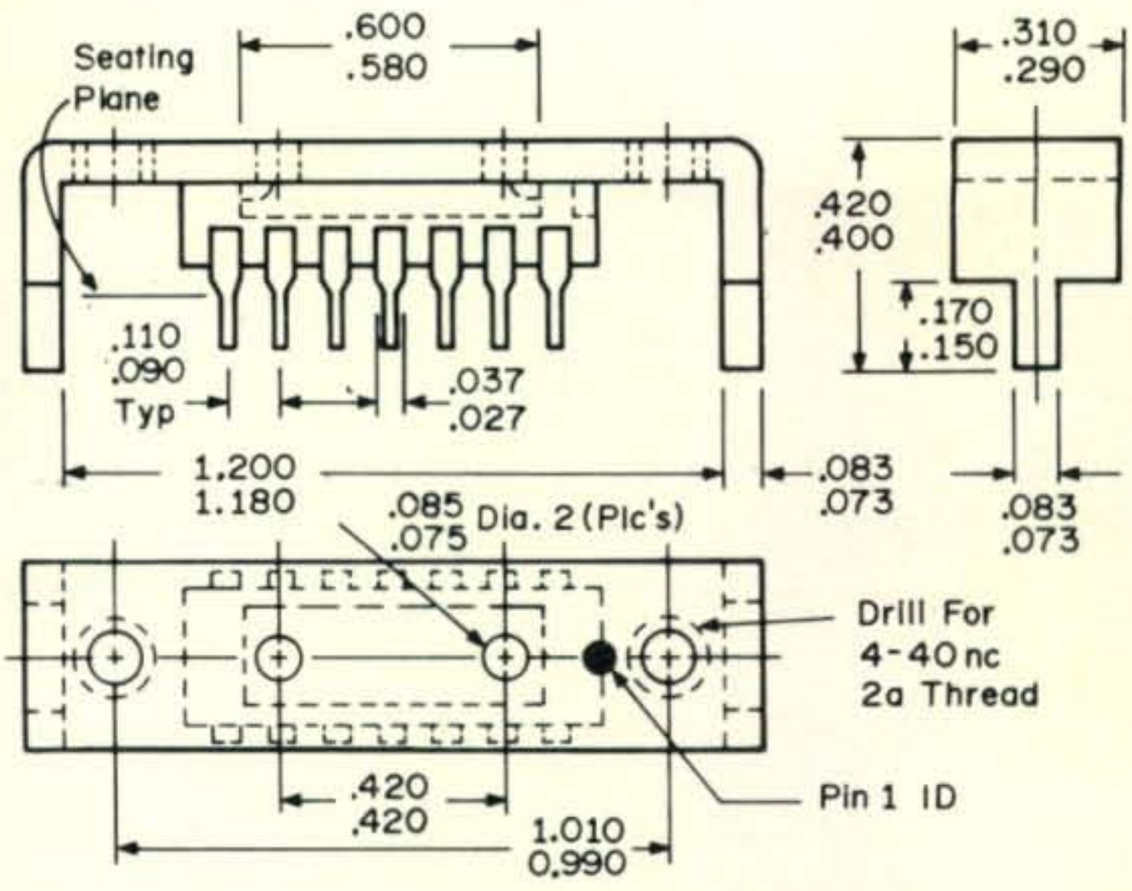

Fig. 1—The outline of the μA 706B chip discussed in text.

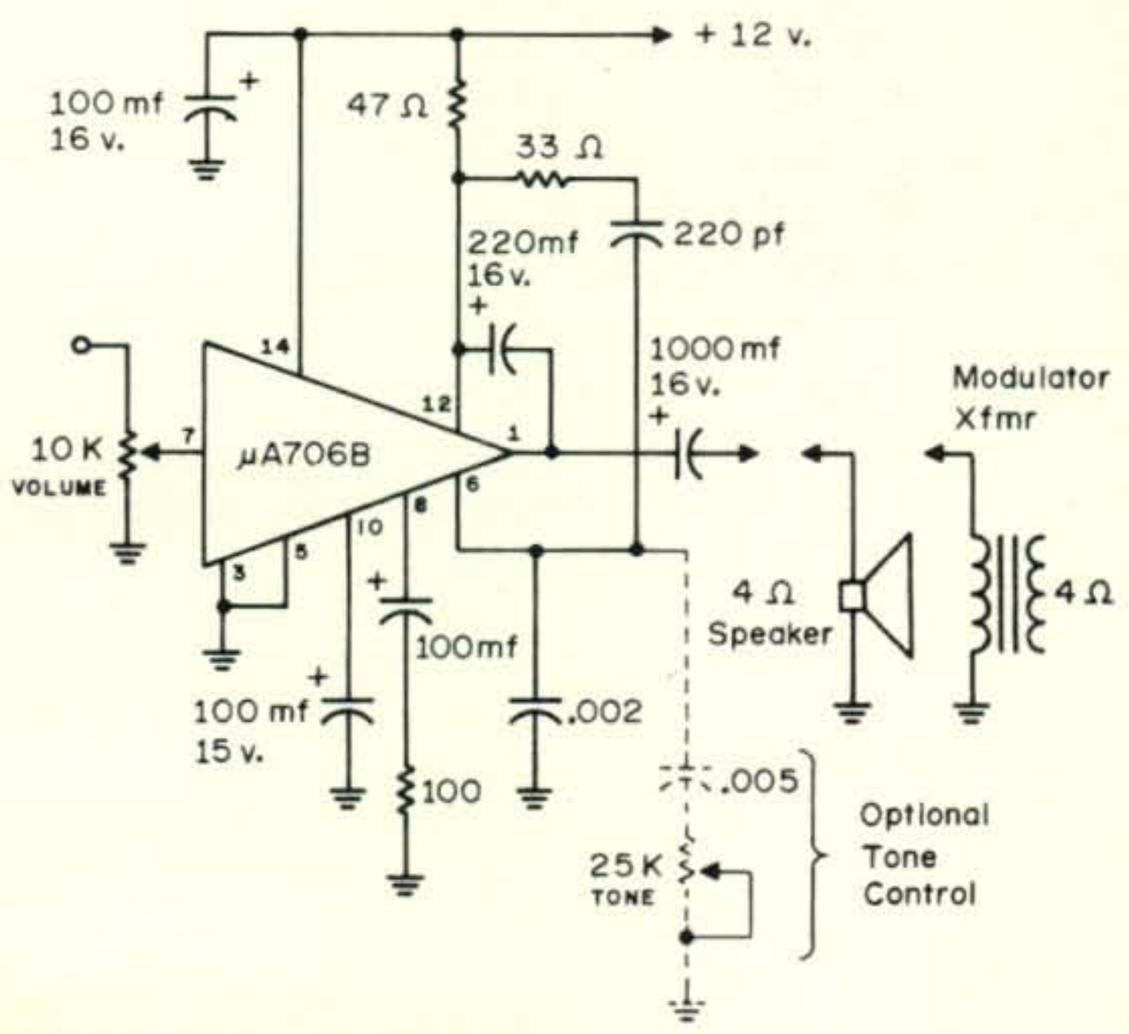

Fig. 2—The circuit of the audio amplifier discussed in text. If you do not want the tone control, leave it out and replace the 220 mf capacitor with a short.

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

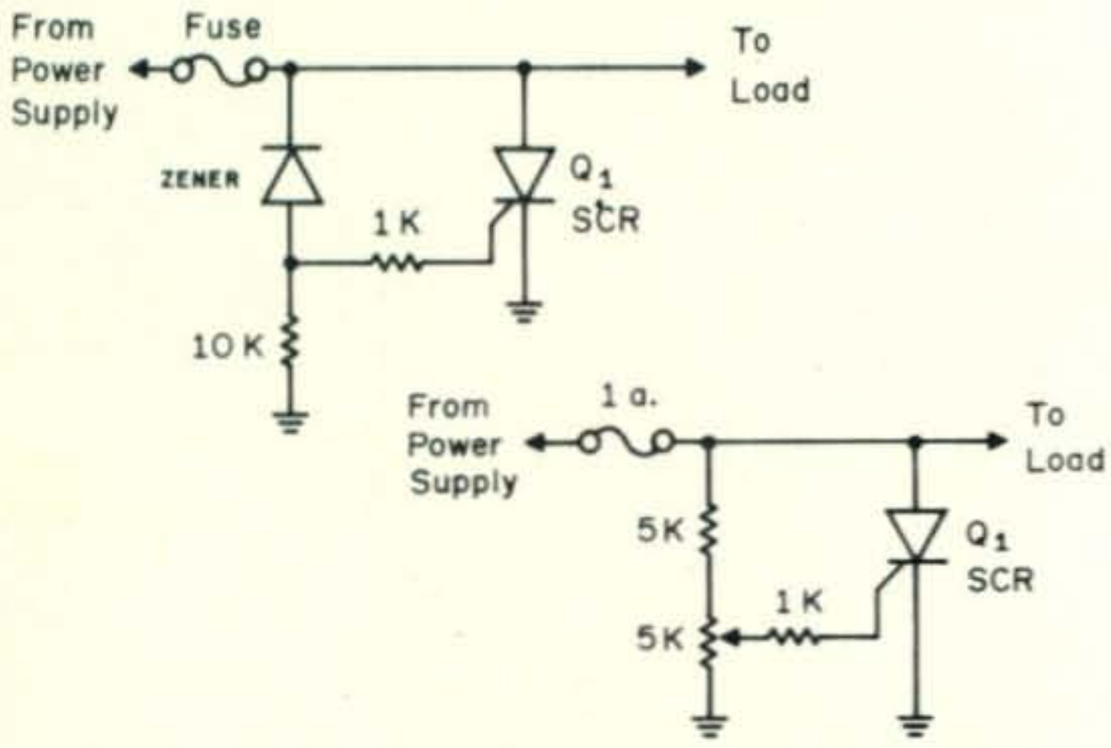

Fig. 3—Two simple "crowbar" circuits.

the circuit of Figure 2 and are pleased to say that it works quite well. The μA 706 is only $4.20 for 1-24 pieces, $3.36 for 25-99 and 100 and up, $2.80.

During the past several months we have received several requests for an inexpensive circuit that could be used to protect delicate IC's from becoming damaged in the event of an over-voltage type of power supply failure. Such failures could easily come about if the series pass transistor in a typical regulator shorted because of either thermal runaway (inadequate heat sinking) or a marginal transistor as occasionally happens with the special unmarked bargains that are "similar to . . ." but not quite!

A solution to this problem is shown in figure 3. Such a circuit is called a "crowbar" circuit because it is a brute force method of immediately shortening the entire output line of a power supply when the voltage exceeds a pre-determined amount, blowing the safety fuse (or circuit breaker) and protecting the integrated circuits connected to this line. The "crowbar" simply means that you could get the same results by "throwing a crowbar across B+ and ground."

Figure 3(a) shows such a circuit for use with fairly low current supplies. Q_1 is a sensitive gat SCR with a maximum current rating of two to three times the maximum short circuit current of the power supply while the fuse (or circuit breaker) is chosen to have a current value slightly higher than the maximum current that will be supplied to the rest of the circuitry. The zener can be any low power ½ watt or 400 millivolt type with a voltage rating equal to the maximum voltage desired at the output. In normal operation, the zener will not conduct and the gate voltage of Q_1 will be zero. Q_1 will therefore by cut off and the circuit will have no effect. If the B+ value should exceed the zener voltage however, the diode will conduct, supplying a signal to the gate of Q_1 which will then immediately turn on. Since a conducting SCR is practically a short circuit, the fuse or circuit breaker will "pop" and power will be removed from the circuit. Replacing the fuse or resetting the breaker will reset the circuit.

In figure 3(b), the zener has been replaced by a voltage divider consisting of a potentiometer and a fixed resistor. This gives an adjustable tripping point crowbar circuit at the expense of drawing additional current through the pot and fixed resistor. Operation is still the same however. When the voltage at the gate of the SCR reaches the proper level, the SCR conducts, shorts the line, and blows the fuse. Varying the pot and/or the fixed resistor determines the point at which the circuit will trip.

For higher current crowbar circuits, larger SCR's will have to be used and these usually require more gate current. To drive these, simply add the inexpensive one stage amplifier shown in figure 4.

A complete, tested 5 volt 1 ampere crowbar circuit suitable for protecting TTL circuitry with an absolute maximum rating of 7 volts and a typical operating range of 5 volts ± .5 volts is shown in figure 4.

The experiment circuit trips at 6 volts, well below the 7 volt maximum rating. Component cost is only $2 or less, including the fuse. This is quite a worthwhile addition to your multi-chip counter or repeater identifier with many dollars of TTL circuitry—all of which could conceivably blow out if their power supply failed.

Before closing this month, I would like to request that all of those writing to me, or the companies mentioned in the column, for information, please enclose a self-addressed, stamped envelope, not just postage. The amount of mail received is occasionally rather large and the above measure will make possible the quickest answer.

73, Irv, WA2NDM

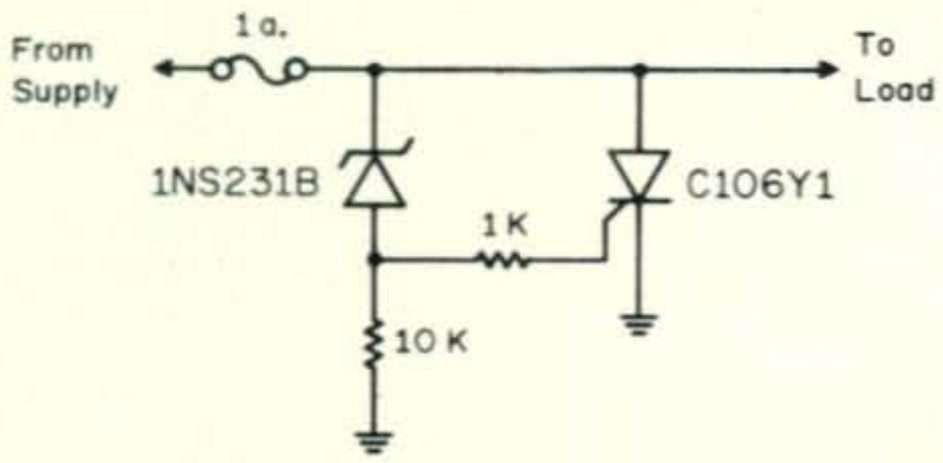

Fig. 4—A simple 5 v. "crowbar" circuit. Note that the 5 v. supply must have a short circuit current of more than 1 amp.

CQ Reviews: The Curtis Electro Devices EK-404 Deluxe Keyer

BY RICHARD A. ROSS,* K2MGA

A LITTLE over a year ago we reviewed a novel new keyer for the c.w. DXer and contest man: the Curtis EK-402, a programmable electronic keyer which could be reprogrammed at will by the operator. This month we will take a look at another in the series of keyers from Curtis, the EK-404.

In outward appearance the EK-404 is similar to the elaborate EK-402, but in function, it is quite a bit simpler in that it does not include any of the programmable memory features of the EK-402. In design the EK-404 is similar to the earlier Curtis EK-38 with a few exceptions. Whereas the earlier EK-38 did not include a variable weighting control, this desirable feature is found in the new EK-404. Reed relay keying is now standard, and better input protection is provided.

The EK-404 Deluxe Keyer is a high quality iambic type keyer with self completing dots and dashes. The iambic feature permits alternate dots and dashes to be formed and properly spaced by simultaneously squeezing both key paddles of the external key, (none supplied with the unit, but the Brown Brothers Models BTL or CTL are recommended). In use, Morse characters such as C, R, K may be formed by simply squeezing the two paddles together, with the correct one being closed slightly sooner than the other, *i.e.*, to form a C the dash paddle must be closed very slightly sooner than the dot paddle. The dash paddle is then released slightly sooner than the dot to ensure that an extra dash is not formed. In operation, the action is quite natural after a few minutes, and is of significant value for relaxed high-speed operation, because of the reduction of hand movements needed to form many letters and numbers. Letters such as F, L, Q or Y are easily sent by holding the dash or dot paddle closed and at the proper moment hitting the other paddle to insert the necessary single dot or dash. All characters may also be sent using conventional paddle techniques rather than "squeeze keying" if desired. Single or dual paddle keys may be used, although squeeze keying requires dual paddles.

Four controls are spaced across the panel of the EK-404: Sidetone Volume, Sidetone Pitch, Weight, and Speed. An on-off switch, pilot lamp, and three position miniature toggle-type function switch complete the front panel complement. The function switch positions allow for Normal transmitter keying through the EK-404, Self Test for keying

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* Editor, *CQ*.

The Curtis EK-404 Deluxe electronic keyer.

the sidetone oscillator only without energizing the transmitter, and Xmtr Tune which closes the key contacts for tune-up purposes. The sidetone is actuated in all three positions.

The Speed control is calibrated from 8 to 50 words per minute. Weighting of characters can be varied from the standard 1:3 ratio to just under 2:3, which is equivalent to a closed key condition. The sidetone oscillator provides continuous variation of tone and volume with sufficient output available to provide an uncomfortably loud tone. Although the sidetone output is not of sine-wave quality, it is not unpleasant to the ear. Through proper selection of the clearly marked octal socket terminals on the rear of the unit, sidetone may be fed to a small bottom mounted speaker or to an external low impedance load. A high impedance audio output is also available at the socket, but this is at a rather low level, and is not varied by the front panel volume control.

Transmitter keying is accomplished through a reed relay rated at 20 va or 250 v. peak a.c. or d.c. at 1 a. Where transmitter circuitry permits, relay-less solid state keying is also possible, selectable at the rear panel socket. Arc suppression is provided for light loads. As with previous Curtis keyers, an optional heavy duty 100 va mercury wetted relay is available for keying heavy loads as in commercial or marine operation.

The power supply is transformer operated using a full wave rectifier and transistorized voltage regulator. Power requirements are 5 watts, and operation is unaffected by line voltage variations from 95-135 volts. Provision is made at the rear panel connector for battery power, requiring 8-14 volts d.c. at 300 ma.

The EK-404 makes use of an instant start clock rather than a free-running one. While both systems carry certain advantages, the instant-start clock appears to lend itself to quicker mastery of electronic keying since the first bit of each letter sent begins instantly as the paddle contacts are closed. The operator thus controls letter spacing and has a feeling of being in direct control of the keying. On the other hand, a free-running-clock keyer can only begin to send a character when the clock is ready, resulting in potentially perfect letter spacing at the expense of all vestiges of keying personality, and for the beginner, an uncertainty as to just when the character will begin to be sent. In any case, however, the advantages/disadvantages of either system begin to merge as speed is increased and experience gained.

In operation the EK-404 was found to be totally jam-proof as claimed by the manufacturer. The "extra dot syndrome" found with some keyers using a dot memory was also totally absent, although the dot memory was foolproof and reliable. Operation of the EK-404 was remarkably easy and only a few days were required for this reviewer to acquire confidence in the units' ability to mask a sometimes ragged fist. It was also pleasant to note that the standard weighting really was standard—1:3, and that the speed calibration was accurate. Curtis indicates that each unit is individually adjusted for both these values before shipping, to compensate for manufacturing tolerances in timing components.

Construction is rugged with all components and circuit board mounted to a U-shaped front panel, chassis and rear apron formed of a single piece of 12 gauge aluminum. The circuit board is glass epoxy; all components are American made and of top quality. The cabinet is of drawn heavy gauge aluminum finished in satin black textured vinyl. The panel and rear apron markings are silk screened in black on the brushed aluminum surfaces, with the front panel highlighted by bright orange trim. The EK-404 measures 8¼ long, 5¼ high and 3¾" deep. Weight is a bit over 3 pounds. The price is $124.95 less key. It is a product of Curtis Electro Devices, Box 4090, Mountain View, Calif. 94040.

—K2MGA

"Stand by for a two-tone test."

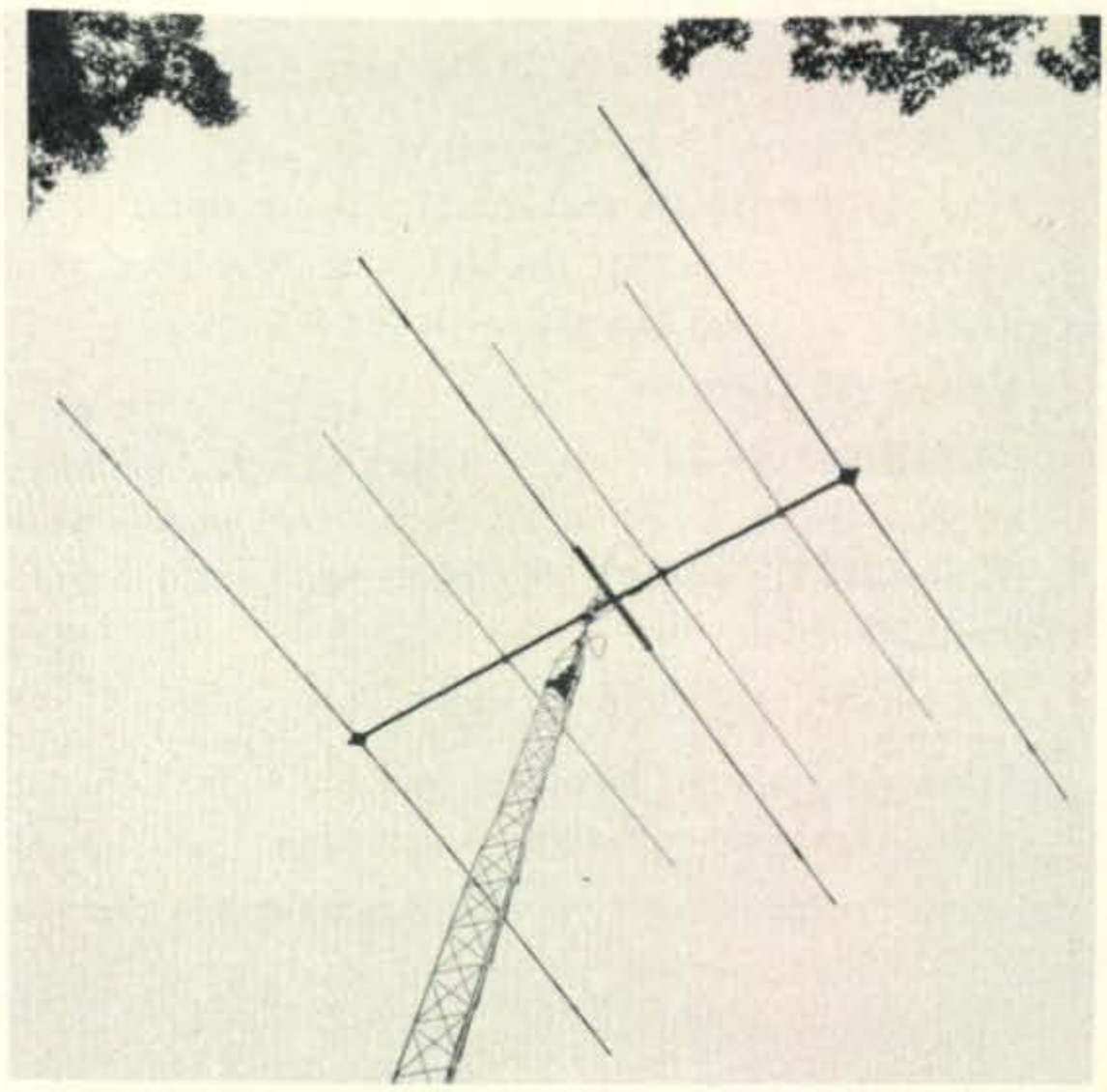
New Amateur Products

Regency 175 mHz Counter

Regency Electronics, Inc. has begun marketing a new 6-digit frequency counter designated EC-175. The compact (6½" x 2½" x 9½") unit uses 7-segment LED displays to provide readings from 5 Hz to 175 mHz to within 0.1 Hz. Five range positions provide last-digit significance of 0.1 Hz, 1 Hz, 10 Hz, 100 Hz and 1 kHz, with automatic placement of the decmial point to correspond to to the range and units being read. LED's indicates over-range readings, and the count rate. Sensitivity is 100 mv at 100 mHz. The time base is a 3 mHz oven controlled crystal oscillator. Provision is made for 10.7 mHz output for equipment alignment. The EC-175 may be powered from 120 v.a.c. or 13.8 v.d.c. The price is $449.00. Circle D on page 110 for further information.

Weinschel Trap Yagi

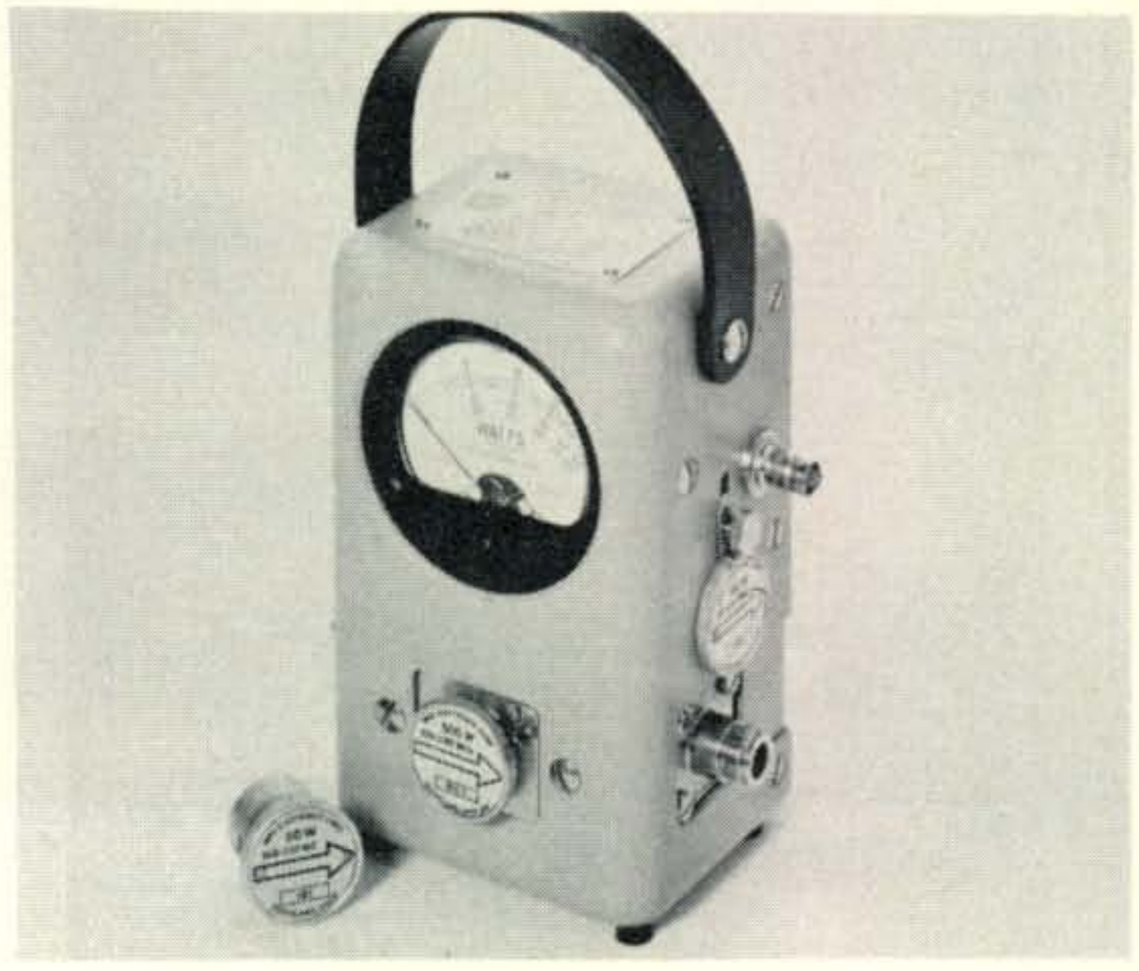
Weinschel Engineering, a newcomer to the amateur market, has introduced a three-band 6-element yagi which offers full coverage of the 10, 15 and 20 meter bands with s.w.r. of less than 1.3:1 at the band centers, and no higher than 2:1 at the band edges, except slightly higher at the high end of 10-meters. Maximum gain over a dipole is 6.9 db. The beam will handle the legal power limit. No pre-setting for phone or c.w. segments is required. Low loss traps are built on fiberglass cores. The broadband performance is achieved by trapping the 20-meter element only for 15 meters, and interlacing a separate 10 meter 3-element beam, all fed with a single feedline. The price is $139.95. For further information circle C on page 110.



Bird Model 4430 Thruline Wattmeter

Bird has announced new version of the popular Model 43 Thruline Wattmeter, designated the Model 4430. The new meter is accurate ±5% from 100 milliwatts to 1000 watts from 2-200 mHz using the same plug-in elements as the model 43, which are available for discrete bands and power levels.

Featured in the new 4430 is an r.f. sampling port for signal analysis on a scope, frequency counter or spectrum analyzer. Sampled output is 53 db below the main signal level from 10-512 mHz, and below 10 mHz decreases to -70 db. The price is $145; plug-in elements are $32.75. For further information circle A on page 110.



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High/Low power switch offers variable power output ranges of .1 to 10 watts. This makes the Inoue IC-20 and IC-21 ideal for mobile and portable use.

ON FREQUENCY ASSURANCE

Trimmer caps on both Rx and Tx for all channels provide on frequency assurance.

IC-21

24 Ch.

10 W.

$389.00 With 7 Channels Supplied

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MODULAR CONSTRUCTION — A REAL INOUE PLUS

Each hand-assembled section is enclosed in a metal module.

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The Inoue IC-20 and IC-21 are engineered to stand up under extreme stress. Metal encased plug in modules eliminate the hazzards of single board construction.

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Each unit is covered by a 90 day warranty. Service problems are quickly solved and down time is minimized by our Module Replacement Program.

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602-942-9715

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Hollywood, California 90028
213-225-6620

Sequoia Stereo
773 8th St.
Arcata, California 95521
707-822-328

NEW MEXICO

Robert Foster Sales
Box 198 Escevosa Star Route
Tieheras, New Mexico 87059
505-281-3975

OKLAHOMA

Blacks Radio Company
413 N.E. 38th Terrace
Oklahoma City, Oklahoma 73105
405-528-0193

Devlin Electronics
4817 E. 35th Ct.
Tulsa, Oklahoma
918-742-7246

TEXAS

Bellaire Electronics Supply
5204 Bellaire Blvd.
Bellaire, Texas 77401
713-667-4294

Electronics Center Inc.
3939 N. Haskell
Dallas, Texas
214-526-2023

Trimble Electronics
2810 Alexandria
Tyler, Texas 75701
214-593-1123

WASHINGTON

NHE Communications
15112 S.E. 44th
Bellevue, Washington 98006
206-747-8421

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ICOM **WEST** **1251 170th N.E., Bellevue, Washington 98008**
Dealer Inquiries Invited

DX

BY JERRY HAGEN,* WA6GLD

SPRING band conditions should be in full swing by now and hopefully the decline of Cycle 20 remains slow and provides some 28 mHz openings for those finishing up their *CQ* DX Award 28 mHz endorsement of 5 Band DXCC.

De Extra

In the November 1971, *CQ* DX COLUMN a plea from a leading WPXer asked that Special Exhibition Stations with Special Prefixes make an effort to work as many stations as possible due to the great popularity of the WPX Award Program through the world. To improve the quality of Special Prefix Operations in the U. S., De Extra proposes that the following suggestions be considered:

1. Plan special call authorization operations well in advance so that publicity and rig considerations receive maximum effectiveness. The FCC requests 60 to 90 days to process the application for a special call. When writing to the FCC be sure to state the location for the special station and give background on the occasion for the authorization. Activities warranting a special call are usually at local or state level and in conjunction with some civic group or organization. Be sure to state the name, call, class of license and expiration date for the Trustee. After obtaining the call, magazines such as *QST* and *CQ* are glad to publish information on operating frequencies and times; however, a 3-month lead time is generally required. Weekly DX Bulletins such as the *DX News Sheet* (from England), the *DXers Magazine* and the *West Coast DX Bulletin* provide more rapid dissemination of information. The *CQ* WPX Manager will be glad to provide information on obtaining and operating a special call station for any interested groups.
2. Plan to have sufficient equipment to produce a good/strong signal. Usually, a local amateur radio store would be glad to provide equipment in exchange for the publicity at the station and on the QSL card! A small triband beam is usually easy to install and gives much better results than dipoles and verticals.
3. Plan to have plenty of operators and preferably some with contest experience. Most clubs have some operators who have been active in DX Contests, Sweepstakes or Field Day who can provide hints on proper operating technique. Normally, much time is spent to obtain a special call and install a station, so why not make as many QSO's as possible?
4. Plan to use frequencies and times so that DX stations and distant W/K operators have a chance to work the special call.

*P.O. Box 1271, Covina, California 91722

The WAZ Program

S.S.B. WAZ

1043.....I1DAB
1044.....JA3LDH
1045.....W4EAL
1046.....KX6FJ
1047.....DL1MD
1048.....DJ8PB
1049.....DJ3LF
1050.....G3OLY
1051.....VE4JK

C.W.—Phone WAZ

3461.....DJ6LD
3462.....WA6INK
3463.....K3CNN
3464.....W4VJH
3465.....PAØLRK
3466.....VE3UOT
3467.....OE3FWW
3468.....W2FYS
3469.....W5PAQ
3470.....DK5EL
3471.....DJ5MS
3472.....WA4HHW
3473.....ZL1BKR
3474.....WØHZ
3475.....W5KHP

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

George, LZ1NE at the rig. His XYL, Radka signs LZ1NI. *(Photo Via W2MLO.)*

CQ DX Award Honor Roll

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 273 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. The total number of current countries on the DXCC list is now 320, however several additions are in process.

CW

K6EC	316	WØAUB	303	W6ISQ	293
W6ID	316	DL3RK	302	WA6EPQ	292
W8LY	309	ON4QX	300	W4YWX	285
K6LEB	307	W6NJJ	297	WA6NWS	285
W4IC	306	W4BQY	295	WA6DEA	284
VK3AHQ	305	K1SHN	293	DJ7OX	276

2XSSB

TI2HP	319	WA2EDQ	310	YV1KZ	299
W2TP	319	W6IMV	310	OZ3SK	298
W3NKM	318	XE1AE	310	K1SHN	298
W9ILW	318	F2MO	308	YS1O	298
DL9CH	317	VE2WY	308	ZL3NS	298
IØAMU	317	G3DO	306	WØYDB	295
WA2RAU	317	I1AM	306	WB2RLK	292
K2FL	316	W9QLD	306	XE2YP	292
W6REH	316	VE3ACD	305	YV1LA	292
W6RKP	316	F9MS	304	K8GQG	289
G3FKM	315	K6EC	304	K1KNQ	285
SM5SB	314	I1ZV	303	HP1JC	283
W6EUF	314	W6KZS	302	K3GKU	283
W6NJU	314	W6FW	301	OE2EGL	279
ZS6LW	314	VE3GMT	300	WAØKDI	279
I8KDB	313	WA2HSX	300	WAØCPX	277
VE3MR	313	K4HJE	300	W8ZOK	275
W3AZD	313	W9KRU	300	DL1MD	274
W3DJZ	313	ZL1AGO	300	K9LUI	274
W6KTE	313	G3RWQ	299	G3KYF	274
W9JT	313	KH6BB	299	G3WW	273
W9DWQ	312	WA3IKK	299	OK1MP	273
IT9JT	311	K4RTA	299	WØSFU	273
W4IC	311	WA6MWG	299		

Operations over a weekend or early evening operation generally produce more QSO's per hour than during weekdays. It is highly recommended that maximum operation be made on 20 meters. De Extra suggests that 14.030 mHz c.w. and 14.300 mHz s.s.b. be adopted as standard frequencies for special call operations. This allows the WPXer to check a known frequency on a frequent basis and to work prefixes which have not had time to announce operation ahead of time. Using these techniques some Special Call Stations have made over 1,000 QSO's per day during the special call period.

5. QSL information is much easier when a QSL manager is provided. Be sure that the QSL manager selected has his proper address in the call book for several years before the operation date. Logs should be kept in GMT time and Date and an SASE (self-addressed stamped envelope) requested makes life more bearable for the QSL Manager (the KD6USA QSL Manager received close to 300 QSL's within three days after the operation was completed). An operator can merely state "QSL to W2XXX with SASE Please." Inexpensive, but attractive QSL's can generally be designed by someone with access

to proper art equipment. In large quantities (over 2000), QSL printing is quite reasonable (one to two cents per card). Most operations receive requests for QSL's from about 50 percent of the QSO's made.

6. The *CQ* DX COLUMN and the WPX Manager are always glad to receive information about the operation after its conclusion. This is especially true if advance information has not been published.

DX Assistance Projects

Two DX assistance programs have been initiated on the West Coast which will endeavor to provide help for DX stations similar to that provided by the International DX Association. The Southern California DX Club has formed Project ECO-Education, Construction and Operation, while a group of prominent Northern California DXers have formed the Northern California DX Foundation. Project ECO hopes to encourage activity in the Pacific and Asia by providing Educational material such as handbooks, magazines and construction information or components. Operational assistance such as QSL's, QSL Managers or information on DXing and propagation conditions will be provided. Prominent DXers in the Pacific and Asia have been contacted and suggestions for possible recipients are being solicited. At this time, a number of handbooks, magazines and some components have been sent to Southeast Asia. In past years, the SCDXC has provided rigs to the Maritius Amateur Radio Society (which was used by 3B7DA) and to SU1MI. Further information can be provided by W6APW or K6LOM.

The Northern California DX Foundation hopes to foster good will through DX projects including all types of assistance to DX stations. The full objectives of the Foundation are still in the formative stage with several projects in work for 1973. Further information can be obtained from W6MAV or K6KQN.

The *CQ* DX Department wishes these new endeavors well and hopes that they can accomplish their objectives and indeed foster DX good will and more activity in all areas of the world.

WPX News

We continue to receive questions on the WPX status of Special calls, such as VU25, C21, C29 and others. The determination of a prefix is by WPX rule 3A (page 67, *CQ*, Feb. 1972). Only the first 2 or 3 letter/numeral combinations are counted for WPX. Thus, VU25 counts as a VU2 while C21 counts for C21 and C29 counts as C29. The same reasoning applies to the USSR special calls used in early 1972.

The Army and Navy combined for highly successful Armed Forces Day activity. WU3SNA was activated in 1971 and 1972 while KD6USA provided nearly 3000 QSO's in 1972.

The *CQ* WW Contests brought quite a bit of WPX activity, especially from the XE and CX boys who activated special calls. Heard from Mexico were 6G1AA, 6F1J, 6J1M and XI1IX. From Uruguay CW2CS, CW3AA and CV8BBH were active. In Venezuela the 4M prefixes were used with 4M5BPJ, 4M-4UA, 4M4AGP and YX5AJ active. Another rare prefix, YV6, was active with the reciprocal call K5LWL/YV6. In Nicaragua WPX

The CQ DX Award Program

C.W. DX

106	W4YWX	108	DJ3LR
107	K2GBC		

S.S.B. DX

243	F9MD	246	W4ZAA
244	W8PQD	247	DJ1XU
245	K3KNH		

Endorsements

C.W.: DK3DF-200; DJ3LR-150

S.S.B.: WA6MWG-300, G3OLY-250, DJ1-XU-200, W8PQD-150, K3KNH-150, W4-ZAA-28 mHz, K6SSN-28mHz, W8PQD-28mHz, W9EVD-28 mHz

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

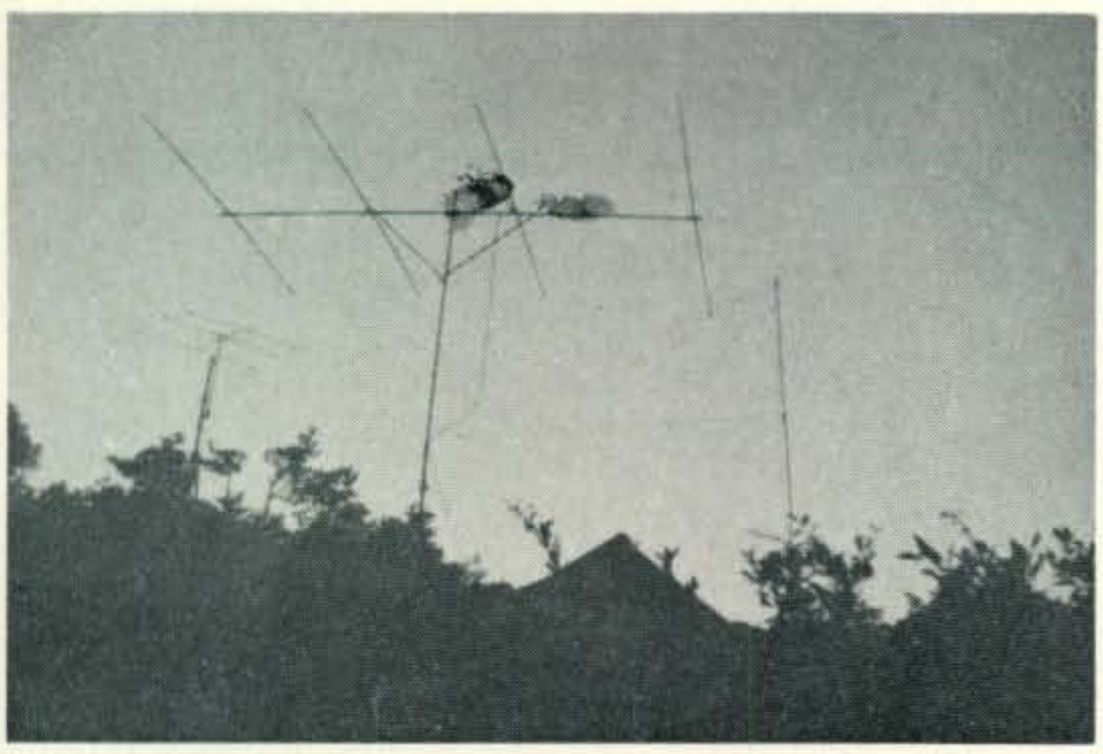
At the top of the CQ DX Award CW Honor Roll is Vip, W6ID. His transmitter is homebrew and feeds a 4 el. 20 meter yagi.

activity was stimulated by HTØA and HTØV. QSL information for these stations is included in the QSL Manager section.

DXpeditions also provide some good prefix activity with DJ6QT providing TYØABD and 5V8WS activity. PY2WH and PY2MI provided activation of the Brazilian PTØ, PQØ, ZZØ, ZWØ and PSØ prefixes from St. Peter and Paul Rocks, Trinidad and Fernando de Noronha.

The Japan Posts and Telegraphs is working on some changes in JA call signs to denote class of license. It is also rumored that they are attempting to do some prefix trading and to obtain all J prefixes by relinquishing other allocations such as 7J and 8J.

PAØSNG notes that Netherlands amateurs have a yearly contest to work the most pre-



JA4ONZ uses his country QTH to best advantage with this FB Antenna setup consisting of a 4 el 20 meter yagi, 10/15 meter yagi and long wires for 40 and 80 meters.

THE WPX PROGRAM

S.S.B. WPX

722.....VE1ANZ
723.....WB5CBJ
724.....WA2VDA
725.....K2AAC

C.W. WPX

1216.....DJ4EJ
1217.....G3DPX/W6
1218.....F9TE
1219.....WB2NSD
1220.....K6ZDL

Mixed WPX

364.....W2OVC
365.....WA5ZWC
366.....WB4SPG
367.....WØSQD
368.....W6KYA
369.....F9TE
370.....WA2VDA
371.....OZ6HS

WPNX

52.....WN6CKR
53.....WN4RGQ

VPX

48.....I1-12387

WPX Endorsements

S.S.B.: 900—IØAMU, 550—W3YHR, 500—WA1KYW, 450—WA5ALB.

C.W.: 750—K7ABV, 600—W3URE, 450—W4KFB, W6CLM, W6NJU, K6ZDL, 400—F9TE, 350—K1DEK.

Mixed: 950—YU1AG, 850—W4CRW, 650—WA2EAH, W6NJU, 600—W3YHR, 500—F9TE.

80 Meters: W4WSF.

40 Meters: K4CIA.

15 Meters: W2EHB.

10 Meters: K4CIA.

Africa: W4NJF.

Asia: W4NJF.

Europe: W4NJF, F9TE.

North America: W4NJF, K3NEZ.

Oceania: W4NJF.

South America: W4NJF.

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

fixes on each band plus a special award for top score on all bands! Now that's real WPX enthusiasm! PAØSNG hopes to reach the 1000 sticker for his mixed WPX Award this year.

Canadian World DXpedition

A group of Canadian DXers headed by VE6BAA has announced plans for a Multi-Year DXperition which should have been initiated by A51 activity in January. Some spots mentioned are AC3, AC4, MP4M,

XZ2, 3C1 and YK. The group hopes to have a large ocean-going trimarran ready for activating islands throughout the world. Frequencies announced for transmitting are:

S.S.B. 3.770, 7.080, 14.190, 21.245, 28.550

C.W. 3.505, 7.004, 14.025, 21.025, 28.025

A trophy will be awarded annually to the amateur radio station which provides proof of the most QSO's with the DXpedition (only one QSO per mode for each band is permitted). Upon completion of the boat, the trophy winner will also receive a 2-week vacation onboard as a full participant in the DXpeditionary activities.

Here And There In The World Of DX

The FEARL (KA's) are holding a club DX Contest for a 30-day period with the member working the highest number of countries to receive a trophy—Irish Amateurs have incorporated "The Amateur Radio Society of Ireland" to encourage and develop Radio Communication and Radio Experiments in EI Land!—Eric, 9H4G makes the new 9H4 prefix available on s.s.b. and is waiting for QSL's to apply for WAZ and the *CQ* SSB DX Award. A new Quad has helped boost the signal for DXing.—Fr. Dave has been active as CEØAE/6 and hopes to have returned to Easter Island by this time.—The Camel Drivers Radio Club (YA) held Field Day in September, but QRPP Battery Power rigs and poor conditions limited the contact total to 32.—YU1OBY (Jan Nebojsa, Vladetina 16/II UL., 11000 Belgrade) would like to exchange butterflies and stamps with someone in W/K Land.

QSL Information

Charles Lambert, WA4EPH (6300 Binns Ave., Richmond, Va. 23225) would like to volunteer his services as a QSL Manager for some DX Stations in need of QSL help.

CW2CS—Via CX2CS
CW3AA—Via CX3AA
CV8BBH—Via CX8BBH
DU1EN—Via CX8BBH
F9ACO—Via K1IXG
FGØAMC/FS7—Via F2QQ
FGØAMF/FS7—Via K2KGB
FP8AA—Via K2OJD
FP8DH—Via VE6AYU
G5BAT—Via K1IXG
GD5BBG—Via K4TSJ
GD3RFK—Via K4TSJ
HI8LC—W2OFB is no longer Mgr
HTØA—Via DL3OH
HTØA—Via YN1VMD
JA3IG—Via WB4SPG
KA1DX—Via WA6AHF
KL7HNN—Via K3ZMI
PY2PA—Via W3DJZ
PY2PE—Via W3DZJ
VK2BVC/9—Via Golden Gate Qsl, 71 Surrey St., San Francisco, CA
VP8MS—Via K4MZU
VQ9HCS—Via WA1HAA
VR3AC—Via K3RLY
XI1IX—Via XE1IX
XT2AC—Via DJ6QT
YBØABE—Via K5GWZ
K5IWL/YV6—Via K5LPE
YX5AJ—Via YV5AJ
ZD3Z—Via OH2NB
ZD8US—Via K8NSA
ZF1VD—Via W4HAW
ZS6ZE (DX)—Via G3JXE
ZS6ZE (W/K)—Via K9MKX
3AØCV—Via K1IXC
4M4UA (CQ WW)—Via W6CUF
4W1BC—Via G3SUW
TJ1AX—Via W6KTE
TU2BB—Via WB4SPG
TY8ABB—Via WB4SPG
TYØABD—Via DJ6QT
TZ2AC—Via DJ6QT
6G1AA—Via W2GHK
GF1J—Via XE1J
6J1M—Via XE1FFC
9Q5RD—Via W9AES
9Y4US—Via K8NSA
9Y4VT—Via W3DJZ

W7VRO—(P.O. Box 981, Bellingham, WA 98225) is QSL Mgr. for the following:

	From		To		
CR6AI	5	Oct. 66			
CR7CH	1	Dec. 71			
CR7IK	23	May 70			
CR7FR	1	Sept. 71			
HK7UL	1	Feb. 66			
HM1AB	1	Aug. 65	27	Nov.	66
HM9AB	1	Aug. 65	27	Nov.	66
KR6MB	6	Mar. 67	28	Aug.	68
KR6NG	20	July 69			
KZ5GN	13	Sept. 66	8	Mar.	68
OD5EE	9	Jun. 66	2	Sept.	66
PY2BGL	1	Jun. 66			
TU2CH	24	Jun. 70	Logs overdue		
VK3UV/VK9	30	May 71	24	Nov.	71
YB9AAJ	18	Mar. 70			
YVSBMN	15	Apr. 66	26	Mar.	67
ZK1CE	5	Feb. 71	2	Mar.	71
ZK1BM	2	Mar. 71	21	Apr.	71
ZS1XR	20	Jan. 66	6	Feb.	68
5H3KJ	13	Apr. 67	22	Feb.	70
5H3KJ/A	28	Feb. 70	1	Mar.	70
5N2AAF	18	Oct. 66	1	Oct.	70
VP2LAM	12	Sept. 71			
VP2LAJ	12	Sept. 71			
8P6DM	29	Oct. 70			
FMØIX	20	Sept. 71			
VK9DM	1	Oct. 72			

73, Jerry, WA6GLD

Don't forget the CQ WW SSB Contest, March 24-25. See the Feb. issue page 63 for complete rules.

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties

#87—Clifford A. Taylor, WB4FBS, 11-16-72.
#88—Harry B. Okey, Jr., WDX6ETT, 11-22-72. (First To S.W.L.)
#89—Dean W. Laughlin, K7JWZ, 12-1-72.

USA-CA HONOR ROLL

3000	2000	
WDX6ETT . 108	WA2GPT . . 165	WA2GPT . . 202
K7JWZ 109	K4FPF 166	K4FPF 203
		K2LFG 204
		500
2500	**1500**	W1GCM . . . 922
K7JWZ 141	W5RDV . . . 201	JA6HKC . . . 923

THE March "Story of The Month" is a combination of interesting data on the Club Station, but mostly about the main County Hunter Operator, as told by Rev. Terence Koch, S.J., K6HZT, Trustee of:

Loyola High School ARC, WB6CPE

(All Counties #74, 9-14-72)

"It was in 1937 when my father was transferred from Chicago to the Los Angeles office. My mother bundled us children into our new 1937 Chevrolet and drove us to California. I think it was that trip across the country when I was six, that gave me the love of auto travel in the west that has never left me.

"Los Angeles was very beautiful then, before the freeways and smog. The Hollywood Hills and the Santa Monica mountains seemed always green and covered with poppies. We had a two acre California "ranch" and it was my job to feed the rabbits, collect the eggs, and to help pick the apricots and plums each June.

"Soon, my brothers had to go fight the war, but I was too young, I entered high school. It took me over an hour just to get to Loyola High School before the freeways were built. At the end of my senior year, the Spirit of God told me very clearly that I was to be a priest. It certainly wasn't my idea, but I entered the seminary of the Jesuit fathers whom I had met at Loyola.

"The years of schooling went by. They were all very happy years, but not exactly fun since I am not, and never have been a student. However, along with the schoolwork, there was ample time to learn of the wonderful world of prayer, meditation, and union with the Creator.

"One episode of my seminary program was to study Philosophy for three years in Spokane. I'm sure I couldn't do *that* again, but the enthusiasm of youth got me through. In Spokane, some other seminarians were hams, and I decided to be one too.

"After exactly one month of code practice, and memorizing schematics, I went down to the FCC and got my General license and the Call W7UEW.

---

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

Father Terry, K6HZT/WB6CPE and Davy.

"When I returned to California, I was given the call K6HZI. I taught high school math in San Francisco for three years and started a radio club at St. Ignatius high school, but I've even forgotten the call we had. I still had plenty of schooling to undergo. Our seminary school for Theology used to be in Los Gatos, California, where I and others operated W6RQG daily. That station was on the air for many years, and maybe some of you remember the call.

"After theology, I was ordained a priest by Cardinal McIntyre in Hollywood in 1960. I started teaching at Loyola high school in Los Angeles in 1962, and got a radio club started. We were given the call WB6CPE. Most of the students had better stations at home than we had at school, so it was not very attractive to them. I started an all out begging and scrounging campaign, and soon we had a fairly good station assembled. I encouraged them to work for awards for the club station, and we soon had DXCC, WAZ, WPX, WAC, etc. etc. They were less enthusiastic about working all states, and no student has ever shown any interest at all in counties. I suppose it has to come after DX.

"However, in checking the QSLs for award credits, I started keeping track of counties worked, and soon found it fascinating. Unlike DX, I didn't have to be at the rig at any particular hour—I could turn it on any time and there they'd be, the county hunters. I could collect counties while correcting papers, while preparing classes, and even while doing chores in the physics lab. next door. And I could also give out counties while out in the mountains, the deserts, and the wide open spaces that I love so well.

"So, I'm going around again to see if I can get them all a second time, as K6HZT. Since it only happened once that WB6CPE in Los Angeles was able to get a county from me while I was mobile in Nevada, I have *all* the County Hunters to thank for all the many counties and for the many years of fun."

In the photograph with Father Terry is his 60 lb. dog Davy. She was found in the mountains in the snow at midnight two years ago. She was then about 5 lbs., and was apparently abandoned by someone. All the county hunters know her as she goes on all the trips and she has been to Kansas City and to Peoria. Father Terry is trying to teach her to at least keep the logs, since she does not seem to be able to master the code or use the mike.

USA-CA-500-#614 was issued to WB6-

Pronto Award.

CPE March 7, 1967 and then Father Terry waited until April 14, 1972 when he had them *all* before applying for 1000-#266; 1600-#183; 2000-#150; 2500-#128; 3000-#94 endorsed All 20 SSB Mobiles and All Counties #74 endorsed All Phone.

Awards Issued

As shown in the Special Honor Roll, 3 additional County Hunters have made All Counties.

Cliff Taylor, WB4FBS/WA5ZUV, ex-DL4BO made #87, Mixed.

Harry B. Okey, Jr., WDX6ETT qualified for #88, All 14 SSB and *First to SWL,* naturally he acquired USA-CA-3000, also All 14 SSB.

Dean Laughlin, K7JWZ won All Counties #89 for #1 to Idaho, he also received USA-CA-3000 and 2500.

Bea Dietz, WA2GPT, applied for USA-CA-2000, Mixed and USA-CA-1500 endorsed All 14; All SSB; All Mobiles. *(Bea, thanks for those messages via the telephone).*

Paul Valentino, K4FPF increased his endorsement of his USA-CA-500 and 1000 to All 14; All SSB and qualified for USA-CA-1500 and 2000 Mixed.

Herb Skidmore, W5RDV added USA-CA-1500 endorsed All 14; All SSB; All Mobiles to his collection.

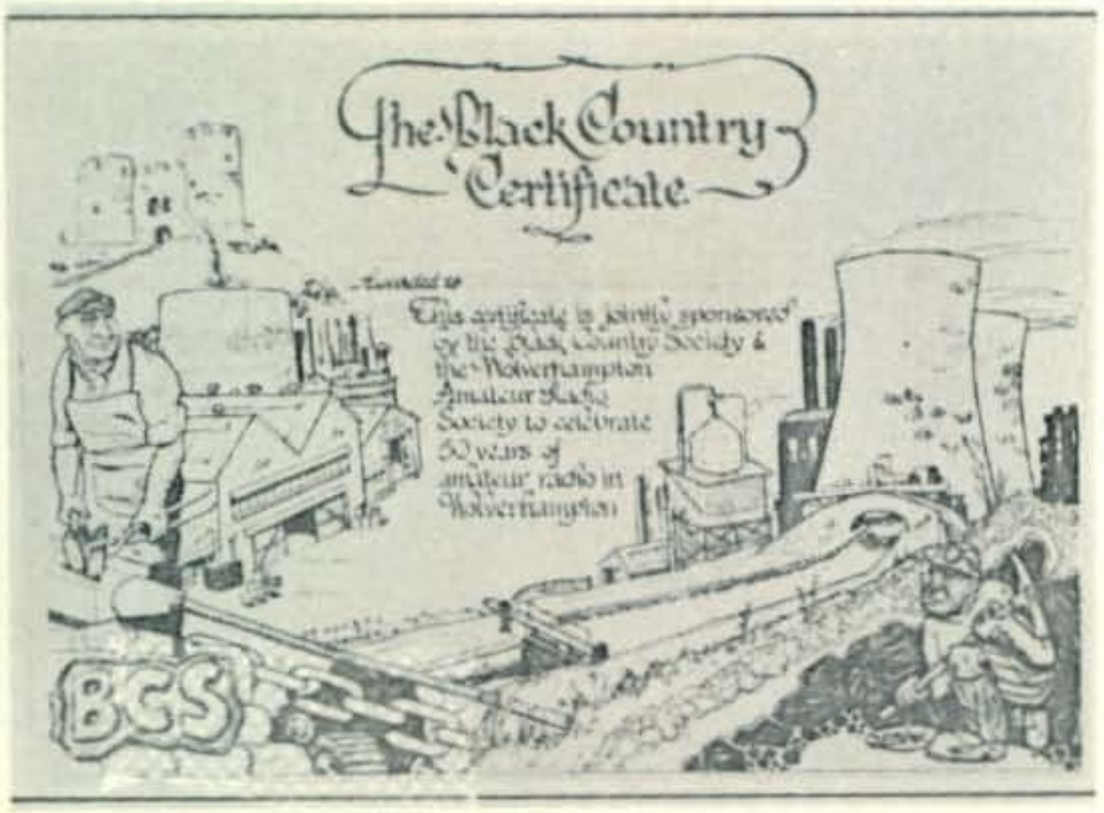
Manuel Greco, K2LFG continued to plug away and sent for USA-CA-1500.

Wendell Kincaid, Jr., W1GCM was issued USA-CA-500 Mixed.

Tamotsu Izuno, JA6HKC won USA-CA-500 endorsed All A-1. The 6th USA-CA to Asia and #1 to a JA6.

Awards

Worked All Black Country Award: The Wolverhampton Amateur Radio Society cele-



Worked All Black Country Award.

brated its 50th Anniversary in 1972 and are offering this award.

Required are four certified contacts with stations situated in an area of England known as the Black Country. This is an area of some 10 miles by 5 miles located to the North and North West of Birmingham. There are about 100 stations to choose from, although not all are active.

The area gets its name from the fact that in the early days the district was covered in a pall of smoke from the old coal furnaces. In its hey day, this was the birthplace of the Iron and later the Steel Industry. The area is defined as being located above an old but now worked-out coal field.

Stations to qualify should have a postal address in one of the following boroughs: Dudley, Walsall, Warley, West Bromwich, and Wolverhampton.

It is not necessary to send QSL cards to claim the Award, a certified log extract with details of the contacts with the required four (4) stations, plus 3 IRCs sent to: Wolverhampton Amateur Radio Society, G8TA, Neachells Cottage, Stockwell Road, Tettenhall, Wolverhampton, England—this will bring the Award via sea mail.

Pronto Award: Formerly issued by the ODXK—Otterhallans DX KLUB, with members all over the world, have requested the Award to continue, therefore the Hisingen Radio Club, SK6AW has taken over the award.

Pronto is issued to anyone who can prove 2 way QSOs with 40 different stations in SM6 (20 different stations for DX stations). QSOs must include at least 3 stations from each of the 4 "laens", (1 each for DX stations). The 4 "laens" in SM6 are: Alvsborgs lan (=P); Skaraborgs lan (=R); Goteborgs & Bohus lan (=O); and Hallands lan (=N).

QSOs of January 1st, 1950 and later are valid.

Pronto is issued for c.w., s.s.b., Mixed, RTTY and SSTV contacts and for one or more bands 3.5 through 432 mHz.

Applicant must have sent his own QSLs and received the QSLs in order to apply.

Application must include a list of confirmed QSOs showing call, date, band and mode. Send QSLs or certified list signed by a Radio Club or two radio amateurs (GCR list).

The fee is 8 IRCs or Sw. Cr. 5, amateurs in countries where IRCs are not available may use unused stamps from their own country in the proper value. Send to: SK6AW Awards Manager, P.O. Box 53055, 400 14 Gothenburg 53, Sweden.

Notes

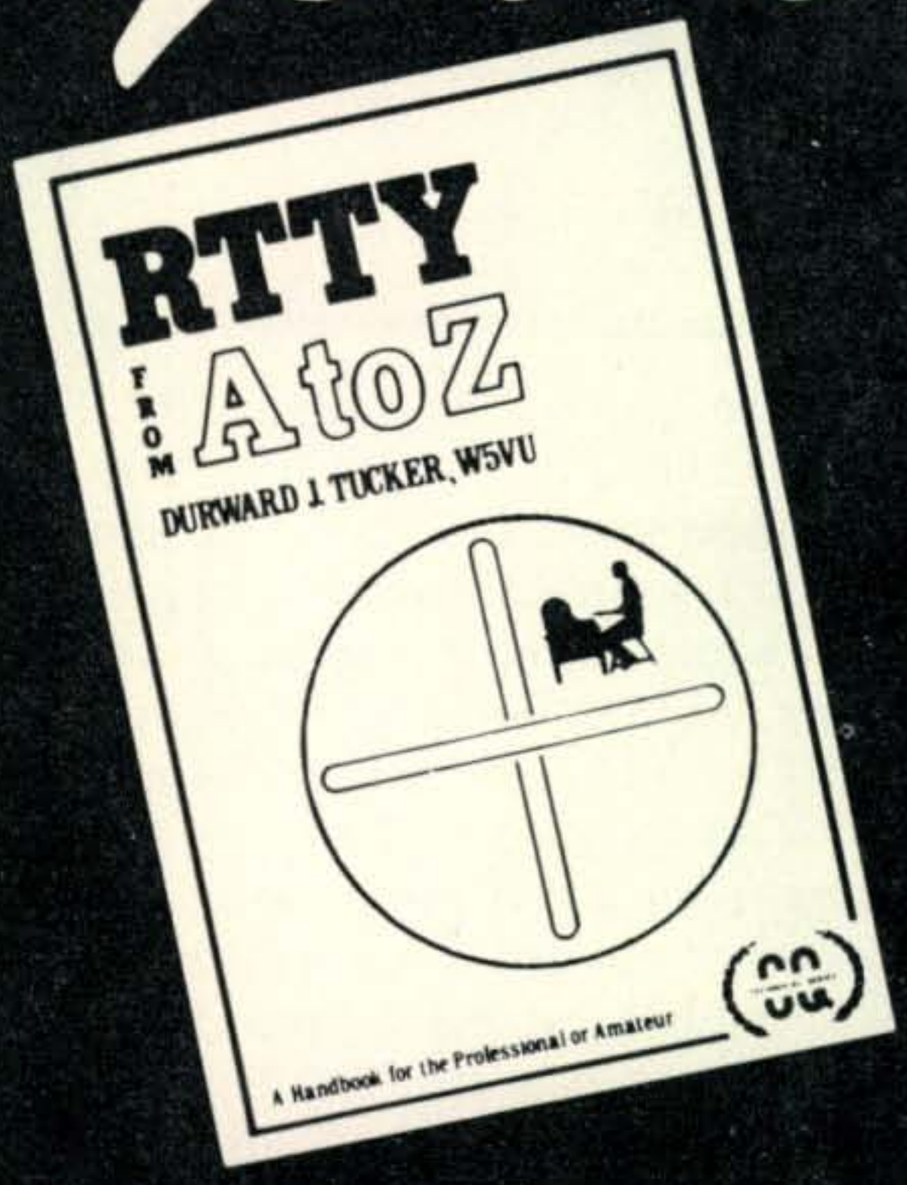
Leave it to Bertha WA4BMC to come to my rescue, first getting much data and fotos for "Stories" and also now explaining about WPE vs WDX. Prior to 1971, Popular Electronics carried/issued WPE (W Popular Electronics) calls for s.w.l.s. When they dropped it, Hank, WDX2FT picked it up and they call it Monitor & DX Hqtrs and he is Director and Amelia J. Greenward, WDX-2BA is Director of Monitor Registration. For any additional details send s.a.s.e. to Bertha, WA4BMC. Oh yes, this was brought to my attention when Harry, WPE6ETT suddenly became WDX6ETT.

In my column last August, I had the pleasure of using some of the very fine data that Don Brickley, W7OK compiled in his *County Hunting History*. As you realize, no one intended to slight any County Hunter, but I got a couple of letters mentioning that some calls were left out, I will gladly list them, but again I'm sure I will leave some out, so I'll apologize before hand. Here are some that have been left out: WAØKGD, WAØLRQ, K5-KDG, W4ARH, WA5OCG, K1VTM, K4-AVX, W7GUH, WB2ZSO, W1BHV, K9-KKK, WA8TEL, WA8NDL, K5HKG, WA8FSX, K1GUD, WA3LGA, WA3HGV, WAØJRZ, WØYLN, K7ZJP/WA5WWW, WA4OIV, K4MHS and W3HCW.

Don't forget the 2nd Annual County Hunters SSB Contest sponsored by MARAC 2200 GMT April 13th to 0500 GMT April 16. See, CONTEST CALENDAR by Frank Anzalone, W1WY for full details.

And don't forget to write and tell me, How was your month? 73, Ed., W2GT.

years in the making



RTTY FROM AtoZ

DURWARD J. TUCKER, W5VU

Drawn partly from the pages of **CQ**, and partly from previously unpublished material, this new RTTY classic has been produced to fill the void in RTTY knowledge among amateurs and professionals alike.

Written to round out the amateurs' RTTY bookshelf which up to now has relied solely on another **CQ** classic: "The New RTTY Handbook," the combination of the two is unbeatable. To properly describe the scope of this volume would demand a volume in itself, but the chapter headings below tell the story:

Chapter 1—**RTTY Basics.** Chapter 2—**The Teletypewriter.** Chapter 3—**Teletype and Radio Reception.** Chapter 4—**Converter (Terminal Unit) Basics.** Chapter 5—**Polar Relays and Distortion.** Chapter 6—**Special RTTY Circuits.** Chapter 7—**Test Sets.** Chapter 8—**Machine Adjustments.** Chapter 9—**Tape Printers.** Chapter 10—**Kleinschmidt Machines, Tape Readers, Teletype Models 28 and 32.** Chapter 11—**Codes, Data Processing & Advanced Machines.** Chapter 12—**Distortion Producing Test Sets.** Chapter 13—**Regenerative Repeaters and Frequency Shift Monitors.** Chapter 14—**Terminal Units.** Chapter 15—**The RTTY Station.** Chapter 16—**FCC Rules, Operating Procedures.**

This 224 page volume is finely printed on high quality paper with rugged card-stock cover for years of regular hard use. Hundreds of line illustrations and call-out type photographs. Detailed and complete index of U.S. Government Technical Manuals relating to RTTY; Glossary of RTTY Terms; and a 258 entry Index.

Your technical library won't be complete until it includes a copy of **RTTY FROM AtoZ**

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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Feb.	24-26	Vermont QSO Party
Mar.	3-4	ARRL DX Phone Contest
Mar.	10-11	World Wide VHF Contest
Mar.	10-11	YL-OM C.W. Contest
Mar.	11	WAB HF Phone Contest
Mar.	10-11	RSGB BERU Contest
Mar.	10-11	Israel DX Contest
Mar.	10-12	Virginia QSO Party
Mar.	17-18	ARRL DX C.W. Contest
Mar.	**24-25**	**CQ WW WPX SSB Contest**
Mar.	24-26	BARTG Spring RTTY
Mar.	25	WAB HF C.W. Contest
Mar. 24-Apr. 1		IARC Propagation Phone
Apr.	1	WAB LF Phone Contest
Apr.	7-8	SP DX C.W. Contest
Apr.	8	WAB LF C.W. Contest
Apr.	13-16	County Hunters SSB
Apr.	14-15	Space Net VHF Contest
Apr.	21-22	Bermuda Phone Contest
Apr.	28-29	DARC RTTY Contest
May	5-6	Bermuda C.W. Contest
May	5-6	Helvetia 22 Contest
June	1-4	CHC FHC HTH QSO Party
June	17	WAB VHF Phone Contest
June 23-July 15		NRL 50th Anniversary

Israel International Contest

Starts: 0001 GMT Saturday, March 10
Ends: 2400 GMT Sunday, March 11

In celebration of the 25th Anniversary of Israel and of Israel Amateur Radio, the Israel ARC has organized this International contest.

Use all bands, 3.5 thru 28 mHz, phone and c.w., but only one QSO per station, per mode, per band. The contest is open to single operator stations only.

Contest operation is limited to 36 hours out of the 48 hour contest period. The 12 hours of non-operation may be taken in one but not more than 3 periods and must be clearly indicated on the log.

Exchange: The usual 5 or 6 digits, RS(T) plus a progressive QSO No. starting with 001.

Points: Contacts with stations in the same continent 1 point, inter-continental 5 points. Stations in the same country may be worked for multiplier credit but have no QSO value.

Multiplier: One for each country worked on each band. (ARRL DXCC list.)

Final Score: Total QSO points multiplied by the sum total of countries from all bands.

Awards: There is a 1st Place Grand Prize which will be presented to the Top Scorer in the contest at the International Symposium of Amateur Radio at the Satellite Era meeting in Netanya, Israel, June 24 thru 29, 1973.

Transportation and all accommodations will be provided by the Contest Committee.

To qualify for the Grand Prize the contest log must contain 25 *different* 4X/4Z contacts.

There are also seven Trophies, that do not have to meet this quota, for the continental leaders. (Australia and Oceania are treated as separate areas.)

More detailed information may be obtained by sending a s.a.s.e. to WB2WOU, Herbert Rugoff, 306 Hooper Ave., Toms River, N.J. 08753.

Logs go to: 25th Anniversary of Israel Radio Contest, c/o 4Z4HF, Joseph Lieberson, Kibbutz SASA, Israel.

RSGB BERU Contest

Starts: 1200 GMT Saturday, March 10
Ends: 1200 GMT Sunday, March 11

We do not have the full details for this one but since it is restricted to RSGB members residing in the United Kingdom, and amateurs licensed to operate within the British Commonwealth and Mandated Territories, I am sure those eligible to participate know what it is all about.

For those not meeting the above requirements, I would suggest you avoid calling stations active in the BERU.

Additional information can be secured from: RSGB HF Contests Committee, c/o

* 14 Sherwood Road, Stamford, Conn. 06905

D. J. Andrews, G3MXJ, 18 Downsview Crescent, Uckfield, Sussex, England. For those competing, your log must be received before May 15th.

Virginia QSO Party

Starts: 1800 GMT Saturday, March 10
Ends: 0200 GMT Monday, March 12

This year's Party is sponsored by the Sterling Park ARC. The same station may be worked on each band and each mode, and Virginians may work other in-state stations.

Exchange: QSO no., RS(T) and QTH. County for Virginia stations, state, province or country for others.

Scoring: One point per QSO. VA. stations multiply total QSO points by sum of states, provinces, countries and Va. counties worked. Out-of-state stations use Va. counties worked for their multiplier (max. of 98).

Frequencies: C.W.—60 kHz in from low end of each band. Phone—3930, 7230, 14285, 21375, 28575. (Check phone bands on even hours.)

Awards: Certificates to high scorer in each state, province, country and each Virginia county. Special certificate to the Top scorer out of state.

Indicate each new multiplier worked on your log. And a summary sheet and check list is also requested with your entry.

Logs must be received no later than April 15th and go to: Pete Raymond, K4EKJ, 804 So. Adler Ave., Sterling Park, Va. 22170. Include s.a.s.e. for copy of results.

B.A.R.T.G. Spring RTTY Contest

Starts: 0200 GMT Saturday, March 24
Ends: 0200 GMT Monday, March 26

This one is being sponsored by the British Amateur Radio Teleprinter Group and is open to all amateurs as well as s.w.l.'s.

All band 3.5 thru 28 mHz may be used, but not more than 36 hours out of the 48 hour contest period may be used for scoring. The 12 hours of non-operation can be taken at any time but in not less than two hour periods. Indicate on/off times in your log.

Exchange: Time GMT, QSO no., and RST.

Points: Contacts within one's own country, 2 points. Contacts with other countries, 10 points. A bonus of 200 points will be earned for each new country worked on each band. The same station may be worked on each band for QSO and multiplier credit.

Multiplier: Is total sum of countries worked on each band. And the number of continents worked. (Counted only once, max. of 6.)

Final Score: (a) QSO points × country multiplier. (b) Bonus points × continents. (c) Add totals from (a) and (b) for final score. The ARRL country list plus VO is the standard.

Awards: Certificates to the leading scorers, and also s.w.l. RTTYers. Scores made in this contest are valid entries in the "World Champion of RTTY" competition. There are also awards for working 25 countries or 6 continents.

Logs must be received by May 31st and go to: Ted Double, G8CDW, 89 Linden Gardens, Enfield, Middlesex, England. EN1 4DX.

Results 1972 H-22 Contest

United States

W1PL	**10,011**
K1SHN	6,384
W1TX	2,880
WA1POD	1,350
K2BK	**8,844**
W2KHT	3,042
W2DF	1,944
W2BWW	1,020
WB2CMO	741
W3ARK	**8,208**
W3GID	5,940
W3GFB	1,649
W3GN	429
WA3PWY	429
WB4OGW	**6,090**
K4IEX	5,280
W4KMS	2,310
W4WSF	462
W4JUK	300
WA5JDR	**702**
WA5ZWC	312
W5QAM	126
K6OC	**2,448**
W6ISQ	1,680
W6GBY	1,020
W6KYA	765
W6UZX	630
W7QK	**1,482**
W8VSK	**10,293**
W8DA	4,278
W8GOC	2,550
W8VKU	108
W9OHH	**2,514**
W9QWM	756
WB9EAQ	243
KØDYM	**4,557**
WAØKDI	**1,321**

Canada

VE1AE	**1,392**
VE2HN	**528**
VE3BR	**3,108**
VE3GCO	2,886
VE3BWY	2,436
VE3DEB	897
VE4MF	**396**

Here is Yuri Blanarovich, VE3BMV (formerly OK-5BU) receiving the Jack Baldwin, VE3BS Trophy for All Band Canadian Phone winner in the 1971 CQ World Wide DX Contest. The presentation was made by Jack at the DX Forum during the Radio Society of Ontario Convention last November 4th. Holding the "keeper trophy" is Miss Sonya Nazarkewycz, soon to become Yuri's XYL.

(Photo credit. VE3CJK, Chris Christiansen)

IARC Propagation Contest

Phone: March 24 to April 1

Starts: 0001 GMT Ends: 2400 GMT

This is the phone section of "The Contest with a Purpose." The c.w. portion was run last month. Complete rules in last month's issue.

Keep in mind that stations worked in other activities can be credited in this contest as long as the correct IARC Zones are given. Therefore your WPX SSB activity can be used for credit in this contest.

Official log sheets, CPR Zone map, IARU country list and all inquiries should be sent to K4ZA.

Logs go to: L. M. Rundlett, K4ZA, 2001 Eye Street, N.W. Washington, D.C. 20006.

Claimed Scores
1972 CQ WW DX C.W. Contest

Single Operator
All Band

4M4AGP	2,518,665
HS4AGN	1,186,150
KH6IJ	1,174,896
W6RR	1,153,680
W3GRF	1,004,226
WA6DKE	959,900
W4NQA	793,968
W9LKJ	757,575
9L1JT	676,600
EA2IA	656,772

28 mHz

W4KFC	100,631
XW8EV	80,808
9H1CH	74,617
W4UZF	62,250
SMØFY	46,060

21 mHz

G3HCT	242,995
WB5DYY	183,921
G5BAU	181,204
K8WWU	172,805
W4AAV	161,862
K1HVV	118,755
K6QZ	113,064

14 mHz

PZ1AH	463,188
WA5JMK	198,203
YV5CEP	194,910
WA6IQM	168,276
W6BH	165,648

7 mHz

W5WZO	190,995
OH2KK	164,916
WA2FCA	98,790

3.5 mHz

KV4FZ	153,202
W1MX	80,410
W3MFW	74,976
YV5AW	66,250
YV1BCD	59,508

1.8 mHz

ZF1GS	11,124
WA4SGF	2,542
W1BB	2,088
OL1AOH	1,843

Multi Operator
Single Transmitter

K6SEN	1,823,212
VE1AST	1,749,766
PJ9JT	1,258,425
DLØWW	913,824

Multi Operator
Multi Transmitter

W3FRY	2,258,772
JA2YEF	1,016,868

CQ WW WPX SSB Contest

Starts: 0000 GMT Saturday, March 24

Ends: 2400 GMT Sunday, March 25

Complete rules in detail were published in last month's issue.

There are no changes from the format used in the past few years. Only 30 hours out of the 48 hour contest period can be used for contest credit. Double QSO points for contacts on 40, 80 and 160 still remains and don't forget, the prefix multiplier is counted only once, *not* once per band. A summary sheet is a must, a prefix check sheet is also desirable. Be sure to indicate your total number of valid contacts.

Your mailing address should be one that is valid 8 to 10 months after the contest. It would be advisable that over-seas stations with APO locations should give their home address.

A new trophy has been added, USA-Single Oper.- Single-Band. The C.J. "Joe" Hiller, W4OPM Memorial Trophy is being donated by the Virginia Century Club.

Mailing deadline for your logs is May 1st. They of course go to: CQ WPX SSB Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Editor's Notes

We keep reminding the many clubs and organizations that have contest activities, that in order that the announcement appear in the proper issue, the material must be in our hands at least *three* months before the date of the activity. Even after I have sent out reminders we are still receiving announcements much too late to be used. You secretaries and contest managers will just have to get on the ball

73 for now, Frank, W1WY

Propagation

BY GEORGE JACOBS,* W3ASK

THE solar cycle appears to be declining again! The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 38 for November, 1972. This is the lowest mean value recorded since early 1966. It results in a 12-month running smoothed sunspot number of 72 centered on May, 1972. The sunspot cycle is based upon smoothed sunspot numbers, and this represents a decline from the level of 74 recorded for the previous month.

A smoothed sunspot number of 46 is forecast for March, 1973.

H.f. propagation conditions usually undergo noticeable change during March, as the sun appears higher in the northern sky and the length of daylight increases. Spring propagation conditions in the northern hemisphere, which begin during March, are typified by *fewer* east-west DX openings on the 10 and 15 meter bands (to Europe and the Far East, for example); a *greater* number of hours in which DX openings can occur on 15 and 20 meters; *fewer* hours for DX openings on 40, 80 and 160 meters; seasonal *increase* in the level of static on all the h.f. bands, and an *improvement* in v.h.f. inospheric propagation.

Beginning during March and continuing through April, a considerable improvement should be noticeable in propagation conditions over long circuits between the northern and southern hemispheres, for example, to Australasia, South America, southern Africa, etc. This results from the relatively similar h.f. propagation conditions that exist in the temperate regions of both the northern hemisphere (where it is spring) and the southern hemisphere (where it is fall), as compared to the more extreme conditions that exist when it is summer in one hemisphere and winter in the other. Good inter-hemisphere openings are forecast this month on 15, 20 and 40 meters, with some fair openings also possible on 10 meters, and an occasional opening expected on 80 and 160 meters as well.

The following is a brief summary of h.f. amateur band propagation conditions forecast for March, 1973. For more specific information, refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* valid during March and April, as well as *Propagation Charts* centered on Alaska and Hawaii. The Short-Skip Charts contain band opening forecasts for predominantly *one-hop* openings over distances varying between 50 and 2300 miles.

For day-to-day propagation conditions expected during March, see the "Last Minute Forecast," which appears at the beginning of this column.

10 Meters: A few good DX openings should be possible during the daylight hours between the northern and southern hemispheres, but not too much else. Some fair short-skip openings should be possible during the daylight hours over distances between approximately 1000 and 2300 miles. Conditions should peak on this band during the afternoon hours.

15 Meters: This is expected to be the best band for DX propagation during most of the

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For March, 1973

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: 1, 12-13, 20, 23, 28	A	A	C	C
Normal: 2, 5-7, 9-11, 14-15, 18-19, 21-22, 24, 26-27, 29	B	C	D	E
Below Normal: 3-4, 8, 16-17, 25, 30-31	C	D	E	E
Disturbed: None	D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

B—Good opening, moderately strong signals with little fading and noise.

C—Fair opening, signals between moderately strong and weak, with some fading and noise.

D—Poor opening, signals weak with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (4) will be excellent on Mar. 1, fair on Mar. 2, and poor on Mar. 3 and 4, etc.

* 11307 Clara Street, Silver Spring, Md. 20902

daylight hours. The band should open to most areas of the world during the day, with conditions peaking during the afternoon hours. Some openings to southern and tropical areas may also be possible during the early evening hours. Excellent short-skip openings are forecast during most of the daylight hours, for distances between approximately 1000 and 2300 miles.

20 Meters: With increasing hours of daylight, 20 meters should remain open longer for DX than during the winter months. This should be the optimum band for DX propagation conditions during the sunrise period, and again during sunset and the early evening hours. The band is also likely to remain open well into the hours of darkness on paths to southern and tropical regions. Excellent short-skip conditions are expected during the daylight hours for openings between approximately 750 and 2300 miles, with many openings continuing through the evening hours as well.

40 Meters: Propagation conditions are expected to be good enough to support DX openings to many areas of the world on this band from sundown through sunrise. Conditions are expected to peak during the hours of darkness. Excellent short-skip openings are expected over distances varying between approximately 100 and 600 miles during the daylight hours, and between 600 and 2300 miles at night.

80 Meters: Some fairly good DX openings should be possible during the hours of darkness and the sunrise period. Static levels should be higher and the band noticeably noisier than during the winter months. Excellent daytime short-skip openings should be possible between 50 and 250 miles, with the distance increasing to between approximately 400 and 2300 miles during the hours of darkness. DX conditions usually peak on 80 meters when it is dark at the *westernmost* terminal and sunrise at the *easternmost* terminal of a path.

160 Meters: No openings are expected during the hours of full daylight because of intense solar absorption. Short-skip openings up to a distance of 2300 miles, and an occasional DX opening may be possible during the hours of darkness and the sunrise period.

V.H.F. Ionospheric Openings

A seasonal increase in short-skip openings due to sporadic-E propagation usually begins during March, and an occasional 6 meter opening may be possible by this mode during the month. Sporadic-E openings generally occur during the daylight hours, over distances between approximately 1000 and 1300 miles.

Trans-equatorial scatter propagation (TE) is expected to pick up during March and the spring months, and some 6 meter openings should be possible during the month. TE openings must cross the magnetic equator at or near a right angle, and the optimum time for such openings is between 8 and 11 p.m., local time. Conditions favor openings between the southern third of the USA and the southern area of Latin America, but some openings may be possible to other areas of the USA as well.

Auroral activity often increases during March, and there is a good chance that a number of v.h.f. ionospheric short-skip openings will be possible by means of auroral-scatter propagation. Check the "Last Minute Forecast" at the beginning of this column for those days that are expected to be disturbed or below normal, since these are the days on which v.h.f. auroral openings are most likely to occur during March.

Not much meteor activity expected during March, although some v.h.f. meteor-type openings may be possible when minor meteor showers peak on March 15-16 and March 25-26.

Contest Info

The *CQ* WW WPX SSB Contest will be held during the weekend of March 24-25. Normal propagation conditions are expected on the 24th, but they may be somewhat below normal during the 25th. Check the "Last Minute Forecast" for more details. DX Propagation data applicable during the Contest period appeared in last month's column. Also check the October, 1972 column for suggestions that might prove useful in piling up contacts and points during the Contest.

Anniversary

This month's column marks the beginning of my 23rd year as PROPAGATION Editor for *CQ*. I have found conducting this column a very stimulating and interesting sidelight to my deep interest in amateur radio. I want to thank all of you, whom, over the years have taken the time to drop me a line expressing an interest in radio propagation and in this column in particular. I also feel that special recognition is due the Editors and Publishers of *CQ* for recognizing the impor-

How To Use The Short-Skip Charts

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts, the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a *propagation index* of (2), or higher.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. 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. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *standard* time is used at the *path mid-point*. For example, on a circuit between Maine and Florida, the times shown would be EST; on a circuit between NY and Texas, the time would be CST since the path mid-point falls in this time zone. Determine the path mid-point, and use the appropriate standard time. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones, *add* 2 hours in the PST zone, 3 hours in MST zone; 4 hours in CST zone; and 5 hours in the EST zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart are given in GMT. To convert to *standard* time in Alaska and other areas of the USA, subtract 10 hours in the Alaskan Standard zone; 9 hours in the Yukon zone; 8 hours in PST zone, 7 hours in MST zone, 6 hours in CST zone, 5 hours in EST zone. For example, at 20 GMT it is 12 Noon in Juneau and 15 or 3 P.M. in NYC.

4. The Short-Skip Chart is based upon a transmitter power of 75 watts c.w. or 300 watts p.e.p on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10db loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

tance of familiarizing radio amateurs with propagation forecasts and the correlations that exist between h.f. radio and ionospheric variations. During the years ahead it is my intent to continue to keep radio amateurs advised of propagation conditions in this column and to explain some of the behavior patterns of the natural phenomena that make h.f. communications possible.

73, George, W3ASK

[*Charts continued on page 90*]

CQ Short-Skip Propagation Chart
March & April, 1973
Band Openings Given In Local Standard Time At Path Mid-Point Using 24-Hour Time System

Band (Meters)	*Distance From Transmitter (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	08-09 (0-1) 09-12 (0-2) 12-14 (0-3) 14-16 (0-2) 16-18 (0-1)	08-09 (1-0) 09-12 (2-1) 12-14 (3-2) 14-16 (2) 16-17 (1-2) 17-18 (1) 18-20 (0-1)
15	*Nil*	08-09 (1) 09-15 (0-2) 15-17 (0-1)	07-08 (0-1) 08-09 (1) 09-10 (2) 10-15 (2-4) 15-17 (1-3) 17-18 (0-2) 18-20 (0-1)	07-08 (1-0) 08-09 (1) 09-10 (2-3) 10-15 (4) 15-17 (3) 17-18 (2-3) 18-20 (1-2) 20-21 (0-1)
20	11-13 (0-1) 13-15 (0-2) 15-16 (0-1)	07-10 (0-1) 10-11 (0-2) 11-13 (1-3) 13-15 (2-4) 15-16 (1-3) 16-18 (0-3) 18-20 (0-2) 20-07 (0-1)	06-08 (1-2) 08-10 (1-3) 10-13 (3-4) 13-15 (4) 15-18 (3-4) 18-20 (2-3) 20-22 (1-2) 22-06 (1)	06-07 (2-1) 07-08 (2) 08-10 (3) 10-15 (4-3) 15-18 (4) 18-20 (3-4) 20-22 (2-3) 22-02 (1-2) 02-06 (1)
40	06-07 (1-2) 07-09 (2-3) 09-18 (3-4) 18-19 (2-3) 19-21 (1-2) 21-00 (0-1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-18 (4) 18-19 (3-4) 19-20 (2-4) 20-21 (2-3) 21-00 (1-2) 00-06 (0-1)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-11 (3-1) 11-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-20 (4) 20-21 (3-4) 21-00 (2-3) 00-02 (1-3) 02-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-21 (4-3) 21-22 (4) 22-00 (3-4) 00-02 (3) 02-05 (2-3) 05-06 (2)
80	07-08 (2-3) 08-11 (3-4) 11-18 (4-3) 18-20 (3-4) 20-22 (2-3) 22-02 (1-2) 02-05 (1) 05-07 (1-2)	07-08 (3-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-22 (3-4) 22-02 (2-4) 02-05 (1-2) 05-07 (2)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-02 (4) 02-05 (2-3) 05-07 (2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-02 (4-3) 02-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-2) 03-05 (3-2)	05-06 (1) 06-19 (0) 19-20 (1-0) 20-22 (2-1) 22-03 (2) 03-05 (2-1)

ALASKA
Openings Given in GMT*

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	21-23 (1)	20-21 (1) 21-23 (2) 23-01 (1)	20-23 (1) 23-02 (2) 02-05 (1)	06-13 (1) 07-12 (1)*
Central USA	21-00 (1)	20-22 (1) 22-00 (2) 00-02 (1)	20-00 (1) 00-02 (2) 02-04 (3) 04-05 (2) 05-06 (1)	07-09 (1) 09-12 (2) 12-14 (1) 08-12 (1)*
Western USA	21-01 (1)	20-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-21 (1) 21-00 (2) 00-03 (3) 03-05 (2) 05-07 (1)	06-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

SURPLUS sidelights

BY GORDON ELIOT WHITE*

IN 1963 the Navy contracted with the National Company, of Malden, Massachusetts, to design and produce a successor to the Collins' R-390-A general purpose receiver. The result was the AN/FRR-59, (also known as the AN/WRR-2, when supplied in a shipboard mounting). This is one of the last military tube-type receivers, and it is now beginning to show up in surplus outlets. It will rank as one of the better Viet Nam vintage surplus items.

The WRR-2 is heavy—more than 250 pounds unpacked—but it offers crystal stability, digital tuning, and good sensitivity in all receiving modes. Perhaps most important for modern communications, it (unlike the R-390-A) is designed for single sideband. In fact it offers simultaneous reception on upper and lower sidebands through separate detector sections.

Not only is the WRR-2 a good receiver—it is becoming reasonably widely available. Columbia Electronics is offering it at prices competitive with the R-390 series. They have the -A version for a little more money. It has the modification for half kHz channel spacing.

The specs on the WRR-2 include frequency coverage from 2 to 32 mHz in four bands. A triple-conversion superhet, the WRR-2 has a final intermediate frequency of 80 kHz. This offers good selectivity, but is a bit of an oddball frequency, and prevents using the set with some existing auxiliary gear such as RTTY converters which are designed for 455 kHz i.f. outputs.

Modes available are s.s.b., a.m., c.w., m.c.w., FSK (FAX or RTTY), with three audio outputs. Sensitivity is rated between 1.5 microvolts and 6 uv for 6 db signal to noise plus noise ratio, with 600 milliwatts output into a 600 ohm load. The better sensitivity of course is offered on c.w., narrow bandpass, with wide-band a.m. voice the poorest, as you would expect.

Stability is given as no worse than 1 in 10^7 or otherwise stated as one cycle in ten mHz.

Crystal tuning in the standard model is in 1 kHz channels, or ½ kHz channels in the -A version. Continuous tuning is also offered, with a slight derating of the stability.

As the photo indicates, the WRR-2 is a large set, designed to go into a 19 inch rack, or for tabletop use.

There are two major sections, the tuning portion, or "converter," CV-920/URR, which contains the oscillators and the r.f. sections, and the "demodulator," AM-2477/URR, which holds the i.f., demodulator, and audio components. This is normally mounted at the top of the WRR-2 set, but since the cabling is all external, it can be set up with either section on the upper end. The cabling is hooked to rear-panel connections, which are labeled, and require no further comment.

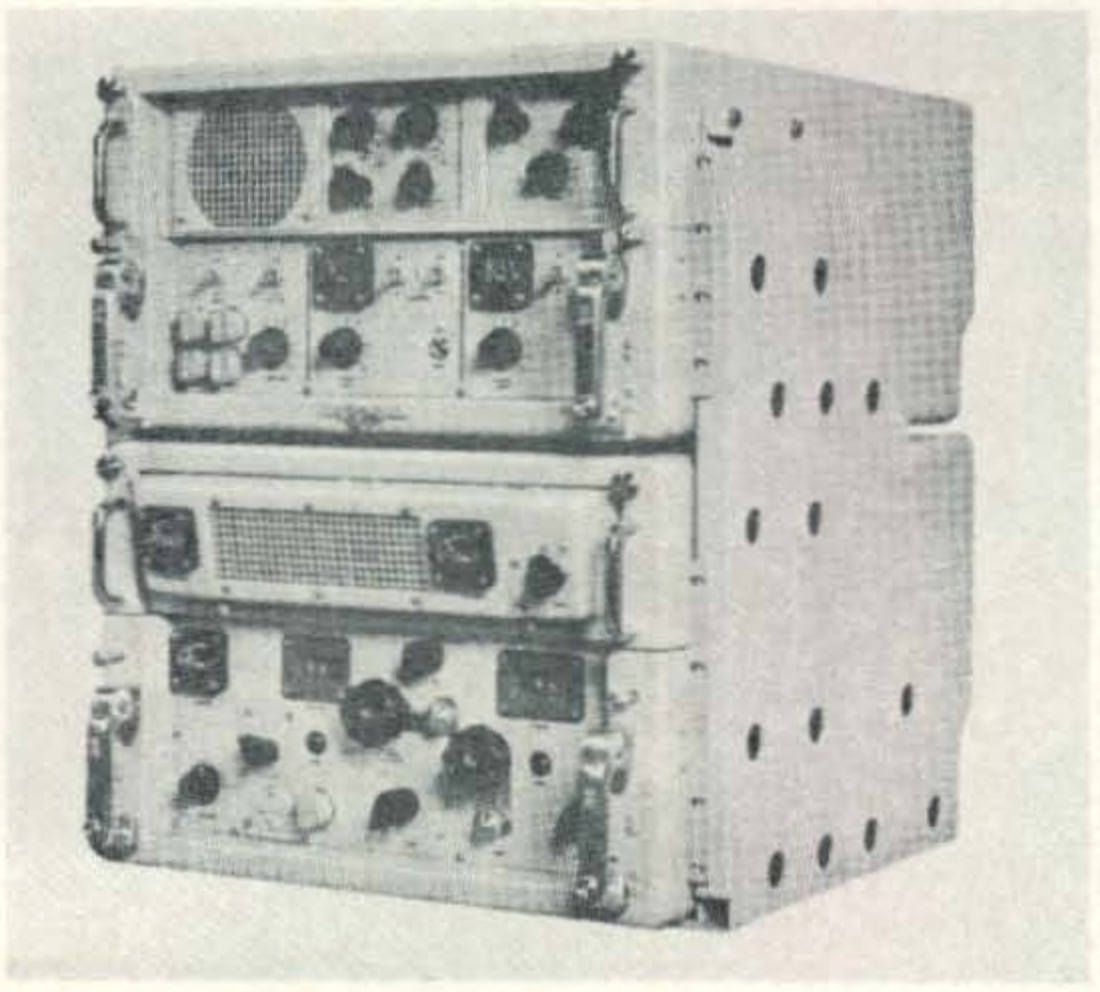
The antenna input is designed for 50 ohm coax.

The master oscillator crystal is ground for 1 mHz (and comes in the CR-36/U crystal, mounted in a military HC-6/U holder.

Power required is 117 volts, 60 Hz a.c., 250 watts. Taps are available on the two power transformers to adjust the set for power mains which have higher or lower voltages, over a range from 105 to 125 volts.

The set contains more than 60 vacuum tubes, mostly of the seven and nine pin miniature type. It does not have the sub-miniature type tube that proved such a problem in the RCA SRR-11, -12 and -13 sets which preceded the WRR-2, and which have been seen in surplus almost since they were built, in the 1950's.

The power supply uses solid-state diodes,



The AN/FRR-59 (AN/WRR-2) general purpose receiver.

* 1502 Stonewall Rd., Alexandria, Va. 22302

except for a pair of voltage regulator tubes.

A couple of hints: The Navy means "*squelch*" when it says SILENCER. There is a fairly effective squelch circuit in the WRR-2, of course labelled SILENCER.

There is a *fuse* in the antenna circuit. If blown, this could be confusing. Interestingly enough, in positions #1, #2 and #3 of the "antenna coupling" control, the fuse is bypassed, but the incoming signal is progressively attenuated. This is the Navy's way of guarding against front-end burnout in the high r.f. fields often found aboard ship. Only the NOR or fused position offers no attenuation.

The circuit is quite complex. The first intermediate frequency is variable between 1625 and 1725 kHz. The second i.f. is fixed at 220 kHz, and as stated above, the third i.f. is 80 kHz.

The fixed oscillator contains drift-cancelling circuitry which, through a feedback circuit, effectively holds the selected channel. The variable-tune mode has no automatic frequency control feature.

The preselector has two stages of r.f. amplification, using type 5654 (6AK5WA) pentodes, followed by a four-stage tuneable first i.f. filter, which is varied over its 100 kHz-wide range.

Actually, with its sideband circuits, the WRR-2 is one of the most complex receivers I've ever seen for the 2 - 32 mHz bands, easily outstripping the R-390 series, however it does offer some improvement in mechanical simplicity, compared to the forest of moving i.f. coil slugs, cams and gears of the Collins' design. You'd better get a good set in either model however. Anything beyond tube replacement or minor fixes of loose connections might prove to be pretty tough unless you had a good source of spare parts. Some of the Collins parts can be bought in surplus. I don't know about the WRR-2.

But if you get a like-new set, checked and operating, and give it decent handling it ought to be solid for a good many years.

More Surplus Outlets

I have another group of Surplus outlets to add to my earlier listings:

South Bend, Indiana—Midlands Sales Co., Box 371, 46624

Norfolk, Virginia—B. F. Williams, Box 7057, 23509

South Belmar, New Jersey—Claude's Surplus Electronics, 621 18th Ave. 07719

St. Louis, Missouri—Gateway Electronics, 8123 Page Blvd. 63130

Chicago, Illinois—Majestic Radio, 2808 S. Michigan.

In this regard, I would very much appreciate all observations from *CQ* readers on good surplus outlets in their areas. ■

Propagation [*from page 86*]

HAWAII

Openings Given in Hawaiian Standard Time

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	10-12 (1) 12-14 (2) 14-15 (1)	08-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	07-13 (1) 13-15 (2) 15-19 (3) 19-21 (2) 21-05 (1) 05-07 (2)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 20-22 (1)* 22-01 (2)* 01-02 (1)*
Central USA	10-11 (1) 11-14 (2) 14-16 (1)	06-08 (1) 08-13 (2) 13-16 (3) 16-17 (2) 17-18 (1)	08-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-23 (2) 23-05 (1) 05-08 (2)	18-19 (1) 19-22 (2) 22-01 (3) 01-04 (2) 04-05 (1) 19-21 (1)* 21-02 (2)* 02-04 (1)*
Western USA	09-11 (1) 11-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (4) 15-17 (3) 17-18 (2) 18-20 (1)	15-18 (4) 18-20 (3) 20-00 (2) 00-04 (1) 04-06 (2) 06-09 (4) 09-11 (3) 11-13 (2) 13-15 (3)	17-19 (1) 19-20 (2) 20-21 (3) 21-23 (4) 23-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-04 (3)* 04-05 (2)* 05-06 (1)*

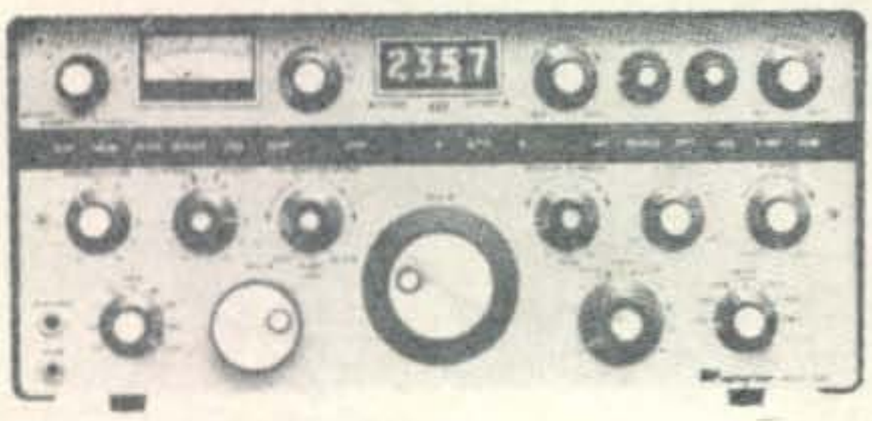
*See "How To Use Short Skip Charts", in box at beginning of this column.

Q & A [*from page 12*]

good transceiver. But occasionally one will 'pop up' with a.c. line frequency hum modulation on received signals, especially when these exceed S-9. The hum seems worse when the r.f. gain control is turned down. Increasing the value of C_{102} on the a.g.c. may seem to solve the problem but it alters the a.g.c. time constant, thereby causing the r.f. output to build up slowly when switching to the transmit position. The power supply is of course first suspected, but the cure that 4X4IO found was to trace the a.g.c. section in the schematic carefully and substitute the *unshielded* wires (for the a.g.c. circuit) with shielded wires (outside the harness). This solved the hum problem."

Our hearty thanks Gideon (4X4IO). We hope other amateurs send Q & A tips like this to help out fellow amateurs. (Incidentally, make *sure* that the shielded wires mentioned above *are* grounded.)

73, Chuck, W6QLV



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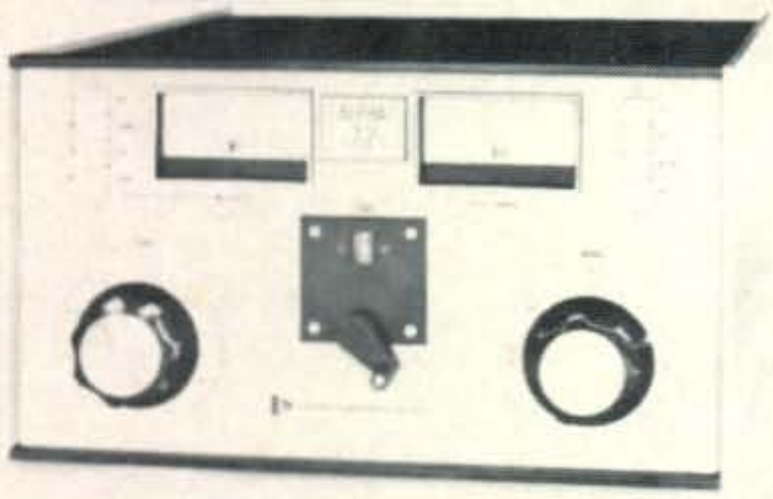

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ARGONAUT 405 LINEAR AMP. 50w out $149.00
210 POWER SUPPLY.....$24.95
250 POWER SUPPLY, powers 505 & 405... $49.00
315 10 thru 80 meters, new.....$229.00
235 CW Xtal Filter for Model 315.....$14.95
TX100.....$109.95
KR5.....$34.95
RX10.....$59.95
KR20.....$59.95
AC4.....$14.95
KR40.....$89.95
KR1 ..... $18.95
PM2B.....$64.95
KR2.....$12.95
PM3A.....$79.95

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NO XTALS

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COLLINS

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FPM-300, 10 thru 80 transceiver, new, $595.00

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SUPER BRICK, 2 in 45w out.....$99.95
BLOCK BOOSTER, 10 in 50w out, new..... $99.95
.....demos.....$79.95
"10-0" $195.00
"35-0" $185.00
P1416 — P.S. 12 VDC Reg. 16 Amp.....$90.00

INSTRUMENTS

GR 1001A SIGNAL GEN ..... good, $425.00
DIGIPET 60 digital freq. counter, with 160 scaler. Range 1 kHz — 160 MHz.....$349.00
FR-114U 6 digit E-put meter, frequency .1 - 10k, .0001 to 10 sec.....like new, $225.00
SIMPSON 260-6 VOM with probes, new.....$68.50
SIMPSON 270 VOM with probes & leather case new.....$81.00

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reduced to very low values (point E on curve C). Q_1 is protected as well, because the current through it is also greatly reduced. Q_1 remains in the cut-off condition until SCR_1 is restored to its non-conducting state, which is done by reducing the current through it below the sustaining value. The easiest way to accomplish that is to turn off the current supply to the power transformer—*after* the short-circuit or other condition that caused the circuit to act has been cleared.

A limitation of this circuit is that Q_1 must be able to withstand the full peak-output voltage of the rectifiers across its collector and base. But it doesn't have to do so while also carrying full current, as it does in figures 4, 5 and 6. The principal feature of this circuit is that it protects both the load and regulator transistors from damage, because of its fast-response time; and, as a bonus, the circuit doesn't require a new fuse every time it acts.

The *IR* drop across sensing resistor R_S is lost to the load, of course, but that seems a small price to pay for the protection involved. And speaking of price, the cash-outlay for the SCR, the zener diodes, and the resistors is less than the price of a *single* transistor rated for 25 watts at h.f. ■

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Weighs only 4.62 lbs.

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Here is the compact, beautifully constructed and conveniently installed transceiver that will give new purpose and meaning to your mobile operation. **SB-144** will open the door to the fun that goes along with rock-solid, "through-the-repeater" contacts. New repeaters are popping up daily so, as you travel, you'll want multiple-channel capability.

SB-144 provides you with an even dozen channels selectable by an instrument-type knob with solid feel and identified by large numerals, softly back lighted. The effect is functional---professional. The full-vision panel meter helps too---shows relative strength on receive---indicates all is well on transmit.

Most competitive units lack these features. There are 12 separate crystal positions for **both** transmitter and receiver allowing that many repeater pair-offs or a combination of repeater and mobile-to-mobile channels. As part of the big value, SBE includes three **sets** of crystals with frequencies chosen to be the most widely used nationally.

Extra power is always a big help. **SB-144** delivers 10 watts of output power and does it with less than 1.9 amps drain from a 12V car battery. The receiver is a "hot" double conversion design with FET front end for high sensitivity and low cross modulation. **SB-144** is an advanced design transceiver and doesn't use tubes---is all-solid-state including FET and four I-C's.

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Song of the Flea [*from page 42*]

There's more to it of course. But you'll soon find ways to beat out the pack, QRP or no. Just keep at it.

Thus far, I've talked only about intangibles—the fun, the excitement, the sense of accomplishment. But there is one concrete benefit you get from QRP. If you are one of the unfortunates who is plagued by TVI, low power will almost certainly end your problem immediately. A few weeks of it, and your neighbors might even begin to talk to you again.

If you're lucky enough to have a good antenna, I predict you will be as surprised at your success as I was. In my first 30 days of QRP operating, during which I averaged only 60 to 90 minutes each day I was on the air, I had a total of 109 QSOs without exceeding 3 watts, and as little as ½ watt. No doubt this is a tribute to the TH6DXX as much as anything else. This record included WAC, and numerous VK/ZL/JA contacts. Total countries worked: 49. Look out, DXCC. Here I come.

Tired DX blood? Go QRP. Try it—You'll like it. ■

Allied Receivers [*from page 37*]

er, the b.f.o. will stop oscillating. As the slug is brought further up, the b.f.o. will again begin oscillating. Turn the slug up 1½ turns from this point. Tuning will be very broad at this point and is not critical. The b.f.o. will now be at maximum output.

To correct for the loss of audio due to the replacement of C_{72} with a lower value, and to correct for poor frequency response in this stage, replace Q_{17} emitter resistor R_{76} (1K) with 100 ohms. The audio level will be restored to its original value and the frequency response on sideband signals will be considerably improved.

It is most important that once the decision has been reached, to make these modifications that *all* modifications be made, as satisfactory results will not be obtained if any of the steps are eliminated. ■

Zener Diode Bias [*from page 33*]

The use of a Zener diode by-pass resistor is also convenient in the case of low frequency a.c. or d.c. amplifiers, both power and voltage, where a cathode resistor can not be adequately by-passed, and a substantial reduction in stage gain would take place if a bias resistor were used.

Placing a by-pass capacitor across the Zener diode/resistor combination will maintain a low impedance at high frequencies where the internal impedance of the Zener diode tends to increase. Because the capacitor need not be effective at low frequencies, it can be considerably smaller than is usually used.

In brief, by properly proportioning the components, the resistor will carry most of the d.c. component of cathode current, while the Zener diode carries the remainder of the d.c. component plus the low-frequency a.c. component, and the by-pass capacitor carries the high frequency component. Although push-pull circuits are shown in the diagrams, the use of Zener diodes for cathode biasing is equally applicable to single-ended amplifiers. It is also applicable to any other situation where it is desired to develop a constant voltage by passing a current with a large d.c. component and a variable component through a resistor. This can result in smaller and more economical components in all positions.

This circuit should not be used for transistor amplifiers since transistors are current-operated and not voltage-operated devices. ■

Loop Box [*from page 27*]

busses were wired across the matrix from one terminal strip to the other. Flea clips were carefully positioned under the leads and diodes were soldered to the bus leads at the top and the flea clips at the bottom. Underneath the board, connections can run through the clips in still a third direction. This will provide ample number of connections for the inputs to the matrix.

The matrix is really quite an impressive package by the time you are done. It might be mentioned here with a bit of humor, it will be the diode right in the middle that goes bad; so save yourself some trouble and put that one in last.

The top view photo of the aluminum minibox shows that a label-maker gun does a neat job; included is a little code chart glued in the upper corner where it is handy.

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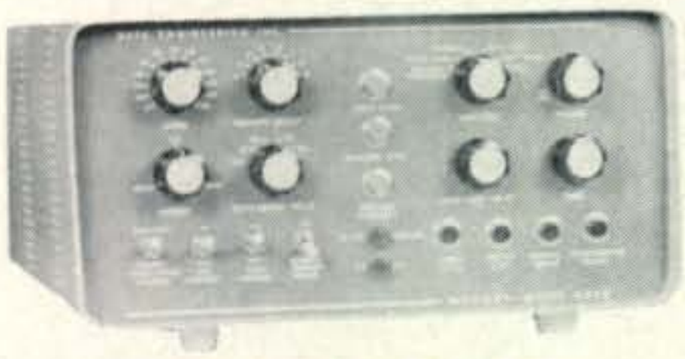

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TONE BURST ENCODER

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- Free descriptive brochure on request.
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PALOMAR ENGINEERS
BOX 455, ESCONDIDO, CA 92025

Why the handle at the bottom? That way you can hold the unit in your hand and at the same time hit the SINGLE push button with your thumb.

Be sure to drill an access hole along the side and in line with the ten-turn potentiometer. This will allow easy screwdriver adjustment of speed.

Operating The Loop Box

Run connections from the jacks on the side to your local loop. Turn the teletype on and it should sit there running open until you turn the power switch to ON. The teletype should now be quietly in marking.

Put the RY switch to LETTERS. Preset, for example, the letter A (mark, mark, space, space, space). Hit the SINGLE LETTER button. Out should have pulsed the letter A.

Turn the RUN/STOP switch to RUN and you will fill up a line full of A's at a mesmerizing rate. (Touch up of the speed control can be made under dynamic conditions.) Return the RUN/STOP switch to STOP.

Place al lthe programming switches to SPACE. Throw the RY/LETTERS switch to the RY position. Push the SINGLE LETTERS button, out pops an R. Push it again, out pops a Y. Turn the RUN/STOP switch to RUN and out will come literally type-baskets full of RYRYRY.

Conclusion

The circuitry used in this test generator produces a quality signal. It was checked on a bias and distortion analyzer, the Nixie tubes read out a 0.0%. Not bad for a little handful.

Take a fond look at your Loop Box as you show your handy-work to the rest of the family. You probably will not get a chance to use it for the rest of the day. ■

Second Time Around [*from page 31*]

"Oh, I tried fooling with a bug once, and I couldn't . . ."

"Not a bug; an electronic keyer and paddle combination. Sending perfect code with a keyer is child's play compared to sending with a bug. Why, you can get a real fine keyer today in almost any price range; and speaking of range, most of the keyers can be adjusted for perfect 3-to-1 code from about ten words a minute to well over fifty. Try sending perfect code with a bug over that range."

"You may have something there, Alf . . . never really thought about trying a keyer. They allow you to use one for the exam?"

"Of course you can use a keyer for your exam; in fact, one guy told me that his FCC inspector keeps one on hand for his 'forgetful' clients; how's that for FCC hospitality."

"Sounds better and better the more I think of it. But, say, what about all this iambic "squeeze" keyer stuff I've heard about . . . that any good?"

"Look, Pete, if I had to make a choice between conventional keying and squeeze keying, I'd say pass over the squeeze keying for the present; its' not for everyone; besides, conventional keying will more than satisfy your needs. But since most good commercial keyers offer both conventional and squeeze keying in the same package, buying one buys the other. However, if you do elect to buy one with squeeze keying, be sure to buy a double paddle—separate dot and dash finger pieces—for squeeze sending; the regular single thumb piece paddle won't work for squeeze work."

"How about my building a conventional electronic keyer, Alf; any good ones around?"

"Terrific micro job in the *Handbook*, and hardly a month goes by that some guy doesn't put out another improved version on a micro-micro TO Keyer—umpteenth generation removed. They're all good keyers. Why even my old *Handbook* keyer using a pair of 12AU7's still works like a real trouper—damned thing's indestructible."

"Okay . . . I'm adding an electronic keyer to my list of New Year's resolutions. Since I'm determined to pass that Extra exam this year, I'm going to give myself every opportunity that I can; I'm going to do it right this time."

"Spoken like a true Ham. Now remove the remaining contents from that glass and let's get cracking; we can make that 5:50 to White Plains."

Pete agreed and gingerly side-stepped to the free-lunch table and quickly prepared a small tidbit to tide him over until he reached home—two salted crackers heavily smeared with cottage cheese, with a big cherry pepper poised smack in the middle. They both waved their goodbyes to Angelo, who smiling and waving in return, was just returning the bowl of pretzels to the place where Pete had been.

Said Alf, eyeing his friend's hastily engineered cracker sandwich, "Tell me, how do you reconcile all these refreshments with that all-American airman's diet?"

"Modified airman's diet, ole boy . . . modified. ■

Mt. Athos—SY1MA [*from page 36*]

But through some miracle—it is a holy land, remember—we did eventually find our way back to Karyes for a few hours sleep before boarding the 0800 bus back to Dafni. This was our plan at any rate. We would take the bus to the top of the mountain, have it wait while we gathered our gear, and then ride it in to Dafni. That was our plan. The fact that the road between the towns was washed out tended to wash out our plans as well. We were stranded in Karyes and we had to be back to work the next morning. What could we do. Simple! We would hire mules to take us over the mountain.

Angelos, the local mule owner is quite a nice fellow, and he owns four sturdy mules which we hired, with him as guide, for only $6.00 each. With no other mode of transportation available, the price was a steal so we accepted it, and climbed on the mules. Up at the QTH we found the tent still intact and the gear dry, so we loaded everything up on the beasts of burden and started over the mountain. After about three hours of riding we reached Dafni and had a wonderful bowl of hot bean soup, our first hot food in over 36 hours, and with it some local retsina wine. A feast!

Mount Athos had been conquered: over 1,500 QSO's. And we look forward to many future DXpeditions to this new country now that it has been opened to the world of amateur radio. ■

CQ Reviews AR-2 [*from page 43*]

amplifier. Output power was measured with a Bird 6154 "Termaline" wattmeter.

In all checks the Regency AR-2 met or exceeded claimed performance. Since the 5 watt drive level was not specifically mentioned, it was checked per the claimed 3.2 times power gain figure. All other drive levels were checked against claimed figures. Due to the large mass of copper used in the chassis as heat sink, there was no tendency of the unit to overheat at high power levels. According to Regency, the surface area of the copper is 55 square inches (by ⅛" thick)!

Construction

As mentioned, the Regency AR-2 utilizes a large mass of copper for the primary chassis. The switching circuits are built on a glass

epoxy circuit board, and r.f. circuits are of strip-line design. Workmanship of the sample unit was very good. The circuit board showed more good soldering technique than the hand soldered portions. However, this is quite common, with circuit boards often appearing a bit better looking than hand soldered circuits. The physical strength provided by the large copper chassis makes for a small battleship on the inside. The outside covering is a vinyl covered sheet-metal housing in the traditional Regency black.

General Comments

Performance of the Regency AR-2 amplifier was well within the claims of the manufacturer, providing a power gain of approximately three. This provides a power boost adequate for most f.m. mobile operations, especially when using a repeater. Construction and workmanship as well as basic design and layout were also quite good. The manual provided with the AR-2 is better than the manuals provided with earlier Regency equipment. However, there is still more information needed. A schematic is provided as is a picture of the foil of the circuit board. No voltage or resistance readings are given and there are no components shown on the foil layout. These pieces of information would improve the manual greatly.

Styling is similar to the Regency HR-2/ HR-2A series, and makes for an attractive pair. Rubber feet are provided on the amplifier case to protect a desk top if the unit is used for a base station installation. The mobile mounting bracket has an anti-theft device or "security bracket" which allows the user to place a padlock across one of the bolts holding the unit in the mobile bracket. This feature should be attractive to persons living in high crime areas. Another feature of the Regency AR-2 is the front-panel off-on switch and the transmit light. These allow the unit to be conveniently activated when needed and dropped when the exciter is sufficient. The pilot light tells when the amplifier has been activated, eliminating guessing as to whether or not it is operating.

If a medium power boost is needed by the f.m. operator, the Regency AR-2 is worth considering, especially as a companion for the other Regency equipment. Selling price on the AR-2 is $119.00. For further information contact the local Regency distributor or Regency Electronics, 7900 Pendleton Pike, Indianapolis, Indiana 46226. —K9STH/5

Our Readers Say *[from page 7]*

January Editorial

Editor, *CQ:*

This note concerns your Zero Bias editorial in the January issue. I must compliment you on a splendid piece of writing, but more importantly to substantiate your article with respect to the subscription aspect.

As for Mr. Greene, I've never seen an article by him, or for that matter any issue of *73*, and if I do, I'll judge for myself.

But, I am one of the novices referred to in the article. Your explanation of *CQ*'s policy on free subscription and subsequent advisory for one and two year subscription is exactly correct!

Actually, I was quite pleased and somewhat surprised to get a six month free subscription and realized it must have been a costly – but excellent promotional approach. So when I got your notice (about the 3rd month) for a subscription, I felt it was perfectly business-like and proper; so I subscribed.

I have certainly enjoyed CQ, and it does compliment my ARRL Membership and *QST*. We have enough distortions and half-truths in this life; I just thought I'd give you my support and thanks for a straight-forward editorial.

Robert J. Morelli, WN3SDK
Pittsburgh, Pennsylvania

WAZ New Award

Editor, *CQ:*

It is with the greatest dismay that I have just read in the January issue of *Radio Communication* that *CQ* is now sponsoring a new single band/multi mode form of the WAZ certificate and that only contacts as from 1st January 1973 will be counted.

I have no objection in principle to the multi-band or multi-mode part which I think is an excellent idea but I protest bitterly against the idea that only contacts as from 1st January 1973 can be counted. This puts a quite intolerable burden on overseas DX stations and seems quite unnecessary.

In the old days it was simple. If I worked a W station I sent him a QSL card and the same card he could use for DXCC, WAX or any other award.

The rot set in with the 5-band DXCC Award only counting contacts as from 1st January 1969. I did, and still do, object to any specific date and just because the ARRL made a mistake surely there is no need for *CQ* to follow.

Why on earth can you not, at the least, agree to allow to accept cards for contacts as from 1st January 1969, *i.e.*, same as 5-BDXCC for your new award? I presume it is a contest between amateurs rather than a contest between different amateur radio organizations that is the object of the idea.

It is too much. I am sorry but I am not prepared to QSL twice to any American or other amateur, for a contact on the same band. It is not just a matter of cost, though I would point out that an American International Reply Coupon is worth only the equivalent of 8 cents here when exchanged for stamps. It is the unnecessary waste of time as well. I have spoken to other DX stations in this area who agree with these comments.

In order to avoid a misunderstanding from American amateurs who will not be receiving additional QSL cards from me, I would be obliged if you would please publish this letter.

James C. Pershouse, 9M2DQ
Penang, Malaysia

Announcements *[from page 7]*

day, March 18. The Swapfest will be preceeded by the usual social events the afternoon and evening of March 17th.

Lafayette, Louisiana

The Lafayette Amateur Radio Club, Inc. will hold the annual LARC Banquet on Sat., March 10 at 7:30 PM at the American Legion Home, Surry St., Lafayette. Trophies for QSP party, famous "E" awards and annual "Cajun Award" will be presented. Food will be "Cajun's Delight" by Marshal Dallas Broussard. Happy Hour at 6:30 PM. Advanced registration $5 til Feb. 28; $7 at the door. Reservations to LARC Banquet 1973, PO Box 345, New Iberia, LA 70560. Talk in on 94/94.

Whitewater, Wisconsin

The Tri-County ARC Mid-Winter Swapfest is March 11, 9 a.m. to 5 p.m. at the National Guard Armory, Whitewater. $1 advance, $1.50 at the door (addition $1 reserves display table). Advance tickets eligble for special prize. Talk-in on .94. Refreshments, free parking, everything indoors. Tickets and details: Dan Servais, WA9AJW, RR4, Box 309 AA, Elkhorn, WI 53121 Tel 414-723-2227. SASE.

Columbus, Georgia

The fifteenth annual Columbus, Georgia, Hamfest will be held on March 25 at the Fine Arts Building behind the Municipal Auditorium at the Fairgrounds. For information, write J.T. Laney, K4VGI, 1905 Iris Drive, Columbus, Georgia 31906.

Flushing, New York

The Rockaway Amateur Radio Club will hold its annual Spring Auction on Friday evening April 27 at 8:00 P.M. at the Hall of Science, Worlds Fair Grounds, Flushing. Doors open at 6:00 P.M. to accept items for sale. One dollar donation at the door. For further info contact Al Smith, WA2TAQ, P.O. Box 341, Lynbrook, NY 11563.

Fort Walton Beach, Florida

The 3rd Annual North Florida Swapfest will be held March 25 sponsored by the Playground Amateur Radio Club at the Community Center on Highway 98 from 8 A.M. to 4 P.M. Tickets and details from the Playground, P.O. Box 873, Fort Walton Beach, FL 32548.

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QSLS. Second to none. Same day service. Samples, 25 cnets. Ray, K7HLR, Box 331, Clearfield, Utah. 84015.

QSLs, SWLs, WPE samples 18 cents. Nicholas & Son Printery, P.O. Box 11184, Phoenix, AZ 85061.

CREATIVE QSL cards. Personal attention. Imaginative new designs. Send 25c. Receive catalog, samples and refund coupon. Wilkins Printing, Box 787-1, Atascadero, CA. 93422.

QSLs. Best quality. Samples, 25 cents. Bob DeVaney, Box 213, Troy, TX. 76569.

QSL'S "Brownie," W3CJI, 3111 Lehigh, Allentown, PA 18103. Catalog 25 cents.

MODERNIZE FOR PEANUTS! Frame and display QSL's with 20 pocket plastic holders. Two for $1, 7 for $3. Prepaid, guaranteed, Universally used and approved. Order now. TEPABCO, Box 198Q, Gallatin, TN. 37066.

QUALITY RUBBER STAMPS: Fast, economical service. 8 cents stamp brings catalog. Stamp Specialist, Box 60, North Versailles, PA. 15137.

RUBBER ADDRESS STAMPS. Free catalog. 45 type styles. Jackson's, Box 443F, Franklin Park, ILL. 60131.

BRAILLE DIALS for the blind (at cost) on Drake Transceivers and Drake twins and VFO's. Remove knob, slip on Braille dial and replace knob, that's all. Please state model type. $2.00 ea. P.Pd. Vernon Page, W8EXJ, 1969 Manz St., Muskegon, MI 49442.

ORLANDO HAMFEST and Southeast FM Convention June 2, 3. The "BIG ONE" — 25,000 sq. ft. air-conditioned exhibition, Flea Market area. PLAN NOW! Visit Disney World, Cape Kennedy, Beaches — — something for the whole family! INFO, K4VFV, 1913 Kingsland Avenue, Orlando, Fla. 32808. Reservations, rates, single to twin double $13 — $30, Chamber of Commerce, Convention Dept. P. O. Box 1913, Orlando, FL. 32802.

Evansville, Indiana TARS Hamfest Sunday, May 6, 1973. 4H grounds, highway 41 north 3 miles. Auction, overnight camping, Ladies' bingo, reserved flea market booths, airconditioned. Advanced registration. For flyer contact Robby W0MKZ, 502 S. Lincoln Park Drive, Evansville, IN 47714.

1973 Hobby Electronics Directory. Hundreds of companies, products, and services. Parts, surplus, test equipment, plans, kits and more. $1.50, Newcal Enterprises, Box 323K, El Segundo, Ca. 90245.

SELL: Heath HW32A with HP23A AC Pwr Sup and GH12A Mike, $125.00. Knight R100A Rcvr $40.00. Heath 2 Meter Lunch Box, $25.00. John Upstrom, Box 871, Caswell AFS, Limestone, Maine. 04750.

WANTED: Few GOOD 6146a Tubes — W1BB, Stewart S. Perry, 36 Pleasant St., Winthrop, Mass. 02152.

HEATH HA-10, 1000 watt linear and coax external relay. Mint $160. Schwartz, 1183 Southeast St., Amherst, MA. 01002.

SELL in operating condition will deliver in SE. Make offer on HW32 and PS Challenger, Globe 90 BC348 8503 8506B 88LF TBS50 HQ100 SX100 Navigator VT2 T40 Marconi LF Heathfish-finder Vibroplex. Box 8352 Savannah, GA. 31402.

TECH MANUALS: $6.50 each: R-220/URR, R-390/URR, ALR-5, R-389/URR, TT-63A/FGC. Hundreds more. Send 50 cents (coin) for list. W3IHD, 4905 Roanne Drive, Washington, D. C. 20021.

GREATER BALTIMORE HAMBOREE, Sunday, April 8 at 10 A.M. Calvert Hall College, Goucher Blvd. and LaSalle Road, Towson, Maryland. 21204. (1 mile south of Exit 28 Beltway-Interstate 695), Food service, prizes, flea market. Registration, $2.00. No table charge or percentage. INFO: Contact W3WVC at school address.

22nd ANNUAL Dayton Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. C, Box 44, Dayton, OH. 45401.

WANT OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send full details to W7FIZ, Larry. 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

ROCHESTER, NY is the place to go for the largest Hamfest, VHF meet and flea market in the northeast. May 12th. Write WNY Hamfest, Box 1388, Rochester, N. Y. 14603.

AWARDS HUNTER-Five band awards log book for DXCC, 5BDXCC, 5BWAS. Easy to read and easy to use. Send $2.00 to Five Band Publications, Box 264 Lyndhurst, NJ 07071.

Did you know that new supplements to the book, "CQ YL," are now available? They bring the book up to date with YLRL Officers through 1973 and the 6-th YLRL Convention, held at Long Beach in May '72. If you have a copy of "CQ YL" and would like to add the new supplements (the pages are "slotted" so they fit directly into the "CQ YL" spiral backbone), drop a note with your request to author/publisher, W5RZJ, Louisa Sando, 4417 - 11th St., NW, Albuquerque, NM 87107. Pleaseen close two 8 cent stamps to cover cost of mailing. The one and only book about YLs in ham radio, "CQ YL," contains 21 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.00 postpaid.

WANT: KWM2, any condition. Priced right. Pay cash. W0BNF, Box 105, Kearney, Nebr.

SWAP: Mint 8 mm Movie outfit for mint SB220 Linear. WA0GYX, 1422 So. Pearl, Independence MO 64055.

Electronics Equipment; Test Equipment; Panel Meters: Connectors: Capacitors: Tubes; Transistors; etc. Inquiries invited. F. F. Williams, P.O. Box 7057, Norfolk, VA. 23509.

1973 DESK CALENDAR 12 x 9. Name, address, call, in gold, $2.00. Hank Morgan, 883 Diana, Akron, OH. 44307.

MAGAZINES FOR SALE: CQ/73/QST/HAM RADIO issues at 10 cents each (plus shipping) from Lockheed Ham Club, 2814 Empire, Burbank, CA 91504. Send list and check. Available issues and any refund due will be sent promptly.

WANTED: SB200 or SB220 running condx and manuals, Box 8352, Savannah, GA. 31402.

TO SELL your ham gear, or to purchase new or used or to receive our monthly mailer of reconditioned equipment, contact: ASSOCIATED RADIO, 8012 Conser, Overland Park, KS. 66204.

SELL: Swan 2 meter FM-2X with crystals; and 120 watt mobile linear. Mint, $275.00 for all. Sal, W2IDC, 1 Milford, CT. 06460. (203) 878-4333.

SAFETY BELTS tower climbing, nylon (new)—Lanyard/snap (used), $23.50. Link, Rt. 111, Monroe, CT. 06468.

TRIEX H.D. 71' crank-up tower with elevation motor and mounting hardware, 4 element quad, 2 prop pitch motors, 115'V syncros, $500. Two 4X150A, factory sealed, $15 pr., 813' unused, base $5. W6MDH, 14638 Sylvan, Van Nuys, CA. 91401.

SELL: Mint SB200 delivered in running condx in SE $300, Box 8352, Savannah, GA. 31402.

ANTIQUE radio equipment sale and swap session, dinner and program, A.W.A. Spring Meet, April 7, Canandaigua, N. Y. Write for details: Lincoln Cundall, W2QY, 69 Boulevard Parkway, Rochester, N. Y. 14612.

WE would like to correspond with many radio amateur operators in the United States. The purpose of our club is to make friends through radio and by mail. Please give us letters to the following address. THE GREEN CLUB, Z.C.—591 I-25, Shinonome, Sakai, Osaka, Japan. Club Manager, Masuo Inoue, JH3BCZ.

HALLICRAFTERS SX-117, HT-44, PS-150-120 AC supply, $375. 75A2 $150. You ship. Mike Kopec, K8TLX, 0-1223 North White St., Grand Rapids, MI. 49504.

HOOSIER ELECTRONICS — Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual personal service by experienced and active hams. Factory-authorized dealrs for Drake, Regency, Standard, Ten-Tec, Hy-Gain, CushCraft, Mosley, Ham-M, plus many more. Orders for in-stock merchandise shipped the same day. Write today for our low quote and try our personal, friendly Hoosier service. Hoosier Electronics, RR25, Box 403, Terre Haute, Indiana. 47802.

SELLING OUT. Send address for list. Cline, WA7TMR, Box 216, Logan, Utah. 84321.

REWARD $1000.00 — REWARD $1000.00 — REWARD $1000.00——to anyone having or locating information of my 1942 licensing that will be accepted by FCC. Examination taken at Nashville, Tennessee November 20, 1942 at age 12. Received only operator's license due to war. Federal Records Center has charge card indicating 1942 license, but FCC claims error. Possibly someone understanding files could locate license. If you know anything that could help, it would be appreciated. Herbert Louis Rippe, W8BGH/W8DE, 3785 Susanna Dr., Cincinnati, Ohio. 45239. Phone: (513) 385-8027. Acceptable information gained from more than one source. Reward divided equally. Reward $1000.00.

WANTED: Weston Model 861 or 891 panel meter, 100-0-100 microampere element or 30-0-30 cycle scale. Merrill Eidson, W5AMK, Box 96, Temple, TX. 76501.

TRANSFORMERS REWOUND. Jess Price, W4-CLJ, 507 Raehn St., Orlando, FLA. 32806.

KWM-2 AND 516F-2 Pwr Supply, $675. Nick Berg, 1719 N. Rand Rd., Arlington Hts., IL. 60009. Phone: (312) 394-4032.

SWAP: CN50 (14—18mHz IF) for CN220 conv. WA1NYV, Box 363, Uxbridge, MA. 01569.

SENECA VHF1, 2 & 6M, 119.95. WANTED: Ameco CN220, 20.00. W6RQZ, 1330 Curtis St., Berkeley, CA. 94702. Phone: (415) 526-7345.

SELL, TRADE: Gonset GSB-100 XMTR. Hammarlund HQ170C and HQ-110C. WANT: Swan VX-2, FP-1, 406B, Mark II linear, Heath SB610, Herbert Peery, Box 313, Trenton, MO. 64683.

SEE THE SATISFIERS ON PAGE 70

4-1000A $35, Johnson 6N2 Thunderbolt KW amp. $250; 4-400A $30 and Eimac air socket $7; Parks: 432-3 $33, and 432 MHz preamp $18; 144-1 $29, and 144 MC preamp $16. FOB Money Order, Write Bob Berk, W0NXF, 5218 Prescott, Lincoln, Nebr. 68506.

TRIBANDER: Telrex 3EL 20-10 Model TC99D $80. Jim Vander Werp, 4104 Baits-Lee, Ann Arbor, Mich. 48104.

HEATHKIT Sixer and Twoer, good condition, $30.00 each. Polycom 62B Six and Two A.M., AC, DC $150.00. WA2YPD, 4 Carteret Rd., Allendale, NJ. 07401.

SWAN 250 6 meter xcver (Late). $175. Lafayette ten meter frequency synthesized transceiver. AC, DC cords. New, $70.00. Ameco TX62 $75.00. Send for list. SASE, please. Colella, WA2HQD, 105 18 131st St., Richmond Hill, NY. 11419.

HARVEY WELLS FM 50 W exciter, 30-50 MHz, 115V AC, $20. Drake TV1000 LP. $10. J. Wasiewicz, W2DQC, 229 Sarles La., Pleasantville, NY. 10570.

WANT: "AC" and low frequency coils for HRO-50 T. Sam Thompson, 1537 Ulupii St., Kailua, Hawaii. 96744.

WANTED: Vibroplex Bug — Contact Bryan Bergeron, 328 Glennwood Ave., Morgan City, La. 70380.

FOR SALE: NCL2000 Linear Amplifier, $325. FOB, Meriden, CT. K1EVW. Frank J. Treiber, 525 Crown St., Apt. 10-201.

FOR SALE: Full size 4 element 20 Mtr. beam on 40 ft. boom. Heavy aluminum construction. Local pickup preferred. Price $100 or best offer. M. E. Knowles, 9 Brown St., N. Billerica, Mass. 01862.

SWAP: Johnson KW matchbox with SWR indicator for SBE-34. Wanted 3.1 khz filter for Collins 51J4. Sias, 2159 Dewey St., Eugene, Oregon. 97402.

BC-342 rcvr 1.5-18.1 mhz, with manual and matching LS-3 spkr, AC pwr. $75. Silbert, White Sul. Springs, N. Y. 12787.

SELL: 3" refractor telescope, CE10B w/VFO & VOX, any reasonable offer. WA8CKT, J. Wagner, 950 Sue Dr., Caro, Mich. 48723.

HEADSETS 120 Ohm with plug. Have 24 new. One or all, $2.50 ea. PPD. U. S. A. Adinolf, WB6ZWS, 5113 Arvada, Torrance, CA. 90503.

WANT: Old tubes with brass bases, like UV-200, UV-201, UV-202, UV-203, etc., needed for amateur tube museum, W9LGH, 610 Monroe Ave., River Forest, IL. 60305.

455 Khz Mechanical Filters. Excellent for Solid State SSB. $12.95 w/instr. E. Jeltrup, 27 Lincoln Pl., Ossining, N. Y. 10562.

SELL: Drake R4A, T4X, MS4, and AC3, complete station original cartons, manuals and cables, used one year, $625.00. W2AAF, c/o K2TKE.

WANTED: for cash or trade scope, Telequipment D66 or Hickok CRO-5002. A. H. Bott, 340 South 24th St., Quincy, IL. 62301.

RTTY FOR SALE: Collins OA-3138/TGA-1 Converter, Model 15, w/table. ARC WB6RXH, 19251 Dodge Ave., Santa Ana, CA. 92705. Ph. 714-838-7385

SELL OR TRADE: Duplicates of QST from sixteen, CQ's from 45. Call books from 1920, Handbooks from 1930, Wireless and radio books. List for stamp. Erv Rasmussen, 164 Lowell St., Redwood City, CA. 94062.

B & W5100 and 51SB-B SSB Transmitter, 10 to 80 meters. Very good condition. $150.00. WA3GJH, 3202 W. 26th St., Erie, PA. 16506. Joseph Szymanowicz.

SELL: Mosley S-402 beam, Hy-Gain 402BA beam and balun. Also 14AVQ vert. Open for offers. W7ISG, P. O. Box 175, Mesquite, NEV. 89024. Tel. (702) 346-5485.

SELL: 54" x 19" x 22" Rack Panel Cabinet with extra heavy-duty power supply. Mel, (414) 442-3767. 5711 Brooklyn Pl., Milwaukee, WI.

MECHANICAL FILTERS: 455 Khz w/2.2 Khz BW. For Solid State SSB. $12.95 w/instr. E. Jeltrup, 27A Lincoln Pl., Ossining, N. Y. 10562.

FOR SALE: High quality test equip. Cheap. Tek, H.P., etc. Send for list. K. A. Schwieker, 1124 Opelika Rd., Auburn, AL. 36830.

CLEANING HOUSE: Tektronic DC-10 mc scope, Dual trace Model 512, $125. (1) Motorola P-33 BAC (AC) and (1) P.33 BAM (Battery) 5 watt-Xistor Rcr Walkie Talkies, $165.00 pair only. NCX3, ac and dc supplies, $190.00. WB5BLX, 3728 Wilkie Way, Ft. Worth, TX. 76133.

SELL: ARRL 1947 Handbook, $2.00; "Radio" Handbook, 9th Edition, 1942, $4.00. B. Nastoff, 320 W. 56th Pl., Gary, IN. 46410.

FOR SALE: Galaxy V, acps, vox, cal., $300.00. Will ship. M. H. Carey, WA4DJF, 815 E. College St., Pulaski, TN. 38478.

QST, CQ bound volumes 1945 to 1965. Best offer for each. 73 loose Vol 1 Oct., 1960 to 1969. Offer for set? R. Mendelson, 27 Somerset Pl., Murray Hill, NJ. 07974.

WANTED: Good 4D32 tubes, must be in good condition. WA9YAT, 601 W. 7th St., Hinsdale, IL. 60521.

SELL: USM32 scope, $45; SBE33 DC supply, $20. UCX-300, $25. VCX400, $30. RBA or RBB-$25. Pwr supply, $15. Complete 10 unit plus base 6M radio system with halo hats. Write. Trammell, 1507 White Oak Ct., Martinsville, VA. 24112.

FOR SALE: Hallicrafters HA-2 and HA-6 transverter combination with AC power supply. Two and six meters from 10 meter transceiver. $250 for combination. L. Pfleger, 15000 W. Cleveland Ave., Apt. 225, New Berlin, WI. 53151.

HT32 VOX, PTT, break in CW. Sell or trade for gear or antenna rotor. Jim Miller, Box 94, Bowling Green, MO. 63334.

SELL: VHF Transmitter T23/ARC5, 100-156 MC brand new, in original carton with tubes, $16.95 plus postage on 20 lb. C. Lewis, 9 Conrad Pl., Dover, NJ. 07801.

LIKE NEW: Galaxy GT550 with AC supply and 25kc cal., $375.00 includes shipping. Certified check only. WB4PXW, 555 14th Ave., South, Naples, FL. 33940.

FOR SALE: HT37 — What am I offered? Local buyer. Pick up only. W2OWL, 212/896-1662, evenings. Ruth B. Siegelman.

SELL: Yaesu FTDX-560 with built-in blower, like 570. Spotless condition. Will ship UPS. Price, $425.00. Andros Thomson, Box 326, Parsons, W. VA. 26287.

WANTED: Collins Preselector 55G-1 or let me borrow the circuit diagram to copy. H. Marhoff, Box 569, Largo, FL. 33540.

FOR SALE: Johnson Valiant I, $135.00; 6N2 Xmtr, $85.00. BC-779A Super-Pro Rec., $75.00. Northend Radio FSK, 4A, $60.00 w/power. J. H. Ashley, W4OSC, Box 254, Ware Shoals, SC. 29692.

PRECISION 10-12 portable to date to 12 pin compactors, battery cond. tester manual. Charts, $50. A. Moust, FI3-6091.

CHART RECORDERS: E-A Model AW. 150 ma, 100 mv. Speeds 3/4 in. hr. to 12" min. Have 2 and 14 rolls paper. Sell or trade for 30 mHz counter or 2M FM. WB4HLZ, 3479 Mark Twain, Memphis, TN. 38127.

FOR SALE: Mint National NCX-5, NCX-A; pwr supply/spkr and XCU-27 xtal calibrator. Also Gonset GSB101, 1200 watt linear. Both $525. Jack Hartley, K4WSB, 512 Severn, Tampa, FLA. 33606. 813/258-4441.

NATIONAL: SW-3 receiver with coils & power supply. Best offer over $75.00. Dick Nebel, W2-DBQ, 31 Whitehall Blvd., Garden City, N. Y. 11530. Tel: (516) 741-6603.

SELL: OS-106-B Solid State Scope, $125.00. Also R-388 with built-in Product Det., $325.00. W4AIS, 300 Thornwood, Taylors, SC. 29687.

SELL: Mint SX-111, $75.00. Mint T43GGV with Acc. on .34/.94, 2 freq. model, $65.00. KAAR Dt-76 with acc., $250.00 (on 146.76). J. M. Wright, 605 E. Elm St., Morenci, Ariz. 85540.

SELL: New — Eimac 8877/3CX1500A7, Used — Eimac 8170/4CX5000A, Drake TR4 w/NB — Mint. SASE for details. A. Emerald, 8956 Swallow Ave., Fountain Valley, CA. 92708.

WANTED: Viking Valiant, 572B's, Xmtg variable caps. M. Caldwell, W8IFN, 1068 Windsor, Morgantown, W. VA. 26505.

MECHANICAL FILTERS: 455kHz 2.1khz, $18.95. 300Hz, $22.95. J. A. Fredricks, 314 S. 13th Ave., Yakima, WA. 98902.

SELL: 3251/516F2 with manuals, $450. Sever, 8464 Cleveland Ave. NW, North Canton, Ohio, 44720.

CX-7A, $1395; 755-1, Q-Mult., $275; 32S-3, $475; Cliff-Dweller, CD-75, $45; Mosley CM-1 Receiver, $65; K1VTM. Call: (203) 224-4581.

SELL: Drake R-4B Receiver and matching spkr (MS-4) perfect condx, never used, original carton, $425. Will trade for 4-track reel recorder. George Reed, 20 Altdorf, Tell City, IN. 47586.

FOR SALE: 6 meter transmitter 2KW-AM & SSB. Homebrew with racks and cabinets. $200.00 or best offer. Write L. M. Covey, 238 Jenness St., Lynn, Mass. 01904. Tel: (617) 635-0628.

FOR SALE: 80 mtr VFO ss described in Dec., 1967 CQ, $20. Dow Co-Ax relay 400 ohm 28 volts $8.00. W6BLZ, 528 Colima St., La Jolla, CA. 92037.

SWAP: Clegg 99'er; Telrex Beam for Johnson 275w. matchbox with SWR or 432 converter or whatever. WA2PCL, 101-23 Lefferts Blvd., Richmond Hill, NY. 11419.

WANTED: Late Model Linear. Have for sale Hunter 2000B. Needs transformer. W3MSN, 5108 Boulder, Oxon Hill, MD. 20021.

SELL HALLICRAFTERS SX-110 perfect with manual, $70. Need HW-16 or similar novice set-up. Will trade. Rob Schmitt, 1206 W. 15th St., Tempe, AZ. 85251.

ANT: Lafayette all band tunable 18' vertical complete with coax es plug, $14 ppd. WA3LPK, K. McKewen, 2300 Louise Ave., Balto., Md. 21214.

HEATHKIT IG-57A sweep/marker gen. Factory wired. Brand new, $140. P. Carron, 205 Ridgewood Rd., EAston, PA. 18042.

SASE for tube and xtal list. Have several 8025-A triodes. New, full ratings to 500mc. $10.00 each with spec sheet. Jess Lebow, Jr., K8LJQ, 351 Mower Rd., Pinckney, MI. 48169.

AUDIO CW FILTER: 60db down one octane from center freq. of 750Hz, $12.95. M. Jue, K5FLU, Box 494, State College, MS. 39762.

HEATH HW101, HP23A P.S., SB600. Mint $260. Prefer local deal. (212) 646-7725.

WANTED: For collection Cetron Co. Tubes Type T-200, T-300 or Taylor same type, Eimac T-750, T-1000, T1500. W9LGH, 610 Monroe Ave., River Forest, IL. 60305.

FOR SALE: New obsolete car radio vibrators, also a few old car radios. List SASE. James Fred, Rt. 1, Cutler, IN. 46920.

SELL: HW32, $75, SR42A, $75; BR46A, $65. Viking II and 122 VFO, $75. K9VPS, 3110 Wisconsin, Berwyn, IL. 60402.

SURPLUS METERS: Weston 2521 2 3/4" round 0-100UA scale reads 0-10v. 3.00; Burlington 2 3/4" round 921 DB meter -18 +3 3.00 add postage. Ken Maas, Burlington, Wis. 53105.

FOR SALE: Heathkit model DX60 $70 and Heathkit model DX100 $90. Both with manuals and in excellent working condition. WN3 RJW, Ken Heinz, RD 3,Box 416, Blairsville, PA 15717.

National NCX300 transceiver w/ AC-PS, checked out AOK, $175 U ship, KØCBB, 201 E. Porter, Kirksville, MO 63501.

SELL: 4 1/2" x 19" cabinet-unfinished extra heavy duty 4-400 amp & power supply. WA9IDT-MEL-442-3767.

WANTED: Schematic for army radio AN/PRC-10 and source of battery BA-279. B. Haffner, 14316 Minerva, Dolton, IL 60419.

SELL: BC-312M Receiver with RA120 Pwr Supply for 117v 60 cycle. $35. No shipping, prefer U-pickup. W2NYU, 201-391-8418. NNJ.

SELL OR TRADE: Many items - send for list. CB rcvr, all band rcvr, 6 mtr scvr,etc. K5ZUV/4, P.O. Box 7502, Miami , FL 33155.

SELL: Cushcraft A28-4 10 meter 4 el. beam $25. Turner 454x mic. $10. Wen Turner, W7ISG, Box 175, Mesquite, NV 89024 (702) 346-5485.

FOR SALE: Practical radio comm. Nelson & Hornung Radio manual-Sterling. Elements of radio. Marcus Douglas, 2254 Pepper Dr., Concord, CA 94520 $3. each F.O.B.

FOR SALE: Lafayette HR-45A 6 m scvr, Allied Star-Roamer, Lafayette Comstat 19 CB xcvr, K5-ZUV, Box 7502, Miami, FL 33155.

Kleinschmidt teletype AN/FG 17 w/ reped, TD, desk, good cond $100. U44BBT UHF FM no. cont. $25, Cmuel5 UHF/FM complete $40. Dumont 6m FM no. cont. $20. George Kracke, WA2AGR, RD1, Box 487, Millville, NJ 08332.

TRADE OR SELL: my duplicates of Early radio & Wireless items, consisting of receivers, parts, books, catalogs, handbooks and call books. List for stamp, Erv Rasmussen, 164 Lowell St., Redwood City, CA

WANTED: SSB transceiver. Must be reasonable. State price and condition. M.E. Leisy, 106 Whitecliff Dr., Vallejo, CA 94590.

SB-220 Heath Linear amplifier $340. Pick-up only. WB4WAB, Virginia Beach, VA PH 499-6112.

FOR SALE: Swan 500 CX and AC power, like new $495. Galaxy V Mark II with AC Power, good, $250. W6ME, 4178 Chasin St., Oceanside, CA

WANTED: National HRO Sr. Receiver 1936-1946 vintage. A. Balint, W9IE, 222 N. Broadway Ave., Park Ridge,IL 60068.

FOR SALE: Lafayette Exploair Reganitive type receiver-550kc to 30mc. $17. Bruce Ryle, R.R.2, Rising Sun, IN 47040.

4 x 5 Camera Anniversary Graphic with Graphic Optar 135mm F 4.7, Rangefinder, holders, and flashgun $175. W6RW, 8600 Skyline Dr., Hollywood, CA 90046.

TRADE: CB xcvr, 6mtr xcvr, Star Roamer, more for tri-band beam 2mtr beam, and the like. K5ZUV/4, P.O. Box 7502, Miami, FL 33155.

BC-342 xclnt 1.5-18 mHz rcvr with manual and matching LS-3 spkr. AC pwr. $70. Silbert, White Sulphur Springs, NY 12787.

WANTED: For amateur museum, Cetron or Taylor T-300 Tube, Fleming valve, DE Forest Spherical audion with Candalabra screw base. Other antique tubes. W9LGH, 610 Monroe Ave, River Forest, IL

SWAP: Two Each: Blonder-Tongue TV camera, ITT monitor chassis, camera control. Fully transistorized, rack mounted. For SWAN cygnet, 270B in working cond. Oberstein, 55 Knolls Crescent, Bronx

FOR SALE: Swan 500 and 117XC Power Supply $300.00; TR106 for $45.00. Ham Scan, $25.00. All in excellent condx. Ray Rutske, 3349 Cuneen Trail E., Inver Grove Hts., MN. 55075. K0JPZ.

LINEAR BUILDERS: 30 Amp Filament, Chokes for GG Linears. Perfect for pair 4-400A's, 3-500Z's, single 4-1000A, etc. New, not surplus, $5 each. 2 for $9.50 plus .50 shipping. V. Murrell, K4HHA, Rt. 6, Newport, TN. 37821.

SELL: HT-37 with manu. gud condx and looks, $175.00. Brand new HP-23 AC power transformer. $9.50. Want to buy: Swan 117-XC A.C. supply. W. S. Anderson, WA4MTZ, 68 Russell Ave., Garden City, GA. 31408.

INSTRUCTOGRAPH with 12 tapes, $45. General Amateur Theory Course (reel) 1/2 price, $22. WB9FKK, 6845 N. Ironwood La., Milwaukee, WI. 53217.

SELL: Swan VHF 150, two meter amplifier, mint cond., $185. Little used. WB4SNK, 2710 Sunny Brook Rd., Jacksonville, FLA. 32216. (904) 725-0374.

CQ & QST library bound volume 1950-1965 and 1945-1965. Make offers. Also 73 1960-1969. Reasonable. R. Mendelson, 27 Somerset Pl., Murray Hill, N. J. 07974.

HW-16 xcvr, 9 mo. old, has new final and is in exc. cond., art novice rig. $85 or swap for test equip. WB5GSK, P. O. Box 4, Talala, OK. 74080.

WANTED: Crystals and/or holders. FT-243 types only. Large lots, 1000 or more. W6DOR, 2921 Loyola Dr., Davis, CA. 95616.

SALE: National NCX-3 transceiver with both AC and DC power supplies. $150.00 plus shipping. W. Howard, W4MIO, 2506 Isabelle Cir., Huntsville, AL. 35811.

PROP PITCH Fully converted with Selsyn and compass rose, $65. Pick up only. Peter Butler, W1BPW, 3 Elizabeth Dr., Merrimack, NH. 03054. (603) 424-7373.

TOUCH TONE ENCODERS AND DECODERS' SASE for list. CRD Associates, P. O. Box 291, Western Springs, IL. 60558.

SELL: Heathkit Rcvr HR-10B with crystal calibrator and manual. Excellent, $55. A. M. Fox, Box 895, Greeley, CO. 80631.

FOR SALE: Complete set of Rider's (Vol 1-23) service manuals. Best offer. K7LQY, 1849 Stevens Dr., Richland, WA. 99352.

PHONES: Used ITT Kellogg Phones, ideal for patch or intercom system, $3, $4, $5. WA6OLB, (714) 595-0224.

WANT TO BUY: Johnson KW Matchbox w/bridge and meter. State price and condition. Don Whitney, K5GKN, P. O. Box 249, Osceola, AR. 72370.

SWAP, Two each: Blonder-Tongue TV camera, ITT monitor chassis, camera control. Fully transistorized, rack mounted. For SWAN cygnet, 270B in working condition. Write: Oberstein, 55 Knolls Crescent, Br. 10463.

SELL: HALT. HA-2, HA-6 Transcvr, w/pwr supply, $200.00. Will not separate. J. F. Lavin, WA9-AZL, 2021 N. Oak Dr., McHenry, IL. 60050.

UA1PAA on 700 milliwatts? QRPP? Read about it in the Milliwatt, plus construction projects, QRPP WAS/DXCC and features. $3.40 year. Ade Weiss, K8EEG, Meckling, SD. 57044.

SELL: Dynamic Mike, high impedence, like new, Allied 33-918, $6.00. ARRL Handbook, 1942 $3.00. Ed. & Eng. Radio Handbook, 1947, $4.00. B. Nastoff, 320 W. 56th Pl., Merrillville, IN. 46410.

SALE: Several items Ham & Test gear like new. SASE for list. Want to buy your unfinished or non-working kits. Advise price, condition. Harold Dalton, P. O. Box 641, Easley, S. C. 29640.

FOR SALE: SSB Transmitter, Gonset GSB-100. Cannabalize or fix it, $75. P. H. Hadley, 633 Fairmont Ave., Westfield, NJ. 07090.

SELL: HQ180C general coverage amateur band receiver. 160 thru 10 m. Very good, $275. W2LFZ, (212) 454-8301.

WANTED: Chimney for 4-1000 tube. Please state price in letter. W7VRO, Box 981, Bellingham, Wash. 98225.

WANTED: TH6DXX, W2UGM, 66 Columbus Ave., Closter, NJ. 07624. (201) 768-1884.

MINT HEATHKITS Prof. wired 401, 303, 220, 600, 610, Drake MN2000. Cert. Check, $1000. WA3-LSU, 319 Fawn Hill La., Narberth, Pa. 19072.

ORIGINAL MISSILE GUIDANCE Television. NV-RCA CRV46ABR airborne TV Rcvrs, 28V Dynamotor Power. A. V. Thompson, Box 177, RD 1, Telford, Pa. 18969.

HEATH SB-300, SB-400, $325.00; SB110A, HP-23A, $225.00. KWM-2, 516F2, $625.00. WA3-HMQ, 301 Blacksmith Rd., Camphill, PA.

FOR SALE: 75A4's. All over serial 5000, $500. 200-V, $350; 32S1, p.s., $350. Capacitors: 100 MFD/4KV, $25. Much more. James W. Craig, 29 Sherburne Ave., Portsmouth, NH. 03801.

SELL: Mosley Cubical Quad, Heath SB0401, Bird 500 watt dummy-load wattmeter, more. Write for list. SASE. Rich Levy, WB2MAN, 30-A Arleigh Rd., Great Neck, NY. 11021.

SELL: WRL Duo-300 AC/DC power supply. Like new, $45. J. Heise, 243 Fairway Dr., Fairborn, OH. 45324.

WANTED: Heath wattmer; and station console. Plus QST, 73 CQ binders. - Tom Dornback, 2515 College Rd., Downers Grove, ILL. 60515.

FOR SALE: HP-13DC supply, $35. Needs power transistor, HA-14 Heath Linear and AC supply, $100, Hammarlund Speaker, $15. No shipping. F. Miller, Clarkson, Nebr. WA0ILV.

AWARDS HUNTERS: World's only complete copyrighted DIRECTORY of CERTIFICATES and Awards, $5 to IARS, Inc., Box 385, Bonita, CA. 92002.

WANTED: 115V to 24V 10 amp transformer for low budget project. Heard S. Lowry, K4VFA, 915 Madison St., Manchester, TN. 37355.

SSTV gear, Robot Model 70 Monitor and Model 80 Camera Brand new, plus lens, viewing hood, Sony TC122 tape deck. An $800 value for $500. WA3-LRJ, 1160 King George Ct., Pittsburgh, Pa. 15237.

WANTED: 80-10m SSB Transceiver including PS IF separate. Please state condition and price incl. shipping. Hoyler, 232 Knickerbocker, Pittsburgh, PA. 15235.

WILL PURCHASE OR SWAP for your unusable, or non-equipment if it sutis my needs for experimental purposes. Wanted Central Elec. Slicer or similar. E. Sjolander, Jr., 218 2nd Ave. E., Ashland, WI. 54806.

SWAP: LM Freq. Meter for Spring-wound instructograph. W9NNM, Box 109A, Pembine, WI. 54156.

WANTED: EXACTA camera & lenses; antique radios; 75 watt xmtr 80-10 with break-in; xtal, homebrew OK. (novice) Jim Gunn, WN1QNK, Ossipee, NH. 03864.

LOW PASS FILTER, B&W - 426, 70 ohm, 1st $15. H. Anderson, 639 N. Wahsatch, Colo Sprgs., CO 80903.

WANTED: 2 meter FM Transceiver, K3DTL, Art Prutzman, 302 Wyoming Ave., Kingston, Pa. 18612.

FOR SWAP OR SALE: COLLINS 516E-1 Mobile Power Supply with cables, $100. You pay shipping.—J. Paul Scott, 1304 Osceola St., Dothan, AL. 36301.

Trade 32SI xmtr on R4, HQ215 or 5IJ rcvr or swan 160xcvr. W5BSU 1210 So. 93 East, Tulsa, OK 74112.

FOR SALE: Manual Tone Generators for tone keyed Rep'trs. Any freq. $3 PP State desired freq. WØTBY, 1220 S. Monroe, Denver, CO 80210.

WANTED: Parts from cannibalized KWS-1-Cabling, Tuning and Loading knobs, High voltage connectors J402, P402, etc. send information to M. Ross, 395 Pleasant st., Truro, N.S.

SELL: DX-60 and HG-10. $70. mint conx. Jim Fleming, 6N705 Harvey Rd., Medinah, IL 60157.

WANTED: Early radio "Perikon" crystal detector, parts or info. Uses two minerals in contact. Bob Lamb, WA5ZXC, Box 454, Leander, TX 78641.

WANTED: Rider manuals - Volume 6 through 9 ARRL Handbooks in following Editions: 1-6, 8, 10, 11, and 13-17. Want old ham receivers regardless of condition. State price in your first letter. Thanks. W2GHF, 45 Allen Dr., Woodstock, NY.

WANTED: QST before March 1923 & Collins 32G xmtr. Jock, ZL2GX, 152 Lytton, Gisborn, New Zealand.

TouchTone Pads, Encoders, Decoders. Autopatch systems, Ltd. P.O. Box 291, Western Springs, IL 60558.

400 mHz band HMBREW RX's xtal 1st. conv., 1 mHz tuneable I.F. all sil. xstrs, 117 vac. $30 ea. Jim Limber, 913 S. Carpenter, Chicago, IL 60607.

FOR SALE: Telegraph keys, WWII new mint $5 ppd. Goodman, 5826 S. Western Ave., Chicago, IL 60636.

SALE: Solid Oak Speaker enclosures, unfinished, three sizes, reasonable prices, send SASE to: 2613 Mural Dr., Chamblee, GA 30341.

Want to Buy. Antique wireless spark setup & battery operated radios. T. G. Soukup, 161 Bob Hill Rd., Ridgefield, CT 06877.

Want crystal set, stock ticker, telegraph items and QST's. Dr. D. Spence, Bld. 203, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439.

SELL: Swan 250 $200. Clegg 99er $45. Heath Apache TX-1 $75. Drake 2B $100. Jeff Beals, WB2OUK, 470 Lafayette Blvd, Long Beach, NY.

Hallicrafters SR-2000, P-2000. Excellent condx. No scratches. $795. FOB Dallas, W5RKT, 900A Spring Valley Plaza, Richardson, TX 75080.

Heathkits cheap cond. transist checkers. grid dip, impedance bridge, 0-12 scope, LM freq. meter, others. SASE, 2612 Crestview, Newport Beach, CA 92660.

TRADE: Tektronix 511-AD scope for good 2 meter solid state FM transceiver. James Parsons, 3113 Edgewood Dr., San Angelo, TX 76901.

MAC-KEY: wanted for family keepsake. Teardrop shape key or bug preferred. State price and condition. H. McElroy, WB4PPV, 805 Meadow Lane, Vienna, VA 22180.

CW ops please make note to check in with us 705.5 kHz each Wednesday evening 7:30 PM County Hunters Net.

FOR SALE: SB301 excellent condition with CW filter $180. 1938 to 1970 QST $50 or best offer. 1954 thru 1959 CQ $5. W9UDK, George Zurbuchen, 13631 S. Elm St., Orland Park, IL 60462.

ROCHESTER, NY is the place to go for the largest Hamfest, VHF meet and flea market in the northeast. May 12th. Write WNY Hamfest, Box 1388, Rochester, NY 14603.

Low Frequency DX antenna cost $7200 will sell $350. Collins 237-W1X conical monopole High Gain on 80-40 WAØEMS, P.O. Box 11, Liberty, MD 64068 (816) 454-3213.

HELP: Parts and equipment needed by high school radio club. Send anything! Triton Regional High, c/o Mr. Freeman, Byfield, Mass. 01922.

HQ110 looks, workslike new for $75. DX100 good condx, $25. Manuals for both. U ship or will deliver 150 miles. W1CFM, 58 Rawlinson Dr., Coventry, R. I. 02816.

SELL: HQ110 Rcvr with clock, matching spkr, and manual. Like new condx, W9ZEW, Rudolf Oras, 3636 S. 59th Ave., Cicero, IL. 60650.

SELL: 30L1 Linear, round emblem, $375.00. Mint Drake DC3 supply, $85.00. Want 312B4 or 5 and KWM2 or 2A. M. D. Shapiro, 1138 Boxwood Rd., Jenkintown, PA. 19046.

SELL: EICO 369 Sweepgenerator, $55.00. Collection antique mags. Panel meters cheap. Samkofsky, 4803 Brenda Dr., Orlando, FL. 32806.

SELL: Hygain 153BA 15 mtr beam, $50. Hygain 12AVQ, $20. Both perfect. WB4VKW, Box 224, Tuscumbia, AL. 35674.

FOR SALE: Complete Amateur Station SASE for detailed list and price. Tom Strohmeyer, 2504 Clarendon, N.W., Canton, OH. 44708.

WANTED: Heath SB-650 Frequency Display, in any condx, and Magnum Six speech processor. Mike Ludkiewicz, 143 Richmond Rd., Ludlow, Mass. 01056.

WANT: SSTV Skeds on 6 to 80 meters. Art Prutzman, 302 Wyoming Ave., Kingston, PA.

SELL OR TRADE: SSB Receiving Conv. CV-591A/URR. Units complete unchecked, $45. Clem -K8HWW, 33727 Brownlea, Sterling Hts., MI. 48077.

FREQUENCY SPECTRUM LISTING, $1.00. Computer Printout, WB9HWS, 408 - 51st St., Western Springs, IL. 60558.

TRADE ELECTRO-VOICE, 664, with desk stand for nice D-104 with G-stand. K8CJX, 22960 Valley View, Southfield, MI. 48075.

WANTED: Heath Wattmeter/SWR HM102, Cantenna, older Heath Catalog (about 1963-65), set of late used callbooks, used copy of world radio-tv-fm-guide, and 3-5 pos coax switch. T. Coddington, 7825 Scotts Valley Rd., Lakeport, CA. 95453.

DRAKE RV-4 Remote VFO brand new, $90 P.P. Mini Products C-4 Vert. Ant., $25 P.P. Feely, 15 Locust Hill, Yonkers, NY. 10701.

WANT: Early radio magazines such as Electrical Experimenter, Wireless Age, Radio News, etc. Will pay cash or trade QST's, CQ's or old Radio books. Rasmussen, 164 Lowell St., Redwood City, CA. 94062.

HAMMARLUND SPC-10 SSB converter rack, model for use with SP-600 receiver, new condition, less meter, $75.00. Wayne Cordell, Rt. 3, Weaverville, NC. 28787.

SELL: Hallicrafters SR-150 Xceiver, all mobile accessories inc, antenna. SSTV gear. Mikes, bug, electronic keyer, meters, test gear, relays. Send SASE for list. WA3LRJ, 1160 King George Ct., Pittsburgh, PA. 15237.

NEW 12.5vDC 5A&, Reg., Adjust., AC Pwr Supply, $25; VHF Wattmeter, $45. Trade list SASE. W4-API, Box 4095, Arlington, VA. 22204.

SELL/SWAP: HW-10, 20, 32, KWM-2/SB-110/SX-71/MR-1/MT-1/2ers/6ers/RTTY 15, 19, 26. SASE for list. W9FQN, Rt. 4, Box 428D, Escondido, CA. 92025.

FOR SALE: ARRL Handbooks 1936-40-41-43--44-45-46-47-49-52-53-54-57-63. Price $3 each. Two for $5. FOB. Douglas, 2254 Pepper Dr., Concord, CA. 94520.

SWAN 250 w/PS $195, Swan TV-2, $140. Trade? WB6NKM, 2534 El Tonas Way, Carmichael, CA. 95608.

WANTED: Large numbers of FT-243 crystal holders and hardware. E. Taylor, W6DOR, 2921 Loyola Dr., Davis, CA. 95616.

WANTED: W8FYO Paddle for electronic keyer. K9WEH, 201 E. Marion, Prospect Hts., Il. 60070.

HELP! European radio club needs reasonably good SSB RX in SX-96, HQ-110, 2B, 1A, RME-6900, Heath Mohawk, etc class. Make a good USA club project. Transportation already arranged and prepaid. Inquiries and offers to W5QPX, Baker, 101 Rita Blanca Trl., Amarillo, TX. 79108.

SELL: Hallicrafter SR-150 transceiver and PS-150-120, $250., SB2-LA 1KW. Linear Amp., $150. Both mint condition. K6SHA, 411 Mission Dr., Camarillo, CA. 93010.

COLLINS: 51J4 SER3894, orig wiring, exclnt condx., $400. Art Ford, 56 Gildare Dr., E. Northport, N. Y. 11731.

WANTED: One Drake AM Plug-in filter for TR-6 Transceiver, advise price and condition, K3YMN, 2185 Sampson St., Pgh., Pa. 15235.

FOR SALE: Motorola 80-D FM Xcvr with new T-power control, Heath HW32 Xcvr. Make offer. WB9EZS, 515 and one-half Germania St., Eau Claire, WI. 54701.

WANTED: Schematic of Panalyzor Model SB-86, Model 10,000. A. T. Butler, 1157 Rivermont, Eau Gallie, FLA. 32935.

FOR SALE: Heath SB-301 with CW filter, $225; SB-401, $225. Both prices firm. WB2GBR, RR 1, Box 134, Titusville, NJ. 08560.

FOR SALE: SRRUU, 15kc 600kc, $140; URR27 110mc 190mc, $125; ARR7 550kc 42mc P.S. Prod. det., $45. N. R. 152 RTTY Convert, 850 shift, $45. John Murray, W2OAP, 40-33 61st St., Woodside, NY. 11377.

YAESU FL2000 like new, $160. Pair 6 ele 6m beams. Brand new, never assembled, $35. WA8-MLV, 1008 Englewood, Parma, OH. 44134.

AMECO Code records 104-33 and 106-33. Perfect. Will send to first $6.00. E. Jeltrup, 27A Lincoln Pl., Ossining, NY. 10562.

WANTED: 1/67 thru 9/67 Electronics Illustrated & 12/65 Popular Electronics. Can pay reasonable amount. BOB, 5227 Royal Dr., Mechanicsburg, PA. 17055.

SELL: Vibroplex Bug, $12.00 ppd. WA4KCN, 4921 Edenshire Ave., Memphis, TN. 38117.

SELL HT32R Transmitter. Original owner. Mint condition. $180.00. W7ADS, 109 No. 32nd Ave., Yakima, WN. 98902.

PARTS FOR 1KV FINAL-TRANSF. 3kv, 225MA, choke, 2.5V. Fil. Transf., 2-3MFD 4kv oil caps. All for $15.00. Pick up only. K3KUL, 762 S. Gulph Rd., King of Prussia, Pa. 19406.

SELL: Gonset G-50 yellow in mint condx. $100 or trade for 2 mtr. AM HW-17 Heathkit. W.T. Golson, W5CD, 5465 Washington Ave., Baton Rouge, La. 70806.

SELL: Heathkit Frequency Counter, IB-101, brand new condition, $145.00, you pay shipping. Certified check or money order only. H. C. Richardson, 1109 Dakota S.E., Albuquerque, NM. 87108.

CALL LETTER LICENSE PLATES, expired, wanted for collection. Will reimburse postage. Art Phillips, WA7NXL, 3401 N. Columbus, Apt. 5-O, Tucson, AZ. 85712.

WANTED: HP410B or C Meter and other TV test equipment. Sams AR Manuals have for sale 2 Atwater Kent Radios. P. L. Williams, 106 S. Jefferson St., Lewisburg, WV. 24901.

GLADDING 25, TX16283494 RX76 88 94, Preamp and Touchtone $250 FOB. Keith O'Brien, 8401 N. Atlantic Ave, L-15, Cape Canaveral, FLA. 32920.

WANTED: Set of plug-in coils for Central Electronics 10A exciter. W4YOK, 231 Bittersweet La., Henderson, KY. 42420.

WANT: Johnson 811A tube socket, Johnson T.R. Switch. Larry Kellough, WB9AZQ, 1418 DuBois, Vincennes, IND. 47591.

FOR SALE: Center reading milliampere meters, $2.50 ppd. Goodman, 5826 S. Western, Chicago, IL. 60636.

URGENTLY NEEDED, Source of parts for R390A, Receiver, Manual for CV-157 Sideband Converter. E. Sjolander, Jr., 218 2nd Ave. E., Ashland, WI. 54806.

TEKTRONIX 514D SCOPE. Good working condition. Wife says must get rid of non-essentials. Best offer takes. W0NIZ, RR 5, Box 761, Golden, CO. 80401.

REALISTIC Globster 5 Bd Port. Radio for Eico Model "Space Ranger" 718 Recr in good condition or similar recr. S. L. Ballinger, 11 Lown Ct., Poughkeepsie, N. Y. 12603.

BC-342 1.5-18.1 mhz recvr w/manual and matching LS-3 spkr, AC pwr, $75. Silbert, Box 77, White Sulphur Springs, N. Y. 12787.

WANTED: T4X, R4A, Telrex 20, 15 beams. Sell 3600-0-3600 at 1 amp Xfmr 110/220 pri $25. Rev. Bittner, 814 4th St. S., Virginia, MN. 55792.

NEVER USED MATCHBOX with SWR. Must sell for best offer. WA1MFB, Steve Sturgis, 44 Washington St., Shrewsbury, Mass. 01545.

LOOKING FOR CANDLER CODE COURSE, Telegraph keys. Cash or swap radio parts. W8OHO, 695 E. Ford Ave., Barberton, OH. 44203.

FOR SALE: Mint Clegg Interceptor B with all bander conv. — 80 to 2 meters, $250. Pickup. K3MGO, 12 Larchwood Rd., Wyomissing, Pa. 19610.(215) 374-9342.

FOR SALE: Eico 753 with transistorized VFO and AC-DC supplies, $160.00. W8IIT, 281 Jenny La., Dayton, OH. 45459.

FOR SALE: Hammarlund HQ100C, $100, Johnson Adventurer, XMTR, $50; DX-100, $100; Mohawk RX-1, $125. D. McCrary, 1109 Ewing Blvd., Murfreesboro, TN. 37130.

WANTED: Dolby Noise Reduction Unit, TEAC, Concord, etc., state price and condition. All replies answered. W3WIY, 1705 Kaywin Ave., Bethlehem, PA. 18018.

SELL: SR-160, AC and DC supplies. Mint, $250. K9FRZ, Jim Fleming, 6N705 Harvey, Medinah, IL. 60157.

P.A. Amp. "Recordplayer," $15.00; also 7" reels mag. tape, $1.00 disc. for quantity. WA7NUZ, P. O. Box D, Springfield, OR. 97477.

NOVICES, Crystals for new 10 mtr, and 40 mtr. bands. Also other novice bands. SASE for list. Reasonable. K8LJQ, 355 Mower Rd., Pinckney Mich. 48169.

Marine Band receivers-Collectors items, old Mackay 128X regenerative TRF covers 15-650 kHz, & others. Make offer or trade. W. Small, 27828 E. 15th St., Hayward, CA 94544.

WANT: URM-25F, CR-88A/CRV46246B manuals; VF-1 or HG-10 for school radio club. KØPYV, 8449 Quinn Ave., So. Bloomington, MN 55437.

Wire 62 lb roll No. 18 tinned, 37 lb roll No. 8 copper, offers, Ameco TX62 & UFO $135 new. Eico keyer $45. W5SYB, 5000 Hall, Amarillo, TX79109

FOR SALE: SSB Transmitter, Gonset SSB-100. Fix or scrap it $50. Hadley, 633 Fiarmont Ave., Westfield, NJ 07090.

WANT TO BUY: Johnson Viking Valiant, any condition. Harper Richards, East St., Argyle, NY 12809.

WANTED: B&W LPA-1 Linear Amp. OK if short tubes. K6INO. J. Bothwell, 2824 Clark Ave., Carmichael, CA. 95608.

FOR SALE OR SWAP: Have Model RD-92/UX facsimile picture receiver and matching CV-176A/U freq. shift. converter. Both in perfect condx with manuals. Use with any short wave radio having a B.F.O. Wanted 6&2 meter gear. Bob Eslinger, WA1BZS, P. O. Box 453, Putnam, CT. 06260.

SELL OR TRADE: Best offer: HRO-50 AA-AC-AD tuning coils and dials, 3 GE progress line FA/E33W FM mobile transceivers, Freq. 152,480 MHz complete. A. E. Patron, XE2R.

WANTED: Drake R4B, T4XB, and L4B. Must be real cheap. State price in first letter. W1DBS, John Savonis, 410 Blake Rd., New Britain, CT. 06053.

BC610-E complete with speech amp, antenna tuner. Spare 250TH $150.00. W0ER, Box 577, La Crosse, Ks. 67548.

NEW FPM300 Xceiver warranty card, $525 mint Kenwood R599 rec, $280 and HR212, $210. W9HLA, 713 Oak Lake Bluff, IL. 60044.

WANTED: 6 meter SSB or AM Scheds within 250 mile radius of St. Paul, Minn. WB0IWG, Box 515, Carleton College, Northfield, Minn. 55057.

WANTED: Johnson Matchboxes. Wm. Cannon, 500 N. Home Park Ridge, IL. 60068.

DO YOU NEED RTTY EQUIPMENT? G-10 pc board or general parts. Send SASE to K1UVR, 54 Kaynor Dr., Waterbury, CT. 06708.

FOR SALE: Motorola Test Set Model S1056A Serial 172784 with manual. T. Midlam, K7SQD, P. O. Box 1204, Moab, UT. 84532.

SELL OR SWAP: Triad TY-83 Toroidal Transistor Power Supply Transformer, 12 V.D.C. to 500 V.D.C. at 250 MA. B. Schwartz, 28 Bridlemere, Interlaken, NJ. 07712.

FOR SALE: Hustler Vertical 4BTV 25.00, RM-75-S, 14.00; WA1HFN, 20 Bulkley Rd., Sudbury, Mass. 01776.

K3RCF/2 has a new QTH: P.O. Box 324, Fishkill, NY 12524.

SELL: LM Freq. Mtr w/ac pow. sup. cal. book $40. EV mic. mod 920 $12.50. Mars hybrid phone patch Mod. LE-2 $18.50. W6GAH, 2421 Boundary, San Diego, CA 92104.

TV camera-Fairbanks-Morse-New Vidicon, complete with cables, power supply, manual Works FB $100. J. Buscemi, K2OVS, 8 Wexford Ct., St. James NY 11780. 516-584-7951.

SELL: 100's Antique Radio magazine. Large collection I.C.'s. SASE for listings. TRADE: Goldcrest No. 1068 prof. tripod for Simpson No. 260 or? Samkofsky, 4803 Brenda Dr., Orlando, FL

The Rockaway Amateur Radio Club Annual Spring Auction will be held Friday evening, April 27 at 8 P.M. at the Hall of Science Building, World's Fair Grounds, Flushing, NY. Doors will be open at 6 P.M. to accept items for the sale. $1.00 donation accepted at the door.

STEREO: Lenco turntable $40, Garrard SL65 $40. Sansui 200 $90, 2 KLH 17 spkrs $95. WN4UCC, No. 96 Hallmark Ests, Athens, GA 30601.

FOR SALE: Galaxy 300 with 110 V. power supply Just been factory reconditioned. A-1 condition. $100 you pay shipping. W5JMH, 2328 Ave. N1/2, Huntsville, TX 77340.

G.E. 30-50 mc FM Rec. $15., G.E. 150 mc FM xceiver $15, Lind 30-50 mc FM xceiver w/control $20. W. Davis, K6KZT, 4434 Josie Ave. Lakewood, CA 90713.

Heath SB310 S.W. Receiver & SB600 speaker $230. AR19 stereo receiver w/case $230. Paul Mayo, 2409 Ocean Pkway, Brooklyn, NY 11235.

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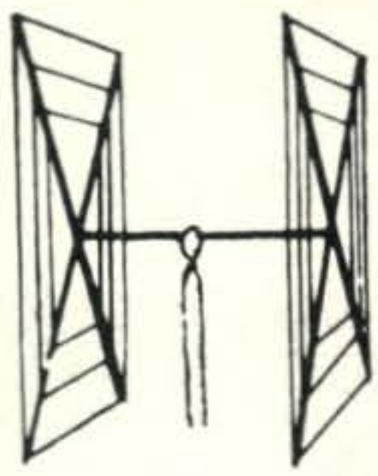

W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy 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	$41.00
10-15 CUBICAL QUAD	36.00
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TWENTY METER CUBICAL QUAD	31.00
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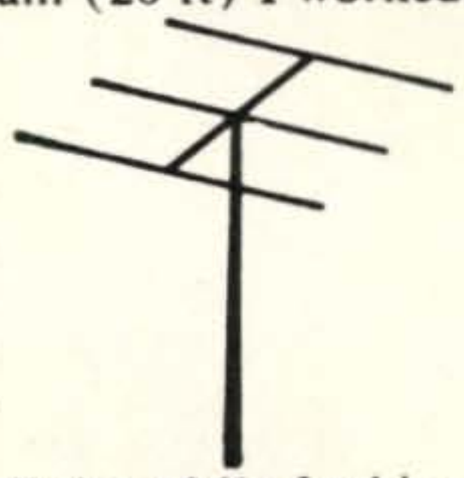
The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



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

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4 EL 20	38*	4 EL 6	24
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3 EL 15	25	12 EL 2	31*
4 EL 15	31*		
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*20' Boom

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FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

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RX wide band, less ovens	$18	$18	$18	$18	$12

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Using a single EIMAC X-2159 super-power tetrode in a Continental Electronics transmission line-cavity configuration, this amplifier combines high power gain with excellent operating stability and complete freedom from circuit parasitics.

A single amplifier stage using two EIMAC X-2159 tubes is capable of over 2.5 megawatts of 100% modulated carrier. Two amplifiers combined would make a 5 megawatt transmitter a practical reality.

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