CQ

November 1973
$1.00

50th

ANNIVERSARY OF THE FIRST TRANSATLANTIC 2-WAY AMATEUR QSO

NOVEMBER 27, 1923

The Radio Amateur's Journal

Heathkit SB-102
80-10 Meter Transceiver . . . 385.00*

Big in popularity because it's big in performance and value, the SB-102 has what it takes to take you anywhere. Sensitivity better than 0.35 uV for 10 dB S+N/N ratio. Solid-state linear master oscillator with 1 kHz calibration, less than 100 Hz drift per hour after 10 minute warmup, and a dial resettable to 200 Hz with bandspread equal to 10 feet per MHz. Front panel selection of built-in 2.1 kHz SSB filter or optional 400 Hz filter, and upper or lower sideband. Built-in 100 kHz crystal calibrator. 180 watts PEP SSB input, 170 watts CW input; built-in sidetone for monitoring; triple action level control to reduce clipping and distortion; built-in VOX; five-position metering facilities. Easy circuit board and wiring harness construction.

Kit SB-102, 24 lbs. $385.00*
Kit HP-23B, AC supply, 19 lbs. $51.95*
Kit HP-13B, DC supply, 8 lbs. $69.95*

Heathkit SB-220
2 kW Linear Amplifier . . . 369.95*

The linear that gives you the most for your money, the SB-220 has two Eimac 3-500Zs in a grounded grid circuit that offers up to 2000 watts PEP SSB input or a full 1 kW on both CW and RTTY, yet requires only 100 watts of drive. Heathkit-quality features include a broad-band pretuned pi input delivering extremely high efficiency with minimum distortion; built-in solid-state power supply that can be wired for either 120 or 240 VAC operation, and changed to the other in minutes should your power requirements change; circuit breaker protection to eliminate fussing with fuses; zener diode regulated operating bias for reducing idling current to a bare minimum, resulting in longer tube life and cooler running; ALC to prevent overdriving; metered grid current, high voltage, and relative power; large quiet fan. Trim, compact table-top cabinet design uses extensive shielding for maximum TVI protection. At this low kit price, it's hard to find a comparison.

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An accurate, reliable instrument for measuring RF output, the HM-2103 has a 50 ohm non-inductive load resistor and features less than 1.2:1 SWR for measuring frequencies from 1.8 to 30 HMz; built-in wattmeter with 0-200 and 0-1000 range, accuracy within ±10% of full scale; power rating of 175 W continuous, 1000 W maximum. High temperature indicator lamp warns of upper temperature limits, and a lamp test circuit is also provided.

Kit HM-2103, 6 lbs. 59.95*

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kit SB-610, 14 lbs. . . . 89.95*

Heathkit Spectrum Analyzer
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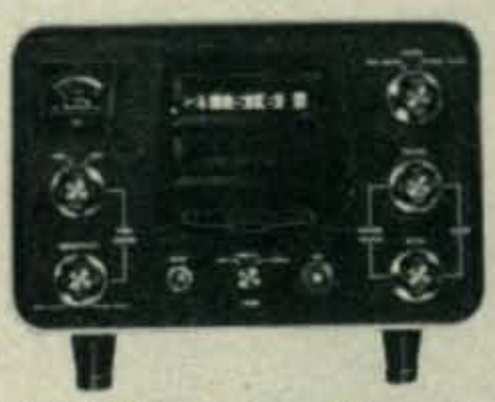

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Hallicrafters' all-american made FPM-300, Mark II "Safari" SSB/CW transceiver is Q5... from the Mauritania solar eclipse expeditions to a famous raft adventure in the Atlantic.

Proven design in the tradition of the HT-37 and solid-state dependability are combined in this compact transceiver featuring state-of-the-art FET's, hot carrier diodes and bi-polar transistors for peak, reliable performance for only $625.

Some of the high performance specifications are:

- Designed for fixed, portable and mobile use
- Equipped with a self-contained Universal AC and DC power supply system
- Compact dimensions (HWD) 5½ x 12 x 11 inches
- Weight: 25 pounds
- Tuning ranges: 8-600 kHz Bands, 80-10 meters
- Built-in speaker
- Power requirements: 117 V or 234 V 50/60 AC; 13.4 VDC negative ground
- Modes: Selectable Upper or Lower Sideband-CW or RTTY
- Type of service: continuous operation with 2-tone S SB-CW-RTTY (50% duty cycle)
- Power Output: 125 Watts P.E.P. (Nominal) into 50 ohms
- Receiver Sensitivity: Less than 1 uV for 15 db SN Ratio
- Selectivity: 2.0 kHz
- Receiver IM: 60 db below 2 equal 10MV signals
- Receiver Image and IF Rejection: Greater than 60 db.
- Internal Receiver Spurious: Less than equivalent 1 Microvolt Signal
- Transmitter IM: 30 db below P.E.P. (26db below one of two equal tones)
- Adjacent Channel Desensitizing: 3 db with greater than 10,000 MV
- Sideband Suppression: -50 db minimum @ 1 kHz
- AF Power Output: 2 watts
- Stability: 100 Hz after warmup. Max. 100 with 10% line voltage change
- Frequency Readout: Within 1 kHz ± 100 kHz of Cal. Point not more than 3 kHz across entire 500 KC Band
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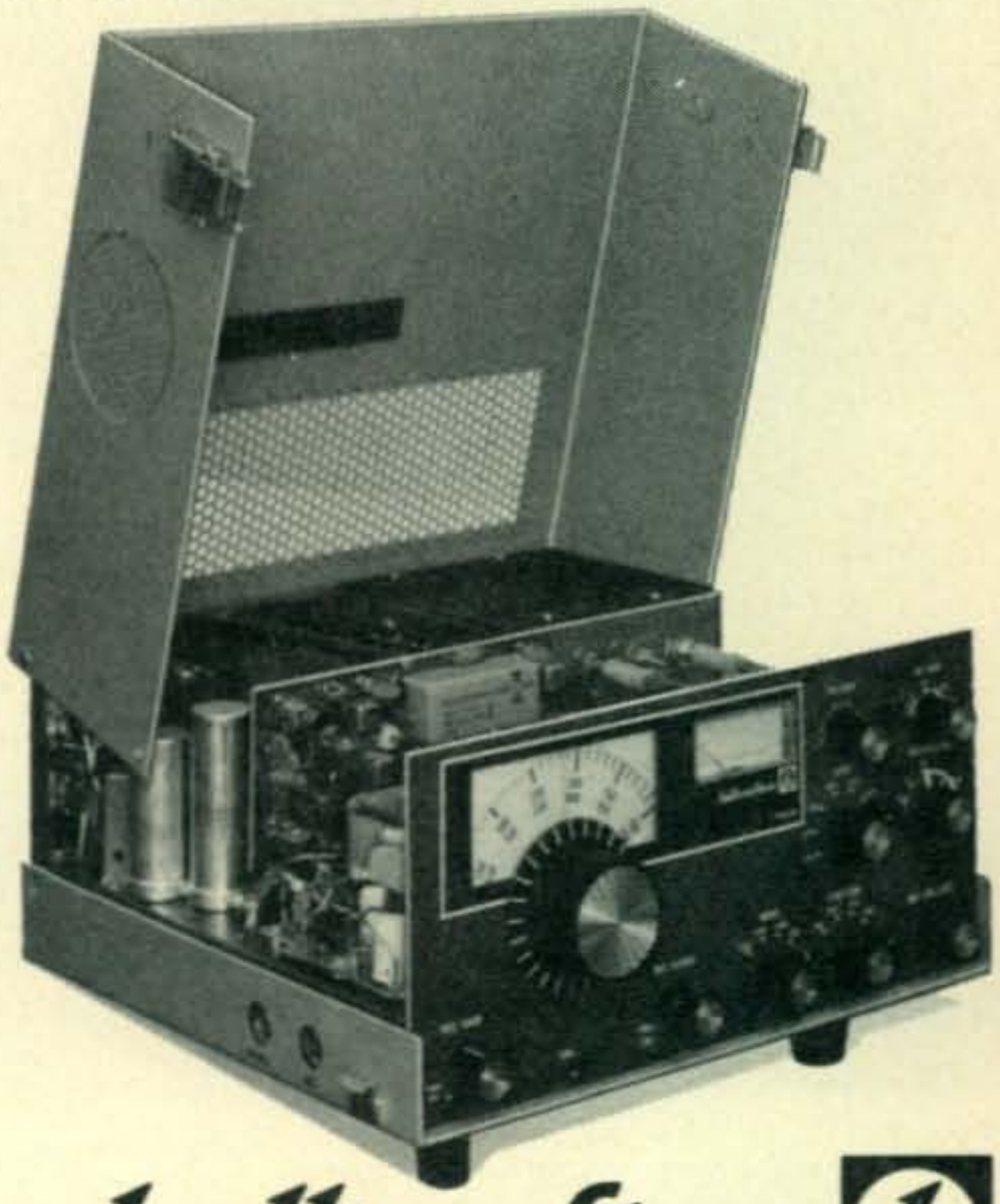
- CW Sidetone
- Audio Frequency Response: 500-2500 Hz Nominal
- AALC: 12 db Compression
- AGC Figure of Merit: 60 db minimum
- Crystal Calibrator: Provides 25 kHz Calibration Signals
- Optional Accessories: MR-300 Mobile Installation Kit; HA-60 Blower Fan Kit, works on AC or 12VDC



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CQ

NOVEMBER, 1973 VOL. 29, NO. 11

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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The voice of

HY-GAIN'S THUNDERBIRD 10-15-20

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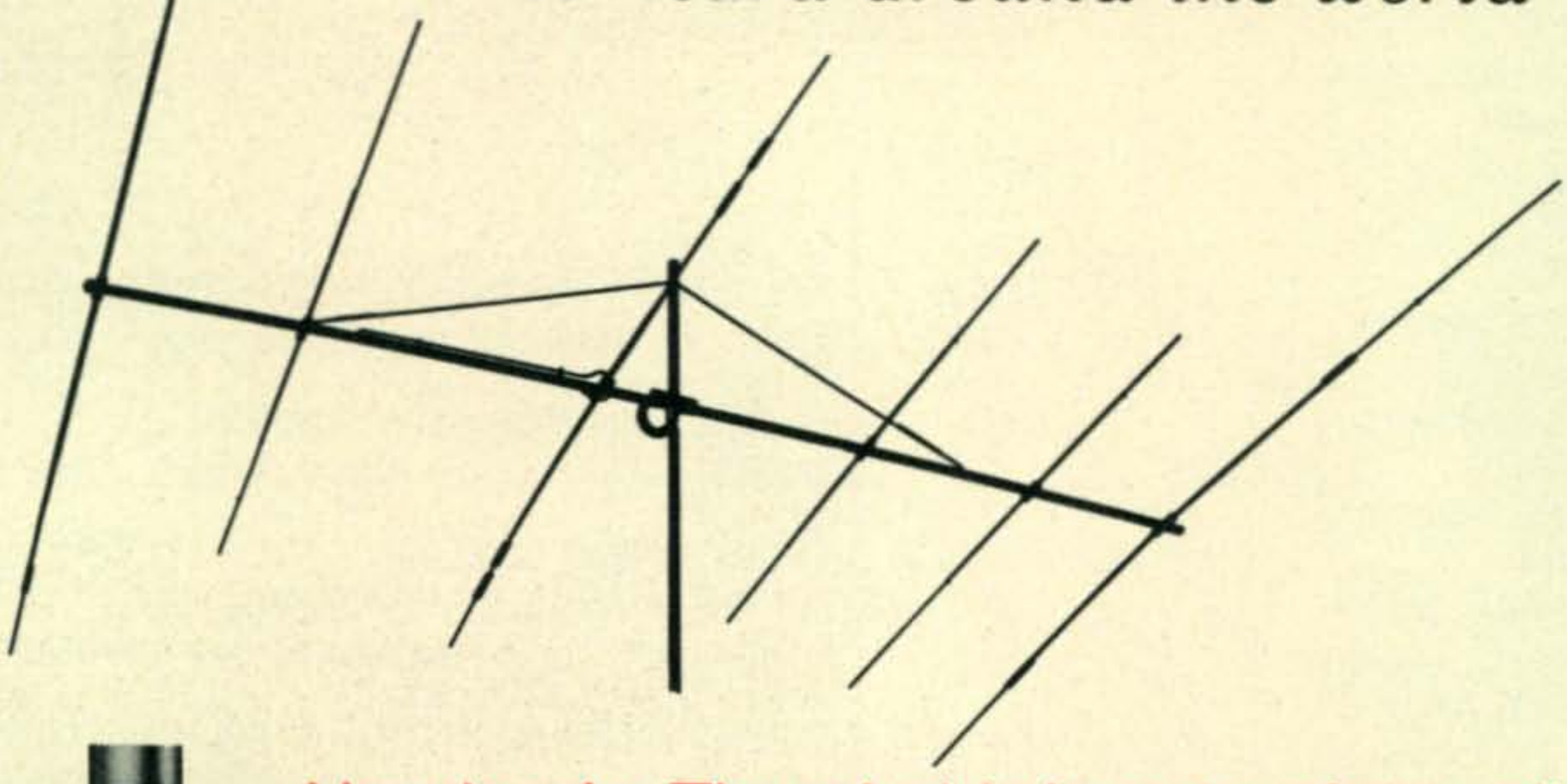

Here's why Thunderbirds outperform all other tri-banders:

* **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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Model 390
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ZERO BIAS

As heralded on this month's cover, November 1973 marks the 50th anniversary of one of the more significant achievements in amateur radio history: the first two-way trans-Atlantic amateur QSO. Adding to the significance of the feat is the fact that ARRL played a key leadership role in making it work, a fact which cries out for comparison with ARRL's present position.

QST for January 1924 noted the accomplishment:

"The Atlantic Ocean was bridged in two-way amateur operation for the first time in history when Station 1MO in West Hartford, Conn., communicated for almost two hours on the night of November 27th with French Station 8AB, operated by Leon Deloy in Nice, France. Later that same night Station 1XAM, sometime 1QP, in South Manchester, Conn., also worked 8AB.

"For years we have dreamed of this; for over a year we have seen it coming; for weeks we have been sure that winter weather would see the thing accomplished. It has been done, fellows; we are actually in back-and-forth contact with Europe over our amateur sets. For the first time in history we have worked a European amateur, and for the first time the amateurs of distant foreign countries have sat by their respective firesides and talked to each other with ease.

"The story of how it was done goes back to this summer when Mr. Deloy, the leading French amateur, visited this country to study American amateur methods with the avowed intention of "working" us this winter. Hundreds of our fellows met him at the A.R.R.L. Convention in Chicago this fall. Returning home, Deloy applied the "dope" he had collected here and built a short-wave transmitter and when all was in readiness cabled Traffic Manager Schnell, that he would transmit on 100 meters from 9 P.M. to 10P.M. starting Nov. 25th. This news was spread immediately by broadcast and many stations commenced listening. Schnell built a special short-wave tuner for the job and at 9 P.M. on the 25th was tuned to 100 meters and waiting. Promptly at 9 o'clock Deloy started up, and from the very first word he was copied by 1MO. Altho Deloy has been heard in America before, this was in itself an achievement. For an hour he called "ARRL" and sent the cypher group "GSJTP" for identification purposes. The next night, No. 26th, Deloy again transmitted and, having been advised by cable that he was QRK, sent two messages, which were copied not only by 1MO but by 1QP. One of these, the first amateur message ever sent from France, reads as follows:

NICE, FRANCE

"A.R.R.L.

WANT THIS FIRST TRANSATLANTIC MESSAGE TO CONVEY MOST HEARTY GREETINGS OF FRENCH TO AMERICAN AMATEURS.

LEON DELOY

"The other message made a further schedule and proposed listening for a reply on about the same wave. Meanwhile 1MO got permission from the Supervisor of Radio to test on the short wave, and the following night, the 27th, was in readiness. Deloy came on at 9:30 and for an hour called America and sent two more messages. At 10:30 he signed off, asking for a QSL, 1MO gave him a long call on 110 meters, and European and American amateurs were working for the first time, for Deloy came right back! It brought the thrill that comes but once in a lifetime. Deloy's first words were:

"R R QRK UR SIGS QSA VY ONE FOOT FROM PHONES ON GREBE FB OM HEARTY CONGRATULATIONS THIS IS FINE DAY MIM PSE QSL NR 1 2."

Of the three amateurs primarily involved in this historic operation, Leon Deloy, 8AB and John Reinartz, 1QP have since passed away. Fred Schnell, then 1MO, now W4CF, is living in Florida in retirement.

Why do we bring it up? Well, perhaps to sound a note of humility in this jaded, ultra-sophisticated age we live in, and then it might just be a nostalgic sigh . . .

Some Not-Too-New Faces

You'll notice two new departments in this issue of *CQ*: Novice and QRP. Both will be regular features in the months to come. At the helm of the Novice department is an old friend of *CQ* readers, Herb Brier W9EGQ, who wrote his first Novice column in *CQ* back in 1952, about a year after the Novice license came into existence. Herb's warm yet professional guidance helped thousands of newcomers over the rough spots during his 43-column tenure with *CQ*, and he gave many thousands of electronics hobbyists insight into amateur radio through a more recent column in *Popular Electronics*. We're proud to again welcome Herb to the *CQ* staff.

Anyone who has pursued QRP as an "alternate life style" in amateur radio has encountered the call K8EEG. Ade Weiss, as Editor/Publisher of the *Milliwatt*, has done more to encourage the efficient utilization of the amateur bands than any other individual. For this reason, and because he happens to be a top-notch writer, we're pleased to welcome Ade to *CQ*'s growing roster of experts - and columnists. Ade's new column, "QRP," will appear monthly, and is in no way intended to supplant the *Milliwatt*. Instead, it is hoped that through his new QRP department in *CQ*, many more amateurs can be encouraged to try their hand at flea power operation and experience the excitement and thrill of launching a QRP signal thousands of miles, through sheer skill and efficiency. You'll find K8EEG's introductory offering on page 49. Welcome aboard, Ade!

73, Dick, K2MGA

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OUR READERS SAY

Surplus TTY Machines

Editor, *CQ:*

It has come to my attention that many radio hams were using teletype machines which are now obsolete for their particular kind of operation but which would be perfectly suitable for the TTY network of the Western Institute for the Deaf.

It would be greatly appreciated if this information could be circulated to your subscribers in the British Columbia area through your magazine so that if any wish to donate their obsolete machines, they may contact the Western Institute for the Deaf, 2125 West 7th Avenue, Vancouver 9, B.C., Canada where they would be gratefully received.

Maurice D. Young, M.B., M.R.C.P.,
Professor,
Department of Paediatrics
University of British Columbia

Allied 190 Receivers

Editor, *CQ:*

I have received a considerable amount of mail with regard to my two articles on the Allied 190 receivers, and have gleaned some information as a result from a number of people who have made the modifications outlined. Indications are that there are variations in the transistors employed in various runs of this receiver which may cause some problems. To offset these variations the following is suggested: 1. Change TH2, a 10K thermistor to a 4.7K resistor instead of 100K as originally specified. 2. Change R67, 680 ohm a.g.c. amp emitter resistor to 220 ohms. 3. Add 1K resistor in series with ground end of VR2 to ground. VR2 is the center control of the three section stack comprising the audio and r.f. gain controls.

The above will insure that adequate bias is applied to all controlled stages under no signal conditions assuring maximum sensitivity.

Since the 190 series receivers are now a closeout item at a considerably reduced price, they are even a better buy for someone wishing to make the modifications.

Bruce L. Mackey
Cortland, New York

A Simpler Matrix

Editor, *CQ:*

In Albert D. Helfrink's, K2BLA, article, "An Integrated Circuit Morse Code Keyboard", he rightly points out that one should be careful of mistakes while constructing the diode matrix decoder as it is difficult to correct these errors after the matrix has been completed. It is also obvious that should one of the diodes fail at a later date, as is the wont of many surplus diodes, the builder is also in for it. An alternate method is to use broad gaps between the conductors on an etched double sided copper clad board. Etch the necessary strips onto both sides using any suitable technique. For each diode to be used, drill one hole through the appropriate conductor on the nine strip side into a gap between the conductors on the forty-plus strip side into a gap on the nine conductor side. Then solder the diode on both sides. Replacing a diode is now simple. This not only allows for the possibility of construction errors, but also for future diode failure replacement.

Also one item that is seldom mentioned is that when a T2L device is switching it does not draw a constant current. Feedback through the power supply into other circuits is always possible which can cause spurious response and even unwanted triggering. To minimize this, I have consistently connected a 1mf capacitor from Vcc to ground on each integrated circuit. Finally, Mr. Helfrink does not mention inputs to pins 9 and 12 of Q1. Unused inputs should be connected to Vcc through a 1KΩ resistor inorder to minimize sensitivity to noise and to optimize switching times. I hope these suggestions are as useful to others as they have been to me.

Clinton H. Holder, Jr.,
College Station, Texas

Free Ham Shop Ads

Editor, *CQ:*

Wanted to let you know I have been a subscriber to *CQ* now for 3 years and my subscription runs for another year or so.

I have used your FREE want-ad service at least twice a year for the past 3 years and have always been able to buy or sell the advertised item within a couple of weeks after the magazine was mailed.

This is really a fabulous fringe benefit and I feel this alone more than repays me for the price I pay for *CQ*. Obviously, however, I get much more out of your magazine or I would have cancelled before now.

Keep up the good work and keep up the free *CQ* ads.

Joe G. Roberts
Phoenix, Arizona

Motives of Regulation

Editor, *CQ:*

I think the time has come to voice my feelings in amateur radio's public print regarding the current status of the Federal Communication Commission's procedures and practices in the area of amateur radio.

For the past twenty-seven years, I have been actively involved in radio broadcasting in the engineering and technical phases. During these years, I have had ample opportunity to observe the operations of the Commission in both the rule-making and regulatory areas. I have never before been as disturbed and uncomfortable as I am now.

This letter is really prompted by the recent rejection of my application for a Repeater License by the Washington Office of the Commision. That rejection has made me stop and think about just what it is that the Commission is trying to achieve, and frankly, I fail to understand either its goals or its motivations.

As Chief Engineer of several radio broadcasting operations, including both FM and AM directional stations, I thought that I was in reasonably good condition to present to the Commission an application which would be properly set in engineering terms and timely filed. But apparently I was wrong. The paperwork that I hand-carried to Washington ended up in the circular file. The Commission,

in its infinite wisdom, did not accept the antenna that I had selected and installed some two years ago, on one of the towers of the AM directional station for which I am responsible. The installation of the antenna was accomplished during some major structural changes to the broadcast system, for which a major proof-of-performance was required on the directional array. I might add that the antenna which I chose and the Commission subsequently rejected for lack of type approval is in widespread and common use in the commercial FM mobile radio service for base station applications. But, oddly enough, this antenna does not appear on the mysteriously-generated approved list of the Commission.

[Continued on page 78]

Announcements

Raleigh, North Carolina

December 17, 1973, marks the 70th Anniversary of the first-powered flight which the Wright brothers made at Kitty Hawk, North Carolina. Pending FCC approval, the Raleigh Amateur Radio Society and amateurs from Kitty Hawk area will operate special event sta. KH4NC at Kill Devil Hill which was the site of the historic flight. Proposed operations will be conducted from 0000 GMT, 15 December through 2400 GMT, 17 December. Frequencies to be used will be 3530, 7030, 14030, 21030 and 28030 kHz - cw., and 3910, 7210, 14280, 21355 and 28505 kHz phone. Special commemorative QSL will be available to stations contacting KH4NC, SASE pls., via K4CIA.

Fairbault, Minnesota

The Winter PICONET-HANDI-HAM Hamfest will be held Saturday, December 1, 1973, at the Eagles Club in Faribault. There will be a dinner, program and prize drawing. Registration starts at 9 a.m. Info: Don Franz, WØFIT, 1114 Frank Ave., Albert Lea, MN 56007.

Kearny, New Jersey

The 9th Annual Telephone Pioneer QSO Party is scheduled for the weekend of December 1-2, 1973. It will start at 1900 hours GMT, Saturday and end at 0500 hours GMT on Monday, Dec. 3rd. All bands may be used and suggested freqs. may be obtained from your Chapter Secretaries. Stanley S. Holmes Chapter, 100 Central Ave., Kearny, 07032.

Massillon, Ohio

An auction and flea market, presented by the Massillon Ohio ARC, will be held on December 7th. Send card for flyer giving details. MARC, Box 8711, Canton, OH 44711.

Deluxe Screen Modulator

The August issue of *CQ*, containing the article, "A Deluxe Screen Modulator for Beginners," by R. Jayaraman, contained some mistakes. Beginning with fig. 1, the 6AU6 pin connections are entirely wrong! Rather than take the space to show the correct connections, consult a tube manual for pin connections. Also, capacitor values greater than 1 should be in pf except as noted. On p. 37, left column, 5th line from bottom "difference" should be "diffidence." On p. 82, left column, 12th line should read "full 300 volts" instead of "full volts." Our apologies.

Everyone has something.

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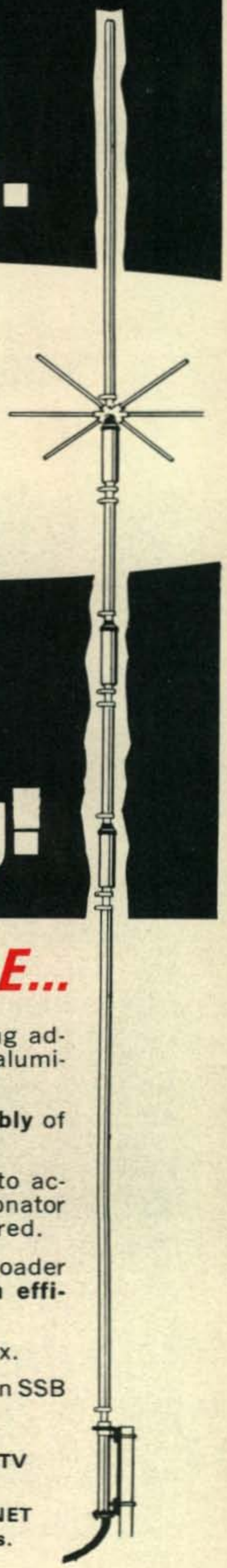

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Q AND A

BY CHARLES J. SCHAUERS,* W6QLV

ONE of the biggest problems facing most amateurs (especially our new ones) is troubleshooting a piece of equipment for *intermittent operation*. Now with printed circuit boards, modules and what have you, it certainly is not an easy task to pinpoint an intermittent! But it can be done.

I remember working on an SB-34 for three days before I found my trouble. This set as you know is transistorized except for the final and driver. My trouble turned out to be a keying transistor. Now why would a transistor work some of the time but not all of the time? I still don't know. I used a scope, vacuum tube voltmeter and other instruments and it seemed that everytime I tested a component it tested ok, both under load and no-load. This was frustrating.

I had an intermittent in an old KWM-1. I would be listening to my contact and "poof" out would go the receiver section. I worked on that set for two days until I found an intermittent a.f. coupling capacitor.

Anytime you run into an intermittent look for the following in sequence: defective relays; defective tubes or transistors; coupling capacitors; resistors that change value after heating up; defective crystals; dirty or worn switch contacts (especially the "self-cleaning" variety); worn pots; improperly seated plugs and finally, cold soldered connections or connections that could be affected by galvanic action or corrosion.

Try to isolate the section or stage giving you the trouble and concentrate on it *first*.

SB2-LA Linear Intermittent

"I have an SB2-LA linear amplifier which uses (6) 6JE6's in parallel, I'm sure you are familiar with it. Recently it became intermittent. To make it operate I have had to push the mike button three or four times, then as I was talking I noted that the output had dropped off. Any quick hints as to what I look for?"

---

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, N.Y. 11050

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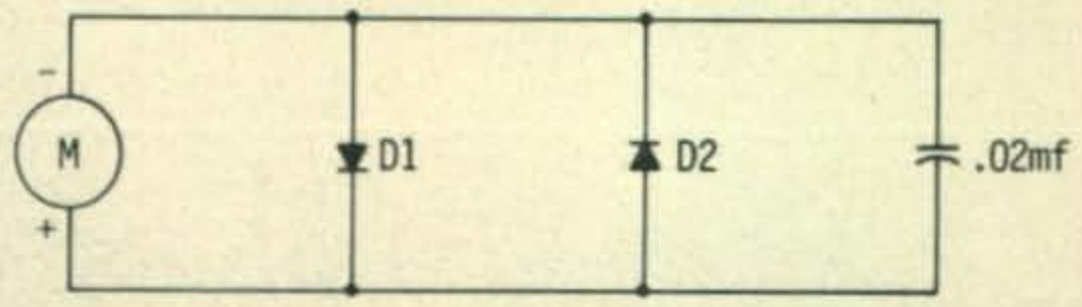

Fig. 1—A simple method of meter overload protection.

Yes. I had an SB2-LA and it developed the same trouble. I found that relay (K_1) needed replacing. It is a 12 v.d.c. 3 p.d.t. relay (Advance GHB-3C-12V or equivalent).

SB2-LA Conversion For 10 Meters

"I would like to modify my SB2-LA linear for operation on 10 meters. Is this feasible? How much work would be involved?"

It can be done but the low plate load impedance (around 300 ohms or so) requires a large input capacitor and the inductance used would be very small. The bandswitch must be changed as well as the coil in the final. You could replace L_2 (15 meter coil) with one for 10 meters which would match the capacitance available, but your efficiency would be rather low. There are a number of SB2-LA's around and maybe someone has added the 10 meter band, if so, we'd like to hear from him.

Battery Shelf Life

"I got a terrific buy on batteries (not mercury) which I use for bc radios etc. I understand the average shelf life is about 9 months or so. Any way to prolong this?"

"Yes. Wrap the batteries in moisture proof wrap and put them in the freezing compartment of your refrigerator or in a freezer. Prior to using, let them lay around a day or two. The shelf life can be increased up to 45% by cury) which I use for bc radios etc. I understoring them in a *cold* place. Incidentally, mermore without cold storage.

Meter Protection

"I teach a class in electronics and one of the problems we have is burned out meters, volt-ohm meters. The v.o.m.'s we have been given to use in class do not have overload protection. All students make mistakes (and so do I). I've looked through the literature and cannot find anything inexpensive enough to use (our budget is limited anyway). Any cheap way to protect a meter against reverse polarity, transients etc.?"

I think so. See Fig. 1. Use silicon diodes rated at *under* 500 volts p.i.v. (peak inverse voltage). The capacitor is added to guard against transients and r.f.

Improving The SB-100 a.v.c.

"Any information on improving the a.v.c. action of the SB-100 so one does not have to

ride the gain control on strong signals?"

Yes. See the article in the August 1968 *CQ* (Page 73). Copy of the mag is $1.00. Send your order to *CQ*.

Swan 500C Sidetone

"I have an old Swan 500C transceiver. It has worked fine. I have had trouble lately with the sidetone. Sometimes it works on the receive position sometimes not, and it is intermittent on transmit. What do I look for?"

Check diode D_1 and capacitor C_1 (.005 mf). You might also check the 330 ohm resistor in the secondary of the output transformer in the circuit of the a.f. output amplifier tube, 6GK6.

Galaxy GT-550 SB Suppression

"I bought a new GT-550 Galaxy transceiver and it has always been a fine set. Recently however, I was told that the upper and lower sidebands were "leaking". I asked my contact (who uses a Collins receiver) to tell me what he meant. He said that there was not much difference between the upper and lower sideband signals (suppression). So I checked with others and found the same report. What would cause this? What is the correction?"

In the GT-550, separate crystals are switched for changing sidebands. Two crystals are used, one at 8998.75 and the other at 9001.25 kHz. The v.f.o. is shifted by the frequency difference. This is accomplished by a diode switch. First check the tubes involved in the circuitry. Then check the crystals. Make sure that the 6GX6 (product detector and carrier oscillator) is operating properly.

SB-200 Linear Intermittent

"I have had an SB-200 Heathkit linear since 1970. This amplifier has certainly been terrific. However, recently the s.w.r. meter etc. and output are intermittent. What do I troubleshoot?"

The relay, RL_1. Any electro-mechanical device wears!

Swan 250C A.M. Function

"I have a Swan 250C which has worked extremely well on s.s.b. and a.m. Now the a.m. receiving is out. Where do I troubleshoot?"

Check the 12AX7 product/envelope detector. Especially check L_{1101}, R_{1103} and the 150 pf capacitor that feeds the b.f.o.

Drake 2-NT Sidetone

"My Drake 2-NT c.w. transmitter has worked for a long time but now the sidetone is gone. What do I do?"

Replace the transistor 2N3394. But before you do check associated components.

S-Meter For The SB-34

"It would be nice if the meter on the SB-34 transceiver could be used as an S-meter. Any information on this?"

Yes. See the January 1970 *CQ*, page 35. The OC71 transistor can be a HEP-253 or equivalent.

SB-220 Modification

"I bought an SB-220 linear second-hand without an instruction book. I used it with my KWM-1. I had a problem with the antenna relay so I naturally took off the linear cover to check it. I turned on the power and the linear went out. What do I look for?"

First an instruction book. When you remove the cover you short the B plus line and this more than likely knocked out a couple of your diode rectifiers. The circuit breakers do not act quickly enough and there is no over-load relay in the set. Never, never, buy a used set without the instruction book.

Before you check the SB-220 with the cover removed, disconnect the interlock switch, and KEEP ONE HAND BEHIND you. The interlock does *not* remove primary power. When working around linears with high voltage one must be careful! It is better to have an interlock that when actuated "shoots" a couple of diodes rather than the operator! Take care!

SX-122-A Receiver n.l. & a.m. Fault

"I bought a second-hand Hallicrafters SX-122A receiver. Now it does not work on a.m. nor does the noise limiter. What do I check?"

First check the 6BN8 tube which operates as the a.g.c. rectifier-amplifier and a.m. detector. Then check the diode 1N456 noise limiter section. I'll bet it is the 6BN8 tube! It is doubtful that the diode is out, but check it too.

73, Chuck, W6QLV

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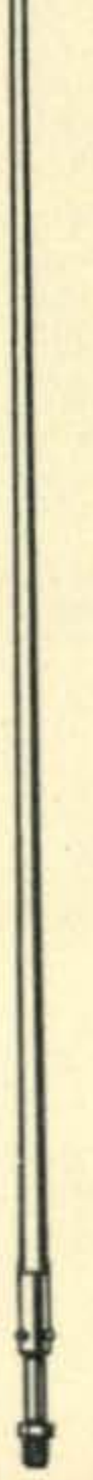

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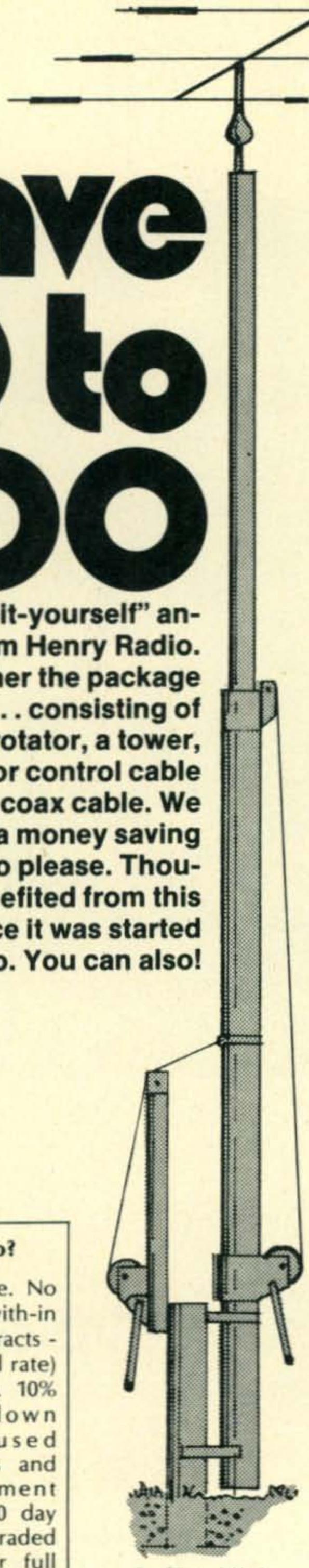

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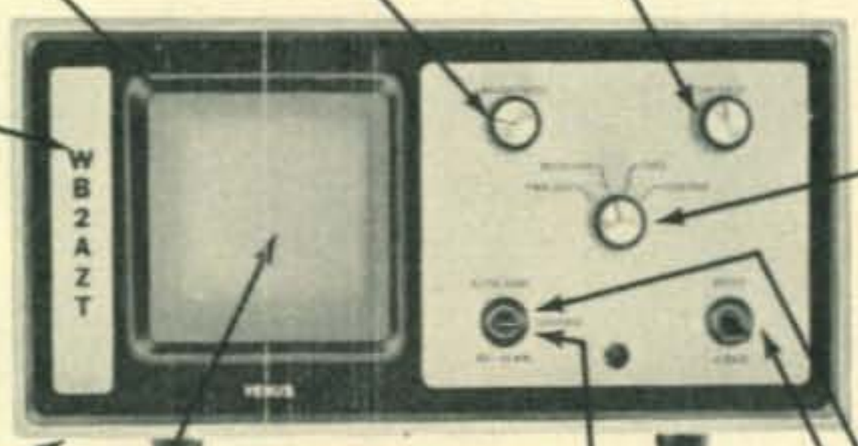

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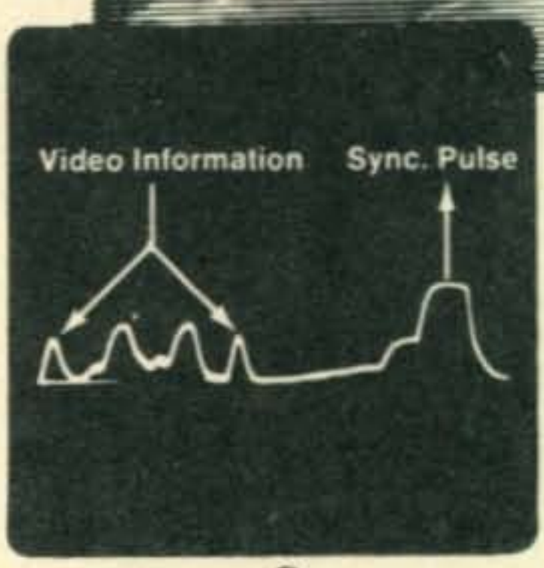

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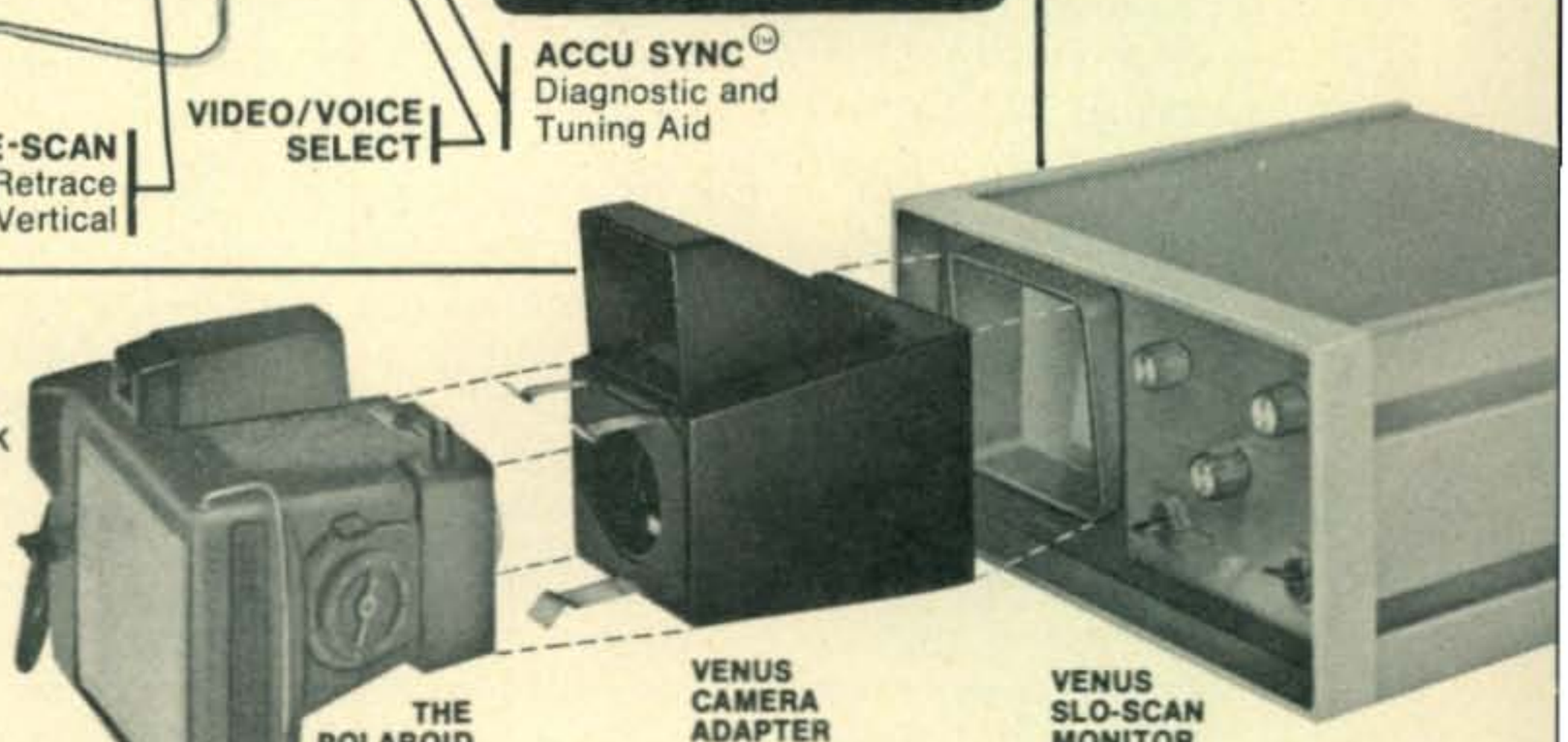

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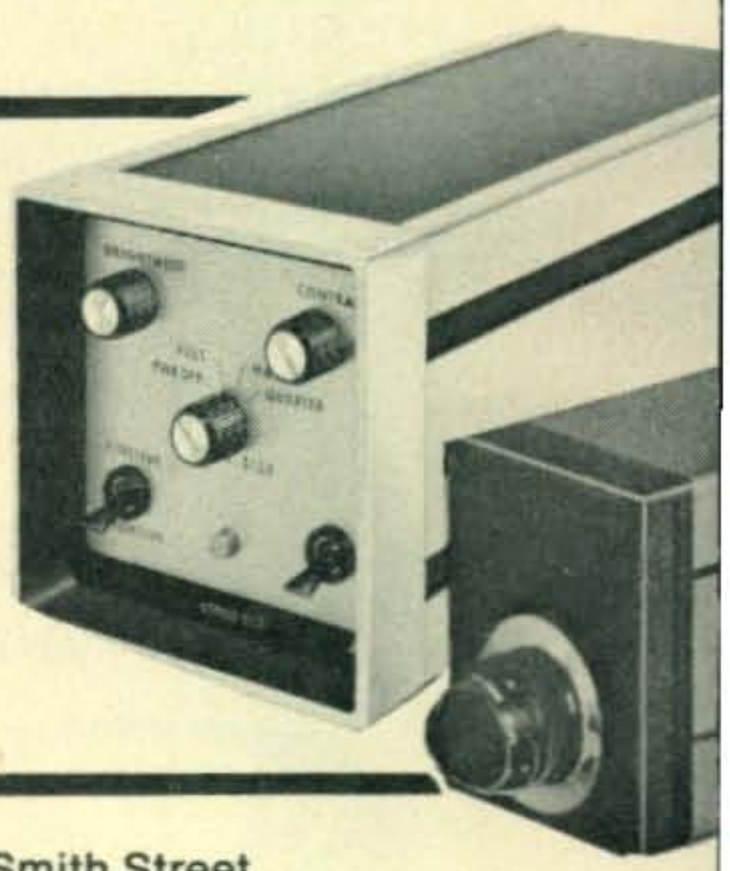

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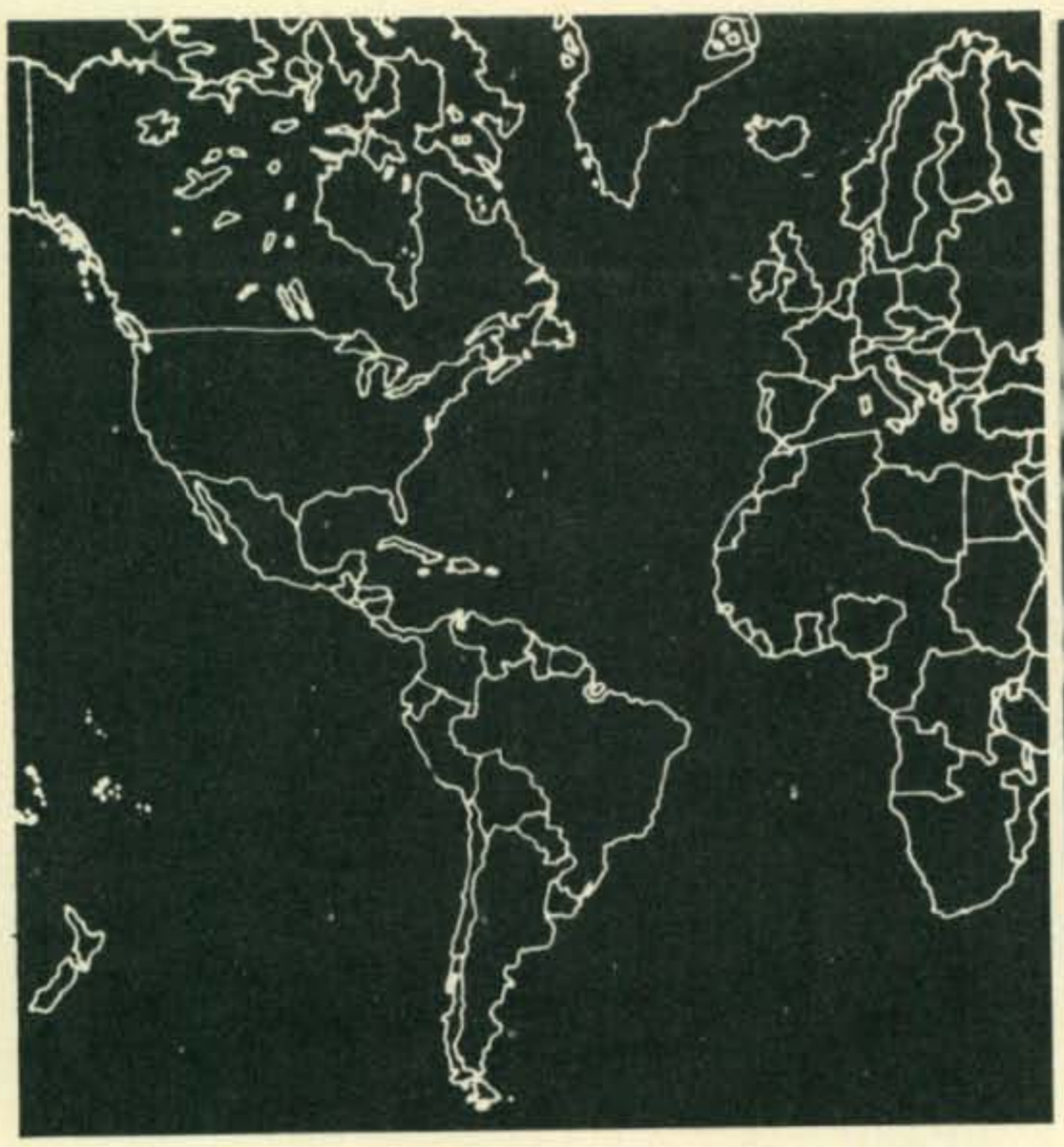

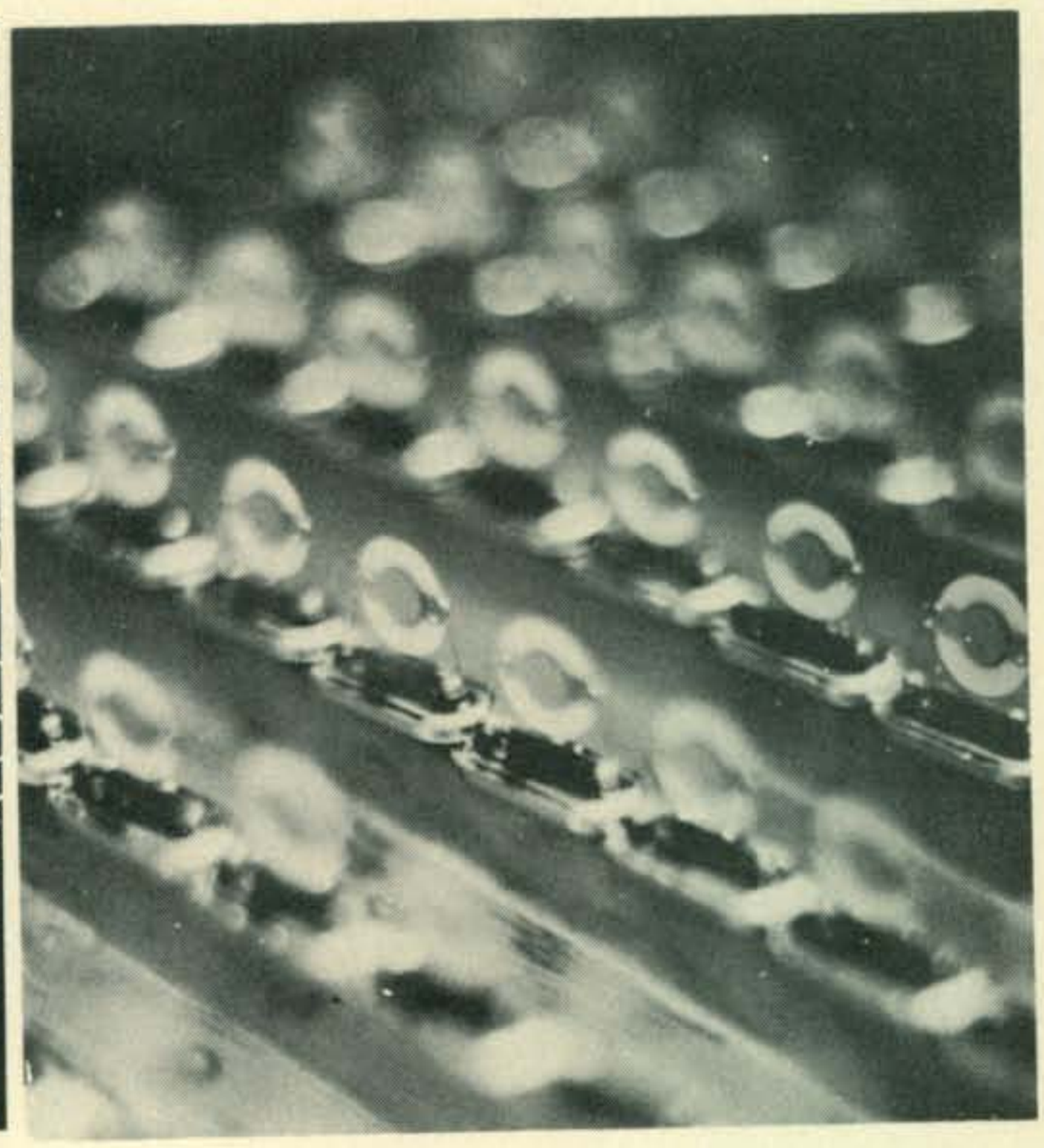

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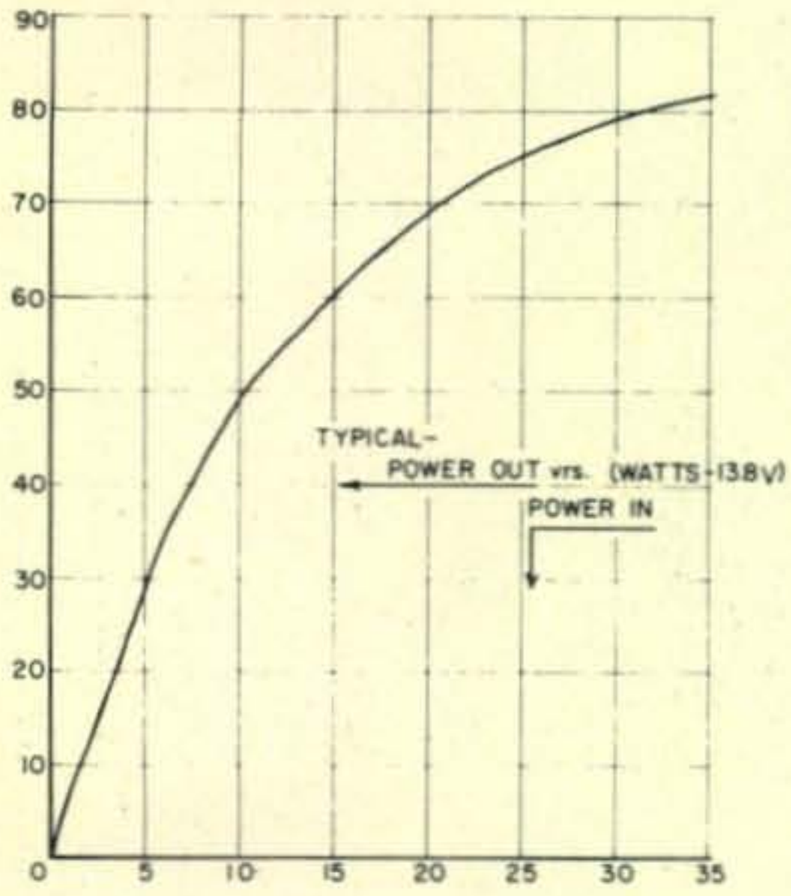

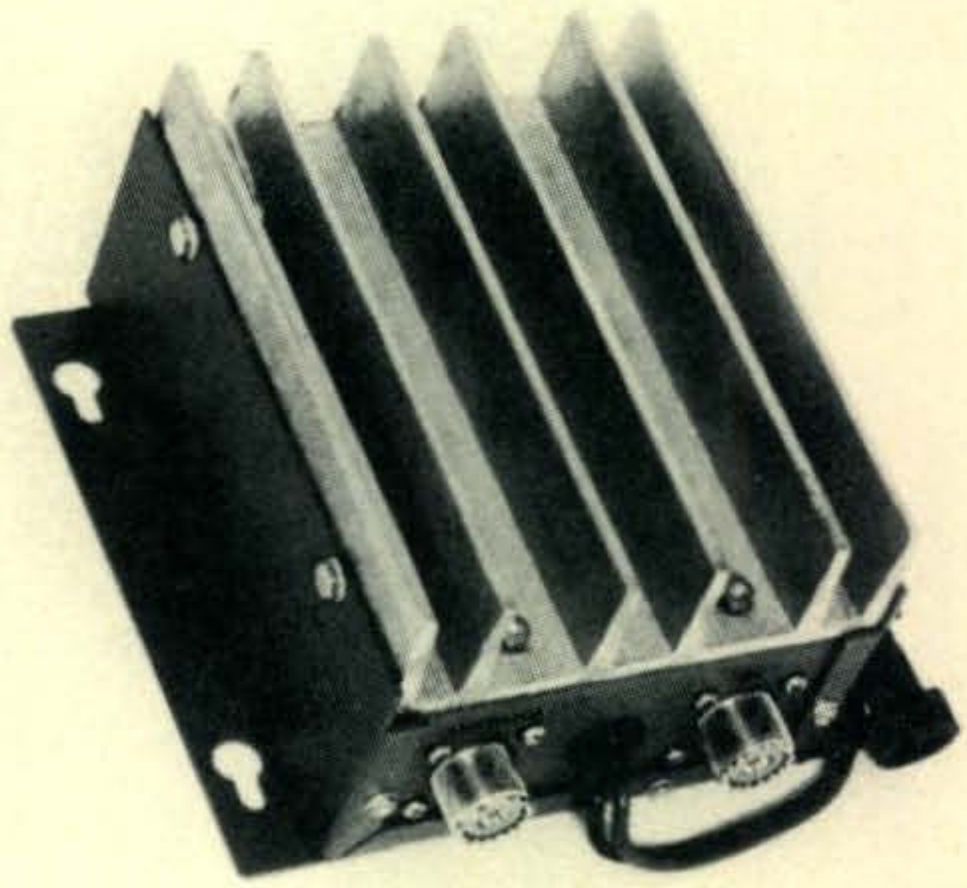

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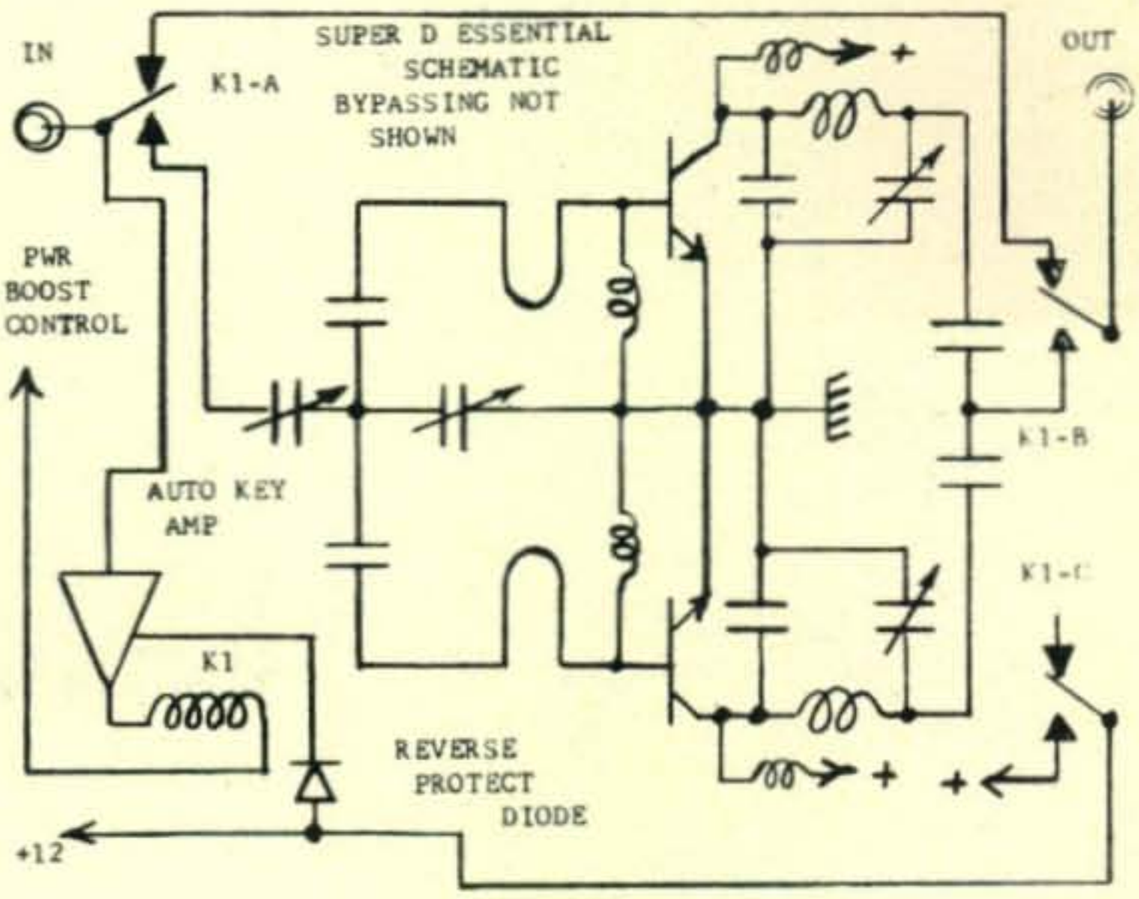

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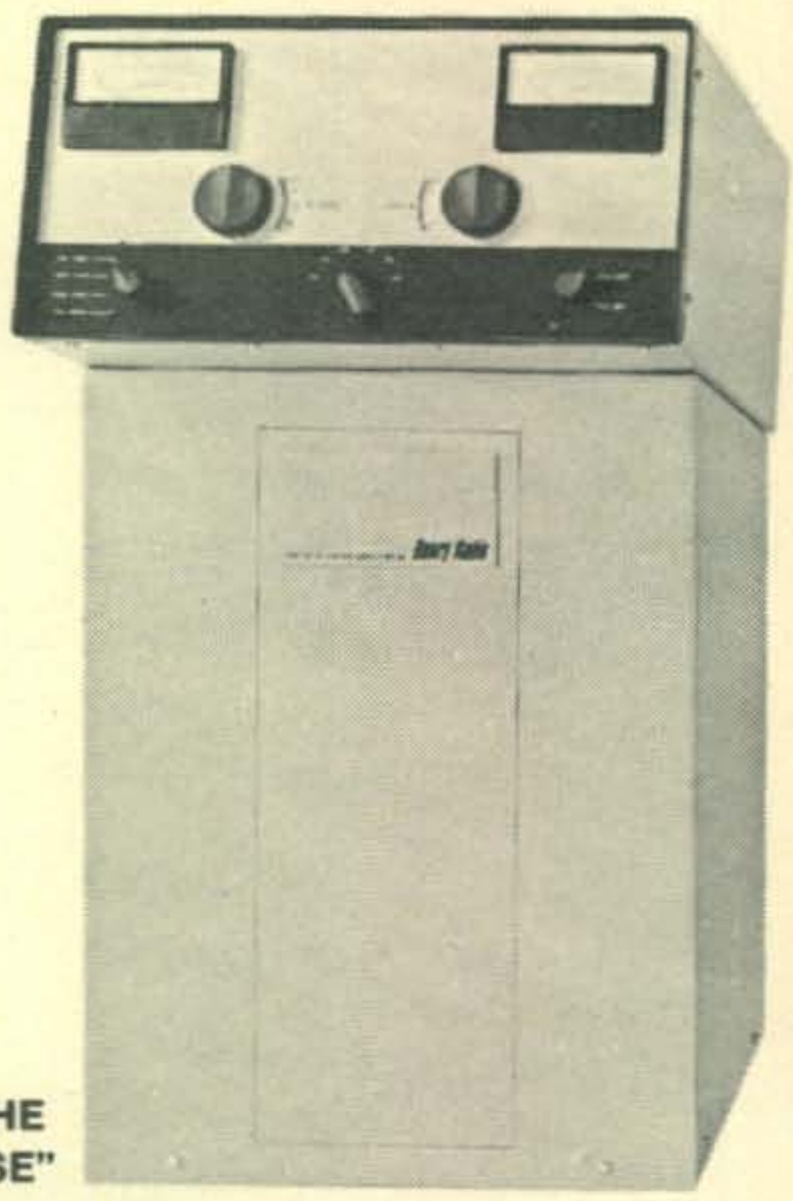

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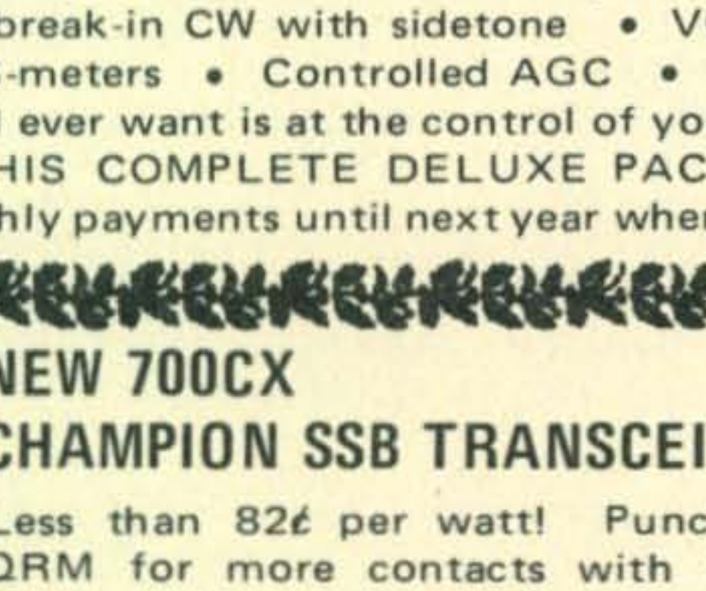

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A Memory For The Integrated Circuit Morse Keyboard

BY ALBERT D. HELFRICK,* K2BLA

MANY techniques of storing Morse code messages have been developed over the years by professionals and amateurs alike. The majority of them have been "hardware" type affairs such as code wheels, inked tape, etc. Magnetic tape recordings allowed flexibility with a large number of recorded messages; however, the tape recorder does not allow the message to be sent at speeds different from that at which it was recorded. More recently digital techniques have been used. Most of the more recent message generators have been of the hard wired" type where the message can be changed only by making circuit modifications. One commercially available memory is programmable by sending to the machine (in perfect rhythm and without error, I must add). This article describes a memory addition to the Integrated Circuit Morse Keyboard described in a prior edition of *CQ*,[1] which can be easily programmed at about 55 w.p.m. and can be recalled and sent at any speed. The memory can store a complete three-by-three CQ or any other similar length message.

If the reader has already read and understood the *CQ* article describing the keyboard, there will be little difficulty in understanding the memory. All the circuits found in the keyboard are repeated in the memory except at a much larger scale.

The heart of the memory addition is a nine dollar dual 200 bit MOS shift register by Signetics, used as a 400 bit sequential access read/write memory. This unit has input and output signals directly compatible with DTL or TTL logic, internal recirculating logic, and comes in a standard 14 pin DIP package. An additional power supply is required to supply two negative potentials to the shift register. The peripheral logic is standard TTL and is fully compatible with the keyboard power supply and logic.

*R.D. #1, Box 87, Boonton, N.J. 07005

[1]Helfrick, A.D., "An Integrated Circuit Morse Keyboard," *CQ*, Sept. 1973, p. 26.

Theory of Operation

Reviewing the keyboard operation, the dots and dashes are generated by two JK flip-flops. If the clear input of FF_1 only were high that flip-flop would toggle and generate a dot. If the clear input to FF_1 and FF_2 were high both flip-flops would toggle and generate a dash. If the state of the clear inputs to the two JK flip-flops in the keyboard could be recorded, this information could be utilized in an identical dual JK flip-flop circuit to reconstruct dots and dashes in the same order as recorded. This is exactly the method used in the memory addition. The dual 200 bit shift register records the state of the clear input to the JK flip-flops in the keyboard while the keyboard is generating Morse characters. When the register is read out at some later time an accurate record of dots and dashes is stored in the shift register as zeros and ones.

It is necessary to store spaces in the shift registers. Word and letter spacing are accomplished by the operator when operating the Morse keyboard. When sending from the memory these spaces must be stored, otherwise a gibberish of dots and dashes will result. Spaces are represented by zeros in both shift registers. When sending the contents of the memory, a circuit detects zeros in both shift registers and causes a pause of three dot times before resuming. Table I summarizes the codes used in the memory addition.

	Shift Register A	Shift Register B
Dot	1	0
Dash	1	1
Space	0	0

Table I—Codes used in memory addition.

In order to determine where in the shift register the message starts, a 200 state binary coded decimal counter is paralleled to the shift register clock to keep a continuous record of the register position.

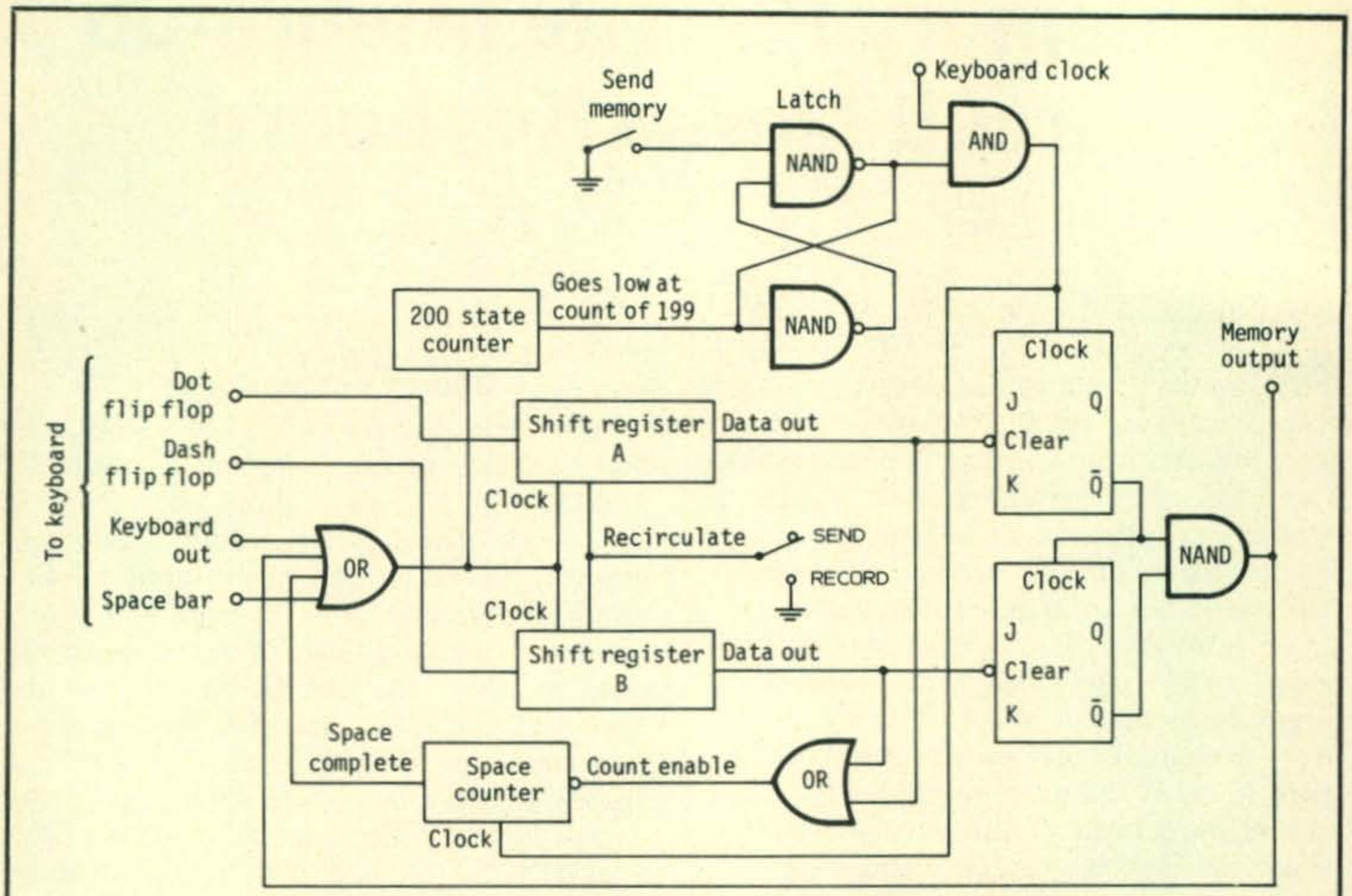


Fig. 1—Simplified block diagram of the IC keyboard memory.

Circuit Analysis

Referring to fig. 1, assume we wish to store the following message from the keyboard: CQ CQ CQ DE K2BLA K2BLA K2BLA AR K. Assume also that all the shift registers, counters and flip-flops are reset and the memory is placed in the record mode.

Depressing the C" key on the keyboard causes the clear inputs to FF_1 and FF_2 (in the keyboard) to go high since "C" starts with a dash.

The first negative transition of the keyboard clock causes the keyboard output to go high and begin the dash. The positive transition of the keyboard output stores the state of the clear inputs to FF_1 and FF_2, or in this case a one in each shift register. The clock pulse also advances the 200-state counter to position 1. The keyboard continues in the normal fashion and prepares to send a dot. When the keyboard output goes high to begin the dot, the clear input to FF_1 is high and to FF_2 it is low. Thus a 1 will be stored in shift register A, and a 0 in shift register B. The counter advances to 2. This procedure is repeated until the letter C is recorded into the memory. Table II shows the bit locations in the counter and shift registers.

Binary Coded Decimal Outputs (Counter)

1	2	4	8	10	20	40	80	100
0	0	1	0	0	0	0	0	0

Shift Registers

Position	0	1	2	3	4	5	6	7	8	9	10	____	199
A	1	1	1	1	0	0	0	0	0	0	0	____	0
B	0	1	0	1	0	0	0	0	0	0	0	____	0

Table II

It is necessary to store a space into the memory in order to separate C from the next letter, Q. Since the keyboard is in a standby state both clear inputs are low. The space bar clocks the shift register and counter without disturbing the keyboard and stores zeros into both shift registers. The key is depressed and the memory stores that letter. Now the space bar is depressed twice in order to supply a longer space to separate the first CQ from the second; the counter and shift registers are shown in Table III.

This procedure is continued until the entire message is completed. Then zeros are stored in the remaining register positions until the register returns to the starting position.

When the RECORD switch is thrown to SEND several things happen. First, the keyboard no longer has control over the memory. Second, the shift registers are switched to a "recirculate" mode. This means that the data that appears at the output is put back into the input so that the stored data will not be lost and may be stored as long as the power is applied. Finally, the output of the shift register is allowed to control two JK flip-flops connected identically as the two in the keyboard.

When the SEND MEMORY key is depressed, clock pulses are gated into the memory and dots or dashes are generated by the two JK flip-flops in the same manner as the keyboard. A dash is generated when the output of shift registers A and B are high and a dot when A is high and B is low. If both A and B are low, the condition is detected and the memory pauses three dot times, constituting a space. At the completion of a dot, dash or space the shift registers and counter are advanced and the memory sends as instructed by the contents of the shift register.

BCD Counter

1	2	4	8	10	20	40	80	100
1	0	0	0	1	0	0	0	0

Shift Registers

Position	0	1	2	3	4	5	6	7	8	9	10	11	199
A	0	0	1	1	1	1	0	1	1	1	1	0	0
B	0	0	1	0	1	1	0	0	1	0	1	0	0

Table III

Construction

The eleven dual in line integrated circuit packages are mounted on a copper clad perforated board and set within the keyboard housing. The power supply was relocated to a separate aluminum box, and expanded to include a —5 volt and a —12 volt source. The +5 volt regulated power supply used in the keyboard as described in *CQ* has ample current to supply the memory addition. All the leads to the power supply box, with the exception of the line cord, are shielded wires to preclude any r.f. energy from disrupting the circuit.

The 2511 shift register is an MOS circuit and although the gates are zener protected they are not indestructible. It is the most expensive IC in the circuit, hence it is advisable to use a socket for this IC rather than to solder directly to it. If the builder chooses to solder directly to the device standard MOS handling techniques should be used.

The following connections must be made to the existing keyboard:

Keyboard clock to pin 1 of SN7476 ($Q3A$) in keyboard
Keyboard out to pin 6 of SN7400 in keyboard
"Dot" to pin 3 of SN7476 ($Q3A$) of keyboard
"Dash" to pin 8 of the SN7476 ($Q3B$)
Memory out to the base of the relay driver transistor in the keyboard.

Two additional keyboard keys need to be connected. The space bar switch is connected between "space bar" and ground. Any of the other unused switches is connected from pin 13 of the SN7400 in the memory addition to ground.

	Type	*Vcc Pin*	*Gnd Pin*
A	SN7408	14	7
B	SN7413	14	7
C	SN7490	5	10
D	SN7490	5	10
E	SN7476	5	13
F	SN7400	14	7
G	SN7404	14	7
H	2511 (Signetics)	14	No Connection
J	SN7476	5	13
K	SN7476	5	13
L	SN7430	14	7

Table IV—Integrated circuit for the IC keyboard memory. Vcc is + 5 v.

Finally the record-send toggle switch is bridged across the speed control pot in the keyboard.

Operation

If the memory is constructed properly as shown and correctly connected to the keyboard, the following sequence should be followed to record and send a message.

Before storing any message, determine whether or not it will fit into the dual 200 bit

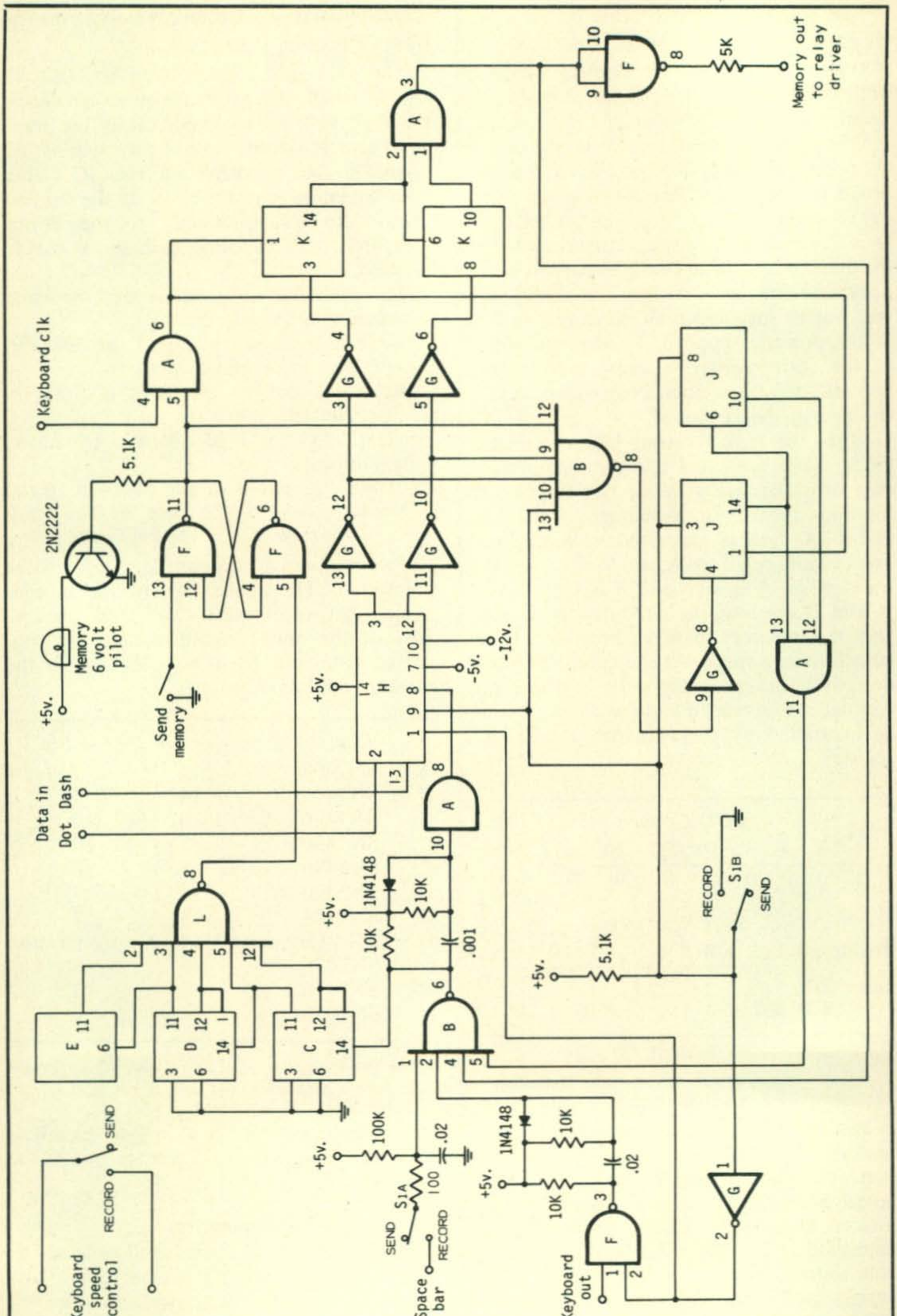


Fig. 2—Schematic diagram of the memory addition to the IC keyboard described in CQ for September 1973. IC types are described in Table IV.

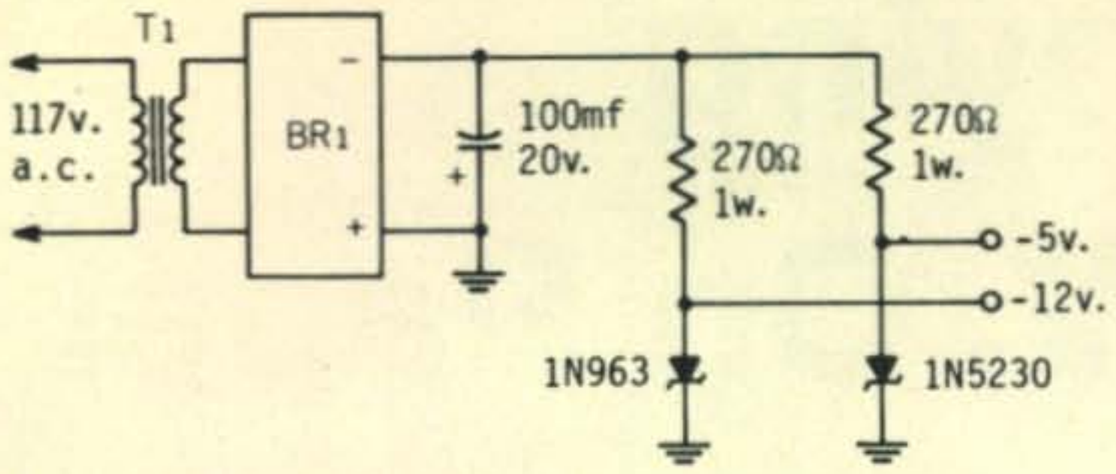


Fig. 3—Circuit of power supply delivering —5 and —12 v.d.c. for the memory and original keyboard. T_1 is a 12.6 v. filament transformer. BR_1 is a ½ amp. 50 p.i.v. bridge rectifier assembly.

shift registers. This is done in the following manner: a) determine the number of dots and dashes in the message. b) Determine the number of letters and c) determine the number of words. Add a + b + c. If this number is less than 200 the message will fit. If it exceeds 200 it will be necessary to alter the message. Consider the following example: CQ DX CQ DX CQ DX DE K2BLA K2BLA K2BLA AR K. The total number of dots and dashes is a) 111. The total number of letters is b) 31. The total number of words is c) 11. Here CQ, DX, DE, K2BLA, and AR K are considered words. Hence a + b + c = 153, certainly less than 200. The memory will accommodate this message.

Turn on the power and clear the keyboard by depressing any two numbers. Turn on the RECORD switch and index the memory by depressing the SEND MEMORY switch. When the MEMORY light goes out the memory is ready to record.

The sample message is recorded in the following manner: C space Q space space D space X space space C space Q space and so on, putting one space between letters and two between words. There is no space between A and R since these are to be sent as one letter. When the last letter has been recorded, press the SEND key momentarily and wait until the MEMORY lamp is extinguished. Turn the RECORD switch off and the message is now available for sending on demand by pressing the SEND MEMORY key.

Errata

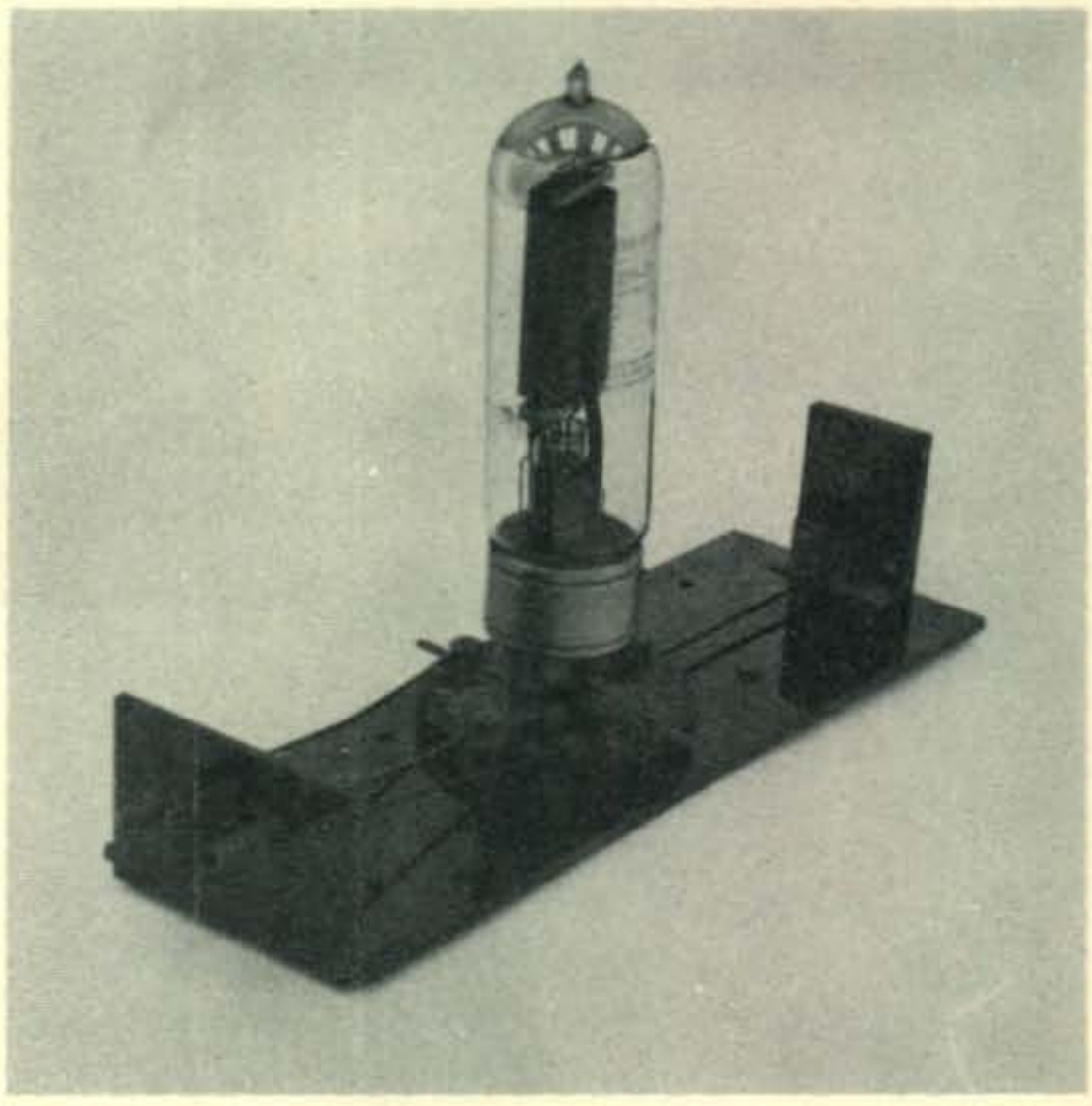
The main schematic, fig. 5, of the "Integrated Circuit Morse Code Keyboard" on page 29 of September *CQ* contains an error which will prevent normal operation of the unit. The Q_2 outputs to the diode matrix must be fed through inverters as shown in

[*Continued on page 78*]

Answer to "Whatzis Quiz for Old Timers"

As every old-timer knows, the device pictured in the Whatzis Quiz in the August issue of *CQ*, page 75, is a plug-in adapter board for the old 204A transmitting tube. Those unlucky owners of a "flat" 204A could save money by purchasing this adapter that exactly fitted the double ended socket of the 204A. The adapter was plugged in the radio transmitter and a 50 watt tube placed in the adapter to do the job of the 204A. Apparently the difference in plate dissipation between the "50 watter" and the 150 watt 204A was little cause of concern!

The tube shown in the adapter is the infamous Western Electric 211D having an oxide coated filament. This tube would turn "gassy" at the drop of a hat! Rare was the old-timer that actually bought a 211D, however, as most of the tubes were obtained as "rejects" from Western Electric equipment. In spite of the fragility of the tube, the 211D was a popular final amplifier in the ham gear of the early "thirties."



Winners who correctly identified tube and adapter are: W8DX, WØMFS, W6FET, K6RTU, W9GFS, K6MY, WA7ODH and W6TXR. Congratulations!

Tips For Copying C.W. On Paper

BY AL D'ONOFRIO,* W2PRO

THE following tips for "putting it down" are not any revolutionary breakthroughs; far from it. Instead, they're just a tidy collection of helpful "tricks" that I and others have happily discovered along the way.

These little tricks don't come wrapped with a money-back guarantee, for when all is done, improving your code speed is still by and large up to you. Specifically, it boils down to a steady regimen of daily code practice, just as you would "practice" in developing any other kind of skill. But as in developing any skill, you invariably discover little tricks on your own, tricks you wished someone had told you earlier. They're usually simple little tricks, so simple that perhaps that's the reason no one bothered to mention them.

As a preface, keep in mind this fundamental point: you copy easier code, better code, when your body and mind are relaxed. These tricks help to keep your hand moving easily and freely across the paper and to keep your mind free from unnecessary tension. It's the tension that accompanies your natural desire to succeed, to put it down on paper, letter perfect, that builds and builds until you "bust." Keep your tensions under control and you've got the lion's share of the problem solved.

1. Strive to be consistent in your copying habits; consistency leads to a familiar atmosphere in which to copy; a familiar atmosphere, in turn, promotes a feeling of well-being and relaxation. Select a way of sitting while copying that suits you, and stick to it. Select a pad and pencil, (or pen), that you find easiest to work with, and stick to them. Try different pencils and pens, especially felt-tip pens. The heft and easy flow of a felt-tip pen helps to promote a feeling of easiness and relaxation. Don't settle for the first No. 2½ yellow pencil that's handy—experiment with others; try different colored paper, too. Colors, especially the quieter tints, play a big part in setting a mood, too.

2. Wear comfortable headphones while copying. Aside from your "incoming mail" disturbing the household, the headphones keep the household from disturbing you. Headphones enable you to concentrate comfortably on the important business at hand.

3. Select a way of writing that you find both easy and natural, and stick to it. Don't waste your time learning a military-like way of printing, creating each letter in a certain precise way, according to someone else's idea on what's best for you. Put each letter down on the paper in the way that comes natural to you—that's your way.

4. Don't print unless you feel more comfortable doing so. It's a waste of good energy. But, if printing is right for you, then by all means, print—use a baroque font *if* it suits you.

5. Try writing each letter separately, with a generous space between words. Additionally, try writing each letter about twice as large as you normally would were you composing a letter to a friend. The detached letters and "bigness" will impart a feeling of freedom and relaxation. At all costs, stay away from writing wiggly little tightly strung words. This kind of writing usually leads to a nervous breakdown. Think small and your nerves tighten; think large and your nerves unwind.

6. Don't stare at the word or letter you're putting down. Paying undue attention to the letter as you're writing it is akin to asking the centipede: "Tell me, old sport, how do you know which leg to put first?" And we all know what happened to "old sport." Let

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your attention deliberately wander *around* the word being put down. As you write, keep your focus casually and comfortably circling around the main action. In a way, this advice is like that of not gluing your eyes on the bumper of the car ahead of you. You know that the best way is to allow your eyes to take in the whoe scene, comfortably and naturally. In putting it down, try to take in the whole scene, too.

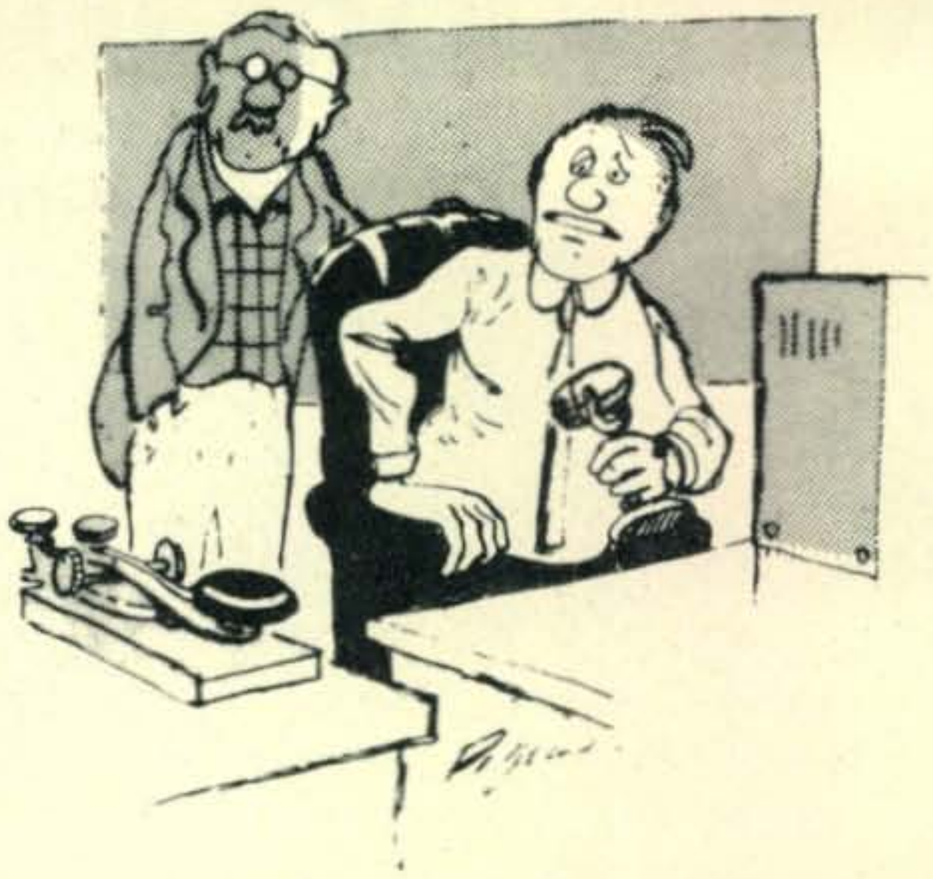
7. If the literal sense of the message being put down is too distracting and interfering with your ability to copy—a major problem with many hams lacking c.w. experience—use your other hand to cover the message. It's a sort of weak crutch; but it's helped many a struggling ham get through that stage.

8. A long stretch of c.w. at the same pitch can often put you to sleep. If you're not ready for bed, adjust the pitch with the b.f.o. Each new setting of the pitch will perk you up and give the note a fresh, new quality. A musician gets the same effect by changing keys within a composition; you get it by changing the pitch with the b.f.o.

9. When you feel the pressure building to the point that you know you're going to miss the next few letters coming up, close your eyes for a second or two, but continue to copy. This visual break acts as a mental strain-relief value, releasing excess tension and returning you to "normalcy." You can copy quite a bit with your eyes resting this way; try it the next time you feel the pressure building.

10. When you do miss a letter, don't fret over it...skip it completely. Surprisingly, the missing letter will often pop out glaringly at you when the entire sentence is considered in context.

As a fitting post script, accept the fact that we all experience both good days and bad days: days when you copy easily, and days when nothing seems to connect. This is all part of the learning curve, as with any other learning experience. The important thing is to keep in a easy and relaxed and optimistic frame of mind whenever you begin "putting it down." You might start off each copying session with Coue's "Every day in every way I'm copying better and better c.w.—I know I am." Anything that helps to reduce tension and to put you in a relaxed and optimistic frame of mind is certainly worth a little time investigating...isn't it? ■



"Miss that thing – I could blame my mistakes on it."

"Best pal ran off with my wife. I miss the crazy guy."

"So you picked up a station 12,000 miles out. Isn't this all the object?"

No Room for Tower Guys?

BY GEORGE HANDS,* WA7TGB

MANY hams are probably faced with the same problem I was—no room to guy my tower. The tower shown was not really a worry to me, as it was rated at 11 square feet of antenna at an 80 mile wind. But I really wanted to test the idea of "strut guys," a guying method well known to those hams from the power line construction industry. A strut guy starts at the top of a tower (or line pole) and extends out over a strut and then to the bottom of the tower or pole. Referring to the photos, I will describe the procedure to follow if you need guys, and don't have room for "down" guys (that should form at least a 45° angle to the tower for maximum efficiency).

The tower shown is 60 feet tall. In photo 1 the struts and the guy wires have been outlined for clarity. (The other lines coming down are for an inverted V and a flag.) Picture 2 shows the important parts of the struts. The struts themselves are made of 1 inch aluminum conduit. I suggest you purchase two 10 foot lengths of conduit and cut them to 6 feet long. This will leave two

*3901 East Yucca Street, Phoenix, Ariz. 85028

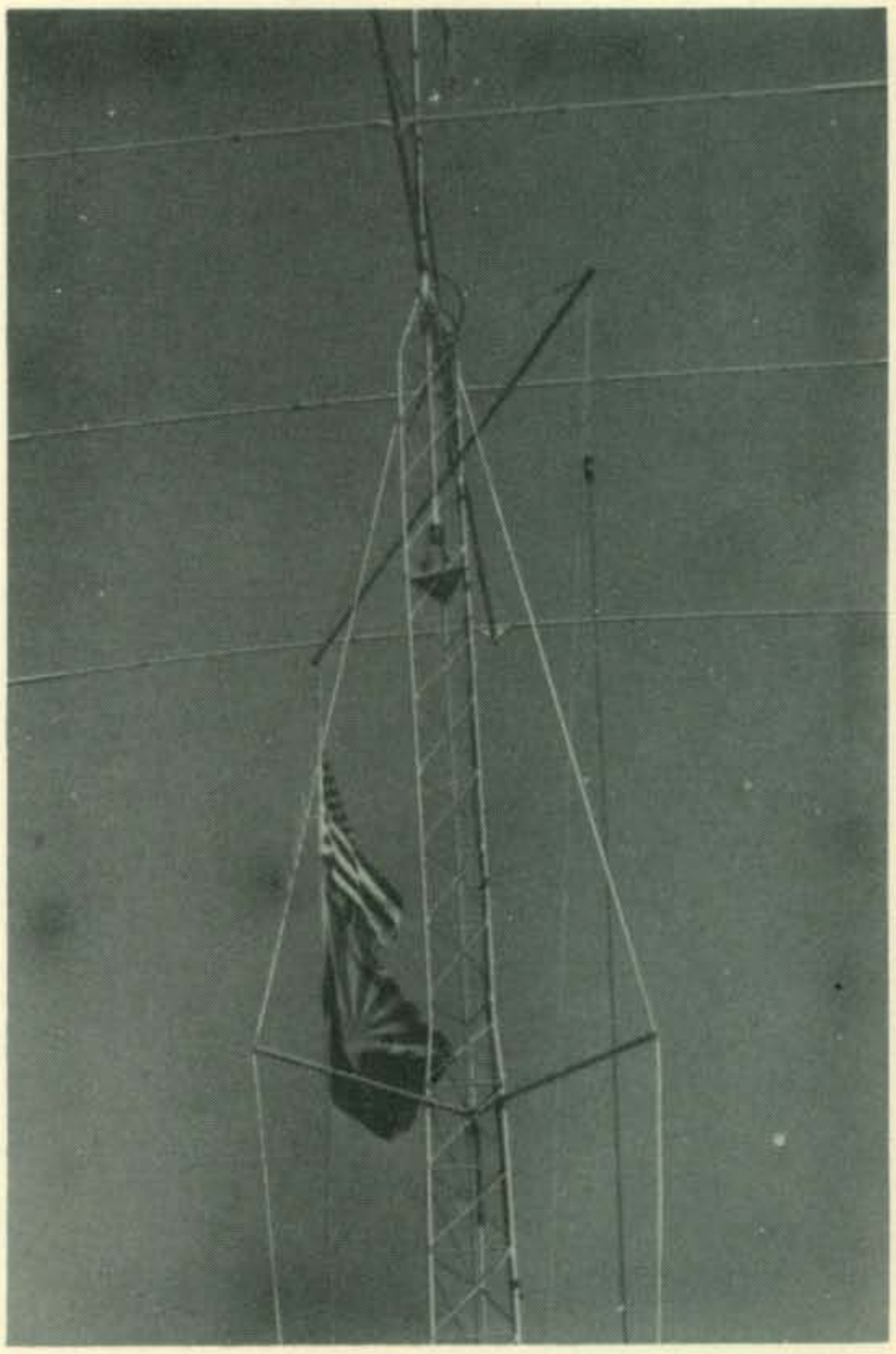


Photo 1—Retouched view of the tower with struts and guys installed. Other lines are for flag halyards.

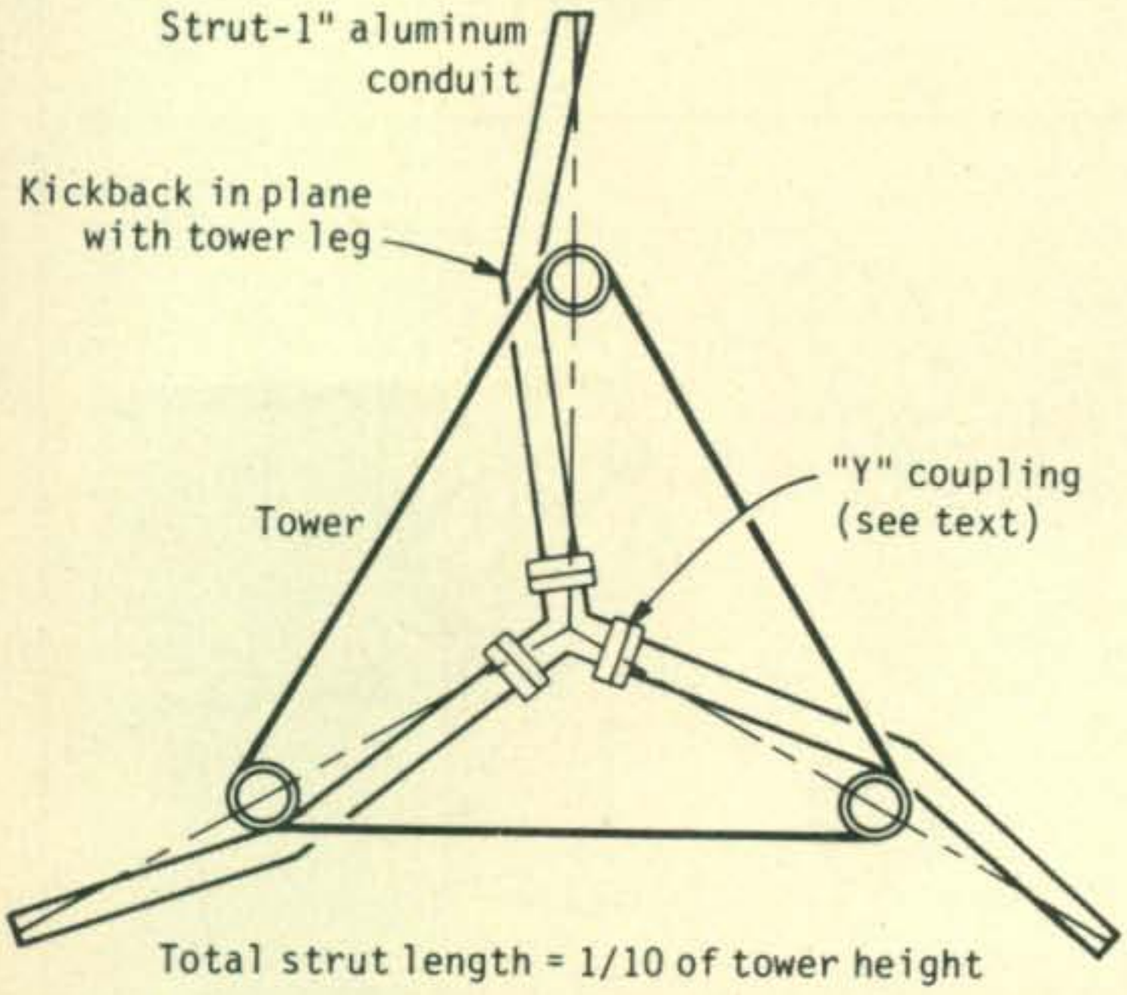


Fig. 1—Strut design—top view. "Kick bend" in each strut is used to align strut end with tower leg.

pieces 4 feet long. Screw these together with one of the couplings supplied with each length of conduit and cut the third length to 6 feet. There you have your three struts. On shorter towers a 4 foot strut will do. Cut a slot 1 inch deep in outer end of each strut to accommodate the guy wire. The inner ends must be threaded to fit a 'Y" fitting made from three iron 1 inch threaded pipe nipples. Their length is not critical, but they must be welded together in a 120 degree "Y" configuration.

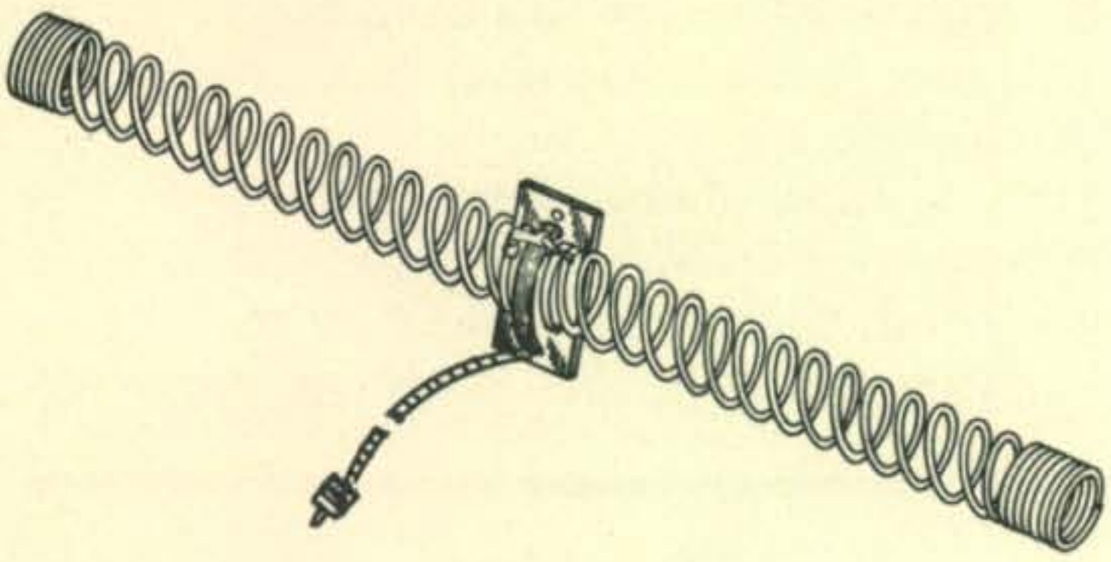
U bolt clamps are used to clamp each strut to its tower leg. After the strut legs have been screwed into the Y configuration and tightly clamped with the U bolts, you

[*Continued on page 80*]

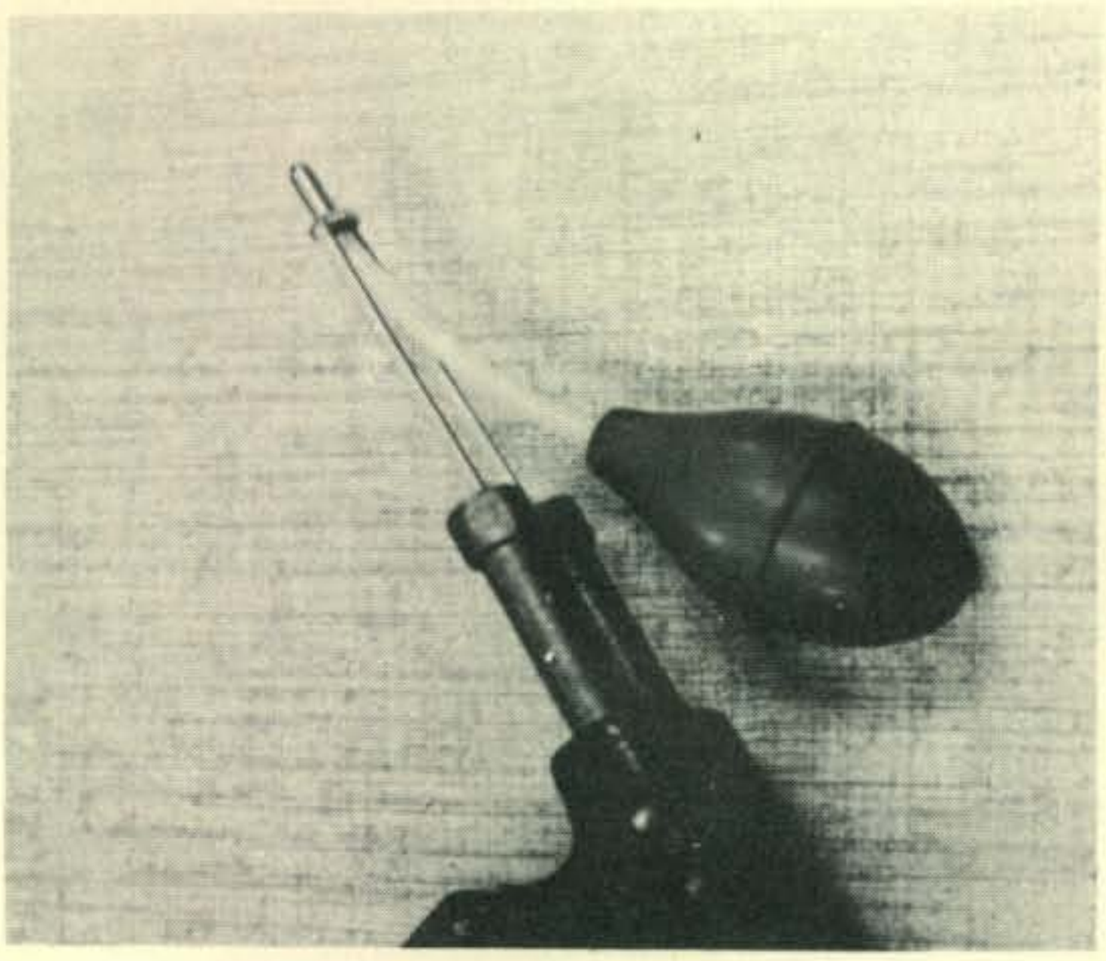
New Amateur Products

Slinky Dipole Antenna

The problem of assembling an efficient antenna for portable or limited space applications has been tackled dozens of ways by amateurs over the years, with varying degrees of success. The new Slinky Dipole Antenna from Teletron Data Corp., Bohemia, N. Y. promises to be one of the best solutions. Consisting of two special "Slinky" coils



(custom made by the famous toys' manufacturer), the antenna permits over 300' of wire to be stored for transportation in a 4" dia. by 8" long cylinder. In use, nylon suspension cords strung through the coils are fastened to suitable supports and the coils extended to the lengths specified for the band desired: 80, 40, or 20 meters. 80 m. length is only 70 feet. A balun is included as well as 50 feet of RG-58/U for the $24.95 kit price; coils alone are $14.95. For more details check A on Reader Service coupon.

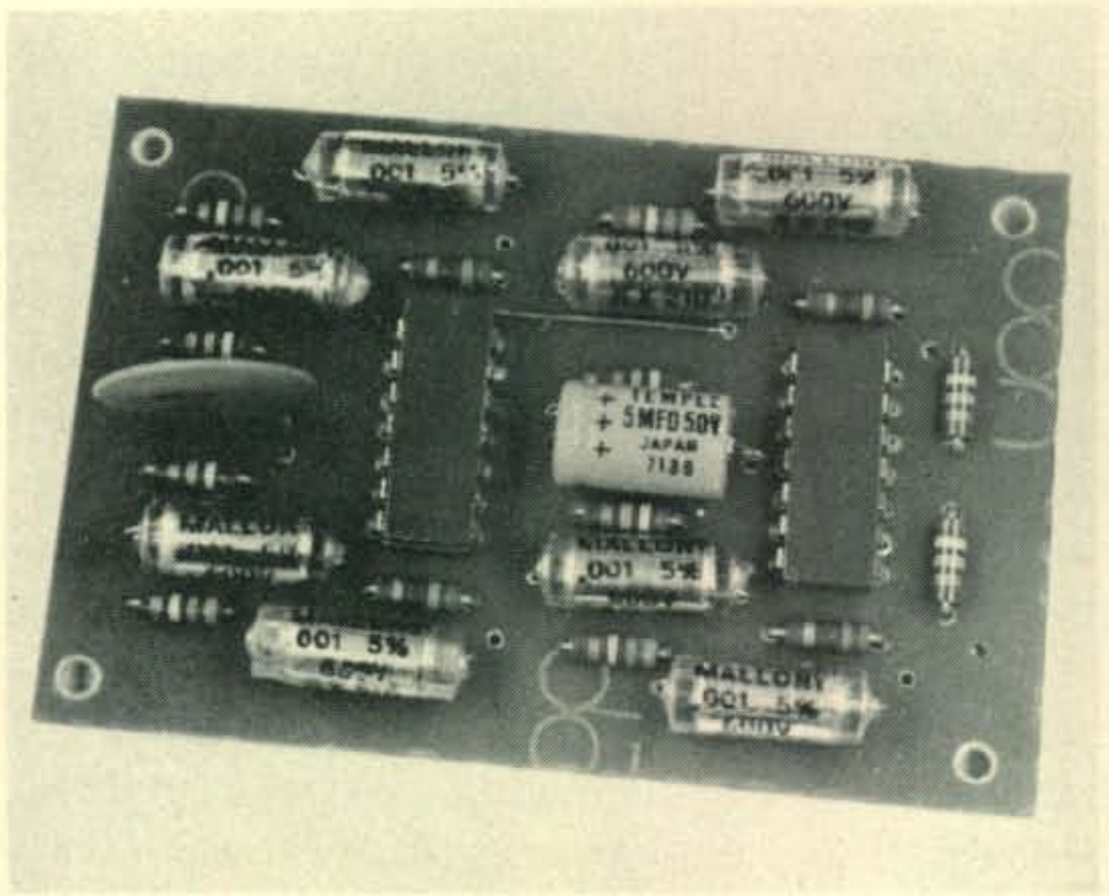


Gunmaster Solder Gun Tips

Many amateurs have relegated their trusty soldering guns to the depths of the tool box with the advent of printed circuits and heat sensitive solid state devices. A new tip element from Gunmaster Universal Industries, Kings Park, N. Y. returns the gun to the workbench by converting it to a low heat device. The universal tip holder accepts two thread-in tips for either low heat soldering (Slug Tip) or desoldering (hollow Dum-Dum tip). Heating time is somewhat longer than with a conventional tip allowing better control of temperature for the job at hand. The hollow tip clears solder by capillary action; or a solder sucker may be attached to the back of the Dum-Dum tip. Check B on Reader Service coupon for more details.

MFJ Audio Filters

Using op amp IC's, it's possible to design audio filters with outstanding selectivity characteristics to suit a variety of purposes. MFJ Enterprises, Mississippi State, MS. is offering three different filters in either kit or wired form at prices from $5.95 to $15.95, which make highly-desirable add-ons to the simple



receiver, or even to many of the high-priced dandies. The tiny p.c. board filters require 6 to 30 volts d.c. at a few mils and are available in two c.w. filter versions offering 6 db bandwidths switch selectable from 80 Hz to 180 Hz with a center frequency of 750 Hz. A low pass filter model provides attenuation of 40 db/octave about 2.5 kHz. Boards and components are of excellent quality. For full details, check C on Reader Service coupon.

The WD-11

The New Low-Current-Filament Tube Marked A New Era In Radio Communications.

BY J. K. BACH*

RADIO Broadcasting on a commercial basis began over half a century ago with KDKA, the Westinghouse station in Pittsburgh, and within a short time commercial stations began appearing in all major U.S. cities. Nearly all receivers at the time, however, were simple low sensitivity crystal sets, and most areas of the country were out of range of these new stations.

The answer to the problem obvious to us today: buy a more sensitive receiver and plug it in. But the receivers of that day didn't plug; they required storage battery power, and recharging these cost a dollar weekly when it could be done at all (equivalent to four times as much today). On the farms and in small towns, receiver operation on this basis was largely out of the question. Even in large cities, in fact, many homes were still lighted with gas; electric service was by no means universal as it is today.

The answer to the problem came in 1922 when the long-since-forgotten WD 11 tube was developed and introduced by Westinghouse Lamp Co. Here was a tube whose filament could be lighted for weeks by a single Columbia #6 dry cell, costing thirty-five cents; a revolutionary achievement which opened up the whole country to broadcasting, and caused the emergence of an electronics technology country-wide. The WD 11 in its Aeriola Senior receiver and succeeding models changed the entertainment habits—and the thinking—of the nation. Metropolitan newspapers hired their own "experts" to conduct columns of advice and present building plans for receivers, functions soon taken over by the radio magazines.

The reign of the WD 11 as *the* dry-cell tube was short, only about three years. It was superseded by GE's UV 199, announced a year later than the WD 11, but which got off to a slower start. The '99 required less filament *current*, but not a whole lot less filament *power*. It was rumored that the bell-ringing '99 was far superior as an r.f. amplifier and this canard effectively killed the WD 11 as an experimenter's tube. WD 11 prices dropped sharply. RCA by its cross-licensing policies eliminated the nonsense of bring-back-the-dead-tube-and-we'll sell-you-another and deserves a lot of credit for this. The great tube availability due to lower prices fostered technical development.

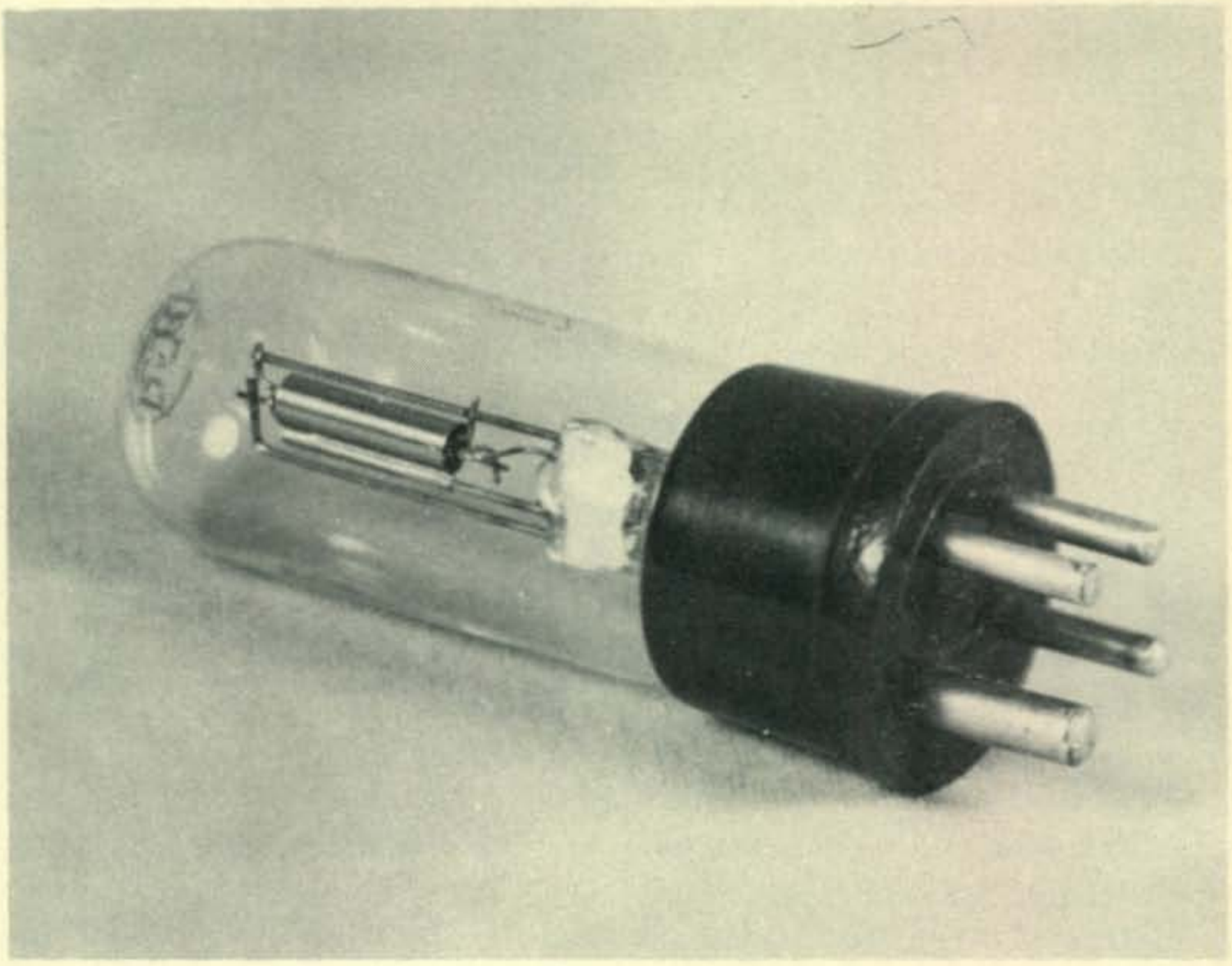
The '99 is still listed by a few suppliers, with the going price $5.00; The WD 11 is exclusively in the hands of collectors, and the price is whatever you have to pay for it. (The tube which illustrates this article cost fifteen dollars.)

All of those pioneers involved in the development of the Westinghouse WD II have passed on, and there is next to nothing in print about it. In an effort to piece together its history, I inquired of Westinghouse, which referred me to two retired employees, Lauren Peckham and Bruce Roloson. With their aid, which I gratefully acknowledge, it is possible to complete descriptions and trace developments and even hazard some inferences to fill in the gaps. This brief history of this revolutionary tube owes them a lot.

The concept of a small vacuum tube powered by a dry cell for portable equipment is due to Doctor Frank Conrad, of Westinghouse. The date was probably late in World War I, and the suggestion probably made to Signal Corps brass. At the time he had no thought of broadcasting, which he later initiated, and the development contract was given, not to Westinghouse, but to Western Electric.

Why Western? The reasons were not made public, but probably depended on the technical fact that the standard Tungsten filament could not be scaled down without reducing the emission to an impossible level.

*Ivy Hill Road, Walden, N.Y. 12586



A later version of the Westinghouse WD II. Note that this tube uses a Bakelite base and has no evacuation tip visible at the top of the tube. The white "spot" at the center of the photo is not a highlight in the photo, but is the lime getter painted on the glass element support within the tube. Earlier versions used a brass base.

But Western had been using the Wehnelt (VAY-nelt) cathode in telephone repeater tubes since 1915—that's right, only nine years after the Audion was invented! These first tubes looked very much like the wartime VT-2. This cathode was a filament painted with a mixture of Barium and Strontium Nitrates, the same salts which produce the greens and crimsons in fireworks. In tubes they are reduced to oxides in processing. Such filaments are at least twice as efficient as Tungsten, operating at a dull red heat. They have high emissivity, are stable, and can have extremely long life.

The actual design for the new tube was undertaken by H. J. Van der Bijl (VAN der BEEL) of Western's tube department. He was already well known on the continent as a tube designer, and he had invented grid modulation.

He was a proponent of simplified tube construction, and so mounted the new elements between glass beads for bracing. (The standard construction was to fuse the element support wires in a re-entrant "mount" such as is used in lamp bulbs.) Van der Bijl inserted this assembly in a tiny tube with the exhaust tip on one end and an *external* press, like that on an NE 2, on the other. He felt that in such a small assembly the grid could be supported at only one end, provided that the wire be thick enough. Experimental tubes with this construction have not survived, but they must have been impossibly microphonic! In production, tube elements were well braced at both ends. All tubes were microphonic then, except the VT-1 (also his design) but the new little tube was among the best (least microphonic) in this respect.

The filament was of Platinum/Iridium, only .002 inch in diameter, probably the smallest commercially-available wire. The Iridium had no function, though it was widely assumed to have. It was far cheaper to include it than to refine it out, and like Platinum, it was inert and did not poison emissive coatings.[1]

Van der Bijl's little tube was the original "Peanut Tube" and not the UV 199, as is widely believed. It was assigned a whole list of names: VT-5, D-80039, 115-A, later 215-A, SC-201-A, Type N, and it used Western Electric 121 A or 125 A sockets.

In 1921 when the design was licensed to Westinghouse (who at that time made only Tungsten-filament tubes) the company saw no reason to change the size of the grid wire, so that the elements of the Type N and the WD 11 were identical. Westing-

[1]Platinum itself had, in 1900, been a waste product in the gold placer locations in the Colombia rivers. It was a nuisance; the miners called it Juan Blance (John White). Some enterprising Columbians used the hard white metal from the tailings to counterfeit a popular Spanish gold coin, with a gold wash for color. These passed easily, since the workmanship was of high quality. These counterfeits are worth much more intrinsically than the genuine coins today.

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- **Built-in touch tone pad**
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- **Audio output 4 watts @ 10% THD**
- **Speaker built-in to left side of cabinet for maximum mobile reception**
- **Headphone jack for noise-free mobile operation**
- **Independent selectable priority channel**
- **Built-in Auto CQ**
- **Temperature range from -20^{o} to 170^{o} Fahrenheit**
- **Size: 4" H x 8" W x 10" D Weight: 10 pounds**
- **One million channels (1000 Rec. x 1000 Trans.)**

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house did, however, enlarge the tube considerably, provide it with a special push-pin base, the first in this country, and used its own development, the "Lime Getter" which was painted on the flat part of the stem to improve the vacuum. This can easily be seen in the photograph.

The original WD 11 had a tip, a brass base, clear bulb, and lime getter. Later tubes had a bakelite base and were tipless. Sometimes both lime getter, and metallic flashing were used together, but at last only the flashing ("Batalum" or Barium) was employed. It was the large grid wire common to the N tube and the WD 11 that persuaded me that there might be some connection between them, and led me to query Westinghouse. It is startling to see a lighted WD 11 or N for the first time in a dark room. The large grid wire reflects the glowing filament, so that it looks as if the grid were red-hot.

Some collectors want only to display their tubes; others insist on trying them, and I belong to the latter congregation. I bought a Radiola III (a later version of the Aeriola Senior, one of several) and the seller assured me that the tubes in it were for show, being no good. The first lit up like a VR-150 when plate voltage was applied in the tube tester. I switched to low plate voltage, applied normal drive (transmitting tube fashion) and heated the flashed deposit on the tube envelope with a cigarette lighter flame —very cautiously—as old timers used to do. It hardened up very well and is now OK, with no grid current and the rated G_m of 400. But even if it hadn't, I could have used it as a detector, or even as an audio amplifier with 15 v. or less on the plate. That's what we used on the sensitive UV 200, and even if it is a "transistor" voltage, it works better than you would think.

The other tube tested open, but the filament clamps appeared to be still under tension. I tried resoldering the filament prongs which sometimes works on old tubes, but didn't this time. I then gave the filament two or three short pulses of 2.5 volts, and as I had hoped, the clamps re-welded themselves and it lighted up fine with the normal 1.1 volts. It, too, tested OK. If it hadn't, I would have placed it in series with a 10 watt bulb across the 120 volt line. Ten watts does not figure to a quarter amp, but remember the surge current in the cold lamp filament.

The WD 12, like the UV series, is a Shaw-based WD 11 with a bayonet pin on the side. The WX 12 has a UX base, with long pins. The Western Electric 239 A is, curiously, a first cousin of the WX 12; which latter was itself derived from the old type N. The WE 231 D is much different; it is most like the '99 in ratings, but has a V filament, oxide coated. They are interchangeable, except that the 231 D has a higher transconductance and is less microphonic. RCA's 864 is a V-filament flat plate super WX 12, noted for its quietness. The filament glows so dimly that it is difficult to see, even in the dark. But the G_m is right up there. These are still available at reasonable prices, and will interchange with WD 11's and 12's in all applications. For instance, you could equip an Aerola or Radiola III with them by changing the socket.

The coming of the a.c.-powered tube slowed but did not stop battery tube development. Even smaller fllaments were wanted, and pure nickel was finally drawn down to a thousandth of an inch. While the new filaments were vastly cheaper than Platinum, which by now was a precious metal, they didn't work very well.

In 1933 Westinghouse produced Konel, an alloy of Nickel, with Cobalt, Iron and Titanium. Its resistance was high, so it could be used in larger gauge, with increased emission. It made the type '30 a resounding success, and several families of new tubes used it.

The N survived in the Telephone Company until about 1940, the longest span of any tube type. Similarly, that old revolutionary, the WD 11, could still compete with much younger triodes in operating characteristics except that it had been phased out in the '30's.

Probably no tube can stand up to Solid State of the Art, but will any Transistor be collected at some future date, and valued as these old tubes are today? I wonder. ■

Slow Scan TV

BY COPTHORNE MACDONALD,* W0ORX

Courses Via SSTV

How would you like to take aviation ground school instruction this Fall and Winter from an FAA certified Flight Instructor —via ham radio and SSTV? Or a course in basic photography and darkroom procedures? Or a course in do-it-yourself food growing to cut the food bill and eat better? Dan Taylor, WA6LRA, is a Flight Instructor, an accomplished photographer, and a successful amateur gardener. He also believes in the potential of SSTV. He has been working to get the hams in the San Jose area interested in SSTV—building many monitors to loan out, putting out lists of SSTV parts carried by local parts stores, and even setting up a lab in his garage to help people align and troubleshoot their SSTV gear. But, the hardware, he says, ". . . is only the beginning. We have to use it right." Dan is serious about sharing some of his specialized knowledge with others through the medium of slow-scan TV. If you're interested in taking one or more of his courses, write him at 2948 Betsy Way, San Jose, Calif. 95133. I did.

Human Engineering The Control Interface

In SSTV we still have the traditional control and monitoring problems of voice operation (transmit-receive control, receiver tuning, plate current and S-meter watching, etc.). For the most part, the solutions that have evolved for transmitter control and monitoring in audio-only hamming are applicable to the SSTV station also. In the past, though, we have not had to worry much about selecting between different audio sources to feed the transmitter. Often there was only one source, the mike. Some stations also had a phone patch, and possibly a tape recorder. No additional monitoring was required, except possibly a VU meter on the patch. With the coming of SSTV, things have gotten more complex. To draw a parallel to broadcasting, the "transmitter" is the same, but we've enlarged the studio operations." It is necessary now to select between a greater number of sources: camera, FSS, and tape, in addition to mike and patch. Possibly we want to use several mikes or headsets.

The monitoring problem has also been complicated. We want to view pictures; the ones we're sending as well as the ones we're receiving. In addition to this "subjective" monitoring, we may also want to do "technical" monitoring of the video signal. Typical of this type of monitoring are sync indicators to help optimize receiver tuning, and scope monitoring of video and sync waveforms. So, we not only need to select sources, but we need to switch our various monitoring devices. And we mustn't forget the lights. Dim while receiving, bright while the camera is in use.

It's beginning to sound a little messy—and it usually is. Either the operator goes through gyrations in switch throwing more or less continuously, or the lights stay on during receive, etc. Either way the communication suffers. What is needed is a control system organized by *function* so that a lot of necessary (but technically unrelated) things happen when we give a functional command. For example, it would be nice to have the bright lights go on automatically

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Fig. 1—The station control system in use.

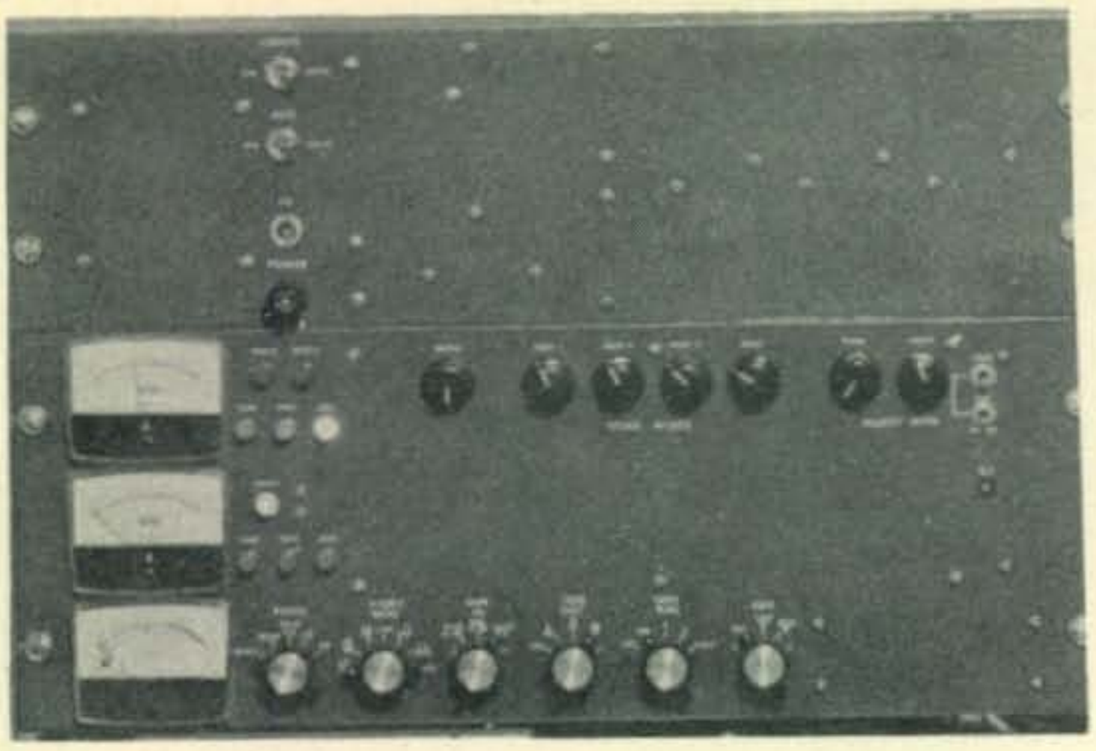

Fig. 2—Front view of the rack mounted portion of the control system.

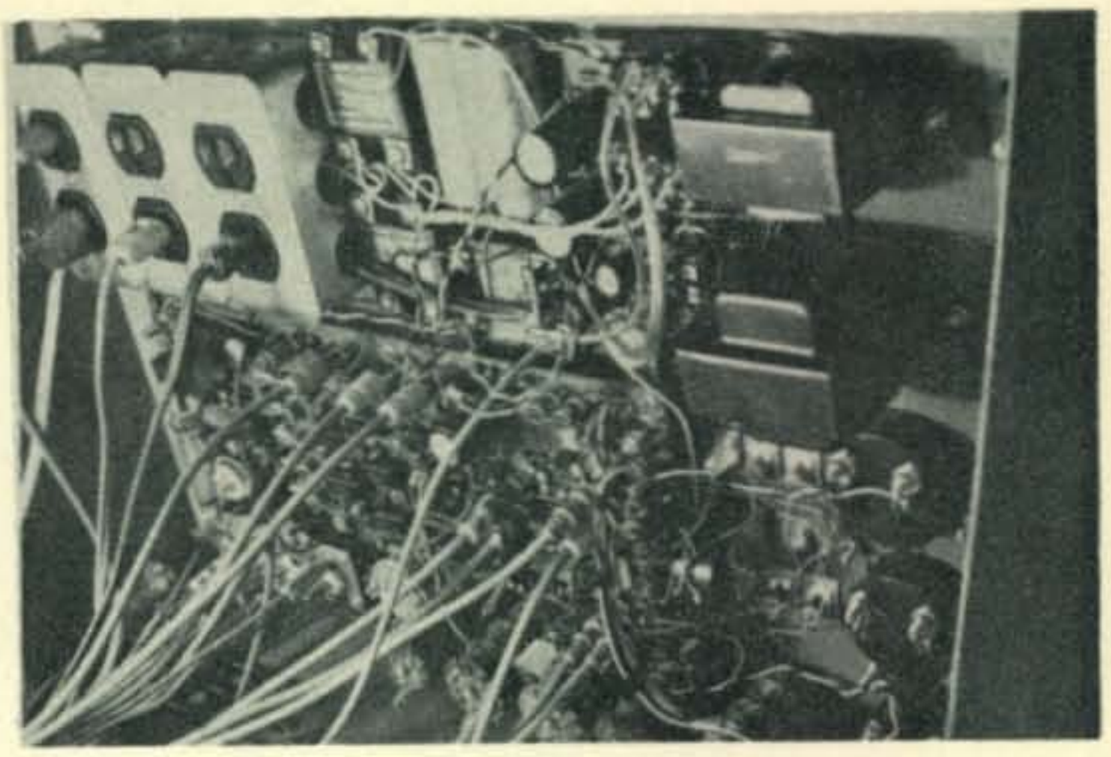

Fig. 3—Rear view of the rack mounted equipment.

when we select the camera output to feed into the transmitter, and automatically go off again when the transmission is over. It would be nice to have the tape recorder motor start automatically when we select the "tape" audio input for the rig. We would like the video picture monitor to automatically switch back and forth between transmitted and received video whenever the rig goes from transmit to receive. In other words, it is no longer enough to do audio switching, and power switching, and T-R switching separately from each other. They need to be tied together so that *one* human instruction can cause *all* the desired switching functions to occur.

There are many, many ways of accomplishing this. The way you choose will depend upon your junkbox, the parts situation in your locality, the time you want to spend building, and the size of your wallet. Let's look at some options. The actual a.c. switching of the lights and tape motors should probably be done by mechanical or solid state power relays for safety. (Most multifunction rotary and pushbutton switches are not intended to switch power line voltages and currents.) With a power relay, only a low level d.c. control voltage need be switched.

There are two basic approaches to doing the rest of the switching. The first is to use many-section rotary, lever, or pushbutton switches to simultaneously switch the audio/video and relay control voltages. This is probably the least expensive approach, and the simplest to plan out. Given enough poles and positions, one can make very complex things happen. The second approach is to get I.C. logic into the act. Here the actual switches can be very simple—momentary contact pushbuttons, for example. Flip-flops can be used to hold this momentary instruction indefinitely. I.C. or diode "and" and "or" circuits then combine the various d.c. instructions to generate control voltages for the power relays, status indicator panel lamps and d.c.-controlled audio switches.

There are several devices on the market that will perform the audio switching function nicely. One is the reed relay. Another is a light-photocell relay of the type that uses a cadmium sulphide photocell (Sigma 301 series, etc.). The third and probably least expensive device is the RCA CD4016AE "Quad Bilateral Switch." This device uses FET principles and is really four separate d.c.-controlled audio switches in one 14 pin DIP package.

Fig. 4—The hand-held control unit.

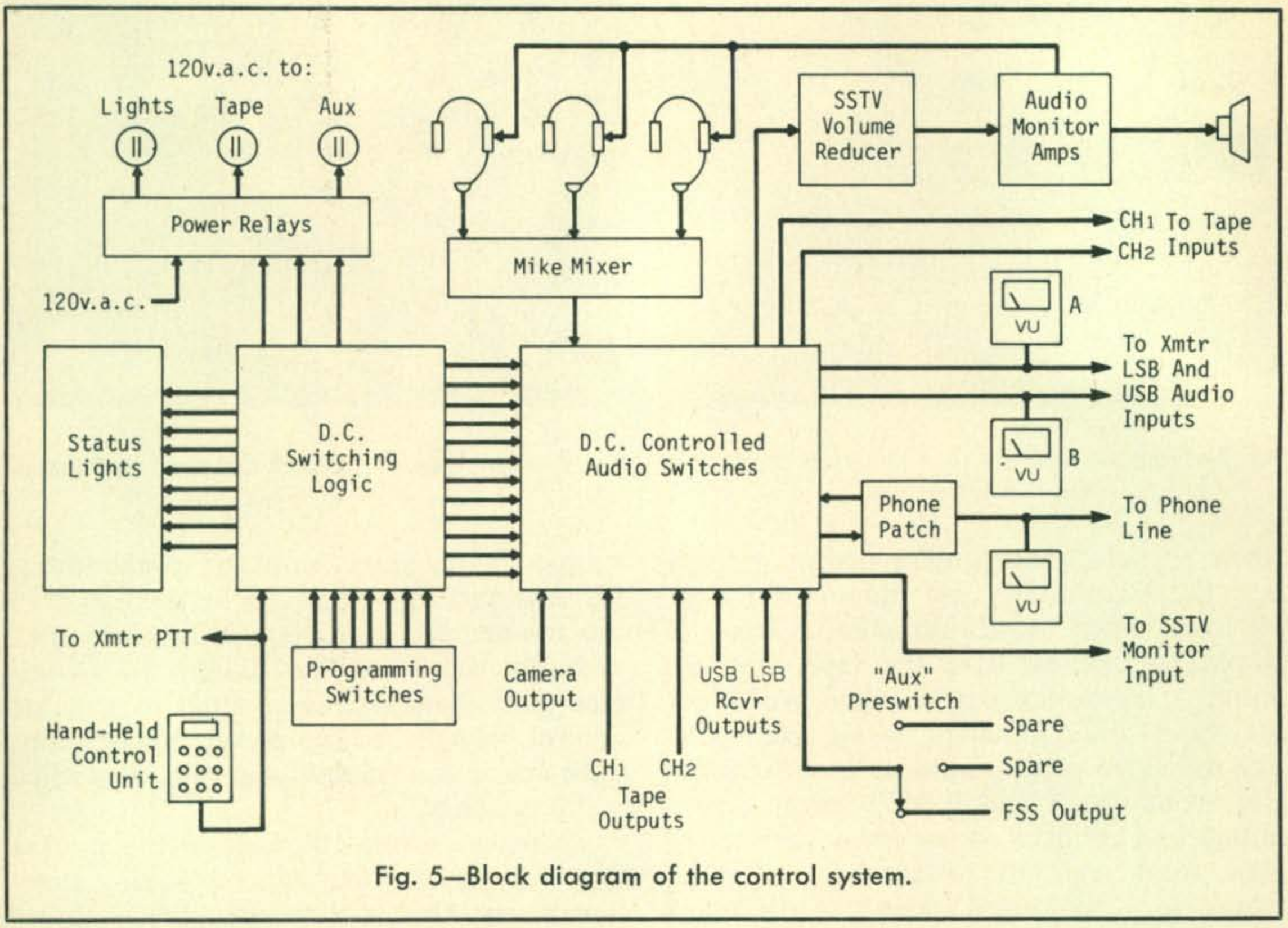

Fig. 5—Block diagram of the control system.

If the system is very complex, some form of "pre-switching" or "patching" may be necessary. In a large system it is impossible to have everything at the operator's fingertips. You plan the system so that he has rapid, effortless control of the most needed functions—even though they must be few in number. Backing up these "operational" controls is a second level of control where the operator can accomplish secondary or little used functions, or program his operational controls, with some additional difficulty. Patch cords and jack panels, computer matrix switching boards with plug-in pins, and rotary switches are all useful for these "pre-switching" and "programming" functions.

The Physical Comfort Interface

The usual problems of ham shack temperature and ventilation could be somewhat aggrevated with slow-scan. Extra lights throw off extra heat, and with the shades or blinds drawn, the fresh air may not move in as freely. No magic solutions here.

Control accessibility may be a problem. First, there are more controls to worry about, and second, there is a greater need to be up and around the shack. Lettered cards need changing. The tripod needs adjusting, etc. One possibility is putting the most frequently needed controls in a small hand-held box at the end of a long cord.

Everyone has his own ideas on what constitutes a comfortable chair. One problem is that the chairs can't be too large if you plan to gather several people in front of the monitor screen and camera. The folding canvas "Director's Chairs" are among the smallest chairs with arms, and I find them quite comfortable.

One potential source of physical discomfort is the reaction of our eyes to a darkened room suddenly being flooded with light. Some scheme to turn the lights on gradually would be nice. A husky Globar thermistor such as the Workman FR291, in series with a 100 or 200 watt lamp is some help, but not the final answer. (This thermistor has a resistance of 79 ohms cold, and 0.47 ohms hot.)

Reaching The Goal

In last month's column I presented a detailed breakdown of what I wanted to accomplish in my own shack. This was an example of the *kind* of list that each of us could draw up, not a formula for everyone.

[*Continued on page 76*]

QRP

BY ADRIAN WEISS,* K8EEG

BEEN hearing a lot of QRPp signals on the air lately? You probably have, because QRPp is the "in" thing and the bands are crawling these days with minitransmitters. QRO types will wonder what all these guys get out of running a couple of hundred milliwatts or a couple of watts that they don't get out of running a hundred or a thousand watts. After all, that makes hamming a lot more difficult, doesn't it? What's the point of operating QRPp? Well, this column will try to fill you in on what you have been missing if you haven't tried the QRPp "way of life."

Most of the new recruits to the QRPp ranks are drawn from the QRO gang, and perhaps a few of their comments will reveal what this QRPp thing is all about.

When he first got "bitten" by the QRPp bug, K6GKU wrote: "Since I was licensed in 1954, I have always looked for the part of hamming that would provide the greatest sense of achievement. QRPp operation has and continues to rate very high at this station. . . ." In about a year of QRPp operation, K6GKU worked over 40 countries—mostly on SSB with 2.5 watts output —and qualified for the difficult ZL-73 Award, which requires QSO's with 50 ZL stations in a single year. And his experience isn't extraordinary by any means!

Or K4ADT: "Am really bitten by the QRPp bug and my interest in ham radio is the highest since 1954 when I was a Novice. My Swan MKII linear and TR-4C are now sitting idle on my desk—I built an HW-7 a few weeks ago and then bought a Ten-Tec Argonaut last Friday and put it on the air over the weekend. I went out in the rain Friday to repair my Delta Loop beam and didn't get the Argonaut on the air till Sunday. Well, you will probably believe this, but I can hardly believe that it even happened to me! I worked EA5, HA1, ON5, PY8, XE1, DK1, KH6, and KL7 with the QRPp rig the very first day! And at home today during lunch, I worked another HA1, YU1, and ZS1 —and you think I'm not hooked on QRPp? And one month later: "Now up to 43 countries with the Argonaut. Am selling the regular QRO rig here, so will be using only the Argonaut from now on."

And then a philosophical comment from K8IKO: "QRPp is the focus of one of the most hopeful and constructive developments in my 39 years in ham radio. The adoption of low power, simple equipment, and careful, thoughtful operating as a "way of life" by many hams in the face of the general trend to appliance operating and "plug-in-and-play" kilowatts is the most wholesome trend I have seen in many years."

There you have it from the fellows themselves. Indeed, QRPp is providing a badly needed revitalization of the amateur radio experience for thousands of hams worldwide. Very low power operation is many things to many people. There's the challenge of working the world with no more than a rig powered by a lantern battery. There's the amazement that such low power can go so far. There's the thrill that comes with each new QRPp contact—and believe me, the thrill never wears off! That's not all there is to it, of course. We'll try to present the various facets of what QRPp operation has to offer by regularly including comments such as the above in this column. We invite you to add your thoughts and experiences.

Trying Out QRPp

If you're convinced that it's worth a try at least, how does one go about getting into QRPp operation? What are the operating techniques that ensure success once you've taken away the power advantage of a 500 or 1000 watt transmitter? The subject of the technical section of this first column is directed at the first question, and we'll get to operating techniques in later columns.

Perhaps the easiest way of getting a QRPp signal on the air is to purchase the superb TenTec Argonaut, a state-of-the-art, all band, s.s.b./c.w. transceiver with about 2-3 watts output on all bands. This rig has been used by many hams since it appeared, all with excellent results. However, putting this amount of cash down on the barrel ($288.00, very reasonable for the quality of

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Attenuation (db)	R_1-R_3 (ohms)	R_2 (ohms)
3	8.4	142.
6	16.6	66.9
9	23.8	40.6
12	29.8	26.8
15	34.9	18.4
18	38.8	12.8
21	41.8	8.9
24	44.0	6.3

Table I—Resistor values vs. attenuation.

the rig) may not be every ham's idea of "trying something out." TenTec also produces the "PM" series of transceivers for under $75.00. These use the direct conversion receiver technique and several-stage transmitters with v.f.o. control, a must for QRPp operation. The Heath HW-7 is a neat QRPp rig and should provide much excitement after it is assembled.

Better yet, the regular QRO station transmitter can be used for QRPp operation without modifications, either temporarily or permanently. Several methods follow.

1. *Decrease Drive To The Final.* This approach is explained in detail by W2NZ in the excellent, "must-reading" article "The Song of the Flea," *CQ*, March, 1973, p. 41. It is simplicity itself. The transmitter is first tuned for maximum output. The DRIVE or AUDIO GAIN control is then backed off until the output drops to five watts or under. A word of caution here. The use of this method in some s.s.b. transceivers will upset the bias balance that is critical for linear operation of the final. Unacceptable signal distortion will result on s.s.b., and on c.w. if the rig uses the audio-keying method of generating c.w. The technique will be useful for all the standard 180-watt-PEP-and-under rigs. However, it may not be possible to use it with a higher power transceiver such as the Galaxy GT550. Try it, and if it works, fine!

2. *Remove The Final Tube.* This approach requires a very slight modification of the transceiver. The objective is to simply bypass the final stage amplifier, and connect the output of the driver stage directly to the pi network output system. To accomplish this, the final tube(s) are removed from their sockets, the B+ lead is disconnected, and the output lead from the driver stage connected directly to the output pi network. Most driver stages produce around five watts output—the probable level can be easily determined by checking the *Handbook* for the plate dissipation ratings of the driver tube.

3. *Symmetrical Resistive RF Pad.* The obvious advantage of this technique is that the transceiver operates at the conditions for which it was designed in terms of power output and biasing. A symmetrical T resistive pad is inserted between the output of the rig and the antenna, and dissipates a chosen amount of the output power. It's a waste, for sure, but that makes no difference if you don't want the power in the first place. The design of a T pad for your particular setup is not difficult if the following steps are followed and the data given in the charts is used.

First determine the amount of power attenuation desired to lower the output of your rig to the 5 watt or under level. A 3 db power reduction is equivalent to cutting the power in half. Hence, if you want to reduce 80 watts output to five watts output, the following 3 db reductions are necessary: 80-40 watts = 3 db, 40-20 watts = 3 db, 20-10 watts = 3 db, and 10-5 watts = 3 db. The total reduction is the sum of the individual reductions, or 12 db total in this case. Table I gives the proper resistances for R_1, R_2 and R_3 of the circuit of fig. 1 for several levels of power reduction. Select the proper values.

Next determine the power dissipation required of each of the resistors. Table II shows the formula for arriving at this dissipation factor, and provides calculated values.

Since the T pad can use only non-inductive resistors, this limits us to the use of 2

$$\text{Dissip. } R_1 = \frac{P_{in}}{5} \qquad \text{Dissip. } R_2 = \frac{P_{in}}{4}$$

$$\text{Dissip. } R_3 = \frac{P_{in}}{10}$$

Power In (watts)	Power Dissipation (watts) R_1	R_2	R_3
50	10	12.5	5
70	14	18.	7
80	16	20.	8
90	18	22.5	9
100	20	25.	10

Table II—Power dissipation requirements for T-attenuators.

watt composition types that are readily available (NB: wire-wound resistors such as the "Brown Devil" type *will not work*). And so, we must resort to using groups of 2 watt resistors in parallel to arrive at practical results. Simply divide the dissipation of Table II by 2 to arrive at the number of 2 watt resistors needed in each leg of the T pad.

Next, we must determine the actual resistance of the paralleled resistors that will yield the desired value of resistance in each leg. The general formula for calculating resistances in parallel is:

$$R=, \frac{1}{\frac{1}{r} \times N}$$

where R is the desired final resistance, r is the value of the resistors in parallel (all must be the same value), and N is the number of resistors required for the power dissipation involved. The formula can be transposed for our purposes thus:

$$\frac{1}{r} = \frac{1}{R \times N} \text{ or } r = R \times N$$

An example will make this all clear. We want to drop 80 watts to five watts output, so a 12 db reduction is needed. From Table I. R_1 and $R_3 = 29.8$ ohms, $R_2 = 26.8$ ohms. Round off to 30 and 27 ohms. From Table II, R_1 must dissipate 16 watts, R_2 20 watts, and R_3 8 watts. Hence we must use eight 2 watt resistors for R_1, ten 2 watt resistors for R_2, and four 2 watt resistors for R_3. Using the formula above ($r = R \times N$), we find that R_1 can be made of eight 240 ohm 2 watt resistors, R_2 of ten 270 ohm resistors, and R_3 of four 30 ohm resistors[1]. The final design for the 80 to 5 watt pad is shown in fig. 2. In construction, leads should be kept as short as possible. It is not necessary that the exact figures be achieved in practice, since 3 db is the minimum significant factor as far as signal levels on the air are concerned. That leaves us with a pretty large leeway for error.

You should have some idea of your output power before starting the design of a T pad. The figures above are designed for 50 ohms input and output and will not change the impedance presented to the feedline. Generally, it can be assumed that the modern transceiver puts out about 45-55% of input, and you can proceed on the basis

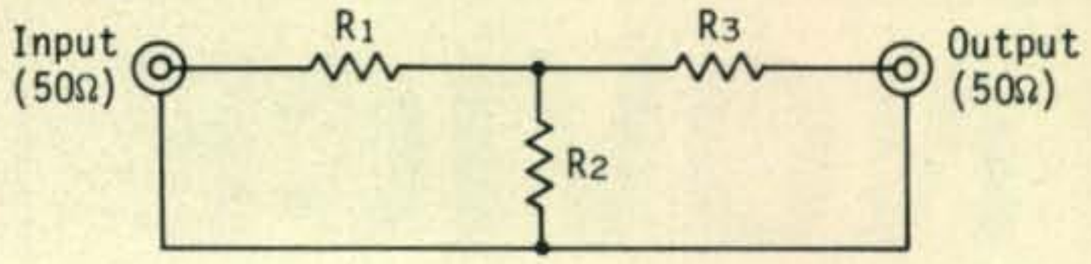

Fig. 1—The basic T-attenuator. Values may be determined from Table I.

of that assumption, unless you have a power output meter that will give you a more accurate indication. Several QRPp operators that I know of have simply used the T pad instead of buying a whole new rig—and the QRO rig is around if you need it in a pinch.

In our next column, we will discuss the various methods of measuring r.f. power output. The standard in QRPp operation is *output* power, since this is the only measure of the important power factor—that which the rig delivers to the antenna.

Also in our next column we'll talk about the most coveted and most difficult awards ever offered—QRPp DXCC and Milliwatt DXCC. We're out of space, but there's a lot more to come. You are invited to help make this column a success by submitting operating reports and comments, schematics, construction projects, operating hints, questions. We'll oblige all. Hope you find the column enjoyable and interesting, and if you do, drop our Editor a card to that effect.

73, Ade, K8EEG

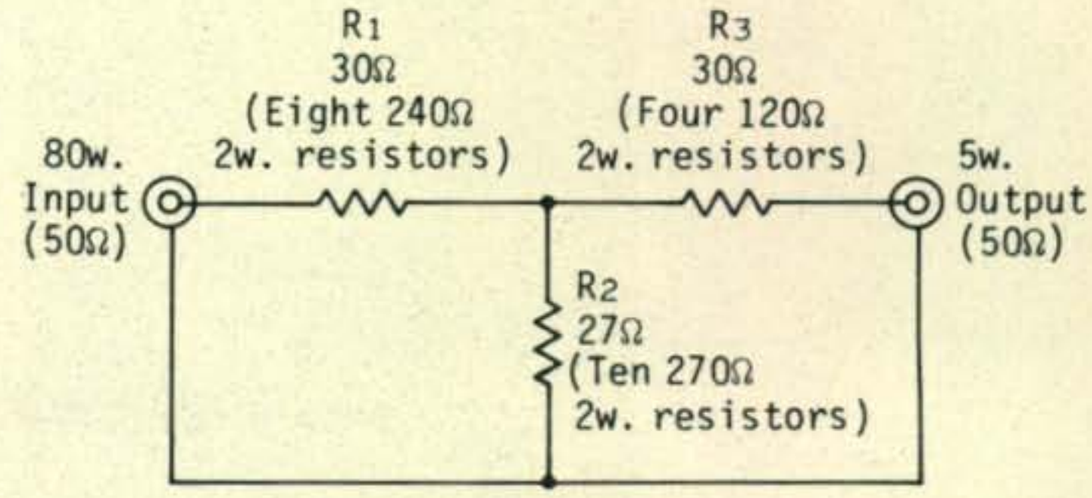

Fig. 2—Using the information of Tables I and II, here is a practical T-attenuator which will produce 5 watts output with 80 watts input while maintaining 50 ohm input and output impedances.

CQ'S DIAL-A-PROP

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NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

THE Novice license became part of the United States amateur licensing structure in 1951 when forward-looking groups realized that the increasing complexities of communications electronics were making it increasingly difficult for people without electronic backgrounds to pass the standard amateur examination. And one of the most desirable features of amateur radio is its universal attraction to people without regard to age, sex, age, social status, or occupation. But the Novice license was not born without a struggle. Many licensed amateurs opposed the new license on the basis of, "I had to struggle for my license: let the newcomers struggle, too." As a matter of interest, similar arguments are still being used in some foreign countries—Australia for one—to prevent the introduction of Novice licenses.

The publishers of *CQ*, were solidly behind the Novice license program from the start. As soon as the license became a reality, *CQ* instituted the "Novice Shack" column devoted to the particular interests of Novice operators. Not too surprisingly, the "Novice Shack" was intensely popular with Novices, but its popularity with other *CQ* readers was somewhat surprising. The column was suspended some years ago when it appeared that its original purpose of giving the Novice his first voice had been achieved, and the Novice scene was being well covered in other publications. But the demise of several of these publications and the shift to a commercial approach in others again left Novices without their own national forum. Starting with this issue, therefore, *CQ* is happy to announce the reactivation of the "Novice Shack" as a monthly feature under the direction of the present writer, who was its first regular conductor.

*385 Johnson St., Gary, Indiana 46402

Dr. C. A. Ninan, VU2CAN, and his wife Mary at W6LS, the club station of the Lockheed Amateur Radio Club, Burbank, California, before returning to India. Dr. Ninan, who came to the United States for advanced surgical training, completed the club's General class license course and Mary its Novice course. Mary should have little difficulty qualifying for an Indian "General class" license, which entails an examination approximately equivalent to the U.S. Novice exam. Thanks to Ray, WB6NSJ, for taking the picture and to Bill, W6DDB, for sending it to us.

Making the Novice Shack A Success

You will have much to do with the success of the new "Novice Shack." Tell me what you want to know. What is your favorite Novice band? How many states and countries have you worked? Send me a clear picture of yourself operating your Novice station. What type of equipment and antennas do you use? Remember that anything that interests you in amateur radio will probably interest the rest of us, too. Do not limit yourself to your brilliant successes. Your experience with a bright idea that turned out not to be so bright after all might save someone else from a similar mistake. Information about code and theory classes in your area will also be most helpful, but we will need plenty of advance notice for announcements of such courses. The writer, in turn, promises to write as interesting and as informative a column as he can with a minimum of preaching. Incidently, as the next few items illustrate, you do not have to be Novice

to contribute to the "Novice Shack," if what you have to say is of interest to Novices.

News From The Top

The following letter from Mr. A. Prose Walker, Chief, Amateur and Citizens Division, Federal Communications Commission, Washington, D.C. 20554, has been shortened slightly by omitting a paragraph not related to FCC policy.

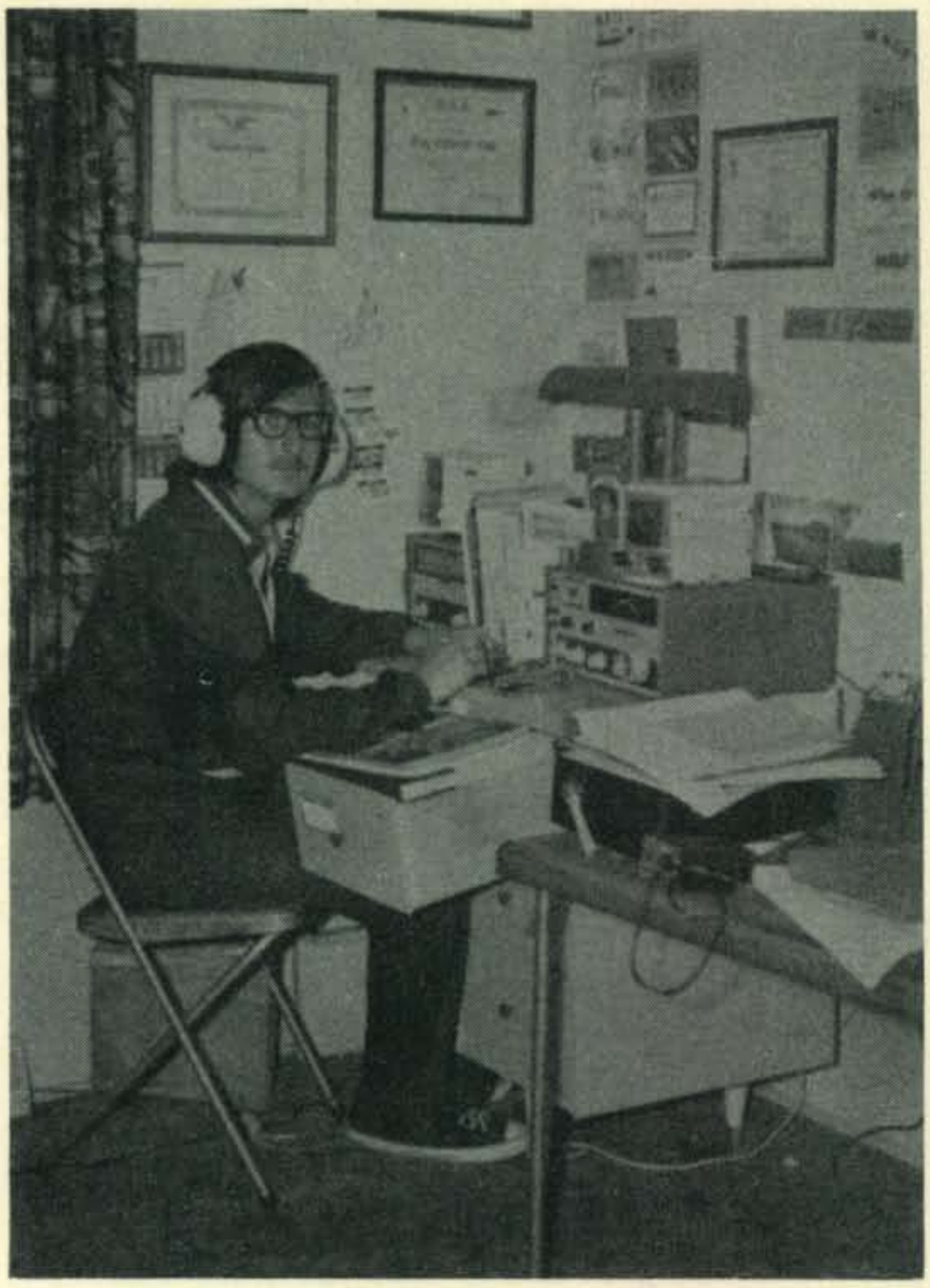
Dear Herb,

Thank you for letting us know that you are again to be a regular contributor to *CQ* magazine. I think that your column can do more good than you imagine. It seems that there has been a change in the thinking about the real purpose of amateur radio. Many people consider it as a social instrument today rather than primarily an educational tool. Sure there is always the inter-communication aspect, but after you get the gear set up and working to provide communication for whatever purpose (emergencies for instance) the rest of it revolves around using the privilege as a laboratory in which to learn. It has been somewhat shocking to read the many complaints about having to learn a little engineering technique in relation to repeater applications. One could almost conclude that amateurs are no longer interested in "advancing their skills in both the technical and communication phases of the art" as called for in the Basis and Purpose of Amateur Radio (Section 97.1 of the Rules).

On the subject of the Novice examination, enclosed is a study question guide for the Element 2 examination now in use. The failure rate for the revised examinations has not risen significantly considering the lack of study manuals based upon the revised guide.

Contrary to what you may have read in the amateur radio press, the examination remains a multiple choice type test. None of our examinations require the drawing of diagrams. This practice was discontinued many years ago. However, the exams do contain one or more diagrams about which questions are asked. For instance, the Element 2 examination uses a diagram of the popular pi-network amplifier stage in a question concerning transmitter power input.

All material in the revised Element 2 examination was selected with a view toward providing very pragmatic questions focused upon the minimum a new licensee needs to know his very first time on the air. Actually, the scope of the material for this exam was reduced over that used previously. Questions relating to radiotelephony were eliminated, for instance. As you will note, the guide is now organized into nine areas. A review of the most often missed questions reveals the area of Rules and Regulations to be the one giving applicants the most problems.



Tom Clary, WN9IHH, 33 Tyler Ave., Hobart, In. 46342, has all states worked and confirmed with his Heathkit HW-16 transceiver and HG-10B v.f.o. and separate 80 and 40-meter dipole antennas, 10 feet high. Although Tom has worked about 25 countries on 15 meters, he prefers to ragchew and county hunt on 80 and 40 meters. He has a 30-w.p.m. code proficiency certificate on the wall beside his WAS certificate.

We look forward to reading your new column.

Sincerely yours,
A. Prose Walker
Chief, Amateur and Citizens Division

The study guide referred to contains suggested study questions without answers, and is what publishers of license manuals use in preparing their manuals. Because these guides change from time to time, it is highly important that you use the latest edition of whatever license manual you select as a basis for your studies. Incidently, the latest edition of the ARRL *License Manual*, delayed by the paper shortage, was

Ted Hall, WN9LYA, 1125 Pike St., Gary, Ind. 46403, a retired photographer, worked 32 states and two Canadian provinces in his first three months on the air. A roof-mounted Hy-Gain 14-AVQ, vertical antenna, a 15-meter dipole in the attic, and an 80-meter inverted V make up Ted's antenna farm. An R. L. Drake 2NT transmitter driven by a Heathkit v.f.o. and Drake 2C receiver and Q-multiplier do the inside work.

scheduled to be published by November first.

The day that we agreed to restart the *Novice Shack*, I received a QSL card from LU5HFI, confirming a contact of a few months earlier. A note on the card said, "I am one of the many who cut their radio eye teeth on your old Novice column in *CQ*—Bud, W9SZR." Upon learning that we were reactivating the *Novice Shack*, Bud added, "I was 14 when I first became WN9SZR, in Beaver Dam, Wisconsin. I used to haunt the drugstore around the first of each month waiting for the new *CQ* to come. I always read W9EGQ's Novice column first. In those days, Novices worked 2, 11, and 80 meters. I wasn't interested in '2,' and 11 meters was dead most of the time; so I laid in wait on my two crystal frequencies of 3711 and 3741 kHz to work anyone who ventured near them. I still remember my 80-meter contacts with VE8VO (British Columbia, Canada) and the Swedish maritime mobile station, SM8TK, as the high points of my Novice career.

"After high school, a group of us organized a radio club at the University of Wisconsin and got the call W9YT, which the university had held much earlier. While attending the university, I worked part time at radio station WIBA, where Ross Hansch, W9RBI (now W9BG) was engineer. Ross and Art, W9LNM, got me so interested in DX that I joined the government service and became DX myself in 1963. Since then I have operated HI8XAL (Dominican Republic), HS3AL and HS5ABD (Thailand). XV5AC (Viet Nam), and now LU5HFI in Argentina.

"My advice to today's Novices is not to let anyone convince them that the General class 13 WPM code and written tests are anywhere near as hard as some people try to make them. The best way to solve the code problem is to get on the air and work other stations. Don't worry that you do not always get solid copy. The chances are that the other operator is not getting solid copy, either; so what's there to worry about? As far as the theory is concerned, rather than trying to memorize the answers, why not make studying for the exam a learning experience? Give yourself an exam by seeing which of the questions in the *License Manual* you can answer without referring to the answers in the book. Check the questions you have difficulty with, and use the index of your *Radio Amateurs Handbook* to locate the pages covering the subjects giving you difficulty until you understand the material. See you on the air soon, 73, A. Fred Bud Laun, W9SZR/LU5HFI."

Next month, we hope to talk about Bill Welsh, W6DDB, and the Lockheed Amateur Radio Club's Novice and higher-class amateur study courses. Bill has undoubtedly taught more such classes than anybody else in the country by a wide margin. We will cover other matters, too, but we cannot say anything about you or publish your picture until you write to us. In the meantime, from now until spring is the best time to try the 21.1-21.2 and 28.2-28.3 mHz Novice bands during the daylight hours.

73, Herb, W9EGQ

CQ Country Chart

A two color, wall-sized country chart is available on poster stock and in large type for only $1.25 per copy postpaid. Address request to: CQ DX Country Chart, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

MANY of the versatile linear integrated circuits now being produced owe their uniqueness to a circuit originally developed to perform precise mathematical operations in the early days of computers. This circuit of course, is the operational amplifier and its uses and characteristics will be the topic of this column for the next three months. I think many readers will find the information discussed quite interesting and of great use in a wide range of amateur and other experimental applications. As in the past, there will be plenty of actual circuitry that can be built to try out the unit.

"Op-Amps" as they are called, are very much with us today and with the exception of microminiature packaging techniques, work in the same manner as their vacuum tube predecessors. The basic representation of an op-amp is shown in figure 1.

The triangle represents a high gain d.c. coupled amplifier with a high input impedance and a low output impedance. The — and + designations indicate inverting (—) and non-inverting (+) inputs. Operation of the amplifier in figure 1 is as follows:

Any negative d.c. signal applied to the — (inverting) input will result in an amplified *positive* d.c. signal at the output and conversely, any posiive d.c. signal applied to the — input will result in a *negative* amplified signal at the output. Using the non-inverting input will also result in amplified outputs, but the polarity of the output signal in this case will be the same as that of the input. In most applications (but not all) the inverting input is the one that is used, the reason for which we will see later.

In the simple example of figure 1, one very quickly realizes that if the gain of the amplifier is even moderately high, it will quickly saturate (not be able to produce more output voltage)

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

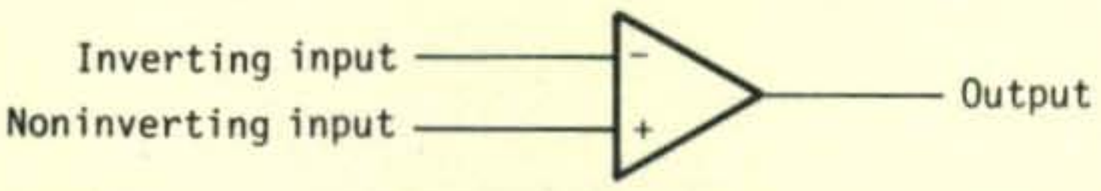


Fig. 1—The basic representation of an operational amplifier.

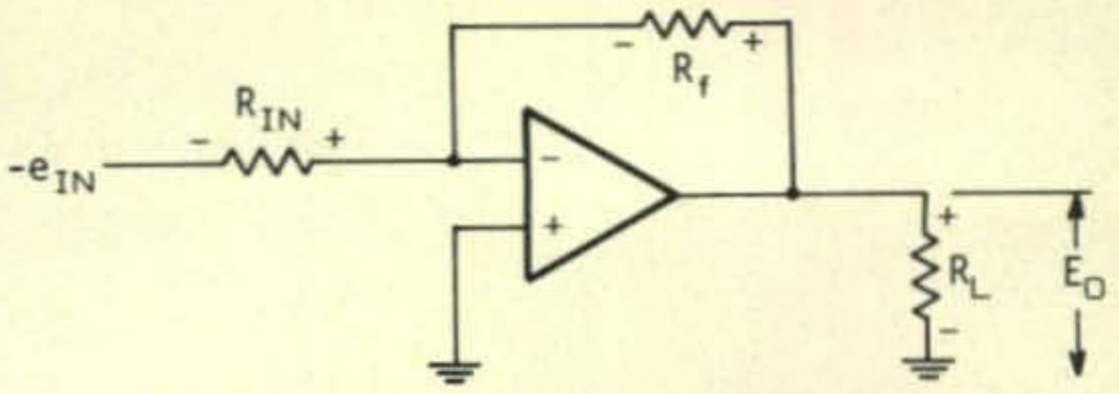


Fig. 2—An op-amp inverter configuration. The power supply requirements for op-amps will be discussed next month.

with low level inputs. In fact, most solid-state op-amps will not produce outputs of more than ± 15 volts, so if the gain of an amplifier is 10,000 (not an uncommon value) 1.5 millivolts is the maximum signal that can be fed to the input. Op-amps are hardly ever used in this manner however.

Figure 2 shows the most common configuration of the operational amplifier—the inverter. In this case, the output voltage (E_o) is equal to the input voltage ($-\epsilon_{in}$) multiplied by the ratio of an input resistor, R_{in}, and a feedback resistor, R_f.

In simple mathematical terms, $E_o = -\epsilon_{in} \times \frac{R_f}{R_{in}}$, the reason for the — sign being the inversion of the amplifier. This circuit, simple as it is, has many interesting uses as we will see in just a moment. First however, just a bit of theory.

Consider the circuit of figure 3. It is the same as figure 2 but actual values are given.

By the formula just given, we would expect the voltage across the load (R_L) to be + 1 volt

$$(E_o = -(-1 \times \frac{1000}{1000})$$

and indeed it will be! Now let us try to see where the actual voltages and currents go. R_{in} will have the input voltage across it with the polarity shown because it is connected directly to the input battery. R_f will have the output voltage across it with the polarity shown because it is connected to the output. Now, look at the amplifier input terminal. What does it see? No matter which way it looks, it only sees zero volts. If you don't immediately see this, trace the two possible paths outward from this point, taking polarities into account, and you will. This is rule #1 for an operating op-amp circuit: The voltage at the input terminal of an op-amp *must* be zero. Now, let us look at the output current from the battery. How much flows, and to where? Well, we just

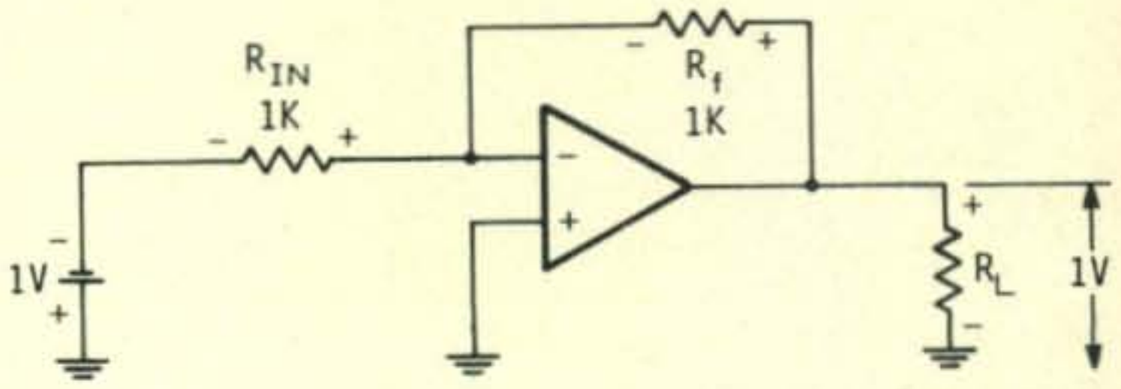


Fig. 3—The inverter circuit as described in the text.

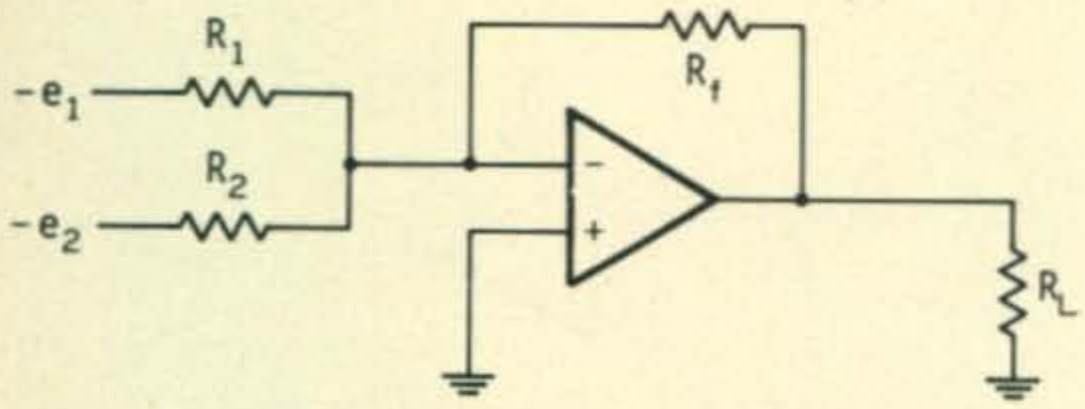


Fig. 4—An op-amp summing circuit. Actual fundamental computing circuit.

saw that the input terminal voltage was zero so it can't flow into the amplifier and since the only other path is through the feedback resistor, it must take this path. To further help it flow through R_f, sitting on the end of this resistor is R_L, the load, with +1 volt of just the proper polarity to "absorb" the input current—which it does. This brings us to op-amp rule #2: No current may flow into or out of the input terminal of an op-amp.

I might add, at this point, that there are more classical and "educated" proofs of these two rules, but as has always been this author's rule, "the absolute minimum of mathematics, unless absolutely necessary".

Now, let us return to figure 2. If R_f were made twice the value of R_{in}, by our two rules, it becomes obvious that the output voltage would have to become twice as high as the input voltage to "draw off" the input current. This is in fact what does happen, and if you try the formula, you will see that it works out perfectly.

What all of this means simply, is that the gain of configuration of figure 2, up to the no-feedback ($R_f = \infty$) gain of the operational amplifier used, is directly proportional to the ratio of R_f and R_{in}. In other words, if $R_f = R_{in}$ then the gain is 1. If $R_f = 10\ R_{in}$, then the gain is 10. If $R_{in} = 100\ R_{in}$, then the gain is 100 and so on. Does this all really work in actual practise you ask—it certainly does!

Now, look at figure 4. What happens here?

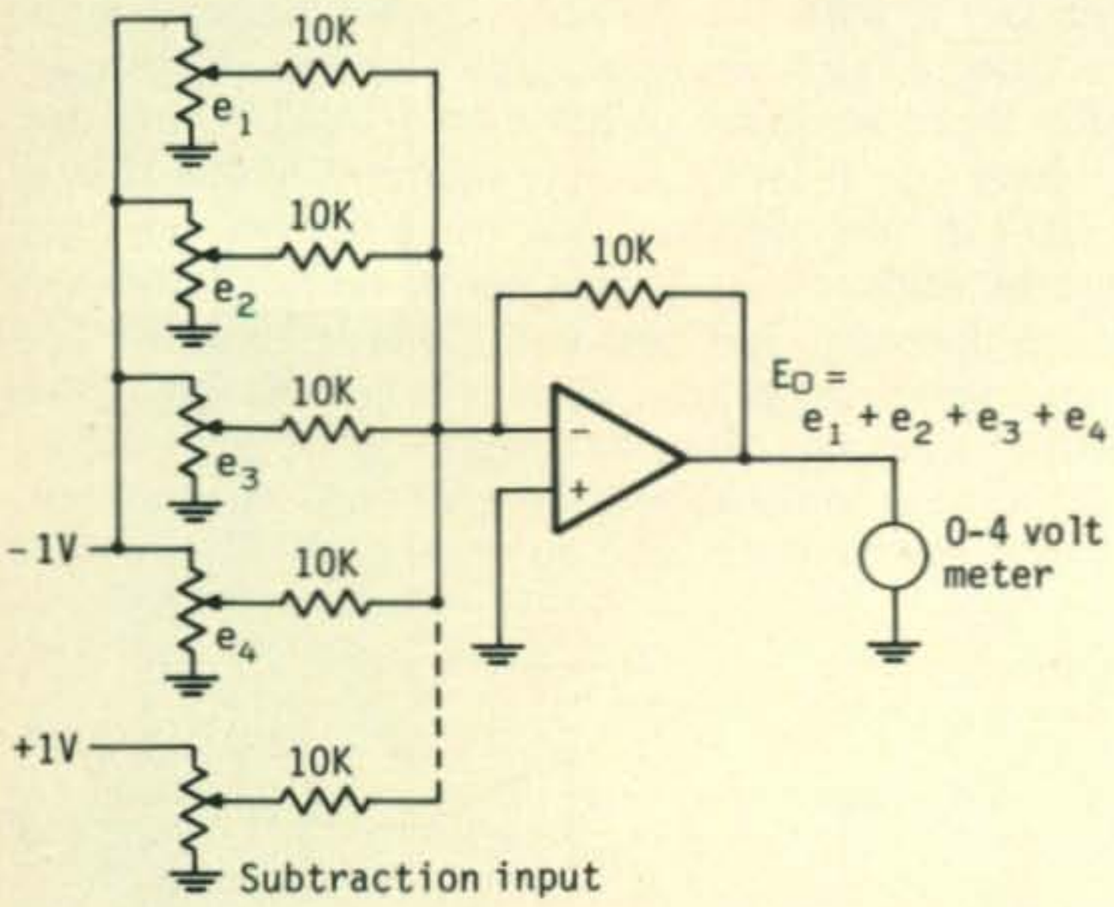


Fig. 5—A practical adder circuit. For simplicity the sign has already been changed in the generalized formula given.

Well, we know that the voltage at the input must be zero (rule #1) and we also know that no current may flow into or out of the input. Therefore, the current flowing as a result of both ϵ_1 and ϵ_2 must be "drawn off" by a voltage at the end of R_f that is equal to the sum of ϵ_1 and ϵ_2 multiplied by the ratio of their respective input resistors and R_f.

Mathematically stated:

$$E_o = -\left(\epsilon_1 \frac{R_f}{R_{in1}} + \epsilon_2 \frac{R_f}{R_{in2}}\right)$$

If all resistors are equal in value, then the output voltage is simply equal to the sum of the input voltages (with a sign change of course).

This is one of the first actual analog computing circuits ever built. Figure 5 shows it in an even more expanded form.

Here we have 4 inputs that may be set anywhere from 0 to −1 volt by means of the appropriate calibrated pot. On the output, we have a 0 to 4 volt voltmeter. Since all resistors are equal, the meter will always indicate the sum of the respective inputs (assuming that the values of the pots are much smaller than the input resistors. A 10 ohm pot for example, will result in a potential accuracy of .1%). Note that the input pots may represent any mathematical quantity such as temperature, pressure, the prices of items in a shopping cart, or in fact any quantity we would like to add. Also, hundreds of such inputs may be added to further expand this basic circuit into the biggest adder you ever saw! Accuracy will of course depend on how closely one calibrates the pots, how accurate the resistors are (remember the ratio) and how closely the output meter can be read.

If subtraction is desired, all one has to do is connect one of the inputs of figure 5 to a +1 volt source instead of −1. Then all +1 volt pots will subtract while all −1 volt pots will add.

Now since everyone should understand the preceding examples and circuits, we will see how we can even multiply or divide with only the slightest variation on the basic circuit. Consider figure 6.

Here, a pot selects a value of ϵ_{in} from 0 to −1 volt as in the previous circuits, but now R_f is made up of a fixed resistor and a pot. When this pot is set to one end (0 ohms), the value of

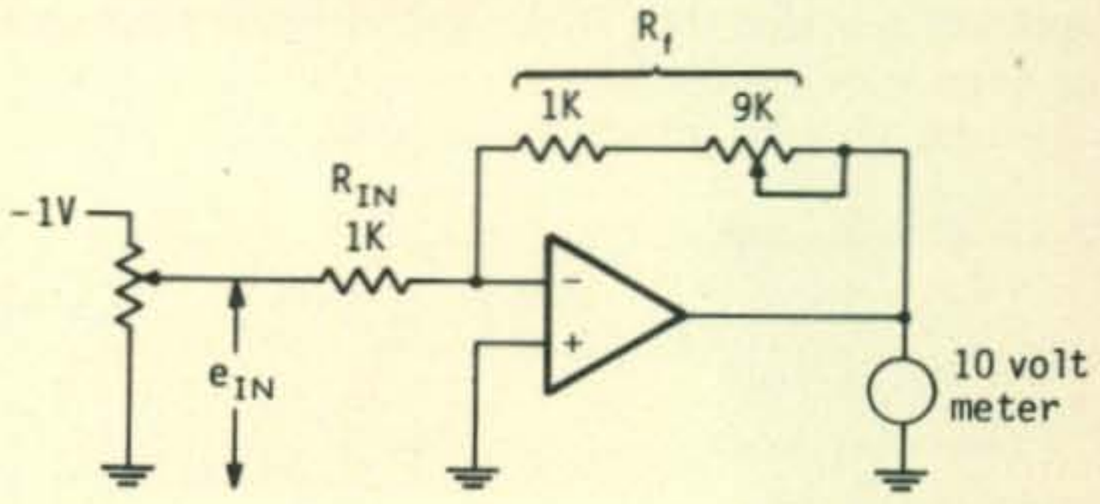


Fig. 6—The multiplier configuration described in the text. Changing the value of R_{in} results in a "fractional multiplier" or divider.

$R_f = 1K = R_{in}$ and the output is equal to 1 × the input. When the pot is set to the other end (9K) the value of $R_f = 10K = 10R_{in}$ and the output is equal to 10 × the input. Any intermediate setting results in a different "multiplier."

To use this circuit as a divider it is only necessary to make R_f less than R_{in}. For example, if R_{in} were changed to 10K, the 0 ohm setting of the pot would result in a "multiplier" of .1 which is the same as dividing by 10. A 5K value of R_f (1K + 4K on the pot) results in a .5 "multiplier" or dividing by 2.

A typical computing application of op-amps is shown as our last example this month. In figure 7, op-amp circuitry is connected to effectively compute the value of the following hypothetical formula:

$$(A + B - C) \times (D) - E = X$$

At this point I am sure some of our readers are already beginning the design of a super calculator with DVM's, precision pots, etc. All I can say is, good luck!

Next month we will look at additional operational amplifier circuitry and some of the actual terminology used to describe the parameters of commercially available op-amps. Finally, in the last part of this short series we will discuss those op-amps that are readily available to experimenter (many for under a few dollars or so).

Before concluding however, I would like to mention a new source for Telefax machines in regard to my conversion series. Bill Johnston, WB5CBC, 1808 Pomona Drive, Los Cruces, New Mexico 88001, has written to us indicating

[*Continued on page 76*]

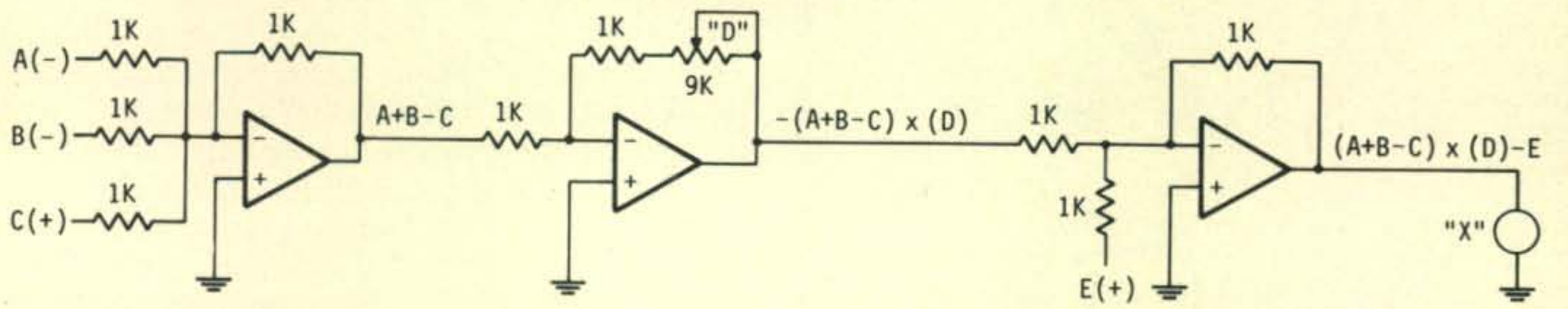


Fig. 7—A simple "computer circuit" described in the text. Note the change in sign as the signal progresses.

DX

BY JOHN A. ATTAWAY,* K4IIF

97.1(e.) *Continuation and extension of the amateur's unique ability to enhance international good will.*

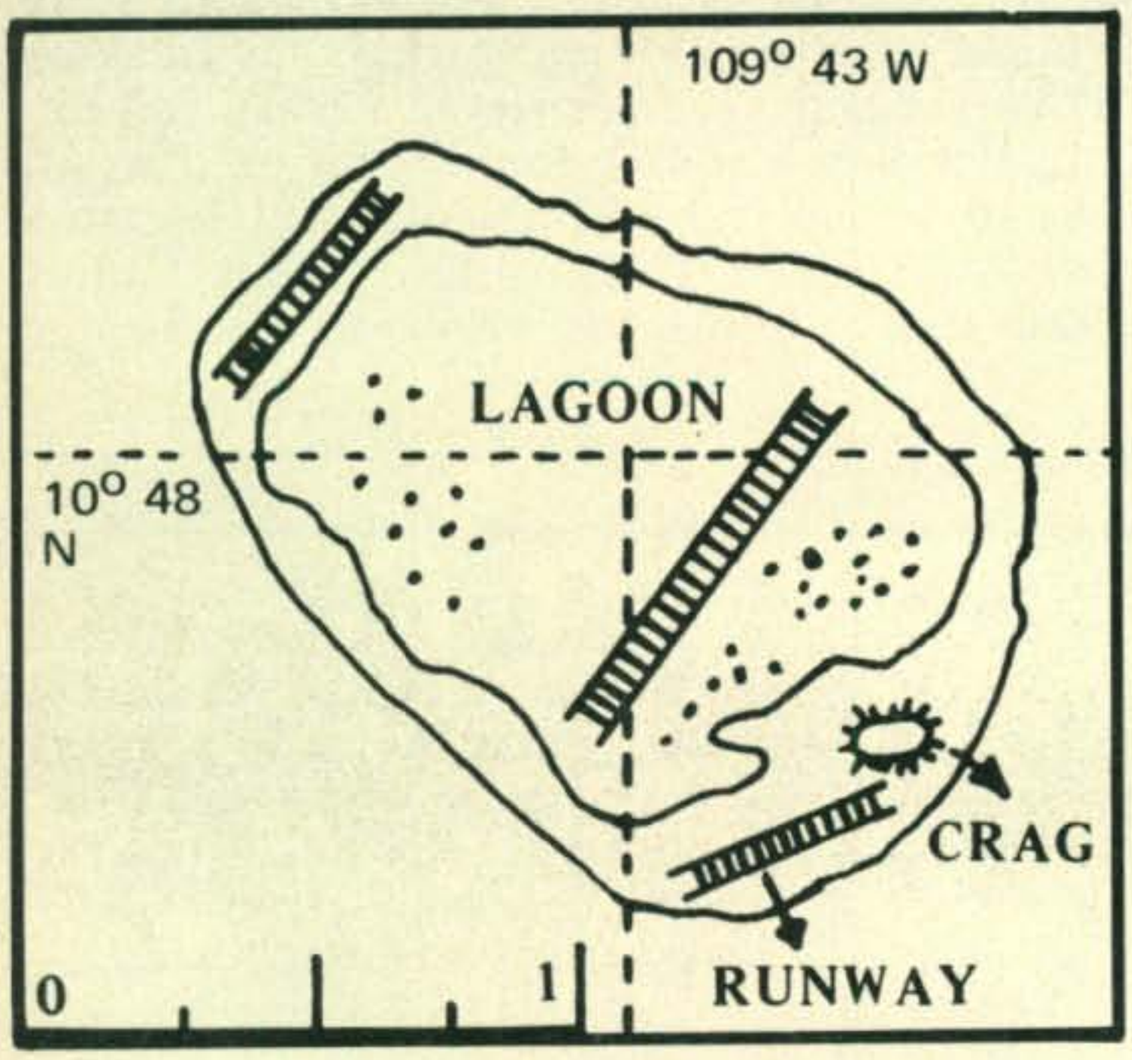
ALL U.S. amateurs will recognize the above passage from the Federal Communications Commission regulations defining the "Basis and Purpose" of the Amateur Radio Service. This is the section which establishes the need and service for DX and DXers, and most DXers work toward satisfying this need.

Occasionally someone comes along with a unique idea for promoting international good will through amateur radio. An outstanding example is the International Reciprocal Operators Club (IROC), whose purpose is encouraging increased amateur operation across international boundaries by visiting amateurs. The stated aims of IROC are 1.) to foster establishment of reciprocal amateur radio operating privileges worldwide; 2.) to work towards the expansion of existing agreements for alien operators; 3.) to provide licensing information to amateurs everywhere who want to operate abroad; and 4.) to establish "licensing kits" that include the necessary forms, official and "unofficial" contacts and general important info to amateurs.

Membership in IROC is open to all reciprocal operators, and to other amateurs who earn the Worked Reciprocal Operators (WRO) certificate by working 20 different reciprocal operating stations or reciprocal stations in all 6 continents. For further information, the Club address is P.O. Box 11, Medway, MA 02053 USA.

IROC is presently establishing a file with worldwide licensing information. All info on this subject will be most welcome.

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



A map supplied by Alex, VE2AFC, of Clipperton Island.

De Extra

MAIL-A-PROP—Another first in the field of propagation forecasts. *CQ's* unique Dial-A-Prop telephone forecast service is now complimented by a mail system allowing those located a great distance away to obtain propagation forecasts at less cost. Coverage is provided on a one week basis, with short skip conditions as well as continent by continent DX tips. If interested, write to MAIL-A-PROP, P.O. Box 86, Northport, N.Y. Mailings go out every Friday by Air Mail. The cost is $2.50/month, $12.50 for 6 months or $20.00 for a year. Five special issues will be sent each month, especially for contests and when drastic changes in propagation are indicated.

Amateur Radio In Other Countries

This short article on Clipperton Island was supplied by our good friend Alex Desmeules, VE2AFC.

"This is Clipperton Calling . . ."

One of the rarest countries in the world is, without doubt, the Island of Clipperton, lost in the Pacific Ocean. Many enthusiastic DXers and DXpeditioners have often thought of putting Clipperton on the air, but since the early 50's no one has succeeded.

Two major facts make a DXpedition to the Island very difficult. First, the French Administration of Posts & Telephones refuses to deliver a license because of "the Island's strategic location", probably because of the heavy French atomic tests. Second, the heavy winds which constantly sweep the Island make a landing extremely hazardous as Clipperton can only be reached by boat or plane. By seaplane, the landing must take place on the lagoon which is only about ¾ of a mile wide and studded with reefs. It may be some time before an FO8 is heard from this "mysterious" Clipperton Island.

The smallest French possession, Clipperton is 2 miles in diameter, 9 miles in circumference and boasts a beautiful lagoon and a few coconut palms. It lies in the Pacific Ocean, 1000 miles west of Mexico and 1700 miles north of Tahiti. It was discovered in the 17th century by a pirate and was first named "Isle of Passion". In 1705, when Clipperton landed in his *caravel*, the name

was changed to the name it bears today in his honour. In 1885, the French navigator Le Coat de Kerveguen took possession of the Island on behalf of France but it was not declared a French possession until 1931. Both the United States and Mexico wanted the island because of its guano and phosphate deposits.

Tides and winds are very high and until the French frigate *Jeanne d'Arc* visited it in 1935, no good map had ever been made.

During the Second World War, the U.S. Navy started a base on the island and studied the possibility of building two runways as well as an area for landing seaplanes. (see map) About 10 men stayed on the island for a short period of time.

In 1944, an Australian officer flying from Mexico to Australia, landed his Catalina seaplane on the lagoon and took off without difficulty. In 1952, the French government intended to install a weather station but the project was never completed.

Let's hope that very soon a DXpedition will be possible on the volcanic Island of Clipperton, one of the most isolated islands in the world. I'm ready to go!

160 Meter News

Longest 160 Meter QSO in History—On July 9, 1973, Tokuro Matsumoto, JA7AO, made contact with John Wright, VP8KF, over a distance of 18,000 kilometers or 11,200 miles. The time of QSO was 1141 GMT on 1803 kHz. If anybody has topped that distance we haven't heard of it. Tokuro also made the first ever Japan to Argentina contact with LU5HFI. If anyone tells you

This fine station is operated by Jose Mari C. Gonzalez, DU1JMG, who is active almost daily on 14.200—14.300 mHz around 0630 GMT and again between 1500 and 1900 GMT. DU1JMG is also active during the CQ Worldwide DX and WPX Contests. QSL to P.O. Box 1381, Manila, Philippines.

that the DX fun is over during the low end of the sunspot cycle you can tell them they are crazy. The action just changes scene, high band to low band.

Other 160 firsts last summer include VK3CZ's contacts with VP8KF on July 7, 1115 GMT, for the first VK to VP8 QSO and with LU5HFI on July 8 at 1115 for the first VK to LU. An exceptionally hard path was conquered for the first time last December when W7DZO worked G3YUV for the first W7 to Europe QSO in history.

CQ DX Advisory Committee

Recently many requests have been made for the names and addresses of CQ DX Committee members in a particular area. Our Committeemen can verify cards for amateurs wishing to apply for WAZ and the CQ C.W. and S.S.B. DX Awards and they are much in demand. Here is the essential information on the Committee, just remember to include the $1.00 certificate fee and adequate postage for return of your cards if you choose to mail them to either a

The WAZ Program

S.S.B. WAZ

1124.....W7SFA	1131.....W5ZWK
1125.....W8AQF	1132.....WA7BPS
1126.....K1QMV	1133.....W3CRE
1127.....DL7AH	1134.....CT1MW
1128.....DK4YA	1135.....W9LAA
1129.....K2ANT	1136.....W6TTS
1130.....W2FCR	1137.....CT2BB

C.W.—Phone WAZ

3582.....YU2GE	3591.....W9KNI
3583.....W2USJ	3592.....WA6CXK
3584.....K8YQW	3593.....W5KFL
3585.....GM3AWW	3594.....WA9SLD
3586.....DK1XC	3595.....LA3K
3587.....DJ4EJ	3596.....DL6GK
3588.....DM4ZEL	3597.....DJ9MH
3589.....DM3LOG	3598.....DJ6TU
3590.....W4BBP	3599.....DK5PR

Complete WAZ rules are shown on pages 64-66 of the June, 1970 issue. 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, Florida 33880.

Prefix chasers still have a few weeks to try for this WS3SKY card as the station will be active for the duration of the Skylab program. WS3SKY is operated by the Goddard Amateur Radio Club, Box 86, Greenbelt, Maryland 20770

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 as of this listing is 320.

CW

K6EC 315
W6ID 315
W8LY 309
W4IC 306
K6LEB 305
VK3AHQ 304
WØAUB 302
DL3RK 301
W6ISQ 301
W4YWX 300
ON4QX 299
W6NJU 296
W4BQY 294
K1SHN 292
WA6EPQ 291
WA8DXA 288
WA6MWG 286
DJ7CX 279

2XSSB

W2TP 319
I0AMU 318
W2RGV 318
TI2HP 318
DL9OH 317
WA2RAU 317
W3NKM 317
W9ILW 317
G3FKM 316
K2FL 316
W6REH 315
W6RKP 315
W3AZD 314
I8KDB 313
IT9JT 313
SM5SB 313
W6EL 313
W6EUF 313
W6KTE 313
W6NJU 313
K6WR 313
ZS6LW 313
VE3MR 312
W3DJZ 312
W9JT 312
WA2EQQ 311
W4IC 311
W9DWQ 311
I1AA 310
F9MS 309
W6YMV 309
XE1AE 309
F2MO 308
OZ3SK 308
VE2WY 307
G3DO 305
K3GKU 305
WA6AHF 305
W9QLD 305
K4RTA 304
VE3ACD 304
K6EC 303
KH6BB 303
VE3GMT 303
IØZV 302
WA2HSX 302
WA6MWG 302
WA3IKK 301
W6KZS 301
W6FW 300
K4HJE 299
W9KRU 299
ZL1AGO 299
G3RWQ 298
YV1KZ 298
SM6CKS 297
K1SHN 297
YS1O 297
ZL3NS 297
WØYDB 294
I8YRK 292
WB2RLK 291
XE2YP 291
YV1LA 291
WB6DXU 290
K8GQG 288
WAØKDI 288
W8ZOK 285
K1KNQ 284
G3KYF 283
OE1FF 283
OE3WWB 283
WØSFU 283
DJ7CX 282
HP1JC 282

Committee member or to the DX Editor or Assistant DX Editor.

Member: Jack Reed, VE3GMT. **Club:** Canadian DX Association **QTH:** 82 Acton Ave., Downview, Ontario

Member: Vern Dameron, Jr., K1DEN **Club:** (New England area) **QTH:** 265 Davis Rd., Bedford, MA 01730

Member: Ed Hopper, W2GT **Club:** North Jersey DX Asso. **QTH:** P.O. Box 73, Rochelle Park, N.J. 07662

Member: Bob Wilson, W3GHD **Club:** Frankford Radio Club **QTH:** 139 Campbell Ave., Havertown, PA 19083

Member: John Kanode, W4WSF **Club:** Potomac Valley Radio Club **QTH:** RFD #1, Box 73A, Boyce, VA 22620

5T5ES transmitted from a scientific station set up to observe the solar eclipse from Chinquetti, an oasis in northern Mauritania. Operators were Richard Matzner, K5HAY (left) and Bob Anderson W3ZUE, holding the mike. They were on the air from une 9—July 2, 1973 using a Hallicrafters FPM-300 and an 18 ft. vertical. A photo of the total eclipse of June 30, 1973 will be featured on the QSL.

The WPX Program

C.W. WPX

1268—WA6EPQ
1269—WB2DZZ

S.S.B. WPX

759—K2ANT
760—JA8AIP
761—DK2XV

Mixed WPX

400—W6EIF

WPNX

61—WN8MTR

VPX

60—DE-H34/17189

WPX Endorsements

S.S.B.: W4NJF—1100, I0ZU—800, W4WSF—750, WA6EPQ—500, WB2MQI—450, K2AAC—400 and K2ANT—350.
C.W.: WB2FMK—800, WA6EPQ—600 and W8DSO—350.
Mixed: W4LRN—1300, W2NUT—1050, WA6EPQ—750, W8CNL—650, K6ZDL—600, W6EYY—600 and WB4SIJ—550.
VPX: SM4-3434—500.
160 Meters: K4ZCP
80 Meters: K1SHN
40 Meters: K1SHN
20 Meters: DJ8WD
15 Meters: K1SHN and WB2MQI
10 Meters: K1SHN
Europe: DK2XV and DE-H34/17189
North America: K4ZCP
Oceania: I4ZSQ and K4ZCP
South America: K4ZCP

Complete rules for WPX, WPNX and VPX may be found on pg. 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size, self-addressed stamped envelope to the Assistant DX Editor, P.O. Box 1271, Covina, CA 91722, or to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

The CQ DX Award Program

C.W. DX	S.S.B. DX
121—W1DXB	288—DK5MG
	289—W6TCQ
	290—VE7TL
	291—W2RGV
	292—DJ6FX

Endorsements

S.S.B.: W2RGV-310, I1WT-275, W8ZOK-275, W6TCQ-275, W6EIF-200, DJ4FT-200, VE7TL-200 and DJ6FX-150.

C.W.: W1DXB—Low Band

Complete rules for the CQ DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and copies of the rules may be obtained by sending a business size, self-addressed stamped envelope to the Assistant DX Editor, P.O. Box 1271, Covina, CA 91722, or to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Member: Gay Milius, W4NJF **Club:** Virginia Century Club **QTH:** 1416 Rutland Drive, Virginia Beach, VA 23454

Member: Tava Franklin, K4AEB **Club:** North Alabama DX Club **QTH:** 711 Pinecrest Rd., Huntsville, AL 35802

Member: Bob Rosier, K4OCE **Club:** North Carolina DX Asso. **QTH:** 2113 Sprucewood Dr., Greensboro, N.C. 27409

Member: Don Busick, K5AAD **Club:** West Gulf DX Club **QTH:** 12301 Zavalla St., Houston, TX 77045

Member: Jay Holladay, W6EJJ **Club:** Southern California DX Club **QTH:** 5128 Jessen Drive, La Canada, CA 91011

Member: Bob Ferrero, K6AHV **Club:** Northern California DX Club **QTH:** 999 Howard Ave., Burlingame, CA 94010

Member: Rod Linkous, W7YBX **Club:** Western Washington DX Club **QTH:** 5632 47th Ave., SW, Seatle, WA 98116

Member: Ed Goodbout, W9DWQ **Club:** Northern Illinois DX Asso. **QTH:** Box 519, Elmhurst, IL 60126

Member: Bill Higgins, WØYDB **Club:** Twin Cities DX Asso. **QTH:** 3534 West 28th St., Minneapolis, MN 55416

Member: Jerry Hagen, WAGLD **Club:** (*CQ*, Asst. DX Editor) **QTH:** P.O. Box 1271, Covina, CA 91722

Member: Frank Anzalone, W1WY **Club:** (*CQ*, Contest Editor) **QTH:** 14 Sherwood Rd., Stamford, CT 06905

Member: John Attaway, K4IIF **Club:** (*CQ*, DX Editor) **QTH:** P.O. Box 205, Winter Haven, FL 33880

Committee members will also enjoy hearing your views on the DX programs and nominees you wish to propose for the *CQ* DX Hall of Fame Award.

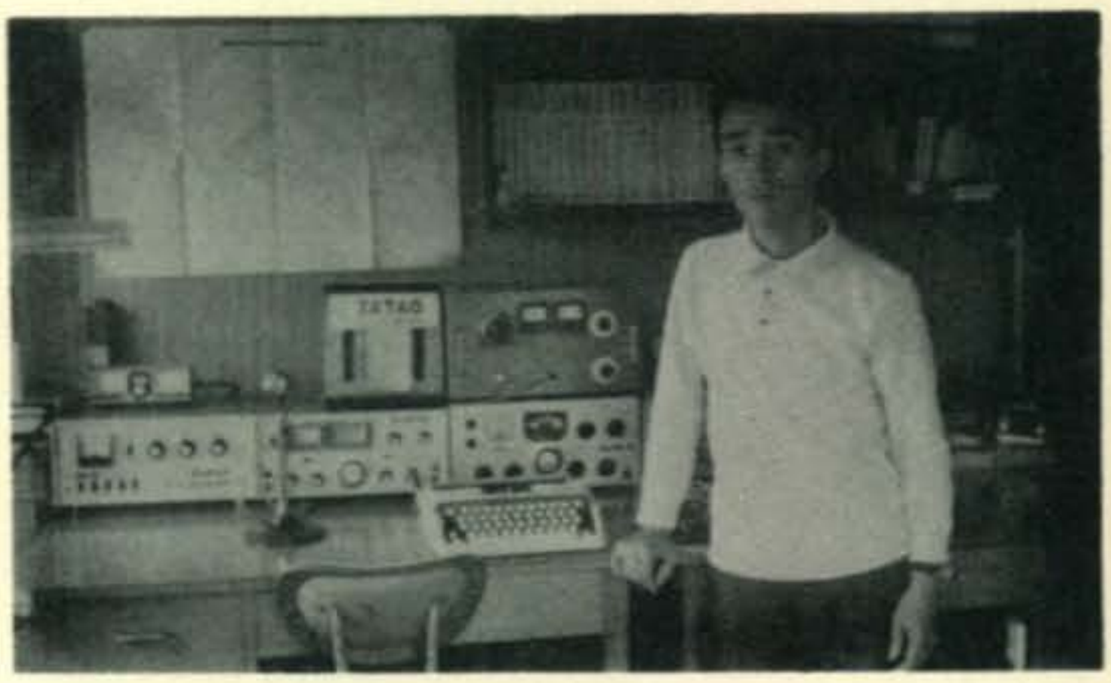
Charlie, WA7BPS, recently completed WAZ which he feels is the most difficult major DX award. Contacts in the 1972 CQ Worldwide DX Contest put Charlie over the top.

For the Novice

CQ's Novice DX monitor, Jim, WN7UMU, reports that WPNX Award chasers are still having a field day on 15 meters but that openings on 10 are about nil. Jim would appreciate receiving more reports from Novices re DX in the 40 and 80 meter Novice bands. His QRA and QTH are Jim Alley, WN7UMU, 2120 Wagonwheel, Las Vegas, Nevada 89119.

Jim reports the following good catches for novices working toward WPNX and the *CQ* C.W. DX Awards:

	Station Freq. (kHz) Time (GMT)	
CO2BB	21190	0100
CP3CN	21120	0000
CR6RE	21186	2100
CX4CR	21120	2130-2200
EL2NS (Karen)	21106	1430
FG7XZ	21110	1600
HI3PC	21100	1600
HK5BWK	21120	2000
WN3RUO/HK8	21115	0000
HP1MN	21130	0000
HR4DHS	21110	1600
KG4FX	21120	0200
KV4HW	21125	1500



Tokuro Matsumoto, JA7AO, world record 160 meter distance holder. See his story under 160 Meter News. (Tnx W1BB)

Tom French, KG6JBG, operating the big rig at club station, KG6ALV, near the south coast of Guam. The station has a complete S-line, a Henry 2KD-2 linear, a 3-wire Rhombic towards California and a TH6DXX beam.

KZ5MS	21135 & 21102	1930 & 1600
OE5LX	21130	1700
PJ2JW	21180	0000
PJ8NLO	21120 & 21142	2000 & 0000
PJ9JT	21105 & 21150	0000-0100
TG9KJ	21115	2100
TI2DX	21120	2200
VP2LAW	28150	1800
WB4HIT/VP7	21125	2300
VK3BZ	21125	0200
VK6HD	21118	0430
VP5LD	21100	2300
XE3IM	21122	1830
XQ3ED	21100	2300
ZS6AFC	21106	1800
5N2ABG	21142	1600
9Y4MH	21120	0130

Plus plenty of CE's, HK's, YV's, ZL's and other fairly easy countries.

The *CQ* Novice Department especially salutes WN4SIJ who joined the elite circle of Novices with over 200 prefixes confirmed.

QSL Information

The Radio Society of Okinawa has many QSL cards for both KA6 and KR6 calls of amateurs who have left the islands. They may be obtained from the Society at Box 465, Fort Buckner, APO San Francisco, CA 96331.

The Society also advises that all KA6 QSLs should be sent to Box 465 and not to FEARL as the Radio Society of Okinawa maintains its own Bureau.

Steve, GM5AXO/KZ5NG terminated operations from Scotland after 5300 QSO's with all 50 states and 180 countries. QSL's should go to WA4NAZ.

A2CEW—Via VE4SW
C3IGM—c/o DJ9NA
CN8BO—To W4GKF
CR7FR—c/o W7VRO
CR8AM—To WB6BGQ, 127 Rio Del Mar, Vallejo, Calif. 94590
CT2BC—Via K4KEW/ø, Marvin Feldman, 5624A Nellis Dr., Richard Gebaur AFB, MO 64038
DU1JMG—To P.O. Box 1381, Manila, Philippines
EA6BG—c/o W1RLV
EIøMIC—Via EI7BM
EP2DO—To KL7BJW
FGøAFA/FS7—John B. Irwin, 578 Morris Ave., A-6, Elizabeth, N.J. 07208
FPøDX—c/o VE6TK
FPøXX—Via K1DRN
GB3MKB—To GI6YM
GM5BCQ—Dave Ellenberg, P.O. Box 192, Middlesex, N.J. 08846
HS3AIG—Jack Corson, FEC-WARIN, APO San Francisco, CA 96304
JD1AHC—c/o JA8AWH
JTøAE—Via OK3YAO
JY3ZH—To K6AQV
JY6FC—c/o K6AQV
JY9GR—Via DK4PP
KF4DT—c/o W4OZF
LA4C—To LA4DM
MP4BJR—c/o K9KXA
OE6HZG—Via W2VMH
PJ8GQN—c/o W2GHK
PJ8HR—To W2JKN
PJ8SE—Via John B. Irwin, 578 Morris Ave., A-6, Elizabeth, N.J. 07208
PSøWH—To W3DJZ
SV1CH—Via WA3KSQ
SV1DB/A—To P.O. Box 1442, Athens, Greece
TA1MB—c/o DK3GL
TA1TS—Via WAøETC
TI2DX—c/o K7NHV
TL8LI—To K6BFH
VKøWW—c/o VK3FF
VP2MYA—Via W5MYA
VP2SQ—c/o W2MIG, 47 Palisade Rd., Elizabeth, N.J. 07208
VP2VV/FS7—To F6AEV
VP5LD—c/o WA1HAA
VS6AW—Via WB6ZUC
WA7SJH/CE3—To K9BQL, Jack Ekstrom, 206 Sweetbriar Pl., Pland, IL 60545
WA9MZU/VQ9—c/o WA9MZU
WP1ORT—To P.O. Box 1973, Portsmouth, N.H. 03801
XT2AA—Via W1AM
XX7FR—To W7VRO
YJ8BD—Via IøIJ
ZK1TA—c/o Box 84099, Los Angeles, CA 90073
ZPøWL—Via WA2LEY
3AøFY—To F9UW
3V8BD—c/o DJ4DW
4W1AF—Via DJ9ZB
4Z4AI, 4Z4IB & 4Z4NNF—c/o P.O. Box 192, Middlesex, N.J. 08846
5R8AC—To W3ABC
5T5EEI—c/o W4FCU
5T5ES—Via K5HAY, 2601 Richcreek Rd., Austin, TX 78757
7Z3AB—To W5NOP
7XøGM—c/o P.O. Box 2, Algiers, Algeria
9E3USA—Via W4NJF
9J2LL—To WB2ZHW
9X5SP—c/o DL8OA
9X5VA—Via W2PPG

73, John, K4IIF

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Oct.	**27-28**	**CQ WW DX Phone Contest**
Nov.	1-2	YLRL Anniv. Phone Party
Nov.	3-4	RSGB 7 mHz Phone Contest
Nov.	2-5	IARS CHC/FHC/HTH Party
Nov.	5-11	ARCI QRP C.W. Contest
Nov.	11	Czechoslovakian Contest
Nov.	10-11	Ex-G Contest
Nov.	10-12	ARRL Phone Sweepstakes
Nov.	17-19	ARRL C.W. Sweepstakes
Nov.	**24-25**	**CQ WW DX C.W. Contest**
Dec.	1-2	College Bowl Contest
Dec.	1-3	Delaware QSO Party
Dec.	1-3	Lone Star QSO Party
Dec.	1-3	Telco. Pioneers QSO Party
Dec.	7-9	ARRL 160 Contest
Dec.	15-23	Space Net VHF Contest
Dec.	22-23	Hungarian Contest
Jan.	12-13	DL QRP C.W. Contest
Jan.	15-17	OOTC C.W. Party
Jan.	**25-27**	**CQ WW 160 C.W. Contest**
Jan.	29-31	OOTC Phone Party
Feb.	9-10	Ten-Ten Net QSO Party
Mar.	**30-31**	**CQ WW WPX SSB Contest**
Apr.	20-22	Zero District QSO Party
Apr.	21-24	WAEDC RTTY Contest

RSGB 7 mHz Phone Contest

Starts: 1800 GMT Saturday, November 3
Ends: 1800 GMT Sunday, November 4

The c.w. section of this contest also took place last month. Logs for this one must be received no later than December 31st and go to: RSGB HF. Contest Committee, c/o J. Bazley G3HCT, Brooklands, Ullenhall, Solihull, Warwickshire, England.

IARS CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, November 2
Ends: 0600 GMT Monday, November 5

This is the Fall edition of the IARS QSO Party with rules same as in previous years. Logs and requests for additional information should be sent to: I.A.R.S., K6BX, P.O. Box 385, Bonita, Calif. 92002

Czechoslovakian Contest

Starts: 0000 GMT Sunday, November 11
Ends: 2400 GMT Sunday, November 11

This is a world-wide contest with extra QSO points for working Czech stations. Deadline for mailing your logs is December 31st to: Central Radio Club, P.O. Box 69, Praha 1, Czechoslovakia.

Complete rules for above three events appeared in last month's CALENDAR.

ARCI QRPp C.W. Contest

Starts: 1300 GMT Monday, November 5
Ends: 2300 GMT Sunday, November 11

This is the 3rd annual contest sponsored by the ARC International with the emphasis on real low power, 5 watts or less output. The contest is open to all whether or not they are members of QRP ARC International.

Exchange: RST, QTH (state/province or country) and QRP No. (non-members send NM and power)

Scoring: Contacts with members count 2 points, non-members 1 point. A station may be worked on each band for QSO and multiplier credit.

There is also a power multiplier as follows: 15 if output is ½ watt (500 mw) or less, 10 if 2 watts, 5 if 5 watts, and no multiplier if over 5 watts.

Final Score: QSO points × QTH multiplier × power multiplier.

Frequencies: 3540, 7040, 14065, 21040, 28040.

Awards: Certificates, (1) Top scorer world wide, (2) highest score in each state, province and country, (3) lowest powered station showing 3 or more skip contacts.

Include a summary sheet with your log showing the scoring, equipment description and power used, and a signed declaration that all rules and regulations have been observed.

Mailing deadline is December 3rd to: Contest Chairman, Earl R. Lawler, W5JLY, Rt. 2, Box 24-K, Burnet, Texas 78611

Ex-G Contest

Starts: 0000 GMT Saturday, November 10
Ends: 2359 GMT Sunday, November 11

This is a new activity to publicize world-wide reciprocal operating privileges, especially between Ex-G Club members and stations in the United Kingdom. Participation of course is open to all who wish to enter.

Operation is limited to 24 out of the 48 hour contest period, and activity will be on the following frequencies: 3950, 7250, 14347, 21415 and 28650.

*14 Sherwood Road, Stamford, Conn. 06905.

Exchange will be signal report, QSO no., and your original call if you are a club member.

Contacts with reciprocal operators are worth two points and the multiplier is determined by the number of Ex-G club members worked. There are also some bonus points for working stations in certain areas.

Suggest you write to address below for additional and more detailed information.

J. Kasser, G3ZCZ/W3, 1701 East-West Highway, Apt. 205, Silver Spring. Maryland 20910

ARRL Sweepstakes

Phone: Nov. 10-12 C.W.: Nov. 17-19
Starts: 2100 GMT Saturday
Ends: 0300 GMT Monday

This one has been around a long time, 40 years to be exact. The format is same as used last year and covered in details in *QST* for October. To minimize QRM to non-contesters certain operating frequencies have been suggested.

The exchange is similar to a message preamble, QSO no., power input (A if less than 200 watts, otherwise send B) your call, the CK (last two digits of year first licensed) and your ARRL section.

Count two points for each completed contact and multiply total by number of ARRL sections worked, a possible total of 75. You may operate a total of 24 hours out of the 30 hour contest period, off periods must be at least 15 minutes.

It is advisable you send for the "SS Package" which includes log and summary sheets and Operating Aid 6. Include a large s.a.s.e. with your request, 16¢ postage will cover First Class mail for about 400 contacts. If you're a "hot shot" you had better figure your requirements accordingly.

Mailing deadline for logs is December 15th and go to: ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111

College Bowl Contest

Starts: 0000 GMT Saturday, December 1
Ends: 0600 GMT Sunday, December 2

This contest is sponsored by the MSC Radio Committee of Texas A & M University to activate the many college club stations. All effforts will be made to have as many college club stations active as possible.

Individual stations are to work college club stations only, once on each band and mode. Only 22 hours of operation out of the 30 hour contest period is permitted. The 8 hours rest may be taken in one period but not more than three periods anytime during the contest. Club stations must operate single transmitter class only.

Exchange: RS(T), name of college, QTH for club stations; RS(T) and QTH for others. (state, province or DX country)

Scoring: Each QSO counts 3 points. Multiplier for all is sum of states, provinces and DX countries worked.

Frequencies: 3560, 3710, 3910, 7060, 7110, 7260, 14060, 14280, 21060, 21110, 21360, 28060, 28110, 28560.

Awards: Certificates in two classes, club station and single operator, to the highest scoring station in each state, province and DX country. A special award for the highest overall college club station.

A summary sheet and signed declaration is requested, and s.a.s.e. if copy of results are desired. Mailing deadline Jan. 15th to: Memorial Student Center Radio Committee, Box 5718, Texas A & M University, College Station, Texas 77840

Delaware QSO Party

Starts: 0000 GMT Saturday, December 1
Ends: 2400 GMT Sunday, December 2

The party is sponsored by the Delaware ARC. The same station may be worked on more than one band but only one mode per band.

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

Scoring: Del. stations score 1 point per QSO, multiply total by number of states, VE provinces and DX countries worked. Others get 5 points for each Del. QSO, and multiply total by 1 if one Del. county is worked, 2 for 2 counties, and 5 for 3 counties. (There are 3 Delaware counties, New Castle, Kent and Sussex)

Frequencies: C.W.—3560, 7060, 14060, 21060, 28160. Phone 3975, 7275, 14325, 21425, 28650. v.h.f.—50.4 & 145.2. Novice—3710, 7120, 21120, 28160.

Appropiate awards will be given, and in addition the WDEL Certificate will be awarded to stations working all 3 Del counties. Party logs showing required data will be accepted in lieu of QSLs.

Send logs and WDEL applications to: John R. Low, K3YHR, 11 Scottfield Drive, Newark, Del. 19711. Mailing deadline January 15th, include s.a.s.e. for WDEL certificate.

Lone Star QSO Party

Starts: 2000 GMT Saturday, December 1
Ends: 0200 GMT Monday, December 3

This is the second annual Lone Star party sponsored by the Austin ARC. The same station may be worked on each band and mode for QSO points, mobile/portables for QSO points and multiplier with each county change.

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

Scoring: One point per QSO, 2 points if its with a Novice, 3 points Novice to Novice.

Texans multiply QSO points by sum of Texas counties, states, (except Texas) VE provinces,

and DX countries worked. Others use Texas counties for their multiplier. (max. of 254)

Frequencies: Phone — 3900, 7265, 14275, 21350, 28600. C.W.—3560, 7060, 14060, 21060, 28600. Novices—Bottom 20 kHz of their subband. All v.h.f. bands. Look for Texans on the hour on 15, on the half hour on 10.

Awards: Certificates to top scorer in each Texas county, state, province and DX country. Also top Novice, v.h.f. and 160 entry. (A min. of 15 QSOs for any award, except DX) Trophies for highest Texas, out-of-state and aggregate mobile scores.

Log forms and check sheets are available by sending s.a.s.e. to WA3GBU. Mailing deadline for entries is Jan. 15th to: Tom Morrison, WA3GBU/5, P.O. Box 13442, Austin, Texas 78711.

Telephone Pioneers QSO Party

Starts: 1900 GMT Saturday, December 1
Ends: 0500 GMT Monday, December 3

This is the 9th annual party in which telephone pioneer amateur radio operators will be able to contact other members in the United States and Canada. The same station may be worked on each band but only one mode per band.

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

Scoring: One point for each exchange with a Pioneer, and one point for each chapter worked.

Frequencies: Phone — 3965, 7275, 14295, 21365, 28675, 50.1/50.25, 144.275/145.500. C.W. — 3565, 7065, 14065, 21065. RTTY frequencies.

Be sure to indicate your chapter name on your log and mail no later than Jan. 3rd to: Phil Lupi, WA2NHH, Stanley S. Holmes Chapter No. 55, Telephone Pioneers of America, 100 Central Avenue, Kearney, N.J. 07032.

ARRL 160 C.W. Contest

Starts: 2200 GMT Friday, December 7
Ends: 1600 GMT Sunday, December 9

This will be the 4th Top Band contest run by the ARRL. Contacts will be between stations in ARRL sections, and with DX. *(no DX to DX)*

Exchange: RST and ARRL section or country.

Scoring: Contacts between stations in ARRL sections 2 points, QSOs with other areas 5 points. The multiplier is the number of ARRL sections, (74) VE8 and DX countries worked. (See list of sections in *QST*)

Awards: Certificates to high scorers in each section and DX country.

You are of course required to keep a valid log of all contacts made, but you are not required to submit a log as a contest entry. To report use one of ARRL's summary sheet and

Bernie Welch, W8IMZ, CQ Contest Committee Member, while visiting Italy spent several days at Vatican City and presented Brother Ed with the CQ Certificate Award won by HV3SJ in the 1972 CQ WW DX Phone Contest. Bernie guest operated the HV3SJ station on 17 and 18 July and reports the pileups were colossal. He even managed to work W1WY.

an alphabetic list of stations worked. (Operating Aid 6). A s.a.s.e. to ARRL will get you the necessary forms.

You may be requested to submit a copy of your log for verification. The usual grounds for disqualification, violation of rules, excessive duplicate contacts and etc. will prevail. And watch the "DX Window" 1825 to 1830, keep it clear for DX stations.

All entries should be received no later than a month after the contest. ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111.

Editor's Notes

The Phone section of our World Wide DX Contest will be past history by the time you will be reading this column. However there is still time to prepare for the c.w. week-end at the end of the month.

Rules are the same as they have been for the past few years and were given in details in last month's issue, so it would serve no purpose to repeat them again. A few reminders may be in order however.

Keep in mind that the WAE country list is the standard for all European contacts. The latest list will be found on page 66 of the July issue. (Note that DL and DM are now considered separate countries.)

Contacts between stations within the North American boundries are worth 2 points, and the N.A. boundaries extend all the way from Greenland in Zone 40 to Panama and the Canal Zone in Zone 7, and the Caribbean islands in Zone 8.

[*Continued on page 74*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE c.w. section of the 1973 *CQ* World Wide DX Contest will be held over the weekend of November 24-25.

Special DX Propagation Charts for use during the contest period appeared in last month's column. Be sure to check these Charts for a prediction of band openings and other propagation data which should be useful during the c.w. section of the contest. For a day-to-day forecast of general propagation conditions expected during November, including the contest weekend, see the "Last Minute Forecast" appearing at the beginning of this column.

A special contest forecast and up-dated propagation information for the c.w. section will be included in the MAIL-A-PROP forecast to be issued for the week of November 20. This special forecast will be sent automatically to MAIL-A-PROP subscribers,[1] and will also be available to non-subscribers for $1.00 and an s.a.s.e. (airmail if more than 200 miles from NYC). Requests for this special contest forecast must reach P.O. Box 86, Northport, N.Y. 11768 by November 12.

Contest Tips

Here are some propagation rules of thumb that should be useful in working DX during November, especially during the c.w. contest period, as long as propagation conditions turn out to be normal or better.

During and shortly after *sunrise*, good DX conditions are expected on 20 meters, in practically all directions. Also check reception at this time form the south and west on 40, 80 and 160 meters.

From a few hours *after sunrise* until *late afternoon* good DX conditions are expected on both 15 and 20 meters. Try 10 meters during the hours of daylight for some openings towards the southeast, south and southwest.

During the *late afternoon* and *early evening*, 20 meters should be the best band for DX openings. Some fairly good openings should also be possible on 40 meters during the early evening, towards the east and south.

During the *late evening* and *early morning* check 40 meters for some fairly good openings to many areas of the world. Some DX openings should also be possible on both 80 and 160 meters during the hours of darkness and sunrise.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For November, 1973

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date *November*				
Above Normal: 5, 8, 22, 24, 27	A	A	B	C
Normal: 1, 3-4, 6-7, 9-11, 18, 20-21, 23, 25-26, 28, 30	B	C	D	E
Below Normal: 2, 12, 15, 17, 19, 29	C	D	E	E
Disturbed: 13-14, 16	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 good on Nov. 1, fair on Nov. 2, and good Nov. 3-4, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, or subscribe to MAIL-A-PROP, P.O. Box 86, Northport, N.Y. 11768.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States and Alaska and Hawaii for distances between approximately 50 and2300miles. Special charts for use between the mainland and Alaska and Hawaii are also included. The following are some typical examples showing how the Short-Skip Chart can be used.

Example 1: What is the best *time* to keep a schedule on 15 meters between a station in New York City and one in Denver?

a. First measure the great circle distance between NYC and Denver on an appropriate map or globe. It is approximately *1600 miles*.

b. Next enter the Short-Skip Chart under the column heading marked "Distance Between Stations—(Miles)", for the range 1300-2300 miles.

c. Note the various times and forecast quality ratings given in the box at the intersection of the vertical column marked 1300-2300 miles and the horizontal column marked 15 meters.

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*11307 Clara Street, Silver Spring, Md. 20902

[1]MAIL-A-PROP forecasts are issued weekly in newsletter format. They contain a forecast of day-to-day propagation conditions, band openings, continent-by-continent DX tips, short-skip forecasts, and VHF and sunspot data. An annual subscription of 60 weekly issues is $20. Send an s.a.s.e. to MAIL-A-PROP, P.O. Box 86, Northport, N.Y. 11768 for a sample copy.

The highest quality occurs between 12 and 14, with a rating of (4).

d. The time of highest quality, 12-14, is the time at the path mid-point. Since NYC is on EST and Denver on MST, the path mid-point is on CST. This corresponds to 13-15, or *1 to 3* P.M., EST *in N.Y.C.* or 11-13, or *11* A.M. *to 1* P.M. MST *in Denver.* This would be the best time period to schedule a QSO between Denver and N.Y.C. on 15 meters.

Example 2: What is the best *band* for working between Seattle and Los Angeles at 3 P.M. Seattle time.

a. First measure the great circle distance between Los Angeles and Seattle on an appropriate map or globe. It is approximately 1100 miles.

b. Next enter the Short-Skip Chart under the column heading marked "Distance Between Stations—(Miles)", for the range 750-1300 miles.

3 P.M. Seattle time is 3 P.M. PST, or 1500 in 24-hour time. Since both Seattle and Los Angeles are in the PST zone, the time at the path mid-point will also be 1500 PST. Under the 750-1300 mile vertical column, check the quality figures at 1500 for each horizontal "Band" column. Use the second of the two quality figures appearing in the parenthesis since the distance between Los Angeles and Seattle is closer to 1300 miles than 750.

c. A quality figure of 1 is found for 10 meters at 1500 PST; 3 for 15 meters; 4 for 20 meters; 2 for 40 meters; 0 for 80 meters and 0 for 160 meters. Twenty meters, therefore, would be the best band to use between Seattle and Los Angeles at 3 P.M. Seattle time.

Sunspot Cycle

The present sunspot cycle continues to decline slowly. The Swiss Federal Solar Observatory reports a monthly sunspot number of 20 for July. This was the lowest level of solar activity reported for any month since December, 1965. This results in a smoothed sunspot number of 50, centered on January, 1973.

A smoothed sunspot number of 30 is now forecast for this month.

V.H.F. Ionospheric Openings

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

Two short but significant meteor showers are expected during November, which should make possible some meteor-scatter type openings on the v.h.f. bands. The *Taurids* shower, lasting for a day or two, should peak on November 4 with an expected count of about 15 meteors an hour. A second shower of about the same intensity, called the *Leonids,* should take place between November 16 and 18. It's expected to peak at an hour or so past midnight, EST, on November 17.

The fall seasonal improvement in trans-equatorial (TE) propagation is just about over, but some T.E. openings may still be possible on 6 meters between the southern tier states and South America. Best time to check is between 8 and 11 P.M., local time. During periods of exceptional conditions, an occasional T.E. opening may extend into more northerly states.

Good luck in the c.w. section of the *CQ* World Wide DX Contest, and please let me

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 like'y 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 time shown would be EST; on a circuit between NY and Texas, the time would be CST since 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 SHT 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 transmitted 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.

Conditions for the CQ WW DX C.W. Contest look good. It will be Above Normal on Nov. 24, and Normal on Nov. 25.

know how the special Contest propagation forecasts work out.

73, George, W3ASK

CQ Short-Skip Propagation Chart
November and December, 1973
Local Standard Time At Path Mid-Point
(24-Hour Time System)

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	11-16 (0-1)	09-11 (0-1) 11-15 (1-2) 15-16 (1) 16-17 (0-1)
15	*Nil*	10-12 (0-1) 12-14 (0-2) 14-16 (0-1)	08-10 (0-1) 10-11 (1-2) 11-12 (1-3) 12-14 (2-4) 14-15 (1-3) 15-16 (1-2) 16-18 (0-1)	07-09 (1) 09-11 (2-3) 11-12 (3-4) 12-14 (4) 14-15 (3) 15-16 (2-3) 16-17 (1-2) 17-18 (1) 18-19 (0-1)
20	*Nil*	07-09 (0-1) 09-11 (0-2) 11-14 (0-4) 14-15 (0-3) 15-17 (0-2) 17-20 (0-1)	07-08 (1) 08-09 (1-3) 09-11 (2-4) 11-14 (4) 14-15 (3-4) 15-17 (2-4) 17-18 (1-3) 18-20 (1-2) 20-22 (0-1)	06-07 (1) 07-08 (1-2) 08-09 (3) 09-15 (4-3) 15-17 (4) 17-18 (3) 18-20 (2-3) 20-22 (1)
40	07-08 (0-1) 08-09 (1-2) 09-16 (3-4) 16-17 (2-3) 17-18 (1-2) 18-20 (0-1)	07-08 (1-3) 08-09 (2-3) 09-16 (4-3) 16-17 (3-4) 17-18 (2-4) 18-20 (1-3) 20-02 (0-2) 02-07 (0-1)	07-09 (3) 09-14 (3-1) 14-16 (3-2) 16-18 (4) 18-20 (3-4) 20-22 (2-3) 22-02 (2) 02-04 (1-2) 04-07 (1-3)	07-08 (3-2) 08-09 (3-1) 09-14 (1-0) 14-16 (2-0) 16-17 (4-2) 17-18 (4-3) 18-20 (4) 20-22 (3-4) 22-00 (2-3) 00-02 (2) 02-04 (2-3) 04-07 (3)
80	08-18 (4) 18-19 (3-4) 19-00 (1-2) 00-07 (1-3) 07-08 (2-3)	08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-19 (4-3) 19-00 (2-4) 00-07 (3-4) 07-08 (3)	08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-19 (3) 19-20 (4-3) 20-04 (4) 04-06 (4-3) 06-07 (4-2) 07-08 (3-1)	08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-04 (4-3) 04-06 (3-2) 06-07 (2-1) 07-08 (1)
160	07-09 (3-2) 09-11 (2-0) 11-17 (1-0) 17-19 (3-2) 19-07 (4)	07-09 (2-0) 09-17 (0) 17-19 (2-1) 19-04 (4) 04-06 (4-2) 06-07 (4-1)	07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (4-2) 20-21 (4-3) 21-04 (4) 04-06 (2-1) 06-07 (1-0)	06-19 (0) 19-20 (2-1) 20-21 (3-2) 21-04 (4-2) 04-06 (1)

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

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

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

HAWAII

Openings Given in Hawaiian Standard Time†

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

ALASKA

Openings Given in GMT†

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

"Sure you deserve a hobby. Why not collect match covers? "

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties
#106—Robert L. Dyson, KØAYO, 7-26-73.

USA-CA HONOR ROLL

2000		1000		500	
WBØDPD	191	K1VSJ	308	K1VSJ	958
WAØLMK	192			WB9ELH	959
1500				IØZQ	960
WBØDPD	230				
K1VSJ	231				

THE "Story of The Month" for November is:

Jerome H. Fischer, W2KXL

(All Counties #80, dated 7-19-72)

As many of you will remember, Jerry and XYL, Dot, were hosts to a fine get-together on May 23, 1971 at his FB ham QTH and a photograph of many of the County Hunter guests (including Roy, ZL1KG and XYL Lil) and a list of them can be found on pages 86 and 88 of *CQ*, September 1971.

Jerry is a great one to talk to in person, or on the air on c.w. or phone, but it is like pulling teeth to get him to put some data into a letter—but Bertha, WA4BMC kept after him.

His first ticket was obtained in 1938 and he operated 2½ and 5 meter mobile as well as fixed 40 c.w., also 80 and 160 phone.

In 1942, before going into the service, he operated as W1NAY in the Boston area 2½ meter mobile, as he had no place for a fixed antenna.

Four and one half years were spent in Army Communications, teaching code and radio fundamentals, repairing Army rigs, etc. . . .

Jerry worked 7 mHz when the net got started, working W4BPC for *many* counties and *many* others like K3FFJ, K3ORP, W4EXI (K6ZA-K4ZA), W4IZR, K7JWZ, W5HDK, K5HDK, W4CHK, K4LSP, KØIFL, WA2QMF, WA2-RWP, W5DAU, K1IIK, WAØKDG, WØKZZ, K8CIR, WAØLRQ, W8WUT, W6JHV *(Yes, many have been left out).*

He has also done his share of mobiling (alone and with others) giving out many many counties. He well remembers the time (on a mobile trip) that George, WA4FGX requested a telegram for a fast confirmation of a much needed South Dakota County—but the best Jerry could do was to send smoke signals from one of the Indian Villages, as he was in the middle of no-where, Hi . . .

Dean, K7JWZ made a special trip to give Jerry his last county, and Dean has done this for many many other County Hunters.

Jerry helped start the 80 meter Net with WA2HGL, K2KQC, K3CRC, and K3FFJ.

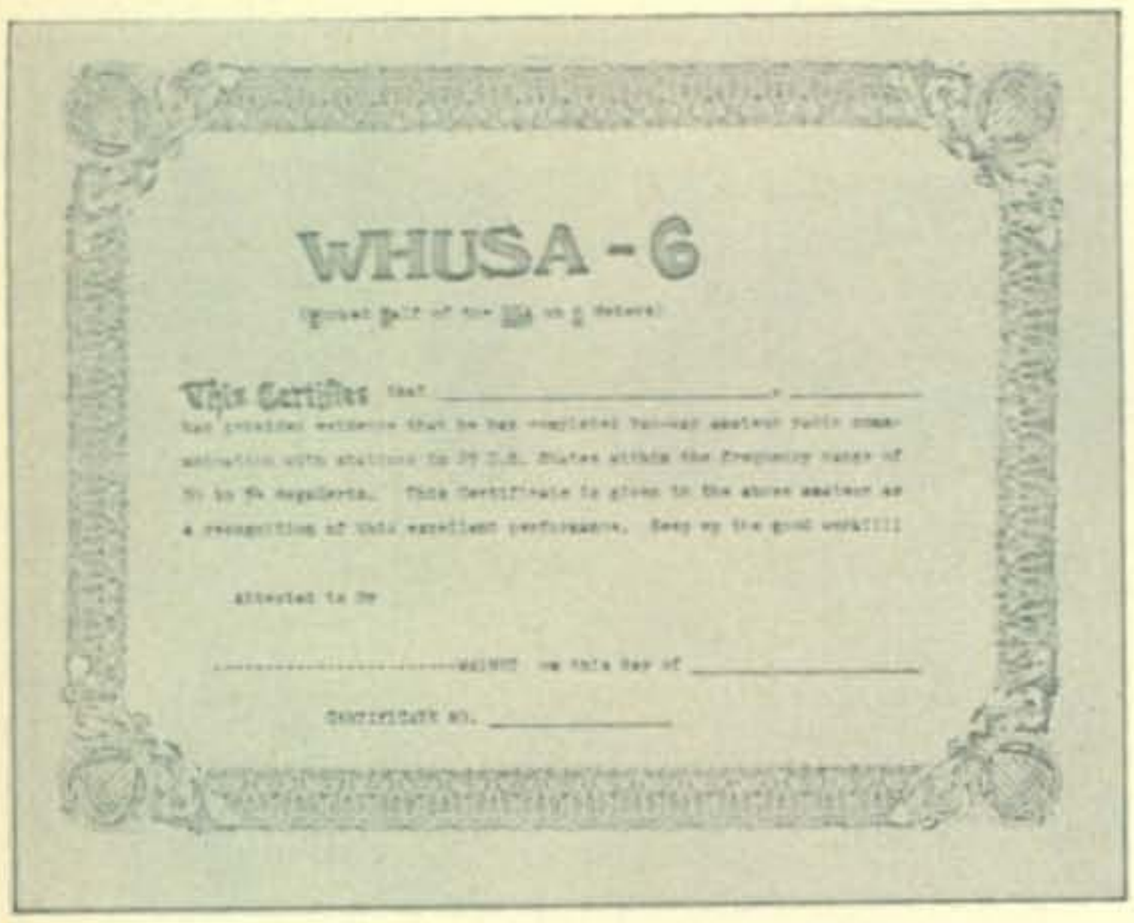
He has worked many famous people on Nets, including General Lemay, Senator Barry Goldwater, Martin Block (silent key, but at one time the most famous broadcast disc jockey in New York City), and Bill Leonard of CBS.

Yes, it is a most interesting hobby, if you don't take it too serious, he says.

Jerry greatly enjoys the yearly Conventions, where you meet all the fine people you have been talking to for years. Everyone has a good time, you talk to people like they were your kinfolk—yes, a great mixture of people from the cities, country, mountains and plains.

Steve, K5KDG & Uncle Ben, W5HDK the only County Hunters who have attended all of the July 4th meetings *and* the first mini one Jackson, Miss.

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



Worked Half USA On 6 Meters.

Jerry also chases DX on c.w., Phone, ATV and SSTV. Operates all bands including 144 and 432, also does much phone patching. Runs 1500 p.e.p. and 1000 c.w. to a 5 element beam from a *great* QTH.

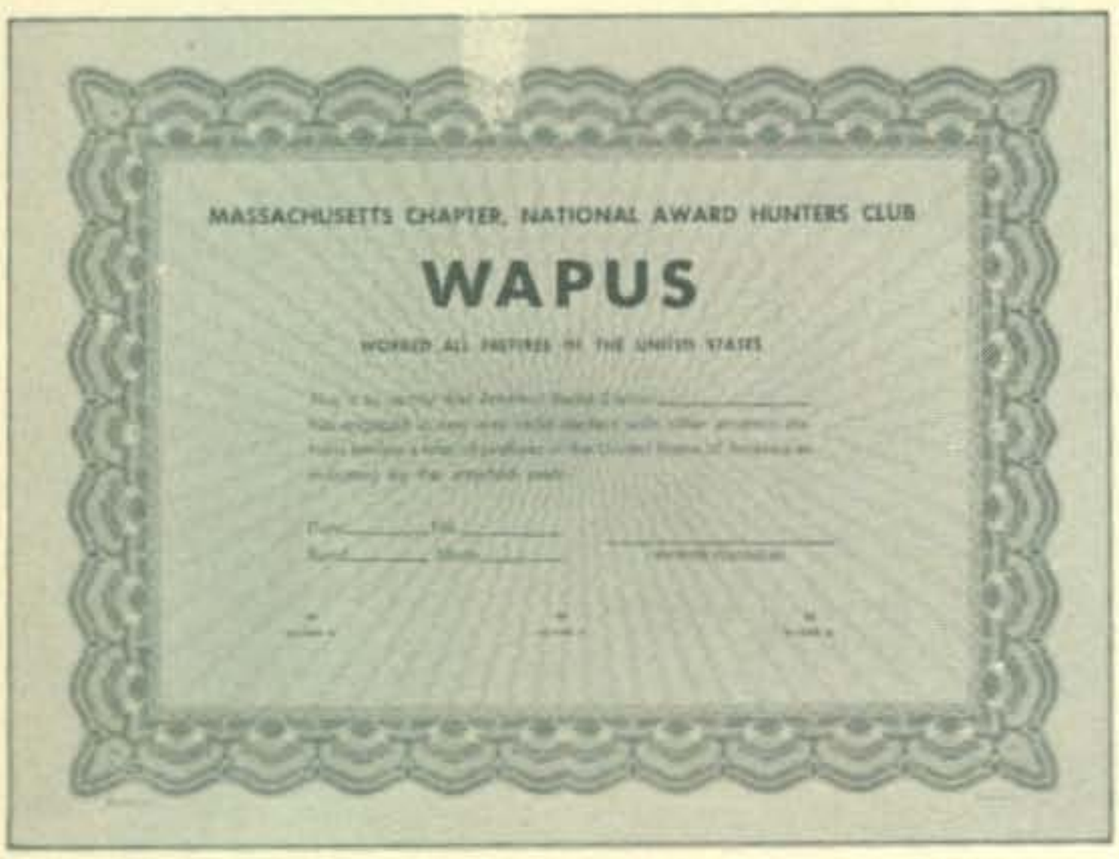
He is getting close to retirement from his own business, which is Industrial Hardware and has been at it going on 53 years. However, his son, now out of college over 2 years is doing a fine job—so he might have taken over the business by the time you read this.

Jerry waited until June 1965 to apply for USA-CA-500-#499 and with all his other interests, which have kept him plenty busy, he acquired All Counties #80, July 19, 1972. *(Happy and fruitful retirement, Jerry! Ed.)*

Awards Issued

In the midst of trying to move to a new QTH, Bob Dyson, KØAYO found time to apply for All Counties #106, dated 7-26-73. As this is being written he is moving to: Rt. 1, Box 230M, De Soto, Kansas 66018.

WBØDPD, Club station of the Mobile Amateur Radio Awards Club, Inc., acquired USA-CA-1500 & 2000, endorsed All Mobile, All S.S.B. Yes, you guessed it, the paper work also



WAPUS Award of Mass. Chapter, NAHC.

became the job of Trustee, Bob, KØAYO, but I'm sure that Skip, WAØWOB did most of the operating.

LeRoy Ullrich, WAØLMK was issued USA-CA-2000.

Howard Bromberg, K1VSJ applied for USA-CA-500, 1000 and 1500 all endorsed All 14 S.S.B.

Cliff McCoy, WB9ELH won USA-CA-500.

Elvio Pizzo, IØZQ made USA-CA-500 endorsed All A-1.

Awards

WHUSA-6: Worked Half of the USA on 6 certificate is being offered to help stimulate activity on 6 meters. Requirements: A signed statement that applicant has worked 25 states on 6. List of stations and states worked. Complete rundown of your equipment. A self-addressed, stamped envelope. Send to: Richard Maltzman, 7 Hampton Road, Sharon, Maine 02067. Oh yes, Richard's call is WA1NRT.

U.S. Naval Research Laboratory Certificates/ QSLs: In my column in *CQ* for February 1973 I had full data on the 50th Anniversary year (1973) for NRL and a letter in June *CQ* by Ray, W6MLZ with slight correction of some of the history. Certificates were awarded to the moon bounce amateurs received on NRL's 150-foot antenna during the 21 January, 30 March, and 1 April tests. All those heard during the tests have received certificates. Certificates are awarded to any amateur working 5 or more of the NRL amateurs, either on different bands or different stations or any combination, during 1973. Special 5 color QSLs will also be issued. Stations are W3BLC; c.w., s.s.b., RTTY, W3-MFJ, W3SRA, W3WOX; v.h.f., W3SFY, W3-BDK; SSTV, WA9GVK, WB4YTU; E.M.E., W3KE; Operation NRL stations W3NKF - W3-KVC. Write to: H. O. Lorenzen, W3BLC, Superintendent, Space Systems Division, Naval Research Laboratory, Washington, D.C. 20390.

Worked Hamburg & The Harbours Of The World: Hamburg is Germanys "Door to the World". To increase the friendship between amateurs around the harbour of Hamburg and radio amateurs throughout the world this (WHHW) diploma was created. It may be obtained by all licensed radio amateurs and s.w.l.s who satisfy the following requirements (no band, mode restrictions).

1. Contacts with amateur radio stations in 40 different sea and ocean harbours all over the world in at least 4 of the 5 continents, but *not* from the applicants own country.

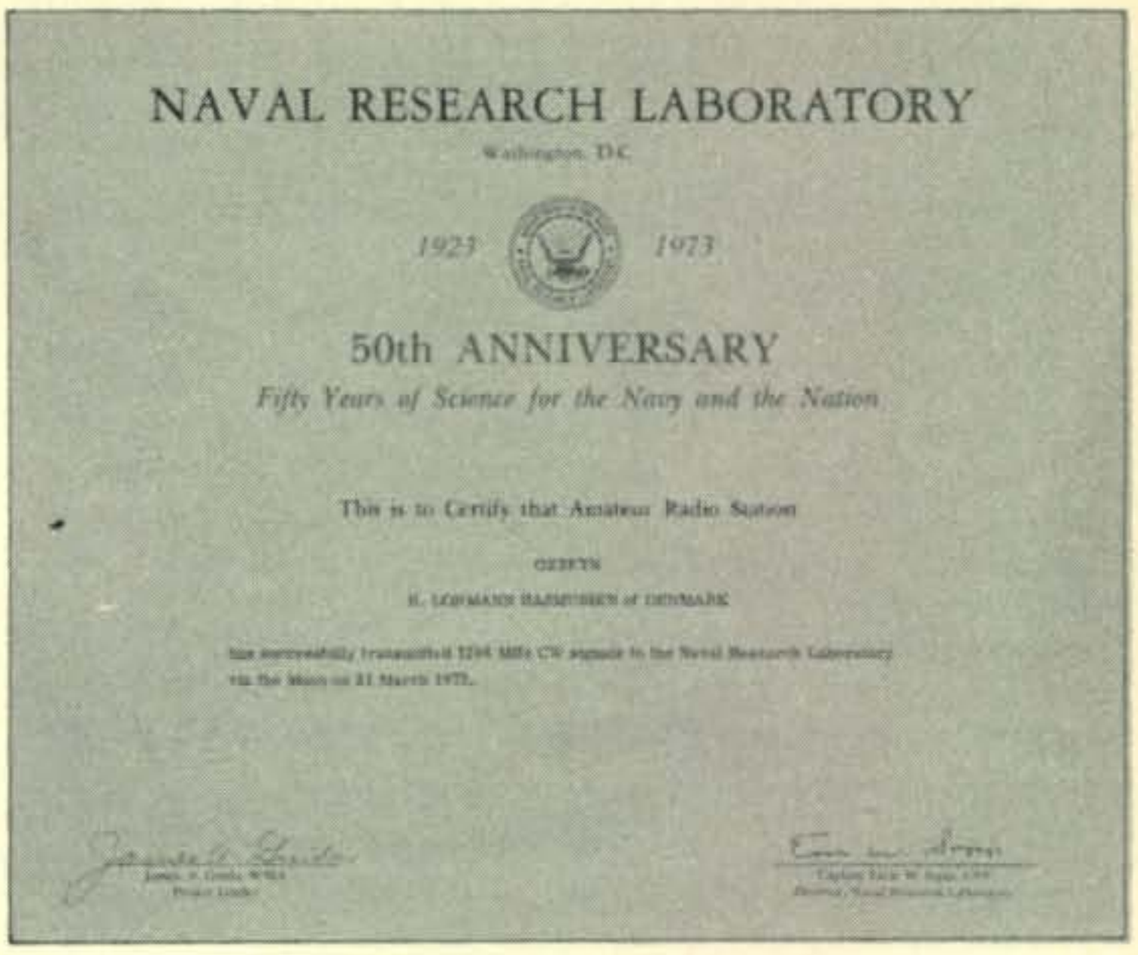
2. Contacts with 10 amateur radio stations around the Harbour of Hamburg from at least 5 different "DOKS". (The following DOKS are valid: E Ø2, E Ø7, E 13, E 14, E 16, Z Ø7, Z 27, Z 28). DOKS E Ø7 or Z 27 must be included. All contacts from January 1st, 1973 or later are valid.

The diploma consists of black Epoxy-copper clad board with beautifully etched partial-view of Hamburg-Harbour. Applications with GCR-List (certified by 2 licensed amateurs), 1 QSL of applicant and the fee of DM 10, or U.S. $4.00 or 17 IRCs to be sent to the Award Manager of issuing club OV-Harburg: Kurt Stegert, DK4-HD, 21 Hamburg 90, Soltauer Ring 10, XIV., Germany. Postal check account: Hmb 393 60-203 Stegert.

Worked All Prefixes — United States: This WAPUS Award sponsored by the Massachusetts Chapter, National Award Hunters Club for working U.S. call prefixes found in the U.S. section of the call-book. (W1, WB2, K5, KL7, WA9, KZ5, etc.). The Award is issued in 3 classes. Class A—work 48 prefixes. Class B—work 32. Class C—work 16. Submit application with GCR list showing date, time, band and Mode. No date or time limit on contacts. Any "special event" U.S. prefixes count. Fee for basic Award is $1.00. Seals for higher class cost 10¢, except no charge for higher class seals at time of application for basic award. All awards are free to B/P. Awards will be endorsed for band and mode. If application is made for an additional band or mode, fee is 25¢ as an additional certificate will be issued. Also available to s.w.l.s. Make checks or money orders payable to "Mass. Chapter N.A.H.C." IRCs accepted on a ratio of 10 to a dollar. Apply to Awards Custodian: George J. Hayes, W1DOM, 29 Belmont St., North Quincy, Mass. 02171.

The Worked All GI Award: Issued for contacting 2 stations in each of the Counties in Northern Ireland—Down, Antrim, Armagh, Derry, Fermanagh and Tyrone. Applicants outside Europe need only one confirmation from each. Send GCR list and 10 IRCs or $1.00 to: (New Custodian) L. M. Lyske, GI3CDF, Erinbrook, Killarn, Newtownards, Co. Down, Northern Ireland. (Sorry to report, so late, the passing of Frank A. Robb, GI6TK after a long illness. He was very active and also custodian of this Award—foto page 91, *CQ* for June 1968. And he was custodian of the White Stick Award—foto page 101, *CQ* for May 1968).

PJ Activity Month: To celebrate the 25th anniversary of VERONA, the amateur radio association of the Neth. Antilles, December 1973 has been designated PJ Activity Month. PJ stations will be on the air as frequently as possible during the month and VERONA members will be allowed to use a special PJ1 prefix for the month of December only. Special QSLs will be sent to all QSOs with PJ1 stations. The beautiful Curacao Certificate, which is normally issued ofr working three PJ2 stations at any time plus a fee of $1 US or 10 IRC's, will be sent *free* for working three PJ1 stations during December. Applications, with QSO details should be submitted no later than Feb. 1, 1974 (airmail please!) to: VERONA, P.O. Box 383, Curacao, Neth. Antilles.


NAVAL RESEARCH LABORATORY

Washington, D.C.

1923 1973

50th ANNIVERSARY

Fifty Years of Science for the Navy and the Nation

This is to Certify that Amateur Radio Station

OZ3FYN

H. LOHMANN HANSTHOLM of DENMARK

has successfully transmitted 1296 MHz CW signals to the Naval Research Laboratory via the Moon on 31 March 1973.

NRL Award to OZ3FYN, Club Station operated by OZ9CR- leading 1296 EU Group.

Editors Notes

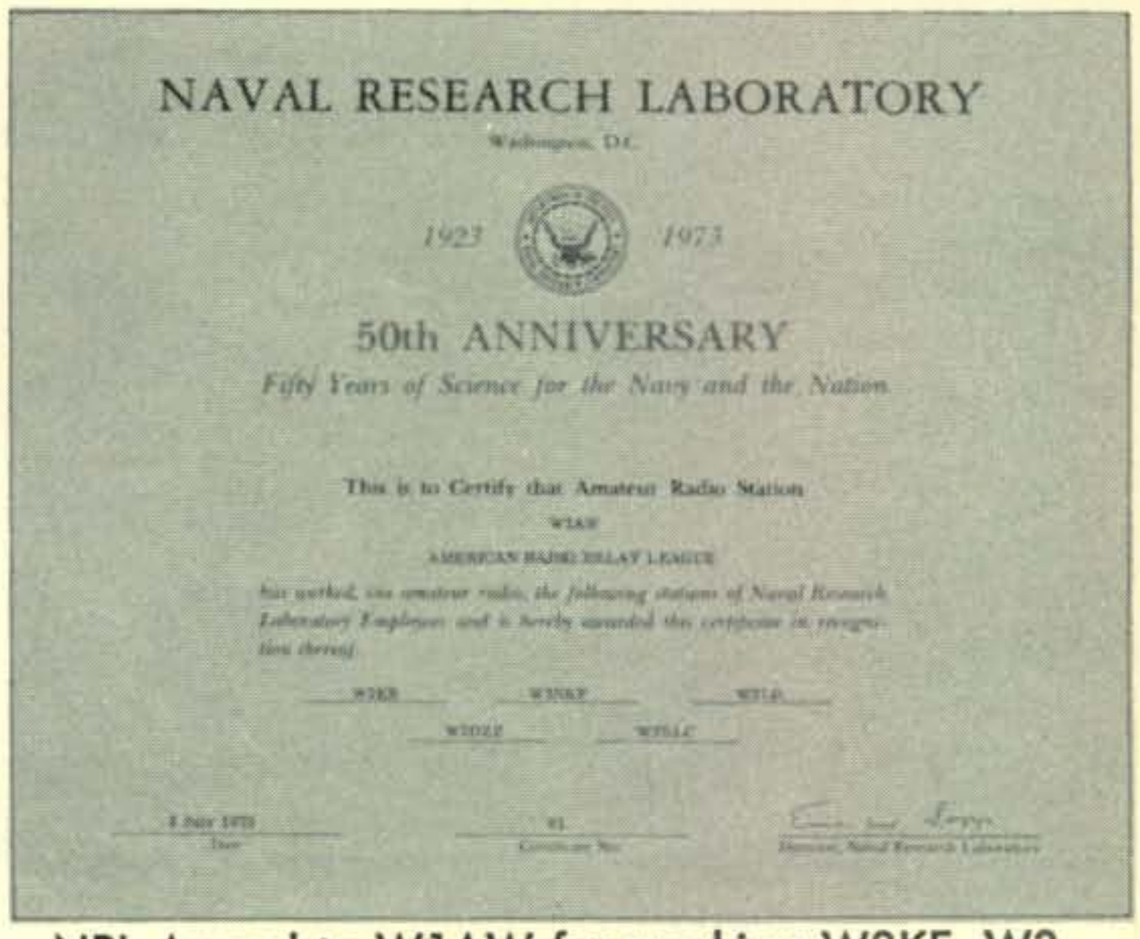
Sorry, but I still get material too late to use, my deadline is 90 days. This November column was written the first week in August.

Also sorry that I can *NOT* get needed QSLs for overseas amateurs and s.w.ls. I do get many such requests, in fact one s.w.l. sent me a list of over 100 QSLs he needed. I can *NOT* help except to plead for all amateurs to QSL and realize that s.w.ls need the QSLs for Awards, just the same as licensed amateurs.

For membership in the Fox-Tango Club (not a dance organization) and receive the monthly *Newsletter* on Yaesu Equipment, send s.a.s.e. to Milton Lowens, WA2AOQ (by error listed as WA2AOO in August *CQ*), 3977-F Sedgwick Ave., Bronx, N.Y. 10463.

Remember, for full details on MARAC, Inc.,

[*Continued on page 74*]


NAVAL RESEARCH LABORATORY

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W1AW

AMERICAN RADIO RELAY LEAGUE

has worked, via amateur radio, the following stations of Naval Research Laboratory Employees and is hereby awarded this certificate in recognition thereof.

W3KE W3NKF W3LB

W3DZZ W3BLC

NRL Award to W1AW for working W3KE, W3-NKF, W3LB, W3DZZ, W3BLC.

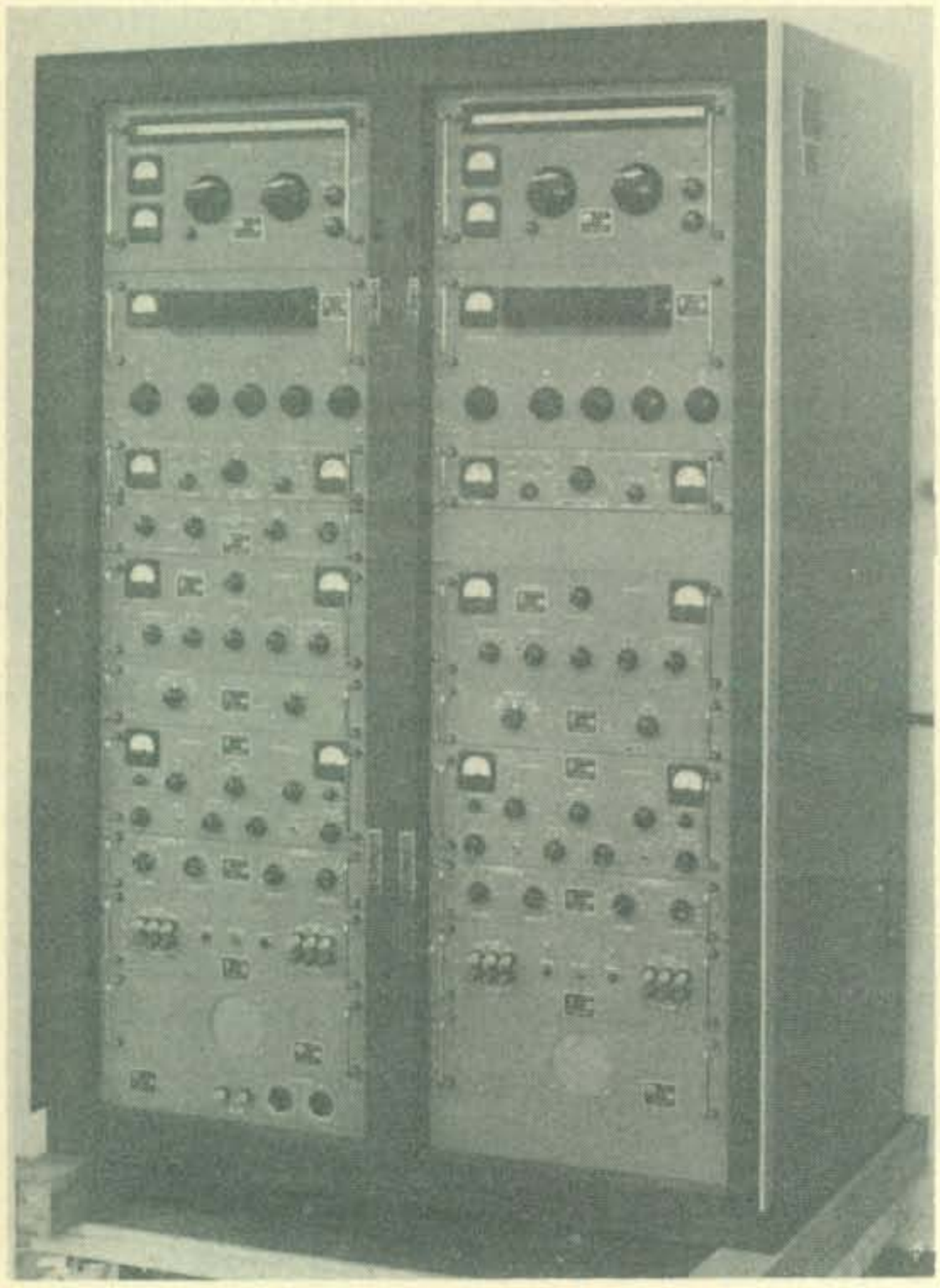
SURPLUS sidelights

BY GORDON ELIOT WHITE*

Now that the Government is trying to sell surplus again, instead of smashing it in its drive to "demilitarize" everything, a few newer items are showing up in the usual channels. I have found units of TT-522/ARC-96, an airborne teleprinter and its ground equivalent, TT-513, and also some AN/FRR-60 dual diversity high-frequency receivers. I discussed the AN/ARC-96 gear last month. Right now I will give some data on the FRR-60. As you can see by the photo it is not exactly a solid-state device, and it occupies a pair of seven foot relay racks.

The FRR-60 was built by Technical Material Corp. about ten years ago. More than 160 of these sets were installed, and a few others were made for other users. They appear to be sold as surplus now, in bits and pieces. Considering their size and weight (288 pounds each receiver, plus a 660 pound rack) it is not surprising that the FRR-60's are broken down into components when they are surplused.

*1502 Stonewall Rd., Alexandria, Va. 22302



The Technical Materials AN/FRR-60 dual diversity high-frequency receiver.

In any event, the various items have been turning up separately, and the lucky new owners have hastened to write to TMC Corp in search of data, notably the tech manual. The book for the entire set however weighs in at about ten pounds. TMC did not print any extra copies, so it cannot furnish free manuals. The book can be bought at a commercial rate of $150, I understand.

W2AZA, who handles these inquiries at TMC, advises me that anyone who wants to set up the FRR-60 had better find all the components and wire it together the way it was designed to be assembled. Although some of the parts can be used separately, it is not easy, and the master oscillator is not a home-brew project for most people.

The FRR-60 is also known as the DDR-5A in commercial practice. It covers the tuning range 2-32mHz and can receive single sideband, independent sideband, amplitude modulation, a.m. Equivalent, c.w., m.c.w., Frequency Shift Keying, FAX, Pulse, and phase signals.

The coverage is divided across eight bands, continuous coverage or synthesized in 100 cycle steps. Automatic Frequency Control, visual monitoring, variable audio filtering, i.f. bandpass selection, and tuneable i.f. notch filtering is provided.

The set has two receivers, each consisting of a tuner, TN-376/UR, a control synthesizer and frequency standard, O-941/UR; visual (CRT) monitor, IP-641/UR, Automatic Frequency Control module, C-4099/FRR-60 (v); i.f. amplifier, AM-3295/FRR-60; detector and audio amplifier AM/3296/FRR-60; variable notch filter, F-711/FRR-60; power supply, PP-341/FRR-60; Audio Filter, F-712/FRR-60; speaker, LS-491/FR; audio switch panel SB-1865/FR, and the cabinet, CY-3567/FRR-60.

The tuner, which covers the h.f. bands in eight segments and has four stages of r.f. amplification, could be used together with a home-brew 1750 kHz i.f. system, but its stability would probably be poor, according to W2AZA, who notes that the FRR-60 uses a very stable reference frequency in the O-941/UR generator to stabilize the first local oscillator. Without the standard, it is impossible to obtain the design stability of one part in 10^8.

The audio amplifier could be used by itself, but it would be nothing but a tube-type amplifier, and is not very special by itself. The rest of the units, obviously, are specialized, and useful solely as designed.

The i.f. signal from the tuner is, as mentioned, 1750 kHz, and in the i.f. amplifier, a second mixer converts down to a 250 kHz second i.f. before detection in the audio amplifier section.

The visual monitor operates on the 250 kHz i.f. and is used as a tuning device for very accurate work such as narrow-band RTTY, FAX, s.s.b., etc.

Nominal input is 50 ohms, unbalanced. Noise figure is rated 6 db or better over the band, i.e. with a 1 microvolt signal and a 7.5 kHz bandwidth, the output signal to noise ratio is 15 db or better.

I.f. selectivity can be adjusted from 250-7500 Hz upper or lower sideband to 1 kHz symmetrical, in nine steps. Audio filtering down to 100 Hz is available.

The cabinets contain special cable-wind motors to retract the wiring to each module after it is pulled out for servicing.

The AN/FFR-60 is obviously not everyone's dish. There are not a lot around, but there have been a few dismantled, and a complete one showed up in amateur channels in England recently. A lot of readers may find parts of the set in their local surplus store, and at least now you will know what the heck you have. If anyone wants to write to me and tell me what parts he has, I'll be glad to keep a "clearing house" on what components are around and advise who has what.

I have a visual monitor, and I plan to build a small converter from 455 kHz to 250 kHz and use it as a tuning indicator with my R-390-A receiver. ■

Awards [*from page 71*]

Nets, addresses, Net controlling, County Hunting in general, etc. . . . send legal size s.a.s.e. with 24¢ postage on it to: Bertha Eggert, WA4-BMC, P.O. Box 6811, Southboro Station, West Palm Beach, Florida 33405.

Especially for c.w. County Hunters (*YES* there are *MANY*), Jim Hoffman, K1ZFQ issues a monthly *CW County Hunting Newsletter*. He also has some of those *County Hunting Manuals* which were prepared by WB6IFA/VE6. Cost $1.50, write to Jim at 42 Gresham Street, Milford, Conn. 06460.

If you have a spare minute and have questions or general information, write and tell me, How was your month? 73, Ed., W2GT.

Contest Calendar [*from page 65*]

Also note that a new European Trophy has been added, for high man on 14 mHz c.w., which brings the total up to 28 Trophies and Plaques world wide.

Since we are now in a period of uncertain propagation it is highly recommended that you check George Jacob's Column or subscribe ($2.50 per month) to MAIL-A-PROP, Box 86, Northport, N.Y. 11768 for the latest forecast. For the very latest last minute forecast use DIAL-A-PROP, 516 883 6223.

I'm a little apprehensive for conditions this year, we are now approaching the bottom of the solar activity cycle but maybe we'll hit a couple of fair days.

Good luck, see you in the pile-ups.

73 for now, Frank W1WY

SPECIAL OFFER FOR CQ SUBSCRIBERS ONLY

Our circulation department has made an exhaustive study of the costs involved in processing renewal subscriptions. This study indicates that the average short term subscription renewal costs approximately $2.00, taking into account postage, printing of renewal forms, labor, etc.

We feel that this is an extreme waste, and that the money would be far better in the pockets of our subscribers. Since CQ enjoys a renewal percentage of about 80% each year, the savings will be substantial for the amateur fraternity as a whole.

Thus, we offer present subscribers only, the opportunity to place low-cost, long term subscriptions, while the present subscription is still in effect.

The cost of these subscriptions will be $12.00 for the first three years extension, and $3.75 for each additional year thereafter. Not only will the CQ long-term sub save you substantial money, but it will reduce drastically the possiblity of computer errors on future renewals.

This offer may be made only on the special post card printed on the magazine mailing wrapper which is used for subscriber copies only. We may have to withdraw this offer at any time, so prompt action is suggested.

Dick Cowan, WA2LRO
Publisher of CQ

Math's Notes [*from page 57*]

that he has over 100 machines in stock for $14 each, F.O.B. New Mexico. All are in good condition and personally checked out by Bill. He also has copies of the original Western Union Shop Manual for $3.80 postpaid, and by the time you read this, may have new replacement exciter lamps for a dollar or two. You might write to him if you are interested.

In addition, the Double K Company, 40 California Avenue, Medford, N.Y. 11763, has completely converted machines—ready to go for $99.50 each. They are fully aligned with automatic sync as per my articles. You can also write to them for additional details. In both cases, please mention *CQ* and MATH'S NOTES.

Until next month, happy computing.

73, Irv. WA2NDM

SSTV [*from page 48*]

If the goal was not for everyone, even less so is the hardware I built to reach the goal. My junkbox is different than yours. What I will try to do is to go into detail on those building-block pieces that are a bit out of the ordinary and might find a useful place in someone else's solution. Let's start at the top of last month's list.

I wanted to get up to 3 people "on camera" at one time. To do this with two people proved fairly easy. With two chairs side by side, at a distance from the camera where both people fall within the field of view, there is enough facial detail. Putting 3 chairs in a row stretches things a little too far. Adding a third chair directly behind the row of two, in the middle, does work however. The lens-to-people distance is about 3.5 or 4 feet for this, using a 12.5 mm FL lens. As shown in fig. 1, the camera is mounted atop the monitor. Proper camera to subject distance is also seen to be a good viewing distance for the 5" CRT. The tripod head camera mount makes it easy to center and tilt the camera.

The solution to the audio pickup problem was three headset/boom mike combinations (Telex CM-610). The ceramic mikes in these units are not the noise cancelling type, but they are kept close to the lips no matter how the head is turned, and the voice to background noise level is kept adequately high. These units are much less expensive than the aircraft variety. Each headset is supplied with a muting switch in the cord so than an individual can kill his own mike if he wants to.

The next several items on my list of goals found their answer in the control system illustrated in figures 2 thru 5. I chose an I.C. logic control system partly because I had a number of I.C.'s on hand, and partly because I wanted to do the most important switching with a small hand-held unit (see fig. 4). I guess the convenience of operating a Carousel slide projector via its remote control unit was my inspiration. If you can control a projector that way, why not an independent sideband slow-scan station with several audio and video sources? Things actually turned out so well that a non-technical guest can easily run the station once the transmitter is tuned, etc. This, of course, gives the guests a much greater sense of participation. They are "running things," not you. (By the way, do you *really* want your wife or girlfriend to become a ham? Who sits in front if the rig and throws the switches during those few times when she talks on the air? She can legally do *everything* under the present rules, so long as you are in the background observing. Let her do the whole thing and see what happens.)

One of the complications in my situation was the desire for ISB compatability in the control system as well as the rig. When communicating with a SSTVer not having ISB, everything must be sequenced in one sideband. When transmitting ISB, the same voice and picture sources are used simultaneously. This control unit permits the operator to connect VOICE (headsets), phone PATCH, CAMERA, TAPE, or AUXiliary input to the primary transmitter audio input(channel "A"). Channel "B" is the input for the other sideband, and pressing the appropriate button will connect CAMERA, TAPE, AUX, or VOICE to that transmitter input. These are all momentary contact pushbuttons that trigger latching-type logic circuitry which keeps the function switched after the button is released. Pressing any button also disconnects the source formerly connected to that input. A rocker switch is used to switch from transmit to receive. The button under the thumb in fig. 4 resets the 10 minute station ID timer. The "C. MON" button connects the SSTV monitor input to the camera output, and turns the camera lights on, for as long as the button is held down. This allows the operator to check and adjust the camera before putting it on the air.

Figures 2 and 3 show front and rear

views of the rack mounted part of the control system. The top 5¼" rack panel is the power supply and power control unit. It supplies +24 v.d.c. unregulated, and+12 v. regulated d.c. to the control circuitry. It also holds the solid-state power switching relays, and a.c. outlets (switched and unswitched): The lower 7" panel holds a large Veroboard containing the logic and audio switching chips, as well as the headset microphone mixer, audio monitor amplifiers, and phone patch circuitry. Separate VU meters monitor the audio levels going to the channel "A" and "B" transmitter inputs, and the phone line. Two groups of status lights near the meters show at a glance which source is feeding which channel.

A row of rotary switches along the bottom of the panel perform set-up programming and pre-switching functions. On the far left is the PATCH control that selects what will be fed into the phone line. This can be the normal channel "A" receiver output, the amplified headset VOICE output, or the "A" or "B" signals to the transmitter, depending on the purpose of the patched call.

The next switch controls the input to the video monitor. Normally, it would be set at the position which causes the monitor to switch back and forth automatically between the transmitted signal in one channel, and the received signal in that same channel. Other positions allow monitoring of CAMERA, TAPE, and AUX outputs. These functions are particularly useful when preparing taped "programs."

The next three switches involve the tape recorder. (I use a stereo reel-to-reel recorded.) In one position of the TAPE IN switch, the recorder inputs are connected to the receiver outputs. In another position, to the transmitter input channels. In a third, they are automatically switched from transmit to receive. This latter mode permits recording both ends of a QSO. The TAPE OUT switch allows either tape channel to feed either transmitter audio channel, or either tape channel to feed both transmitter channels simultaneously. (This would give a DSB transmitter output, legal if the input is voice, but not if SSTV. Only one sideband can contain SSTV.)

The far right hand switch allows the AUX input to be fed by a flying-spot scanner, or any one of several spare audio or

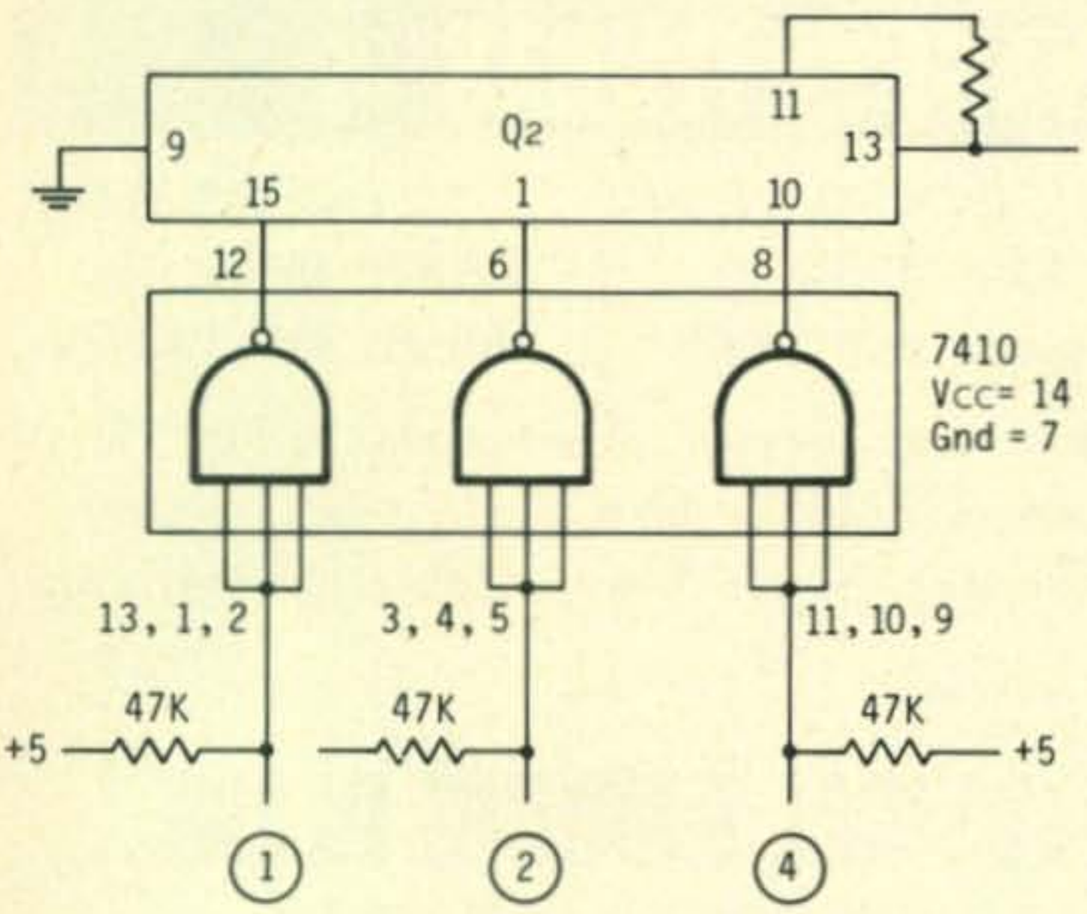
video inputs. On the top panel are two center-off toggle switches. The upper one permits the camera lighting to be always off, always on, or on when the camera is feeding the transmitter or monitor. The lower toggle switch controls AC for an auxiliary device — perhaps a second tape recorder.

Next month: some of the circuitry. .

Vy 73, Cop, W0ORX

Keyboard Memory [*from page 36*]

the schematic below. A single 7410 chip will do the trick. The 47K resistors may not be necessary, but add a bit of a safety margin against noise troubles.



In addition, Al informs us that should TVI develop, or should the keyboard be r.f. sensitive, .001 mf bypass capacitors should be added to ground at all inputs, outputs, and power supply leads. Making the keyboard enclosure as r.f. tight as possible is also recommended.

Conclusion

The memory should cost less than $20.00 to build if the builder is a careful shopper. It is easy to integrate into the keyboard and the pair provide an unbeatable combination. ■

Letter [*from page 8*]

The question that intrigues me is not the Commission's reasons for refusing to accept this particular antenna, but rather why the Commission has burdened the amateur radio service with approval requirements not deemed necessary in the commercial services. The sad facts for me are that by strict interpretation of the Commission's Rules, I cannot even remove the antenna from the tower to attempt pattern measurements because that action would immediately generate a problem with the Broadcast Bureau, to whose rules I am bound regarding the operation and maintenance of the directional array. After careful consideration, I have arrived at the point where I am forced to wonder about the intentions of the gentleman who directs the attitudes and activities of the amateur and citizen's division. What are they trying to prove? Are they not aware that they may be implementing attitudes that could eventually destroy amateur radio if permitted to continue unchecked along the courses now being pursued?

It is reasonable to question the motives and methods of the individual who directs that division when one examines the manner of grossly restrictive rule-making being foisted upon the amateur radio fraternity, and compare the same division's activities and attitudes towards its other area of responsibility, the Citizen's Radio Service.

The question I raise is not what they are doing, ... that is obvious. I want to know why they are doing it and what factors are the basis for their totally inequitable attitudes and actions of the past two years.

During these same past two years, we in the broadcasting business, have watched while a series of strikingly well thought out new regulations issue forth from the Broadcast Bureau... Rule-making which is infused with the realization that the state of the broadcaster's art had advanced to the point where the existing rules were in dire need of revitalization. And while there is little doubt that the new rule-making in the broadcasting Bureau has much lobby pressure from the industry behind it, it is difficult to find any strong or serious opposition to the sweeping reregulation that has been legislated into broadcasting. Many sacred cows of broadcast law have been swept into the musty archives of history in the past two years... The First Class Radiotelephone License has, for all practical purposes, been delivered to the tender care of the Smithsonian Institute since it is no longer required for anyone except the Chief Engineer. The old hassle of taking transmitter readings for the operating logs on a half-hourly basis has been relegated to oblivion and stations of all categories, up to and including fifty kilowatt directionals are now permitted full remotely controlled unattended operation with readings to be taken at intervals up to three hours. The previous requirement of daily inspection of the transmitter site has been relaxed in the simpler cases to once every five days, and in the more stringent cases of the remotely-operated high power directional station, to once every fifty-four hours. The old saw of station identification every thirty minutes within two minutes of the hour or half hour has been relaxed to once an hour as near to the hour as is consistent with normal breaks in programming. I could go on ad infinitum quoting a long series of changes and deregulation of the past two years, but I think my point is clear.

While it is obvious that the people in the Broadcast Bureau get their paychecks from the same coffers as the people in the Amateur and Citizen's Division, it is also obvious that they don't talk to each other in terms of common policy guidelines and philosophy. The latter organization continues to blithely ignore the widespread malpractice, violation, and chaos rampant in the Citizen's Radio Service which it is also required to administer, while it concentrates huge efforts on what seem to many of us to be open attempts to put amateur radio out of

business. Again, I ask what are they trying to prove? To require the Amateur Radio Service to follow rules and procedures not required of comparable commercial services smacks of some kind of perverse thinking. It certainly deserves, if nothing more unflattering, the title of discriminatory treatment.

But again, I ask not what are they doing; rather, why are they doing it? Is not the Commission as a whole bound to be zealous of the public interest? Are not these people paid from our own pockets, servants of the public and thus subject to our overseeing and inquiry as to their actions and attitudes? I, for one, say yes and amen. I am paying their salaries. I am needful of their services. And, as their employer, I say that the time has come to demand a full and extensive inquiry into the activities of the men who are at the head of the Amateur and Citizen's Division.

I have been pained to see, in the past several years, an unhealthy schism develop within the ranks of amateur radio. Factions dividing the fraternity have served only to generate animosity among colleagues and break down the bonds that should be common among us-- the spirit of amateur radio. Further, that schism has caused many of us to forget the true goals which amateur radio originally set out to achieve. In useless bickering among ourselves and between the various factions, we have lost track of what we are and where we should be going. We have lost that immense power that lies in unity and common purpose because we have allowed ourselves to become divided. And unless this senseless division is healed and until the fraternity has been reunited in vigorous pursuit of its objectives, we will remain ineffective and powerless to stand up and fight for our privileges which are in certain jeopardy.

The Federal Communications Commission is empowered to regulate the communication art by the Act of Congress of 1934, as Amended, and I suggest that every concerned amateur look into this document which can be found in many Public Libraries and is available for a nominal charge from the United States Government Printing Office. See what it is that the FCC is empowered to do and determine for yourself whether or not the Amateur and Citizen's Radio Service Division is living up to those responsibilities with which it is charged. If you find, as I have, that there are questions to be answered and satisfaction required, then sit down and write your Elected Representatives, your Senators, your Congressmen, noted hams who are in the public eye... and there are many of them. Forget about which faction you belong to, or which magazine you subscribe to, or which publisher's views you adhere to, or what you feel about this or that league. Remember that you are a member of a unique fraternity of communicators and technicians and that the really important thing right now is the survival of the fraternity under honest and realistic regulation. Don't ask for anarchy... Ask for common sense application of logic in rule-making.

If enough of us can see the real and hidden dangers in the present situation, there may be hope yet and time yet. But if we wait for the other guy to do the job, we will all be lost.

Norman J. Sternberg,
W2JUP/WB2ZWR
Levittown, New York

Tower Guys [*from page 40*]

may have to use a 1 inch pipe hickey to bend each strut (at the tower leg) to bring the outer end in a plane with the tower leg as each guy wire must be in the same vertical plane as the tower leg. (See Photo 2).

The guy wires are secured at the tower top in any convenient manner, provided the fastening point is capable of withstanding guying loads. Check with the tower manufacturer on this point. The guy wire may be almost any type as long as it is strong enough and designed for real guying . . . not the cheap aluminum or galvanized iron types sold for TV antenna installations. I used 5/16 inch steel core aluminum because it was available as a gift. Stainless steel aircraft type cable is preferred.

The lower ends of the guys are secured to the tower base through heavy duty 10" aluminum turnbuckles available from Sears. Photo 3 shows this end of the installation. In my case, the guys were secured to the tower 4 feet above ground level since the tower is hinged at this point. Lateral loads which the guys are taking are thus transmitted to the tower at a point 4 feet above the ground. In other installations, anchoring the lower ends of the guys to heavy screw eyes set securely into the tower's concrete base would transmit loads to the concrete base itself rather than the bottom of the tower. Use proper cable clamps and thimbles on all cable ends and be sure they're TIGHT.

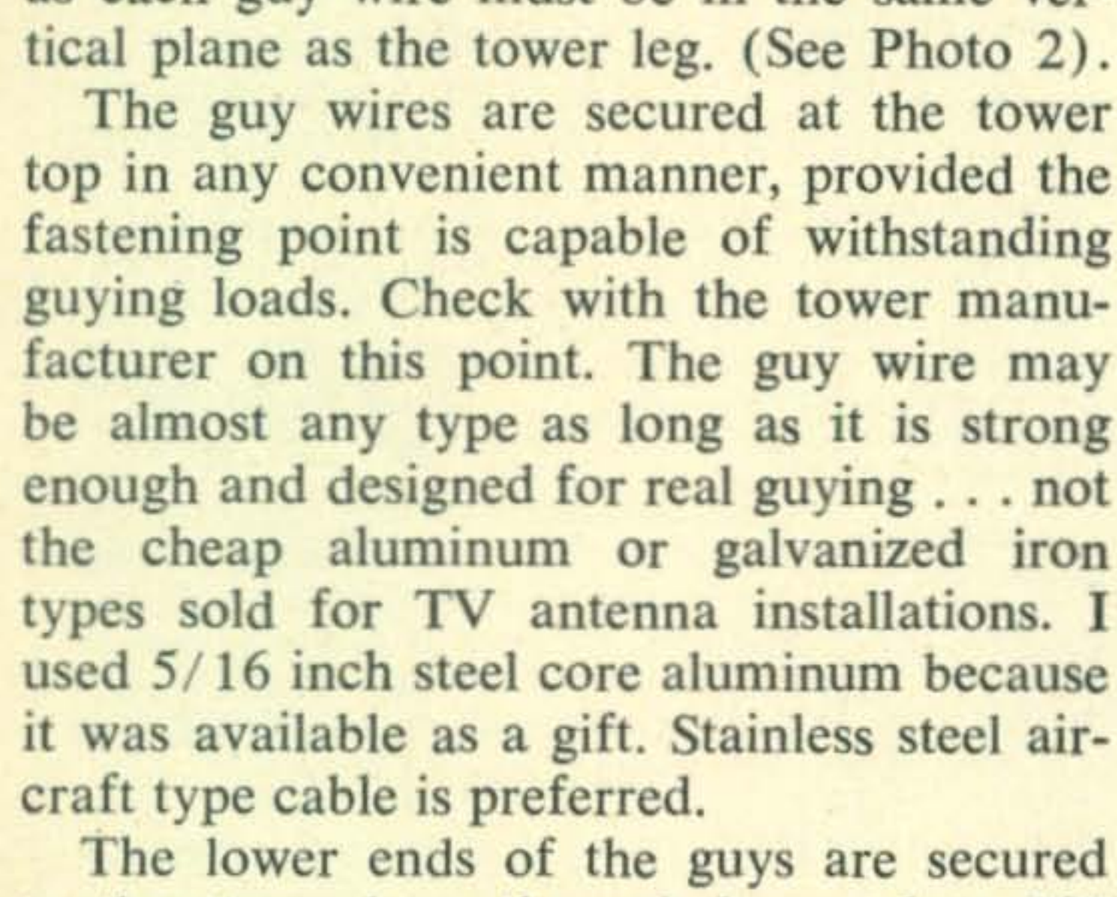


Photo 2—Close-up of strut installation showing slight "kick-bend" in one strut to align strut end with tower leg. Y-connector joins inner ends of struts.

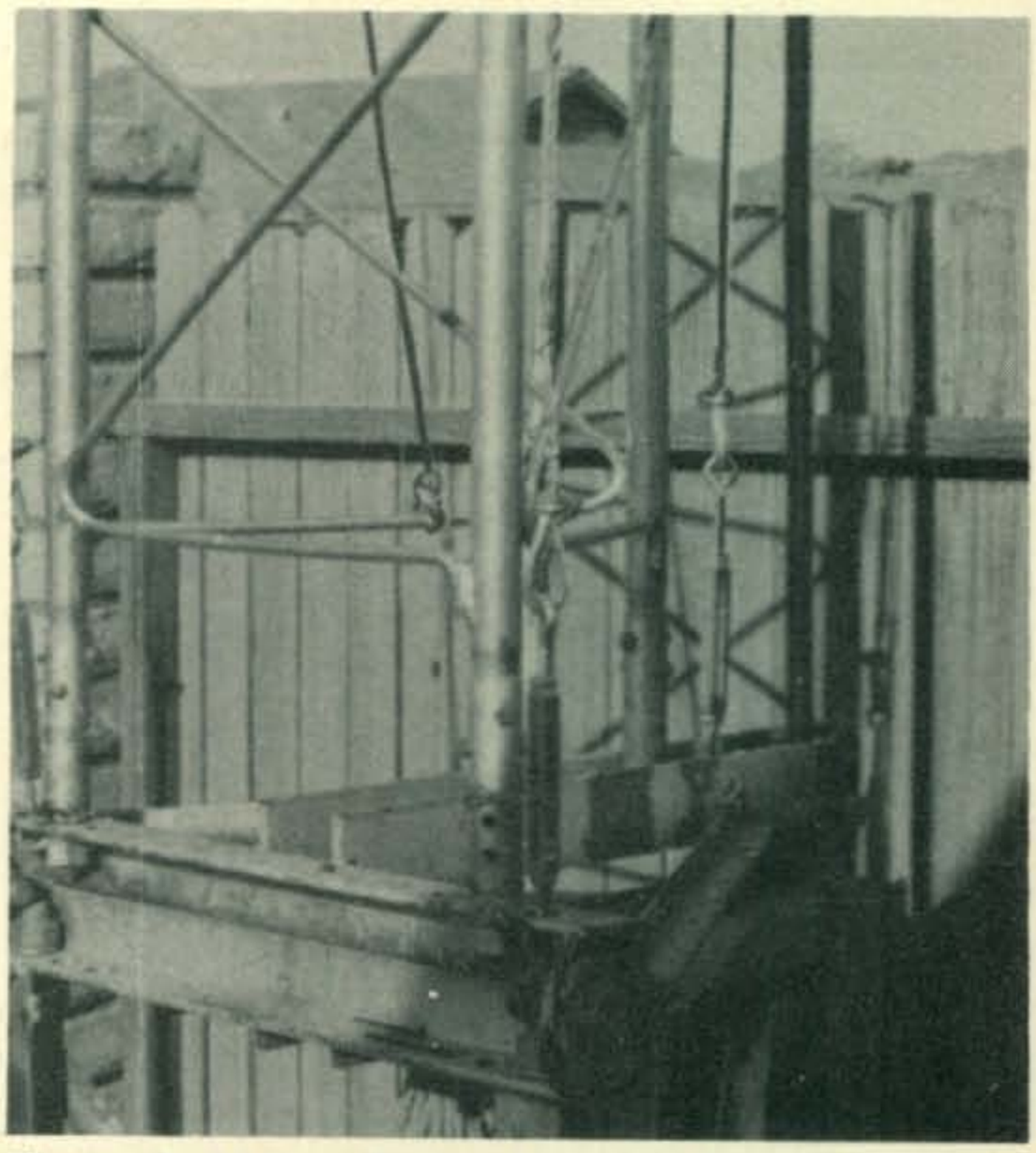


Photo 3—View of the base ends of the guys showing turnbuckles. Use proper hardware at both ends of the guys and protective sleeving where guys pass over struts.

The installation as pictured will easily double the strength of your existing tower and may serve the following purposes:

1. Strengthen your present tower, 2. Allow you to stack more beams on your present tower, 3. Let you economize by buying a slightly lighter free standing tower than you originally thought you needed, or 4. Allow you to get those guy wires out of everyone's way.

What it will *not* do is substitute for a well-installed tower or too small a concrete base. Remember that this form of guying only strengthens the tower itself, conventional guying strengthens the entire installation. The ability of a strut-guyed tower to remain standing in high wind situations is thus totally dependent upon the size, shape, strength and mass of the supporting concrete base, as well as the nature of the ground in which it is set. ■

CQ Country Chart

A two color, wall-sized country chart is available on poster stock and in large type for only $1.25 per copy postpaid. Address request to: CQ DX Country Chart, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

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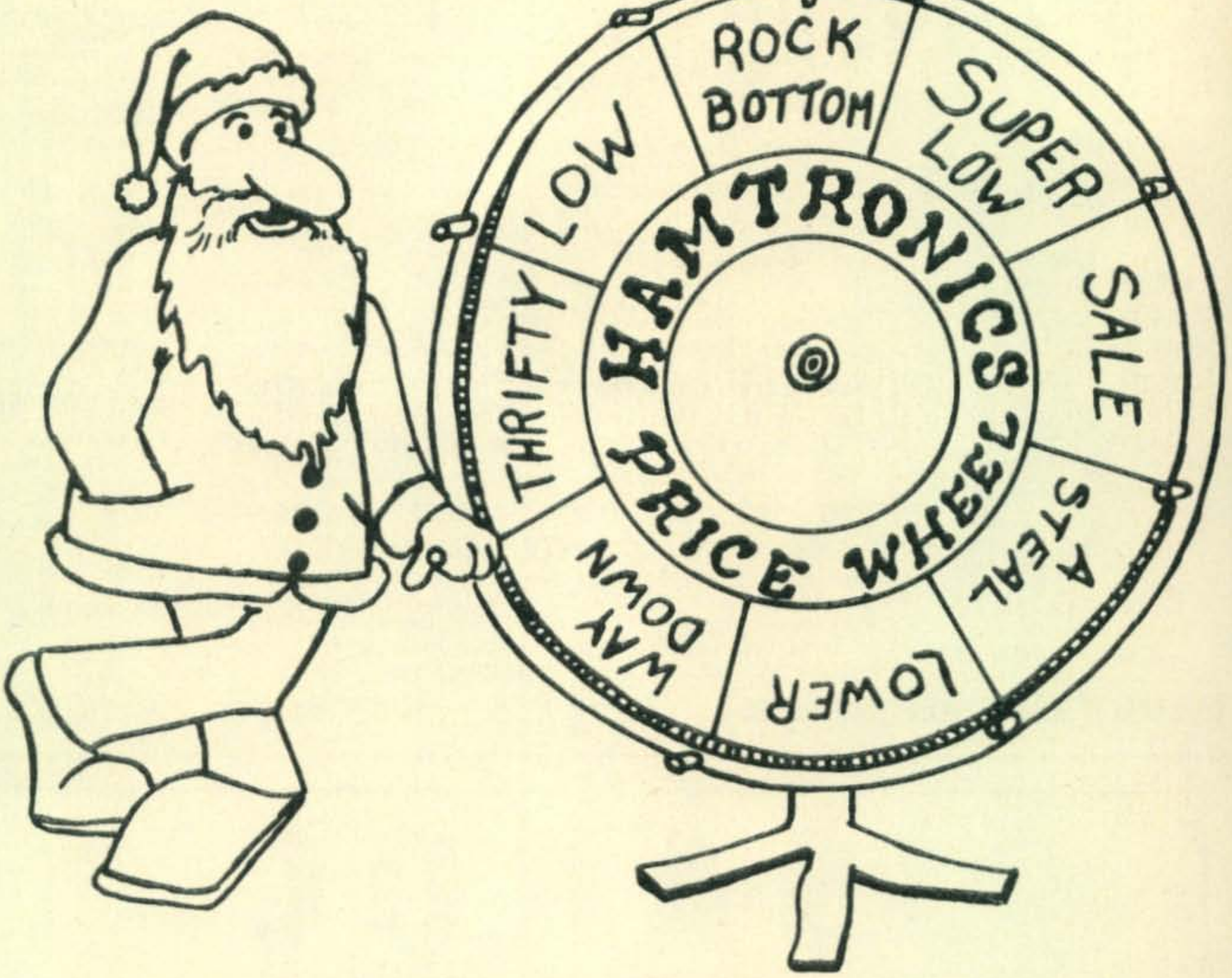

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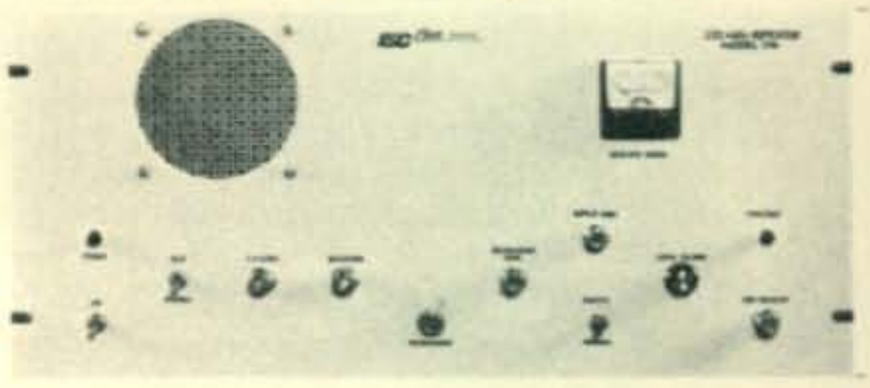

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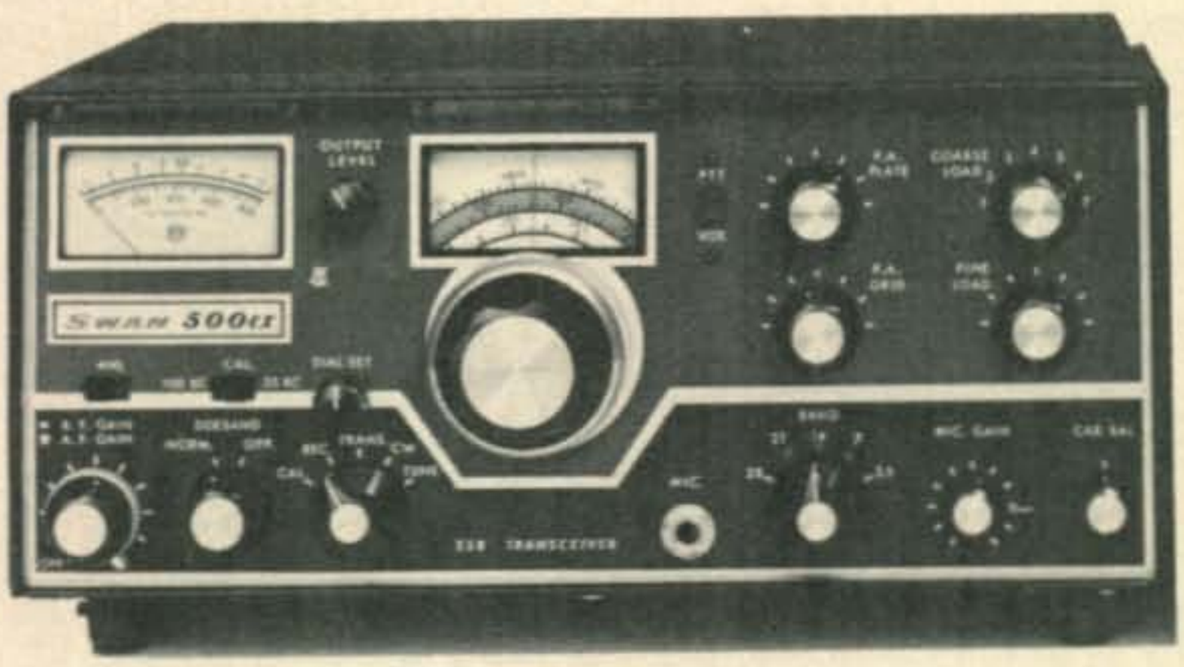

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SELL/TRADE: Friden STW-10 & 'Marchant calculators, $85. Some need clean & adjust $45. Printing adding machines, $25. Ameco TX-62/VFO-621 $125. Knight TR-108 $85. Conar TV camera, $90; 1851 Harpers Ferry Percussion Rifle, $750. 1816 Flintlock, $750. FOB WA3MEG, 12211 Valerie Ln., Laurel, MD 20810.

WANT TO BUY: Complete Collins KWM-2, or S-Line Outfit, also 30L-1 or 30S-1. Must be clean, and priced right. Richard Schark, 417 North Ferry, Ottumwa, IA 52501. (515) 682-5741.

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

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.

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Speaking French? I am interested to find teachers, students or individuals not necessarily fluent in French willing to speak French on Ham Bands with high school students. Catalina Radio Club, 3645 E. Pima, Tucson, AZ 85716.

ADULT BOOKS: Radio Telegraph Op's Lic. Q&A Manual by Kaufman, printed 70 by Hayden. New, never used. $5.50 ppd. for Comm. Telegraph Lic. J. De Shong, KSULB, 11847 E. 16th, Tulsa, OH 74128.

Ham Radio needs good public relations. Publicize all the worthwhile things hams are doing. Send me copies of articles. WA1GFJ, Gade 17 Whitney, East Hartford, CT 06118.

GALAXY R-530 with filters, $675. Kenwood R-599 with 6m converter, $350. W. Vincent, Dover Plains, NY 12522. RD Box 47.

TRADE 16mm movie camera w/turret head and 3 lens, cart loading, interested in matchbox, mobile transceiver or what have you. 367 NoWest Vacaville, CA 95688.

200 POUNDS: CQ-73-Electronic World, some issues missing. No duplicates. Make offer. W0LFH, Harold Roth, 602 W. Nebr., Algona, IA 50511.

SELL: 3600-0-3600 Plate Xfmrs 1 Amp $30, with 110/220 pri fob SB-101 CW filter, $15. W0AIH, Paul Bittner, 814 4th St., Virginia, MN 55792.

COLLINS R388, excellent and unmodified, with manual (51J3). Offer. Heath SB200 linear, fine condx., $165. N. Silk, W6NFV, 24023 Bessemer St., Woodland Hills, CA 91364.

Getting into photography. What have you. State price and condx. Jon Hart, WB2RTA, 26 William St., Glens Falls, NY 12801.

WANT: '71 ARRL Handbook, trade for $2, dozen old ham mags or '72 callbook and Fall '72 supply. Harry, WBZ0CS, 12 Croftan Ct., Malverne, NY 11565.

WANT: Manual for TS-326A/U test osc. Buy or borrow to copy. Also Jan '61 issue of 73. WA8-JEH, 23 Coolidge Ave., Columbus, OH 43228.

IDEAL STANDBY RECEIVER: Heath GR-78 160 thru 10 meters plus the broadcast band and the long wave aviation weather band. Operates on AC or self-contained automatically charging battery. Kit sold for $129.95. Built and in excel. shape, just $99. W9JKL, 860 Maple Tree Lane, Wadsworth, IL 60083. (213) 662-2354.

VERTICALS FOR SALE: Hy-Gain Mod. 18HT Hi-Tower verticals, $100.00 ea. Must pick up at my Qth, will not ship. J. Shank, 21 Terrace La., Elizabethtown, PA 17022.

MEMORY-MATIC 500 Keyer; 800 bit storage, plus new Vibroplex Paddle, $150.00. H. Richardson, 1109 Dakota SE, Albuquerque, NM 87108.

SELL: HYGAIN 3 element 15 mtr beam model 153BA $35. WA9HRN5 Whitehall Ct., Buffalo Grove, IL 60090. (312) 537-4655.

SELL: Heath Digi Prop R/C with 4 Servos, $140. Want Drake R4&T4X series. K0YRL, Joe, 914 E. "C", North Platte, NB 69101.

BOOKS: 1 A&P Mechanics manual by SWENG, '68 used. $2.50 ppd. Comm. Radio Op's Q&A Lic Guide, Ameco Cat. No. 901, $1.10. New, printed '71. J. De Shong, KSULB, 11847 E. 16th, Tulsa, OH 74128.

BC221 2-20 MHz freq. meter, $50. Pye Elect 22 W 2m base station $50. WA2KWB, 26 Valley View Road, Trenton, NJ 08620.

SELL: Astatic "G" Stand like new, $11; Swan VX-2 VOX access, $26.00. Simpson 260 VM exc, $22.50. Others. W2ASI, 15 Kensington Oval, New Rochelle, NY 10805.

SELL OR TRADE: Leeds-Northrop W-S Bridge, Model KS3011. Want Millen G.D.O. Model 90651. K5RME, POB 74, Ingram, TX 78025.

WANTED: Swan 350 with or w/o power supply. W4ZKH, Don Rose, 11 Ivanhoe Circle, Greenville, SC 29607.

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WANTED TO BUY: Collins KWM2. For Sale: 312B5, 30L1, PM2 and Sig F2 Ac supplies, all mint. Marty, (215) 884-6010. Jenkintown, PA.

ADULT BOOKS: 1 Radio Op's License, Q&A Manual, 7th Ed. By Kaufman, printed '71, by Hayden. $4.50 ppd. New. De Shong, KSULB, 11847 E. 16th, Tulsa, OH 74128.

KWS-1, 75A4 rec. 3000 series ser. no. Gud condx. Write Pete Ebie, WA6HZN/6, 6521 Cordoba Rd. Number 35, Goleta, CA 93017. (805) 968-6183. Best offer $750 plus.

MODEL 28LA-1 TTY: 3 speed 60/75/100 wpm gear shift; 120 AC motor, $100. W7MKB, 802 N. Rodney, Helena, MT 59601.

WANTED: Info on 160-meter coils for Central Electronics, 100V transmitter. W7JI, 235 E. 15th St., Tempe, AZ 85281.

SALE: Drake TR-4, $400; L-4 linear, $500. Both in mint condx and have brand new finals. Swan mod 530 SolidState Rcvr. 5 to 30 MHz, $650. WA8VFK. Springfield, OH 45506.

FOR SALE: Knight TR-108 and VFO 2 mtr transceiver AM. 117VAC/12VDC PS. K6THQ, P.O. Box 3344, Industry, CA 91744.

WANT: W2JAV RTTY TU-- reasonable but good cond. J. Wagner, 2175 Wagner Dr., Route 2, Box 142A, Caro, MI 48723. Give P.P. price.

FOR SALE: SB401; DX60 with VFO; Heath 400 Hz filter; Allied SX-190. WB8HWF, 546 Oakwood Ave., Newark, OH 43055.

YOU PICK UP: Hy-Gain 215B (231) 17.8 db gain 2-meter beam; also Hy-Gain 5BDQ 10-80, with traps and all but wire. $10 for either. Gene, WA5-ETK, 817 West 11th St., Littlefield, TX 79339. (806) 385-4167.

SELL OR SWAP: SX101, SX-42, Motorola 41v, BC-221, HW32A. Want HF Transceiver any condx. E. Sjolander, Jr., Box 262, Ashland, WI 54806.

WANTED: Probe MN2000. Sell: Heath SWR AM-2 $9. Harold Cushing, W6LXZ, 5224 Bobbie Ave., San Jose, CA 95130.

FOR SALE: Collins 75A4 s/N5200 2.1Khz, 500 cycle filters and speaker. Very good condx, $400. K2LCS, 163 Ledgewood Cir., Roch., NY 14615. $400.00.

SELL: Heath HW17, $105. HD10 keyer, new, $35. HG-10 vfo, needs work, $20. WA2PWI, Ralph Uttaro, 118 First Pl., Brooklyn, NY 11231.

SELL: Webster Band Spanner mobile ant, $15. Collins 56E1 D.C. supply, $65. A. Bell, Slickville, PA 15684.

WANT: info on Signetics Dolby "B" chips. W. Adams, Box 324, Fishkill, NY 12524.

SELL OR TRADE: Hallicrafters S-76, $30; Elmac RF-67, PMR-7, PSR612, and AC/PS. $75.00.— Command xmtr 7-9mc and P/S. $20.00. Gonset Converter 3.5-30mc. $10.00. WN5JXD, 900 No. Willard, Altus, OK 73521.

T-SHIRTS with your call in 4" letters. State color and size, $3.50. Bill Zandrew, K9VPS, 3110 Wisconsin, Berwyn, IL 60402.

CLEGG 27B-4 sale. Excel. cond., $350.00, 6 mos. old. Touch Pad, $35.00. Ready to use w/or w/o Clegg 27B. WA3UAR/4, 35 Metropark, W., Columbia, SC 29169 or call 803-794-1507.

FOR SALE: KWS-1, Number 1451, $850. 75A-4 Number 4856, 0.5, 3.1, 6.0 filters, spkr, $525. Others. James W. Craig, 29 Sherburne Ave., Portsmouth, NH 03801.

SWAP: Motorola mobile dynamic mic, for Crystal, or ceramic mobile mic, bug, speedkey, or ? K4EXF, Marx, 215 E. Illinois Ave., New Port Richey, FL 33552.

MINT: Drake R-4B, 160 meter, WWV. $350. WA1HFN, Joel Peisach, 20 Bulkley Rd., Sudbury, MA 01776.

SELL: New 811A porcelain tube sockets. 4 at $3.50 postage paid. WA4RDV, 1145 Kerns Ave. SW Roanoke, VA 24015.

TRADE: Mint 1200w Swan Linear for Heath SB-200. So. Cal. only. Will pick-up. John Larson, RT. 1, Box 105 B, Rosamond, CA 93560.

SELL OR SWAP: CV-591A/URR SSB rec. conv. I.F. input 225-1500KHz as is with manual. K8-HWW, 33727 Brownlea Sterling Hts., MI 48077.

SELL: Drake 2NT manual and cables, mint condx, $95. J. G. Swaney, 10534 California Ave., Aurora, OH 44202. (216) 562-6747.

WANT: Weston Model 301 meters regardless of condition. Will trade for or pay cash. James Fred, Cutler, IN 46920.

CHESTER COUNTY (Penna) ARC meets last Thursday in West Chester. For information, call W3HUS, 827-7374.

FOR SALE: ARRL Handbooks, 1947, 57, 59, 53, 51 and 62. $3 each fob. 1937-1938 Jones Handbook, $5 each fob. Douglas, W6CUG, 2254 Pepper, Concord, CA 94520.

DON'T USE YOUR WATCH! Buy a readable 24-hr wall clock from us. Battery or electric. Steve WB5BNM, 1524 N. Okla., Shawnee, OK 74801.

SELL OR TRADE: Tele-Rollic Flex 2-1/4" sq. negative with Sonnar F4-135mm lens and case for FT101 or TS900. Mace, 8600 Skyline Dr., Hollywood, CA 90046.

HY-GAIN 5BDQ $20; P&H AFC-2 Compressor $20; HA410 complete, $75. Others. Art Ford, W2HAE, 56 Gildare Dr., E. Northport, NY 11731.

WANTED: Hallicrafters HA20 DX Adapter State price and condx. WA9HRN, 5 Whitehall Ct., Buffalo Grove, IL 60090. (312) 537-4655.

SELL: SBE34 transceiver excellent condx. $125. Mike and book included. Henry Ankeny, 420 S. 16th, Clarinda, IA 51632.

WANTED: Hallicrafters T-54 television or similar, condition unimportant. Sjolander, Jr., Box 262, Ashland, WI 54806.

SBE-34 transceiver with mobile mount, $250 or best offer. Also Hustler antennae with 20 & 40 coils for $35. Rig has about 25 hrs. use. K4FCZ, 620 NE 21st Ave., Ocala, FL 32670.

FOR SALE: AC adaptors, 6VDC 150MA, standard plug, brand new, $3.00 postpaid. K2MFY, 2 Nutley Ct., Plainview, NY 11803.

WANTED: Gonset, sidewinders, any condition. For sale Heath Mobile KW HA14, HP14, $130. WA8-ZCO, 16245 Beechwood, B'Ham, MI 48009.

FOR SALE: Battery Charger for E.F. Johnson P. P. (250-0846-001), $10.50. Ross Hansen, WN7-TZU, Preston, ID 83263.

CALL LETTER License Plates wanted for collection. I'll pay postage. Art Phillips, WA7NXL, 3401 N. Columbus, Apt. 5-O, Tucson, AZ 85712.

SON WANTS OLD LICENSE PLATES. No Calif. please. Will reimburse postage. WB6KKI, 217 Santa Mariana, La Puente, CA 91746.

SELL: 2EL Hy-Gain 402-B 40 Mtr. beam, best offer. Locals preferred. M. E. Knowles, 9 Brown St., No. Billerica, MA 01862.

CLEANING OUT text books on propagation, antennas and other technical subjects. Send S.a.s.e. for list of bargain prices. George Jacobs, W2ASK, 11307 Clara St., Silver Spring, MD 20902.

DX150-Realistic for sale. John Loseman, Route 2, Box 27, Batesville, AR. $75.00.

CANADIANS Free 120 page Electronics Catalog. ETCO, 464A McGill, Montreal.

WANTED: Sam's CB Series books. Also International, 6024 Freq. meter. Stidfole, 820 Summit, Rogers, AR 72756.

FERRIS Model 16C Standard Signal Generator 50 kc-28 mc, less power supply, $85 plus freight. L.T. Smith, 3108 N. Lincoln, Stillwater, OK 74074.

HT-44, SX-117, PS-150-120 AC sup, $420; CC-1 with CPS-1, SCC-1, 6&2 conv., $120. Gonset G-50, $85. WB2WTJ, 1720 77th St., Brooklyn, NY 11214.

FOR SALE: Galaxy GT550 with CAL 25 calibrator and cooling fan, $325. AC550 supply and speaker $50. W8IIT, 281 Jenny Ln., Dayton, OH 45459.

WANT: Swan 14-C D.C. P.S. unit; and Hustler 80-10 super resonators, bumper mount. and Mast. Markey, 372 Euclid Ave., Number 210, Oakland, CA 94610.

HP524C w/525A 100 mc plug-in, complete w/manuals, $375. B&K 415 used once, $300. FOB. Pete Graulich, WB2NRU, 1157 Concord Dr., Haddonfield, NJ 08033.

TRADE old 5" Hickok scope, working condition, nd 10, 15, 20 meter beam and, or, rotator, working condx. W9EBH, Frank H. Carlson, Aledo, IL 61231.

FOR SALE: Lafayette Receiver, Model KT-320, $25. Martin Rexsen, W2FEI, 495 Oxford Rd., Cedarhurst, NY 11516. (516) 295-5411.

SOLDER: 1 pound spools USA 60/40 rosin core size .032, $2.75 postpaid 48 states. K5ENL, Ed Block, Rt. 4, Grandview, TX 76050.

FOR SALE: Halli: HT-37 xmtr, xlnt cond, w/ manual, $175. Collins- R388(51J) Rel gud cond, w/manual, $375. Rich, WA6LBA, 518 Sutter St., Salinas, CA 93901. 408-449-3395.

DOWKEY Relay 110V $9. Heath SWR $8. CQ-QST, 5 cents postage 4X5 Foto Enlarger 16 mm cameras. New wheel for 1968 Airstream trailer Frentz, Deerwood, MN 56444. Rt. 1, Box 12.

OLD RADIO and wireless equipment wanted. Early battery rcvrs, magazines, catalogs, books, handbks, and call books. Will pay cash or trade CQ's or QST's Erv Rasmussen, 164 Lowell St., Redwood City, CA 94062.

WANTED: TenTec SSB Transceiver matching SS linear. Must be A-1 es reasonable. SELL: Exclnt Heath station console, $59. Exclnt Viking I w/ VFO, $65. Plus shipping. Lindblom, 512 Grandview, Chillicothe, MO. 64601.

WANTED: Any serviceable tuning coils for HRO-60. Contact W0ONL/KL7, 1118 W. Oak, Ft. Collins, CO 80521.

WANT: Schematic for my E.H. Scott Model Number Q-314 receiver. Set uses p/p 2A3's, p/p 56's & a 55 in the audio section. Tubes Number 58 are used in the RF and IF stages w/ a 2A7 mixer and 56 oscillator. The set tunes from 540 kc. to 22 Mc. Orville Schmidt, W7TLA, 3812 5th Ave. North, Great Falls, Montana 59401.

TRANSFORMERS REWOUND. Jess Price, W4-CLJ, 507 Raehn St., Orlando, FL 32806. (305) 425-7251.

WILL BUY for cash if price is right: Your Collins gear. State type and condx. W4AIS, 300 Thornwood Dr., Taylors, SC 29687.

GONSET Police hi-low rec., $40. Sig Gen 5-100 mc, $40, GE 150 mc FM xceiver, $25, Motorola quick call 4 ch decoder, $25. K6KZT, 4434 Josie Ave., Lakewood, CA 90713.

UHF GEAR, VFO xmttr, rcvr, ac p.s. 200 mc (R48, T30) A1 condx, ARC-27, 55 etc. Free price list. SASE. WA2WYH, 2366, E. 23rd St., Brooklyn, NY 11229.

SELL: RBA,-B, and -C with P/S and Cables- $100. HP500B Freq. Meter, $50. UCS300, $20, new L and N Strip Chart Recorders. Inquire. Trammell, 1507 White Oak Ct., Martinsville, VA 24112.

UNUSED Zero Center Micro Ammeters, $6 PP48. John,605 Cherry, Vandenberg, CA 93437. W7ZFB.

PRC 10 radio sets, AM 589 amplifier power supply. Other military types of equipment for sale or trade. M.P. Murphy, 738 Laguna, El Cajon, CA 92020.

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SELL: N.T.S. Course in color TV. Serv. Delta CD Ignition System. B.O., W1AAV, 544 Main St., Medford, MA 02155. (617) 391-6029.

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WANTED: Robot SSTV camera and monitor. Pls state condition and price. All replies answered. L. Langevin, 42 Prospect St., Ludlow, MA 01056.

WANTED: 1945-46 CQ magazines for my collection. I have extra CQ and QST for sale or trade also. Please send info to W0LV, Carl Hvambsal, 5447 Chicago Ave., Minneapolis, MN 55417.

XFMRS 4500 volt 1.7 amp, 220 tapped primary, $65. TS175/U $45. TS382C/U $55. FOB A. Begel, 55 Bear Hill Rd., Cumberland, RI 02864.

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YAESU: FR-DX-400 FL-DX400 combo. With Spr., $495. Excell. condx. Alan Winters, W7WJP, 20005 10th W, Lynnwood, WN 98036.

OSCILLOSCOPE: Heath IO-14 8 MHz Triggered Sweep delay line, DC coupling, with probe. Like new. $200.00. W2DV, Essex Fells, NJ 07021.

JOHNSON RANGER II Xmtr, $110. I pay shipping. WA8ONP, 612 Jennings, Salem, OH 44460. (216) 337-7518.

WANTED: Tri-Band Beam, 40 mtr beam & VHF yagis. State price postpaid. Paul, WA8JEI, 38251 Elmite, Mt. Clemens, MI 48043.

WANTED: Swan 250, 117XC, state lowest price, condition & serial number. Sell or trade Heathkit counter IB-101. Make offer. Richardson, 1109 Dakota SE, Albu., NM 87108.

FOR SALE: AC adaptors, 6 VDC 150 MA, standard plug, brand new, $3.00. Postpaid. K2MFY, 2 Nutley Ct., Plainview, NY 11803.

WANTED: Gonset 2mtr Sidewinder. Gonset 2 mtr 500w.amp & VHF/UHF gear. Paul, WA8JEI, 38251 Elmite, Mt. Clemens, MI 48043.

SELL: Yaesu FTDX-560. In mint condx. Used only on cw. $400.00 firm. You ship. W9MCJ, 19600 DuBois, South Bend, IN 46637.

AVCOM TN-421 tone burst, $15. Crystals for Drake TR-22, 46/88, 88/88, 147.45/75; $6 pr. Auslander, 1499 N. Meadow Rd., Merrick, NY 11566.

FOR SALE: SB-313 SWL Receiver covering 80, 49, 40, 31, 25, 20, 19, 16 and 13 meter bands. $275.00. W8TXX, 1733 Santa Maria, Stevensville, MI 49127.

SELL: HT44, PS150, SX117, $400. Heath AM2 $10; Warrior kw $100. BNI $5. Compreamp, $15. K5MWZ, Box 16099, Ft. Worth, TX 76133.

HEATH SB-401 Xtal pack, unused, $20 delivered. Charles Smith, Box 543, Conyers, GA 30207.

COLLINS 32S-3 and 516F-2, $575. 75S-3, $375. R-4B $325 or make offer. Clem, K8HWW, 33727 Brownlea, Sterling Hts., MI 48077.

220mHz GEAR: Tecraft Xmtr, H.B.A.C. pwr sup. and relay, $55. 145in 220out mixer am, cw, ssb & fm. 5 w out with p.s. $40.00. Paul, WA8JEI, 38251 Elmite, Mt. Clemens, MI 48043.

GONSET G-50, $115; Clegg 99'er, with HA-5 VFO $75. Both A-1 wanted; Swan 6B Linear. Russell, 19680 Mountville Dr., Maple Hts., OH 44137.

4CX1000/8168, Brand new, in seal pkg., $75. Eico scope Mod. 425, $25; RCA Voltohmyst--VTVM, $25; both in very gud condx. WA8VFK, 314 So. Western Ave., Springfield, OH 45506.

SALE: SB-220 Linear. Exc condx. $325. Collins 75S-1, with spk, Q-multi. $250. K7PBU, 14826 Madison Way, Lynnwood, WA 98036. (206) 743-4441.

18 QST Binders, $32. CQ, 1946-70, $75. QST 1931-70, $120. George Rulffs, K1FTR, RFD 1, Sebago Lake, ME 04075.

SELL: Used guaranteed PL-172 tubes, $50. Chimneys, $8. 4-400A metal sockets, $6. Chimneys, $6. Others. Trammell, 1507 White Oak Ct., Martinsville, VA 24112.

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SELL: Hallicrafter S-38-C, good condx, $25.00; Dynamic mike, new, $5.00; old QST & CQ. B. Nastoff, 320 W. 56th Pl., Merrillville, IN 46410.

SELL: Heath Post Marker Sweep Generator IG57A mint, $110.00. Heath scope, $90 Mint. Heath HW12A 80 transceiver, mint $100. W2GHF, 45 Allen Dr., Woodstock, NY 12498.

MUST SELL: Swan FM-2x with A/C sup & mike. Factory xtals. Mint condition. $225 or best offer. WA3RJM, 1180 Ruxton Rd., York, PA 17403.

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SELL: Drake TR-4 34PNB, AC4, MS4, RV4, DC3, SB200, Class-33. Package deal only, best offer. K8YNO, 5632 Haughey, SW, Grand Rapids, MI 49508.

BROADCAST EQUIPMENT WANTED: Battered, scratched or mint, but cheap. FM transmitters, antennas, monitors, consoles, what have you. State condx and price. WA9VLK, 719 W. Water, Kankakee, IL 60901.

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SELL: Clegg 99'er with HA-5 VFO, and Micro. A1, $85. Russell, 19680 Mountville Dr., Maple Hts., OH 44137. (216) 662-2175.

TRANSISTORS: 14 silicon on new circuit board plus many other parts, capacitors, resistors, etc. $3.00 PP 48. K4VCP, 2537 Cannaday Rd NE, Roanoke, VA 24012.

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FOR SALE: Heathkit telephone amp model GD-1024. Also have a few new 4CX250B tubes. Looking for SSTV monitor and camera. L. Langevin, 42 Prospect St., Ludlow, MA 01056.

SELL: HR-2A, 2 meter transceiver, include 34/94, 94/94, 16/76, 22/82, 28/88, 46/88 xtals. 1 yr. old. $180. W9MKR, 447 Belden, Chicago, IL 60614.

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DRAKE R4B perfect, $295 or offer. H. Tatar, M.D., 1625 N. Park Blvd., Cleveland Hts., OH 44106.

HEATH DX-60B perfect, never on air, $70 or best offer. Prefer pickup. D. Yao, WA3MQJ, 116 1942 Hall, Princeton, NJ 08540.

SELL: HQ-170 rcvr. Vy gud. $125. Knight T-150 xmtr w/relay. Excel. $60. Both $175. Plus post. K3HBP, 14 Balsam, Wilm., DE 19804.

FOR SALE: Tecraft TR20/50 with mike, home-made supply, and change over relay, $30.00. Tecraft 6 mtr converter with supply, $10. W8YLJ, D. Carlin, RR1, Bryan, OH 43506.

HEATHKIT SB620 Scanalyzer, $100. Heathkit IB-101 Freq. Counter. Heath IB-102 Scaler, $250. Joe, WB2ROL, 50 Old Oak, Levittown, NY 11756.

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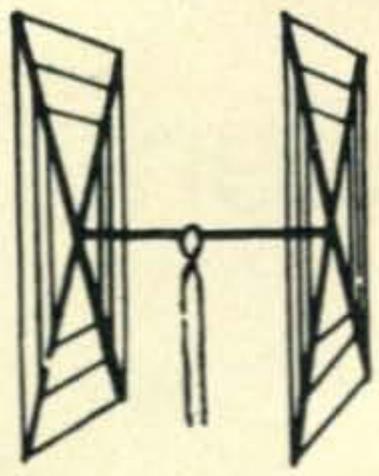
WHICH ANTENNA WINS THE CONTEST ?

In open competition against thousands of commercial and home-brew antennas, WA1JFG won the New England championship with a Gotham beam, by a margin of 5,982 points! WB2JAM won the sectional award for the Sweepstake contest in 1969 and 1970 with a Gotham 4-element 15 meter beam! Hundreds of unsolicited testimonials from grateful hams are our proof that Gotham antennas give you the best design, and the best materials. Forget our low prices - rely on the results of open, competitive contests. Ask yourself: Why do Gotham antennas win?

QUADS

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



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

10/15/20 CUBICAL QUAD SPECIFICATIONS

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

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

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

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

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

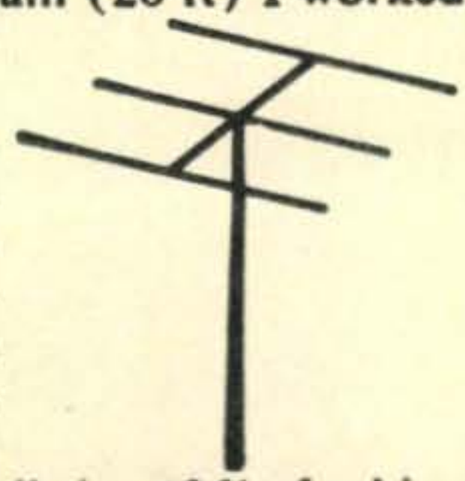
10-15-20 CUBICAL QUAD	$41.00
10-15 CUBICAL QUAD	36.00
15-20 CUBICAL QUAD	38.00
TWENTY METER CUBICAL QUAD	31.00
FIFTEEN METER CUBICAL QUAD	30.00
TEN METER CUBICAL QUAD	29.00

(all use single coax feedline)

GOTHAM
2051 Northwest 2nd Ave., Miami, Fla. 33127 Dept. CQ,

BEAMS

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



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

2 EL 20	$25	4 EL 10	24
3 EL 20	31*	7 EL 10	38*
4 EL 20	38*	4 EL 6	24
2 EL 15	21	8 EL 6	34*
3 EL 15	25	12 EL 2	31*
4 EL 15	31*	*20' Boom	
5 EL 15	34*		

ALL-BAND VERTICALS

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

V40 vertical for 40, 20, 15, 10, 6 meters	$18.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$20.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$22.95

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YAESU

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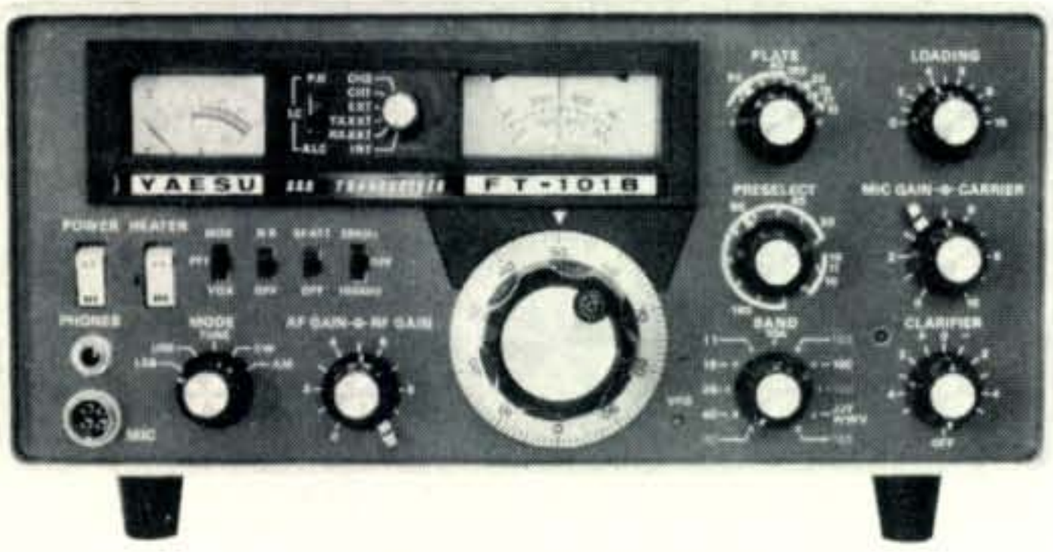
Amateur Price Net
Subject to Change

IT'S HERE NOW The NEW FT101B

With These Added Features and NO INCREASE IN PRICE



$649.00

1. VFO (warning lite) on or off
2. Clarifier (warning lite) on or off
3. Noise blanker on insert card
4. 8 pole filter for better rejection
5. Sidetone output
6. Antitrip input

Amateurs *and* Maritime operators around the world have discovered the FT101's versatility and reliability. Many of the outstanding signals you hear are using the FT101. It's all here—AM, CW, SSB. Receiver sensitivity 0.3 microvolts 10dB signal to noise ratio. 160 meters through 10 meters. Citizen's Band, WWV, 25 and 100 kc calibrators, 5 kc clarifier for net or mobile operation. The built-in noise blanker assures in-motion mobile-peak performance with minimum of noise.

Transmitter stability under most adverse conditions is superb. PEP 260 watts SSB, 80 watts AM, 180 watts CW. 117 V AC supply built-in. 12 V DC fused power cable, AC cable, all accessory plugs are furnished. Matching units available for FT101B, FP101 patch, FP101, speaker FV101 VFO, FL2100 linear. See your local dealer for demo and brochure.

DEALER'S SERVICE POLICY—Factory Service available after warranty has expired.

ADIRONDACK RADIO SUPPLY 518-842-8350
185 West Main Street, Amsterdam, New York 12010

AMATEUR ELECTRONIC SUPPLY 414-442-4200
4828 W. Fond du Lac Ave., Milwaukee, Wisc. 53216

AMATEUR ELECTRONIC SUPPLY 305-894-3238
621 Commonwealth Avenue, Orlando, Florida 32803

FRECK RADIO SUPPLY 704-254-9551
38 Biltmore Avenue, Asheville, North Carolina 28807

GRAHAM ELECTRONICS 317-634-8486
133 S. Pennsylvania St., Indianapolis, Indiana 46204

HAM RADIO CENTER 314-993-6060
8342 Olive Blvd., St. Louis, Missouri 63132

HAM RADIO OUTLET 415-342-5757
999 Howard Avenue, Burlingame, California 94010

HAMTRONICS 215-357-1400
4033 Brownsville Rd., Trevose, Pennsylvania 19047

HARRISON RADIO 516-293-7990
20 Smith Street, Farmingdale, LI, New York 11735

HENRY RADIO 213-272-0861
11240 W. Olympic Blvd., Los Angeles, California 90064

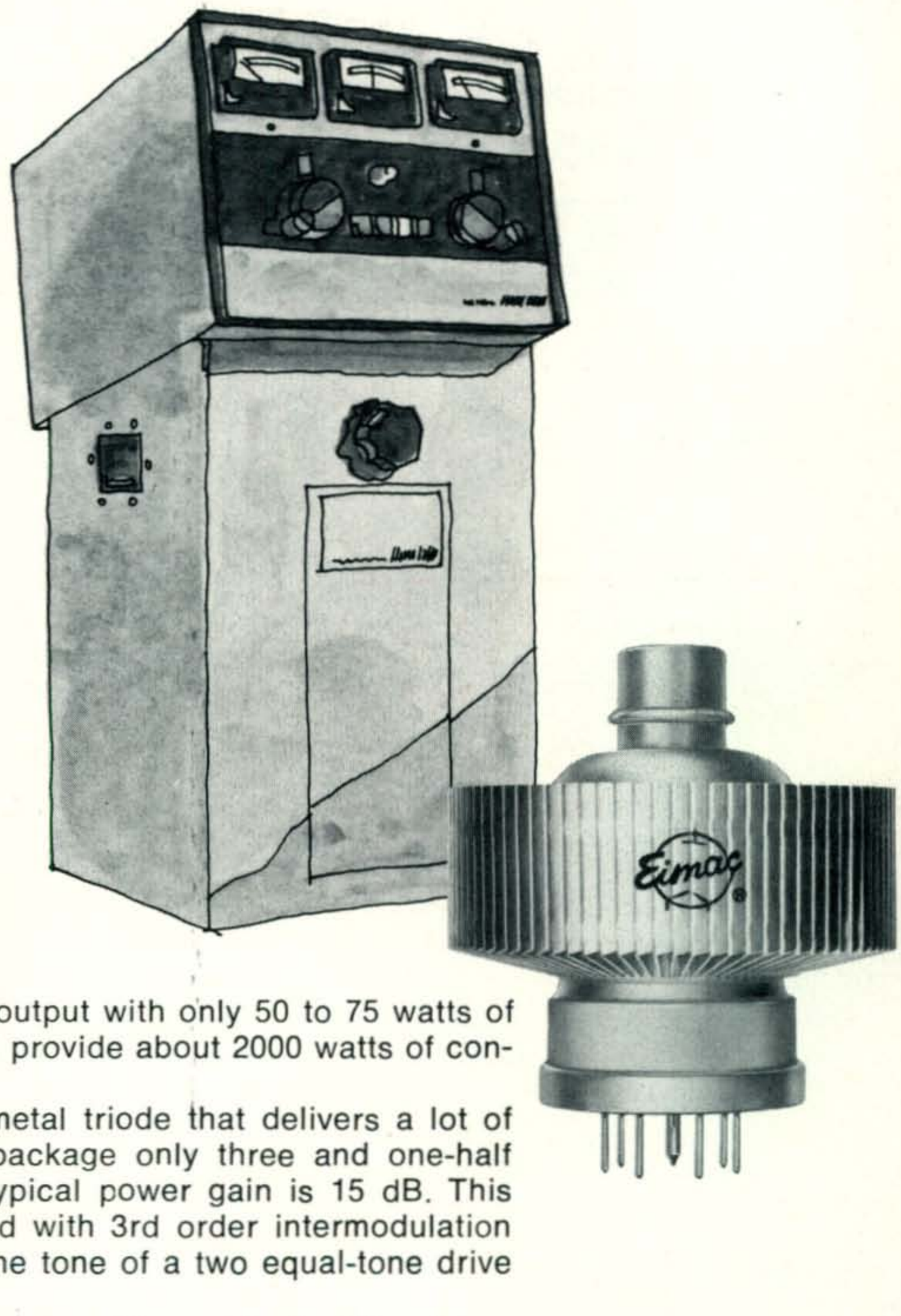
JUGE ELECTRONICS 817-926-5221
3850 S. Freeway, Fort Worth, Texas 76110

RACOM ELECTRONICS 206-255-6656
15051 S.E. 128th St., Renton, Washington 99055

WEBSTER RADIO 209-224-5111
2602 Ashlan, Fresno, California 97326

WILSON ELECTRONICS 702-451-6650
P.O. BOX 116, Pittman, Nevada 89044

EIMAC's rugged 8877 powers Henry Radio's reliable 4K Ultra linear commercial amplifier.



When Henry Radio set out to design a sophisticated linear amplifier for high reliability communications in the high frequency range, they chose EIMAC's high-mu 8877 power triode.

The result is the new 4K Ultra, which operates with 4000 watts input in heavy-duty commercial service. The 4K employs continuous variable capacitive and inductive elements tunable over the 3.0 to 30 MHz range. Optimum input and load conditions are provided for a wide variation in antenna systems. EIMAC's 8877 enables the 4K to deliver over 2500 watts of continuous SSB or CW output with only 50 to 75 watts of drive. For RTTY the 4K will provide about 2000 watts of continuous duty output.

The 8877 is a ceramic-metal triode that delivers a lot of power and linearity in a package only three and one-half inches high. At 30 MHz, typical power gain is 15 dB. This impressive gain is achieved with 3rd order intermodulation products −38 dB below one tone of a two equal-tone drive signal.

With Henry Radio, you know quality counts. And they know you can't do better than EIMAC. For full specifications on the 8877, write to EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070. Or contact one of the more than 30 Varian/EIMAC Electron Tube and Device Group Sales Offices throughout the world.

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division
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