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Amateur Radio

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JUNE 1978 $1.50

CQ

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THE RADIO AMATEUR'S JOURNAL

74820 08240

KENWOOD

...pacesetter in amateur radio

STILL THE SAME FINE, TIME PROVEN RIG. BUT NOW WITH THE SIMPLE ADDITION OF A PLUG-IN CRYSTAL, THE TS-700SP WILL BE ABLE TO UTILIZE THE NEW REPEATER SUB-BAND WHEN IT BECOMES AVAILABLE. STILL FEATURES ALL OF THE FINE ATTRIBUTES OF THE TS-700S: A DIGITAL FREQUENCY DISPLAY, RECEIVER PRE-AMP, VOX, SEMI-BREAK IN, AND CW SIDETONE. OF COURSE, IT'S ALL MODE, 144-148 MHZ, VFO CONTROLLED . . . AND KENWOOD QUALITY THROUGHOUT.

Features: 4 MHz band coverage (144 to 148 MHz) • Repeater offset capability on all FCC authorized repeater sub-bands including 144.5-145.5 MHz • Operates all modes: SSB (upper and lower), FM, AM and CW • Digital readout with "Kenwood Blue" digits • Receiver pre-amp • 1 watt low power switch • Built-in VOX • Semi break-in on CW • CW sidetone • Completely solid state circuitry provides stable, long lasting, trouble-free operation • AC and DC capability (operate from your car, boat, or as a base station through its built-in power supply) • Automatically switches transmit frequency 600 kHz for repeater operation. Simply dial in your receive frequency and the radio does the rest . . . simplex, repeater, reverse • Or accomplish the same by plugging a single crystal into one of the 11 crystal positions for your favorite channel • Transmit/Receive capability on 44 channels with 11 crystals.

TS-700SP

The TS-700SP shown with the matching VFO-700S and SP-70. Also shown is Kenwood's new MC-30 noise cancelling hand held microphone, HS-4 headphone set and the MC-50 dynamic microphone.

arma

TRIO-KENWOOD COMMUNICATIONS INC.
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This NEW MFJ Versa Tuner II . . .

has SWR and dual range wattmeter, antenna switch, efficient airwound inductor, built in balun. Up to 300 watts RF output. Matches everything from 160 thru 10 Meters: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balance lines, coax lines.

BRAND NEW

$79.95

Antenna matching capacitor. 208 pf. 1000 volt spacing.

Sets power range, 300 and 30 watts. Pull for SWR.

Meter reads SWR and RF watts in 2 ranges.

Efficient airwound inductor gives more watts out and less losses.

Transmitter matching capacitor. 208 pf. 1000 volt spacing.

Only MFJ gives you this MFJ-941 Versa Tuner II with all these features at this price:

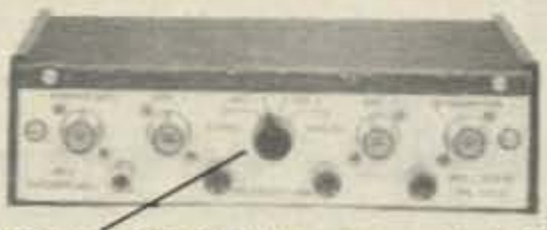
A SWR and dual range wattmeter (300 and 30 watts full scale) lets you measure RF power output for simplified tuning.

An antenna switch lets you select 2 coax fed antennas, random wire or balance line, and tuner bypass.

A new efficient airwound inductor (12 positions) gives you less losses than a tapped toroid for more watts out.

A 1:4 balun for balance lines. 1000 volt capacitor spacing. Mounting brackets for mobile installations (not shown).

With the NEW MFJ Versa Tuner II you can run your full transceiver power output — up to 300 watts RF power output — and match your transmitter to **any** feedline from 160 thru 10 Meters whether you have coax cable, balance line, or random wire.



ANTENNA SWITCH lets you select 2 coax fed antennas, random wire or balance line, and tuner bypass.

You can tune out the SWR on your dipole, inverted vee, random wire, vertical, mobile whip, beam, quad, or whatever you have.

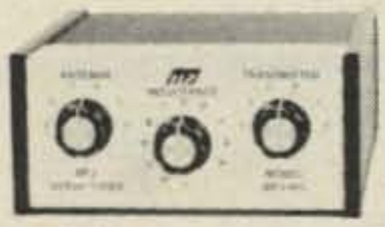
You can even operate all bands with just one existing antenna. No need to put up separate antennas for each band.

Increase the usable bandwidth of your mobile whip by tuning out the SWR **from inside your car.** Works great with all solid state rigs (like the Atlas) and with all tube type rigs.

It travels well, too. Its ultra compact size 5x2x6 inches fits easily in a small corner of your suitcase.

This beautiful little tuner is housed in a deluxe eggshell white Ten-Tec enclosure with walnut grain sides.

SO-239 coax connectors are provided for transmitter input and coax fed antennas. Quality five way binding posts are used for the balance line inputs (2), random wire input (1), and ground (1).



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MFJ-900 ECONO TUNER

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6 channel capability • selectable 1 or 2 - 1 or 5 Watts output • Solid-state • Battery level meter • Earphone jack • Built-in charging terminals and separate charging jack for Ni-cad batteries • Flex antenna • Carrying case standard • Excellent frequency stability allows use with booster amplifier for high power output over 100 Watts • 8 AA batteries or 10 AA Ni-cads.*

*Not furnished.

FCC Type accepted models available.

TEMPO VHF & UHF AMPLIFIERS

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Drive Power	Output	Model No.	Price
2W	130W	130A02	$199
10W	130W	130A10	$179
30W	130W	130A30	$189
2W	80W	80A02	$169
10W	80W	80A10	$149
30W	80W	80A30	$159

UHF (400 to 512 MHz)

Drive Power	Output	Model No.	Price
2W	70W	70D02	$270
10W	70W	70D10	$250
30W	70W	70D30	$210
2W	40W	40D02	$180
10W	40W	40D10	$145
2W	10W	10D02	$125

FCC Type accepted models available.

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Henry Radio

CIRCLE 24 ON READER SERVICE CARD

CQ

JUNE, 1978 VOL. 34, NO. 6

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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Zero Bias

an editorial

What's Cookin' on 10?

It's too soon to predict the new lines of amplifiers that will hit the amateur market by the time this is read, but I am prepared to receive a spate of articles, and in fact am encouraging articles on converting these new amplifiers to 10 meters. My intent is not to flaunt the law nor to circumvent its intent, but to provide amateurs with every bit of information they are entitled to.

I can visualize a resurgence of interest on 10, now that an aspect of "forbidden fruit" has taken hold. I can even imagine little companies starting up in basements selling (by coincidence) conversion kits and components which, when installed, just happen to extend the capabilities of these new amplifiers.

This year should also start the ground work for articles covering the construction of entire amplifiers. High-power parts and hardware that have been stored in the garage will become interesting again as their intrinsic value goes up. Our classified ads should begin to bear this out by the fall season. There will be a brisk business at fleamarkets, with "older" model amplifiers going up in value and sold to the highest bidder. Individual amateurs and non-amateurs alike will see this as an opportunity to capitalize on a "panic" situation. It'll be better than the stock market.

Whether this demand for equipment is real or "forced" through panic, the end result will be a greater marketplace. Will it settle down? Yes, everything does settle down eventually, and this too will reach some proper perspective in time. In the mean time, a lot of folks are going to cash in.

On the other hand, what do you suppose will be going on in Washington during this unofficial field-day? When it becomes fairly obvious that almost any amplifier that can go on 15 meters can be put on 10, with little or no effort, then I would imagine that 15 meters will be looked upon unfavorably by the FCC. Given a little more time, resourceful amateurs (and talented CBers) can double from 20 meters to 10, and triple 40 to 15. You could also double and triple from 80, and so forth, in any combination you want from 160 meters. My point is that eventually, by what FCC Commissioner White called "Overkill", the FCC could strip amateur radio operators of amplifiers on a band by band basis. They could still, in all honesty, claim that they were curing a problem, and that it was for the greater good.

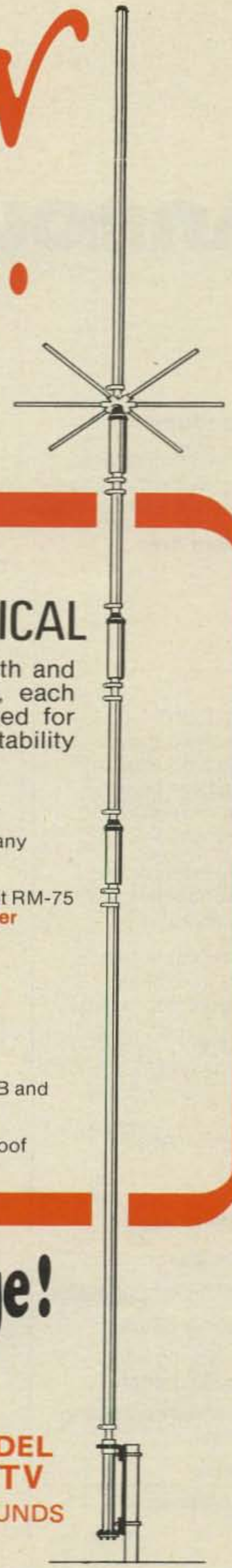
So, philosophically I am at a fork in the road. I can actively work at "getting the jump" on the other periodicals by lining up a series of conversion articles, presuming of course that they are doing the same. If I do that, I have to question whether or not I am encouraging further FCC crackdowns by this tack. I also have to ask myself, as an amateur on what basis can I continually accept unjust legislation from the FCC, seemingly geared towards the demise of amateur radio. Why must amateurs only rise to the challenge "after the fact" and ingeniously toil to find ways, and very clever ones at that, to work around imposed limitations. Amateurs tend to work better and more avidly in a situation of "survival" rather than expend the same energy towards a positive goal. So, I would like to expand my choice point and seek out some alternatives. I would like to go from an either/or situation to one of why not try something else.

There are factions forming to challenge the ban. ARMA, for one, is trying to gather support for a formal challenge. Make no mistake, the ban will be with us for a while, but it is not sacrosanct. The ban is unjustly punitive and should be repealed. It can and should be fought by all of us. If we are to pay the price, and be culpable for the transgressions of others, and in a sense to be an easy out for the FCC, then we should take a closer look at the Commission. We are part of their constituency, the part they obviously would like to bury and forget. We are the reminder that they have become an ineffective agency, unable to impartially enforce their own regulations. We are the ones who attend hearings and read transcripts and have enough technical knowledge to realize very quickly that the people who are supposed to govern have no knowledge of what they are governing. Yet, we accept edicts and say, "thank you, it could have been worse". Why?

I am not advocating anarchy on the airwaves. I am advocating a closer look at the cause of the irritant in our lives. I would rather not accept the responsability for unsound and misplaced judgement, if you please. Perhaps the jobs should not be political appointments. Maybe technical criteria should be set up to ensure a fundamental understanding by Commissioners on what the Commission is supposed to rule on. I am not out to attack and topple giants, nor to look for the quick and easy target for our common frustration. But, it seems logical to me that any system that seeks to cover up its own inadequecy in one area by the infringement of another area has betrayed a public trust, and should be investigated and possibly changed.

73, Alan, K2EEK

if the HUSTLER 4-BTV weighs 39% more... what do others leave out?



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The 4-BTV is longer for greater aperature, larger in diameter for strength and bandwidth, heavier traps for precision and safety factor. Individually, each subassembly weighs more to collectively give you an antenna designed for convenience of assembly and installation, a wide margin in mechanical stability and far superior electrical performance.

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- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
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Announcing

Addendum

Table I for Professor Emil Heisseluft's article, "Selection of Contest Operators Using Biorhythm Charts" (April, 1978 *CQ)* was inadvertantly omitted. Printed here is the pertinent data.

Problem Area	Percent Occurrence (%)	Percentage of Problems caused by Operator Involved Having a Critical Day During Contest Period (%)	Predominant Biorhythm Cycle Involved (P, E, or I)
EQUIPMENT			
Antenna traps destroyed (due to excessive power, operation on wrong band, etc.	10	90	I
Transmitter or power amplifier destroyed	14	86	I
Coaxial cable torn (due to rotation beyond stop points)	6	86	I
Incorrect installation of equipment	60	80	I
Fire	2	100	P,I*
Miscellaneous	8	—	—
Total:	100%	—	—
OPERATIONS			
Duplicate contacts	10	92	I
Out-Of-Band operation	8	90	I
Logging errors	10	86	P,I
CW Keying and decoding errors	6	88	P,I
Falling asleep during contest	20	96	P
Fatigue	40	98	P
Miscellaneous	6	—	—
Total:	100%	—	—

*Double Critical Day

Table 1. Five year review of problem areas encountered during major contest periods, and of the relationship between these problems and biorhythm cycles.

• **Portage, IN** – The fifth annual "Dad's Day" Hamfest will be held on June 18, 1978. This Hamfest is sponsored by the Lake County Amateur Radio Club. The Hamfest will be held at the IZAAK Walton League Picnic Grounds from 8 a.m. until 5 p.m. Talk-in on 146.52 or 147.84-.24. W9LJ – WR9AMU. Tickets are $2.00 at the gate or $.150 in advance. Send check to: Tickets, P.O. Box 348, Griffith, IN 46319.

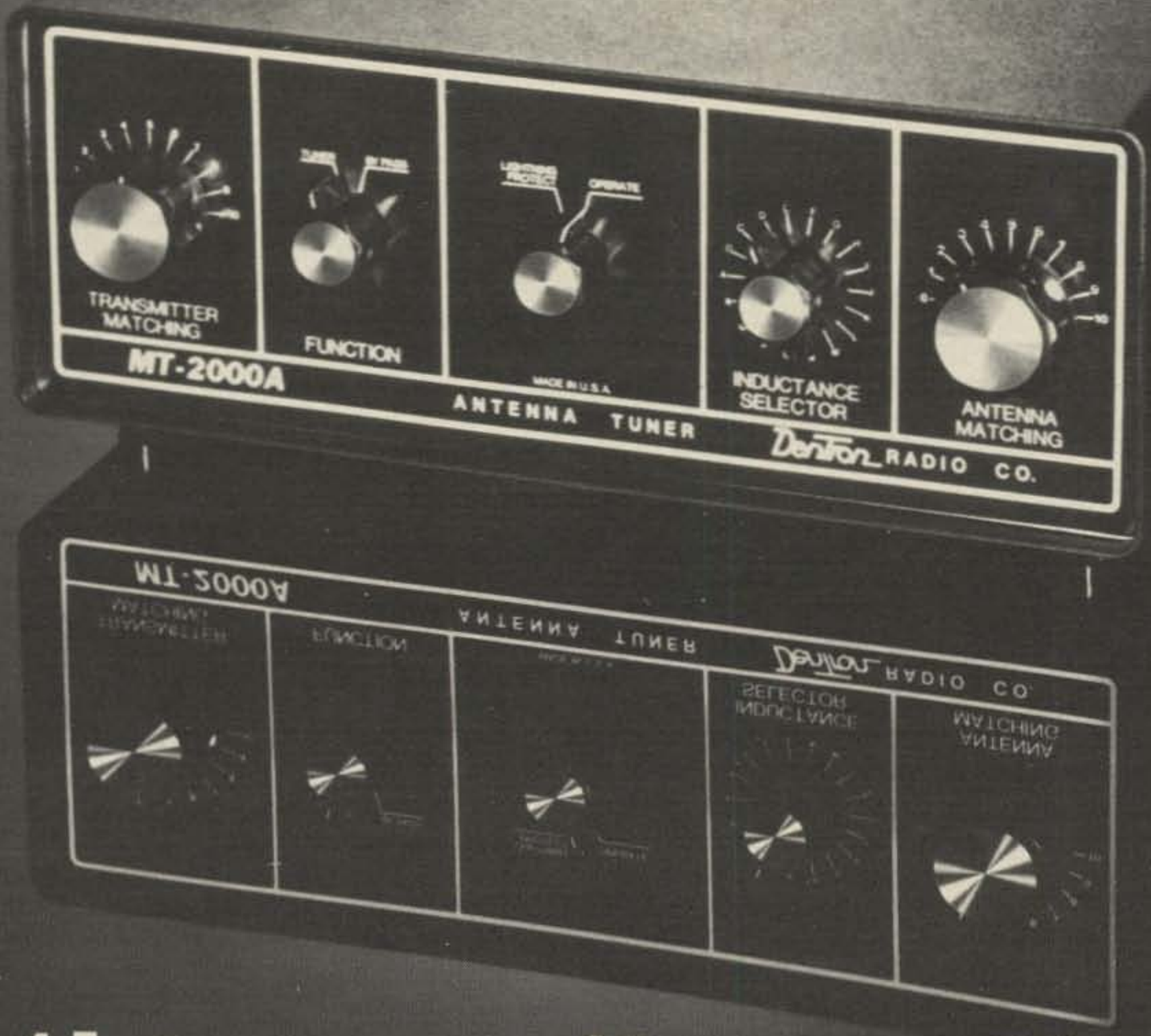
• **Akron, OH** – The Goodyear Amateur Radio Club of Akron will hold its 11th annual Hamfest and Family Picnic on Sunday, June 11, 1978, at the Wingfoot Lake Park from 10 a.m. to 6 p.m. There will be five main prizes, plus kids play areas, and refreshments. Flea market and display space will be free to ticket holders. Family donation is $2.50 in advance and $3.00 at the gate. For details write to: Don Rogers, WA8SXJ, 161 S. Hawkins Ave., Akron, OH 44313, Phone (216) 864-3665.

• **Newberry, MI** – The Superior Peninsula Amateur Radio Klub (S.P.A.R.K.), will be holding their Swap and Shop on Saturday, June 10, 1978, at the Pentland Township Hall, M-28. There will be a Toonerville Trolley and River Trip, a Fish Fry, and many other activities. Donations: $2.00 for registration and drawings. Tables: $1.50 and $2.50. For advance tickets, reservations, and info contact: Larry Baine, W8GBR, Box 67, Newberry, MI 49868, (906) 293-8651, R.J. Beach, W8NBJ, 115 E. Avenue "A", Newberry, MI 49868, (906) 293-8425, or Herb Miller, W8SUN, RFD 1, McMillan, MI 49853, (906) 586-9661.

• **St. Paul, MN** – The Dakota Division's largest Swapfest and Exposition, Amateur Fair '78, will be held on Saturday, June 3rd, 1978, at the Minnesota State Fairgrounds. Free overnight parking for campers, June 2nd only. Talk-in on 16/76 and 52/52. Many great prizes. Ad-

(Continued on page 90)

If they copy the style, they can't match the quality.



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The original DenTron Super Tuner. The original Super Super Tuner. The original MT-3000A. And now DenTron brings you the original MT-2000A, an economical, full-power tuner designed to handle virtually any type of antenna.

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When you consider the MT-2000A's unique features: 5¼"H x 14"D x 14"W, front panel coax bypass switching, front panel lightning protection antenna grounding switch, 3KW PEP, and the ability to match coax, random wire and balanced feedline, we're sure you'll decide to buy an American original and stay with DenTron.

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CIRCLE 11 ON READER SERVICE CARD

Our Readers Say

CQ Reviews the Dentron MLA-2500 Updated

Editor, CQ:

The review of the Dentron MLA-2500 linear amplifier in the September 1977 issue resulted in more mail to this author than any previously published. Many amateurs questioned the efficiency factors given and others requested more information concering spurious emission.

Murphy's law was definitely in effect with regard to the efficiency factor. In the published article, efficiency was given as 66% at 2 KW input and 62% at 1 KW input. These figures were in error. Based on our measured data, efficiency should have read 62% and 56% respectively.

To compound the problem further, Dentron called us, about the time the article came out, to inform us that they had discovered their meter shunts were the wrong value. This resulted in calculated power inputs lower than actually existed, thus increasing the calculated efficiency factor.

In testing linear amplifiers, we normally rely on the published tolerance standards established by the meter manufacturers. In this case, we were fooled; it won't happen again. In re-evaluating the MLA-2500 with our own plate current and plate voltage meters, we found efficiency averaged 51% at 2 KW input and 43% at 1KW input. These are average figures with efficiency varying above and below, depending on the band. We did not experience any band with extremely low efficiency factors, as has been reported by one or two amteurs. If the amplifier is operating into a load inpedance lower than 50 to 55 ohms, it would be reasonable to expect lower efficiency factos due to the Q factor of the tank circuit employed in the MLA-2500.

While I did not specifically state in the review article that the MLA-2500 has a low Q tank circuit, I did describe the small amount of tuning required to achieve full output on any given band. This is indicative of the broad banding which results from a low Q tank circuit. This is not necessarily bad, provided you are driving the amplifier with a good, clean transmitter. The article noted that the second harmonic was 43 dB down from full output. This was 2 dB better than the TS-520 used to drive the amplifier. In many amplifiers currently available to the amateur, second harmonic radiation would have been attenuated by 10 dB or more. This is due in great part to the design of amplifier input and output tank circuits. At no time did the spectrum analyzer display any spurious that was not present in the output of the driving transceiver.

There does not exist at this time a realistic set of test standards for linear amplifiers for amateur radio use. If you read the manufacturers' claims, you still don't know under what conditions they were established. Many of the published reviews of linear amplifiers concentrate on subjective views of a given piece of equipment. To apply existing standards, such as military specifications, to a piece of amateur equipment is just plain dumb. Even the government is beginning to realize how much it has cost them to require unrealistic technical standards for some of the linear amplifiers they purchase. For this reason, I have been endeavoring to put together an article establishing a realistic set of standards for linear amplifiers. It is my desire to help you evaluate design and performance versus cost, in order to make a decision with regard to possible purchases. No one can tell you what piece of equipment is "right" for your particular needs. I promise that this article will be published in the near future.

I value and solicit your comments regarding procedures used to evaluate any amateur equipment, not just linear amplifiers. As a professional engineer, I try to approach equipment evaluation in a manner that is easily understood by the non-professional. It is obvious from the letters received, that there are many factors that never occurred to me, such as the ease with which a tuning dial may be turned by the physically handicapped amateur or the level of illumination of a dial readout. The latter feature being very important to an amateur with impaired vision. If you have specific questions that are not answered in the reviews, write to me directly and I will answer as soon as time permits.

Hugh Paul, W6POK
CQ Reviews

The Eyes Have It

Editor, CQ:

The advise given by Bill Welsh, W6DDB, on page 45 of the March 1978 issue needs some amplification.

Safety glasses do not provide protection from noxious fumes, vapors, or splattering chemicals. Safety goggles do. Goggles should be the type which form a seal with the skin around the eyes. Non-ventilated or ventilated types with covered vents are available. When working with vapors or gaseous chemicals, the non-ventilated type offer the most protection. Safety glasses protect the eyes from frontal flying objects but offer little protection from the sides, below, or above, especially to ricocheting objects, liquids, and vapors.

Protect the lungs too. Provide adequate means for exhausting and ventilating the by products of chemical reactions.

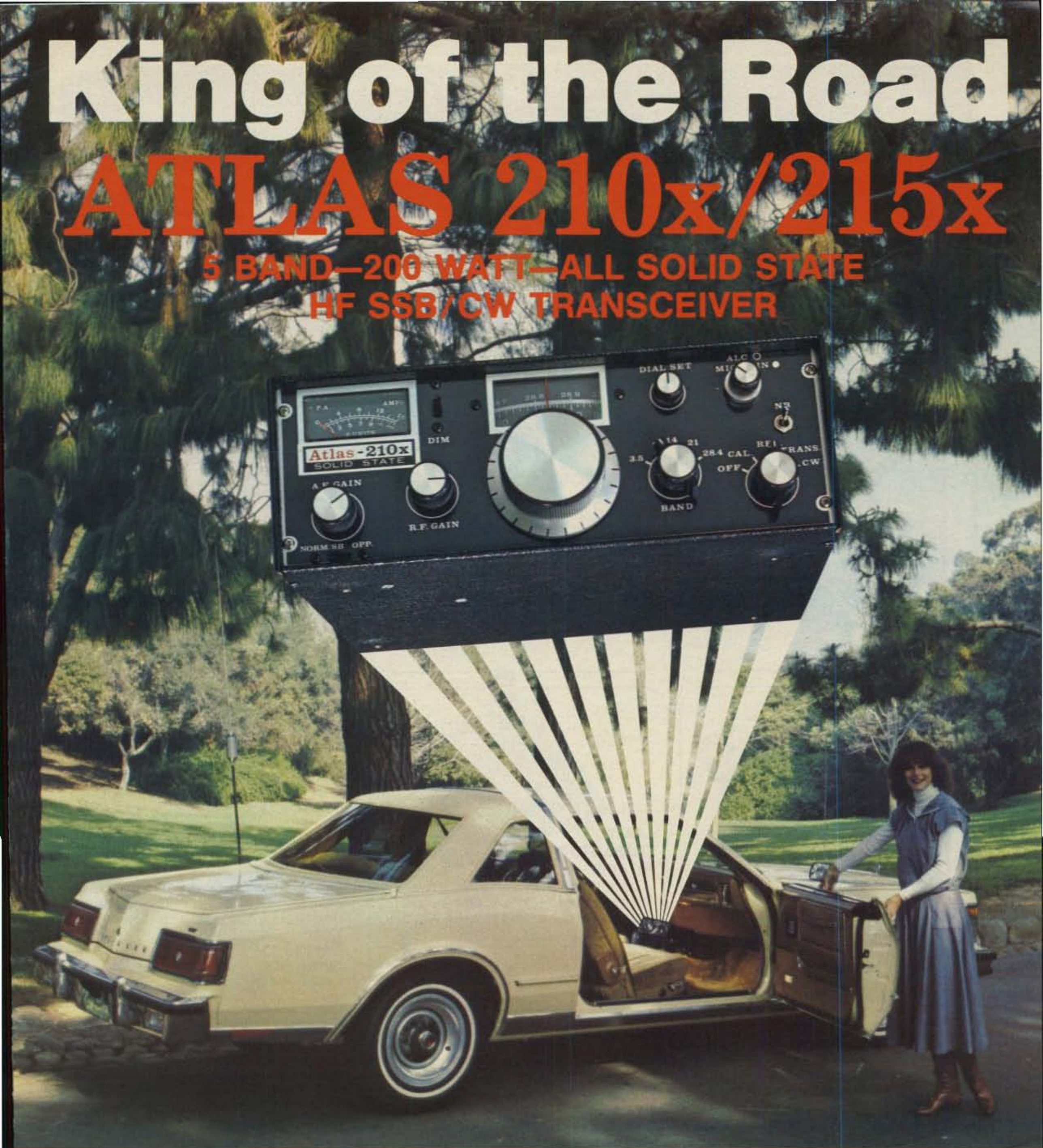
It's a good idea to use eye protection around the shack when clipping leads after soldering, operating drills, saws, and other tools. Protect the eyes from solder splatter. And don't forget eye protection when mowing the grass around the tower (and the rest of the QTH).

Leo W. Lakritz, M.D.
Beloit, WI

King of the Road

ATLAS 210x/215x

5 BAND—200 WATT—ALL SOLID STATE HF SSB/CW TRANSCEIVER



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With its exclusive PLUG-IN-AND-GO MOBILE MOUNT, its light weight (7 pounds), and compact size (3½" high X 9½" wide X 9½" deep) the Atlas 210x/215x is the perfect mobile rig.

To go mobile just slip the 210x into its mobile mount and all connections are made automatically.

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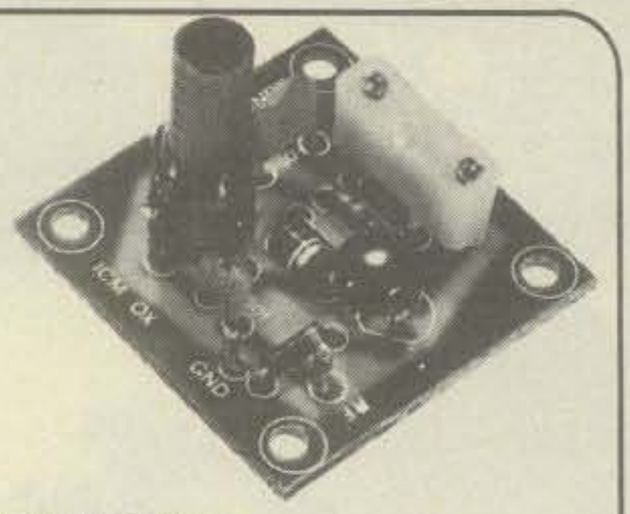

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Crystal controlled transistor type. 3 to 20 MHz, OX-Lo, Cat. No. 035100. 20 to 60 MHz, OX-Hi, Cat. No. 035101
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$4.95 ea.

MXX-1 TRANSISTOR RF MIXER
A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106
Specify when ordering.

$5.50 ea.

PAX-1 TRANSISTOR RF POWER AMP
A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated. 3 to 30 MHz, Cat. No. 035104
Specify when ordering.

$5.75 ea.

OF-1 OSCILLATOR
Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 HI, Cat. No. 035109
Specify when ordering.

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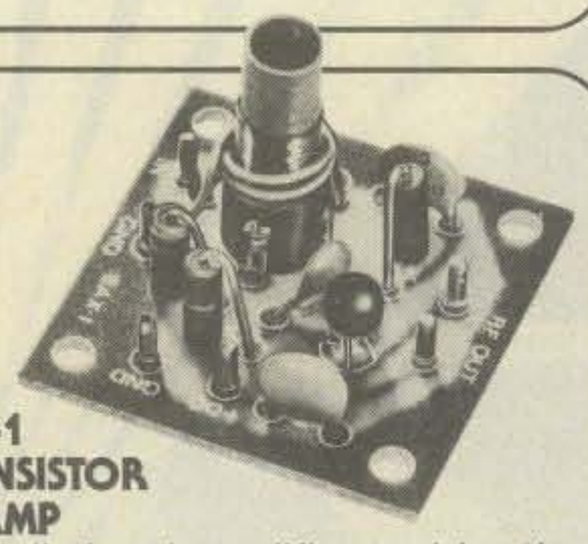

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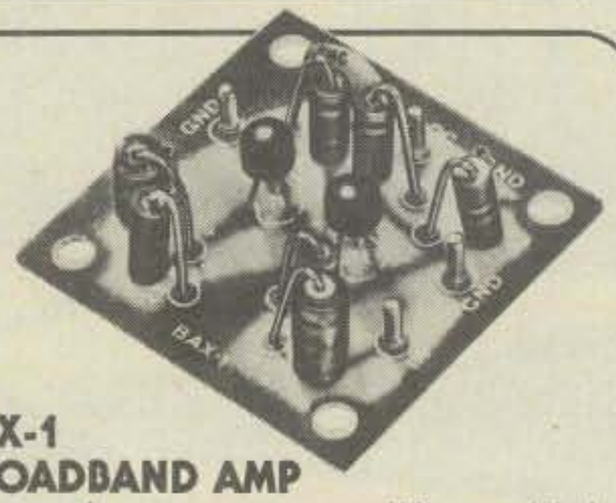

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ALDA 103, the trim little powerhouse with incredible performance for the price! ALDA 103 provides a full 250 watts PEP input for SSB operation, and 250 watts DC input for CW. And when it comes to performance, ALDA 103 is the hottest little transceiver going — all solid state, totally broadbanded and super-stable VFO.

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Power Consumption:	Receive — 5.5 watts (includes dial and meter lamps); Transmit — 260 watts
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Weight:	8-1/4 lbs. (3.66 kg)

PERFORMANCE SPECIFICATIONS

Frequency Range:	80 meter band — 3.5 to 4.0 MHz 40 meter band — 7.0 to 7.5 MHz 20 meter band — 14.0 to 14.5 MHz
Modes:	CW; USB; LSB
RF Input Power:	SSB — 250 watts PEP nominal CW — 250 watts DC maximum (adjustable)
Transmitter:	
Antenna Impedance:	50 ohm, unbalanced
Carrier Suppression:	Better than −45 dB
Side-Band Suppression:	Better than −55 dB at 1000 Hz
Distortion Products:	Better than −26 dB
AF Response:	500 to 2500 Hz
Spurious Radiation:	Harmonics better than −45 dB below 30 MHz; better than −60 dB above 30 MHz
Frequency Stability:	Less than 100 Hz drift per hour (from a cold start at room temperature)
Microphone:	High impedance 3000 ohm
Receiver:	
Sensitivity:	Better than 0.5 watts audio output for 0.5 μV input
Signal-to-Noise Ratio:	Better than 10 dB S+N/N for 0.5 μV input
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ALPHA 76A

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There are lots of so-called "Maximum Legal Power" linear amplifiers on the market. Why is it that so many knowledgable amateurs, after checking out (and often owning) the others, ultimately choose an ALPHA?

For one thing, "maximum legal power" doesn't begin to tell the whole story. Nearly all manufacturers' ratings implicitly assume an amateur service duty cycle much less than 100%. Even the terms "continuous" and "100%" duty have been so debased in recent years as to be meaningless unless explicitly defined. The consequence, too often, is a power transformer or tube going up in smoke during a long operating period.

Every ALPHA amplifier is unequivocally rated to run a full 1000 watts of continuous, average d-c power input, in any mode, with No Time Limit (NTL). You could leave your ALPHA (ANY ALPHA) all day with a brick on the key, at a kilowatt input (or at 2 KW PEP input, two-tone SSB) without hurting it. In fact, you could leave it for weeks: last year we ran a standard ALPHA 76 key-down at a kilowatt for 18 days without ill effect. That's ALPHA POWER. To top it off, your new ALPHA is protected by ETO's exclusive 18 MONTH factory warranty —SIX TIMES AS LONG as the industry-standard 90 days! Now that DOES pretty much tell the whole story.

What's new with the ALPHA 76A? We haven't tampered with success. Behind that sleek new exterior is the same robust, reliable, easy-to-use powerhouse that January QST described with such phrases as, "Typically excellent ETO construction . . . ," ". . . excellent efficiency . . . ," ". . . tunes smoothly . . . ," and ". . . runs cool and quiet . . ."

The basic ALPHA 76 components and circuit remain unchanged for very good reason: hundreds of 76's in service over the past two years have suffered NOT ONE SINGLE INSTANCE of transformer burn-out, and virtually no tube failures—less than 0.1%! That record is particularly remarkable when you consider the extent to which owners take their ALPHA's for granted.

We think the new ALPHA 76A sets a standard for style. And ETO engineers have added a separate Plate Current meter and a new push-button power control system, making it even more convenient to use. But the real beauty of every ALPHA linear amplifier is INSIDE the cabinet . . . where engineering and craftsmanship tell the whole story of ALPHA superiority.

A few ALPHA's may still be available with factory-installed 10 meter coverage. Contact ETO or your dealer today for detailed information and fast delivery. Six meter ALPHA 76/6 available about June 1: $1095. Order now.

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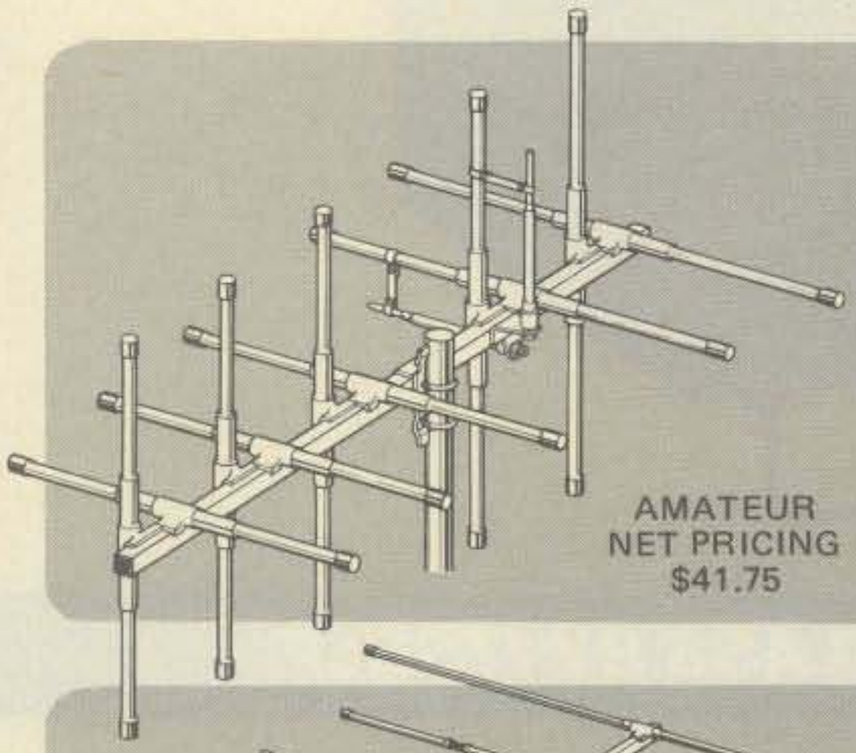

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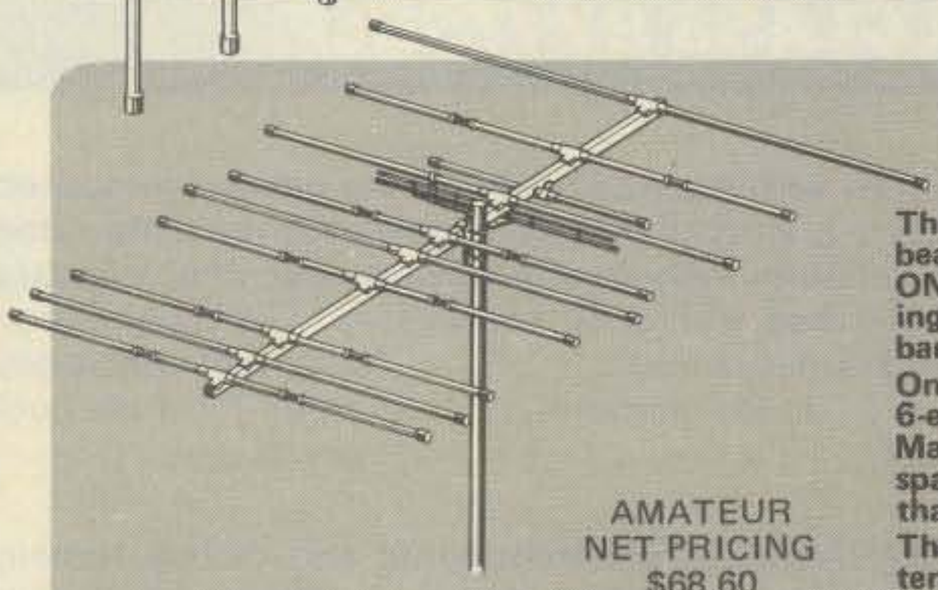
FINCO STINGER A 2+2

2 Meter

The model Stinger A 2+2 is a ten-element, dual polarization 2-meter antenna designed for OSCAR communications or where switching from horizontal to vertical polarization is required. The A 2+2 can even be phased to operate on both horizontal and vertical polarization at the same time (circular polarization). This is not only ideal for OSCAR work but gives your station versatility for ground communications.

Wide, non-linear element spacing gives the A 2+2 superior gain. However, since it is a five element beam in one given plane, the half power beam width does not make satellite tracking difficult because of sharp directivity. The dual gamma match assemblies provide for a very low V.S.W.R. and will withstand 2,000 watts P.E.P.

The Stinger construction features make the A 2+2 extremely heavy duty. Provisions are made for mounting the antenna at the end of the boom — for azimuth control — or at the middle of the boom for normal applications.



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FINCO STINGER A62

6 & 2 Meter

The model Stinger A 62 is a truly remarkable combination 6 and 2-meter beam designed for optimum performance on both bands yet only requiring ONE transmission line. This is accomplished through the use of exclusive phasing elements to accomplish dual band operation with no sacrifice to either band — NO SWITCHING REQUIRED!

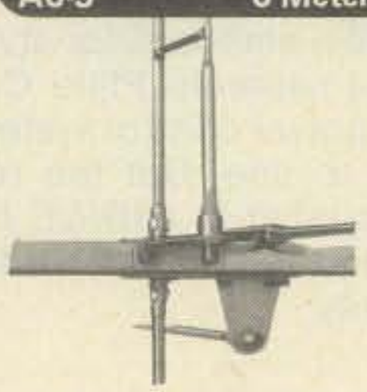
On 2-meters, the A 62 has 6 colinear elements — equivalent to three 1/2 λ 6-element yagis stacked side by side — thus giving outstanding performance. Maximum forward gain is assured on 6-meters through the use of four wide spaced elements. The heavy duty Stinger construction is used throughout so that the antenna will withstand 100 mph plus wind loads.

The A 62 is ideal for mounting on the same mast as your tri-bander or other antenna thus easily opening up the world of 6 and 2-meter VHF communication.

OTHER FINCO STINGER AMATEUR BEAMS AVAILABLE:

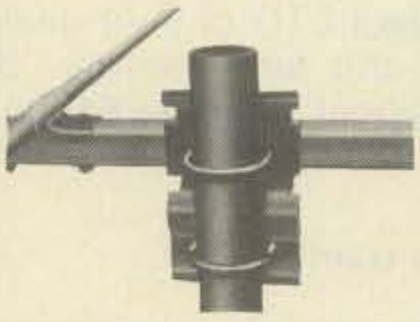
MODEL	AMATUER BAND	ELEMENTS	BOOM LENGTH	AMATUER NET PRICING	MODEL	AMATUER BAND	ELEMENTS	BOOM LENGTH	AMATUER NET PRICING
A10-4	10 Meter	4	16′	57.15	A2-5	2 Meter	5	5½′	25.60
A6-3	6 Meter	3	6′	27.30	A2-10	2 Meter	10	10′	41.15
A6-5	6 Meter	5	13′	41.95	A1¼-10	1¼ Meter	10	8′	29.65

ENGINEERING FEATURES:

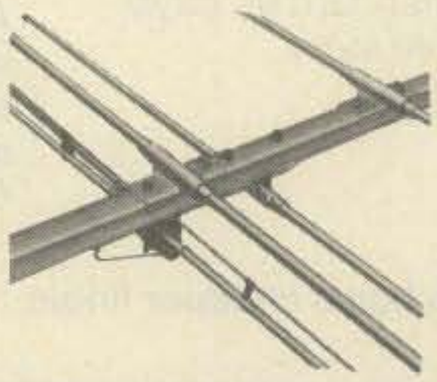


All Stinger Series Amateur Antennas incorporate heavy duty fully adjustable gamma matching systems to allow for maximum power transfer. The design provides for minimum V.S.W.R. and a wide bandwidth. A built in SO-239 type connector assembly is utilized plus the matching systems are power rated at 2,000 watts P.E.P.

Exclusive Stinger square boom construction is used on all amateur antennas. The 1¼" square booms are of .064 wall high tensile strength aluminum which is many times stronger than its round counterpart. Also, special bracket assemblies have been developed to allow instant element to boom alignment — plus they stay aligned in the highest wind and ice loads. All elements are of thick wall high tensile strength aircraft quality aluminum.



A 4"x 6" x full 1/8" thick heavy duty plated steel mast to boom mounting assembly is used on all Stinger Series of Amateur antennas. The bracket assembly locks permanently on the square boom and thus withstands high wind loads and torque without twisting or becoming misaligned. The assembly accepts mast diameters of up to 2" O.D. Provisions for mounting either in a vertical or horizontal plane is incorporated in several models.



Antenna design engineering is a specialty at FINCO. Top quality lab standard test equipment is used throughout the development and design of all antennas. The FINCO antenna test range has been carefully checked for erroneous reflection characteristics that could cause errors in antenna designs. Shown is the sophisticated stub and matching system that has been developed for the Stinger A62, 6 and 2-meter dual band beam. No traps or coils to burn out or detune, thus assuring you of the highest possible performance on both 6 and 2-meters.

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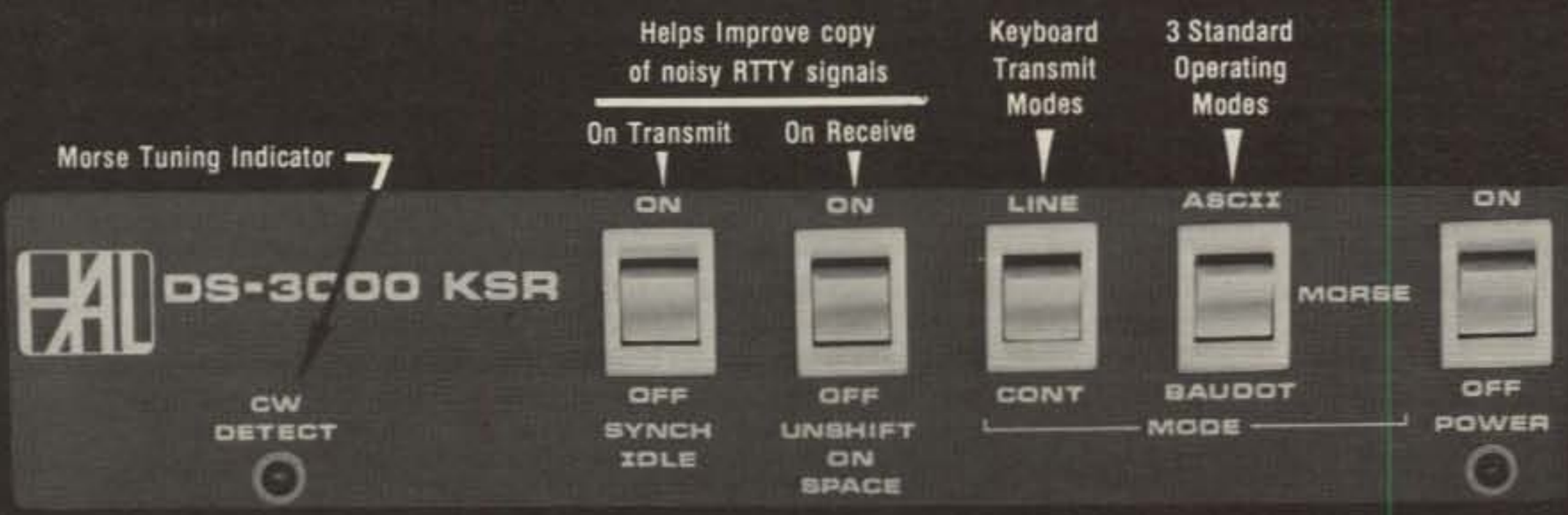

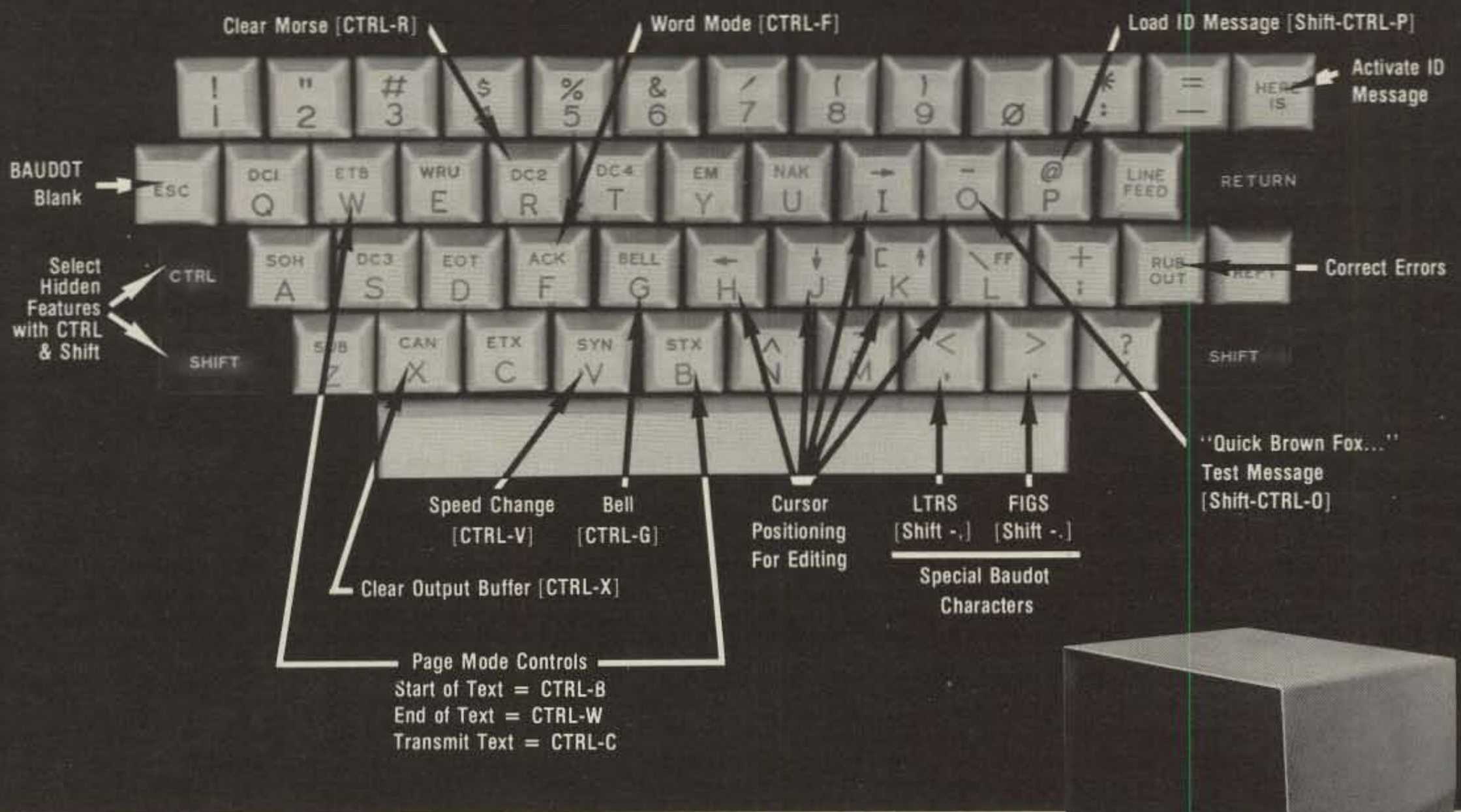

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Phone patches are devices useful for sending messages and spreading amateur radio good will. WA6CNX/1 shows the readers of CQ how to build one.

A Simple Phone Patch

BY RICHARD FERRANTI*, WA6NCX/1

Fifteen meters was dead, except for one soft but clear Maritime Mobile, calling "CQ Stateside" from the 40-foot Cheoy Lee fibreglass yawl *Betty J*, at the improbable home port of Heber Springs, Arkansas. "We're a painted ship on a painted ocean," says the radio amateur skipper, "ten days in the doldrums 600 miles out of Guayaquil at 1°S. 90°W *en route* to the Galapagos. No word to or from home in three weeks." "Sure we'll run a long haul into Heber Springs," you say, and for fifteen minutes the skipper relieves the fears and worries of the real *Betty J* and the loved ones at home. As you say *73*, he gives the word that the first breeze in ten days has just filled *Betty J*'s slatting sails. All of this thanks to the magic little box which makes real-time communications possible: the phone patch.

The above story is a true one. Even if you're not into routine patches with friends, having a connection between your transceiver and the landline can be useful or even necessary. It's not at all complicated or expensive to build a simple, high quality patch which will serve you for years. It makes an excellent first project, to say the least, and may get you interested in the joy of homebrewing other station accessories.

The patch which I'll describe has an interesting history. A number of fine-quality hermetically sealed transformers were purchased by an enterprising amateur, and with some other parts and a case, he built two models of phone patches—one for p.t.t. (push-to-talk) operation, and one for VOX (voice operated switching). Back in the early 60's he sold over 6,000 of these gems, and they're still in demand at auctions and flea markets.

What's even more amazing is that only one amateur magazine would accept his ads—*CQ* Magazine, to be specific. The others thought that phone patching (at least back in the early 60's) had a poorly defined legal status, so their policy was not to accept ads for the device. Nonetheless, the market was very active, and nowadays phone patches are perfectly legal. You can see one of the original advertisements for this patch reproduced with this article.

*14 Divinity Ave. #40, Cambridge MA 02138

A simple patch for p.t.t. operation uses an original high-quality transformer.

Constructing a Phone Patch

The heart of a good patch is a high-quality transformer built for the purpose. Fortunately, the original transformer used in the *KWickPatch* is still available after nearly 20 years. If you want to build a simple phone patch for p.t.t. operation (the easiest way to get started) you'll need one transformer; for the VOX model two are required. One transformer from the *KWickPatch* inventory costs $2.00 postpaid, while two transformers are $3.75 postpaid, from Menlo Pacific Company, P.O. Box 5009, Redwood City, CA 94063.

Fig. 1 shows the schematic of a simple patch for p.t.t. operation—all you need are the transformer, chokes, three capacitors, a switch, and cables for your transceiver. The 1000 pF (.001 μF) cpaacitors can be ceramic discs, while the 0.5 μF capacitor should be a good quality mylar, paper, or similar unit. All capacitors should be rated for at least 150 volts to avoid breakdown from the high voltage ringing signals of Ma Bell.

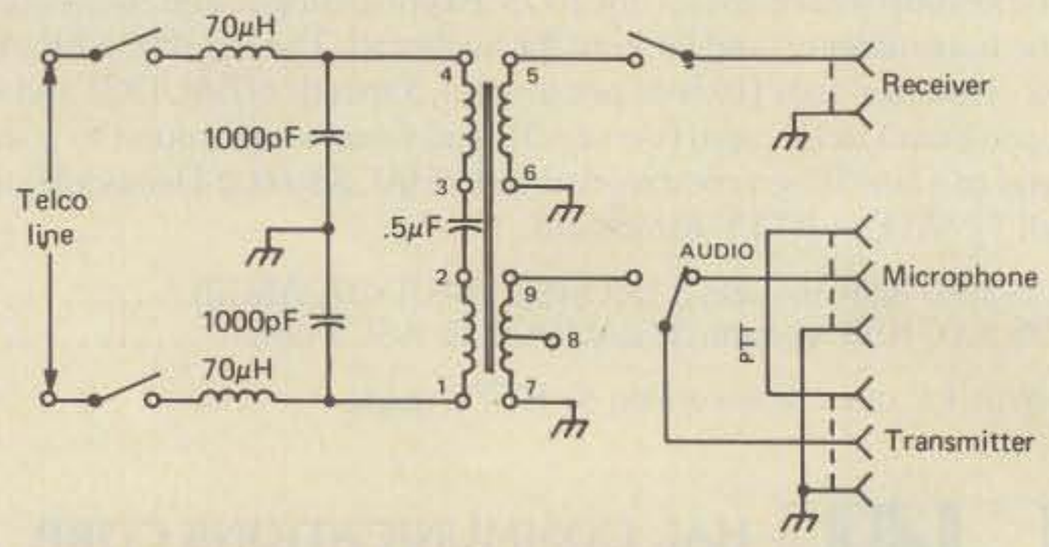


Fig. 1 – Simple patch for p.t.t. operation (1 transformer).

The switch connects the transmit audio input and the receiver output through the patch to the telephone line. Two single-throw double-pole switches can be used, or a four-pole single-throw rotary switch will facilitate simple in-out operation. The receiver must mute on transmit (any transceiver does this) with this patch. An example of Bob, W6BFH's, model p.t.t. patch can be seen in the accompanying photos.

If you want to use the VOX set-up, a few more parts are needed including a second transformer as seen in fig. 2. After you've built it up, adjust the 2.5k null potentiometer with the line and telephone connected for minimum crosstalk between the output of the receiver and the input of the transmitter.

Operation is straightforward. Just switch in the patch and use the telephone handset as both the microphone and the speaker of the transceiver. The p.t.t. version requires that you push the p.t.t. switch on your rig when the party on the phone is talking and release it when the party you're receiving on the rig talks. VOX operation is, of course, hands free.

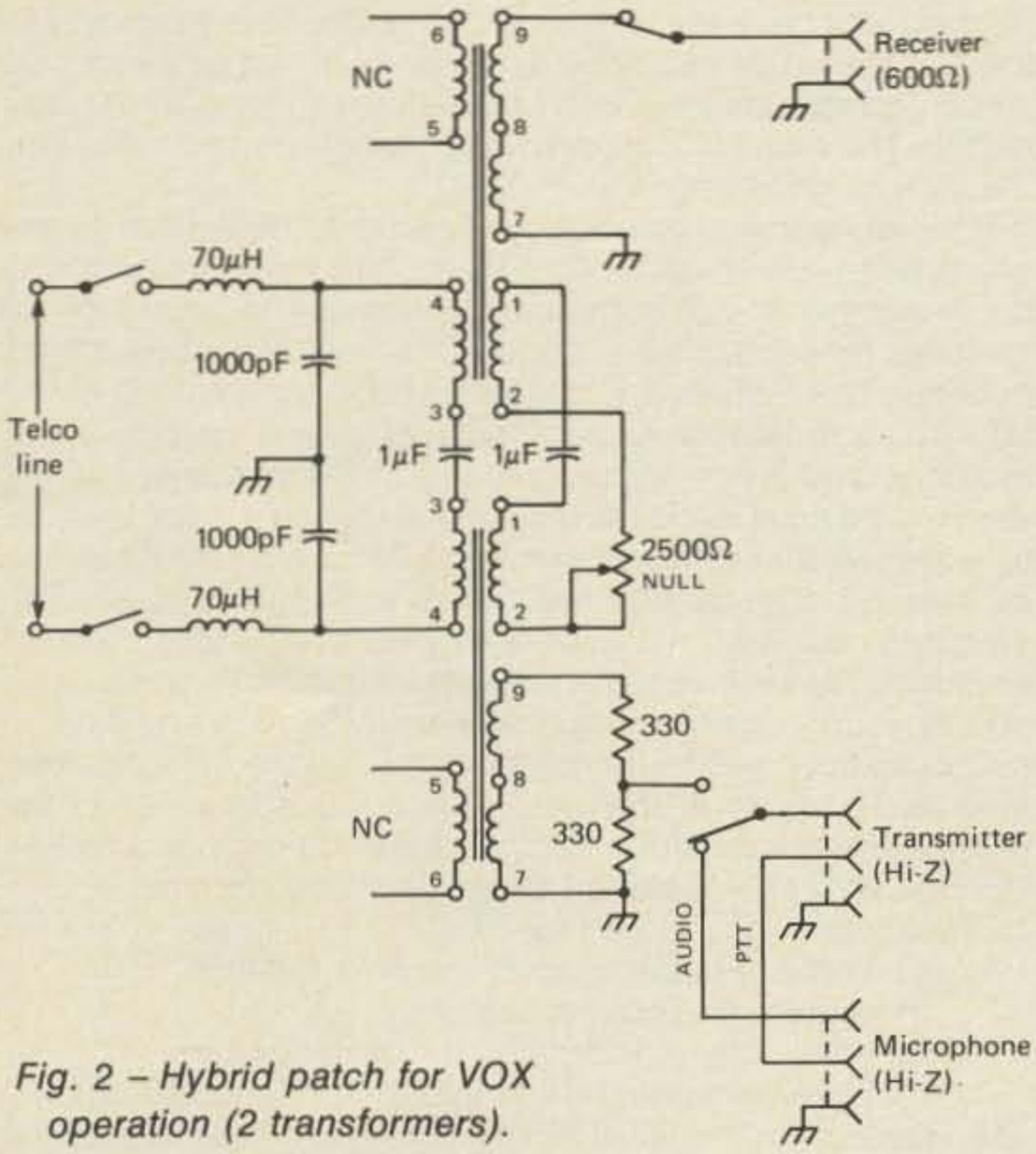


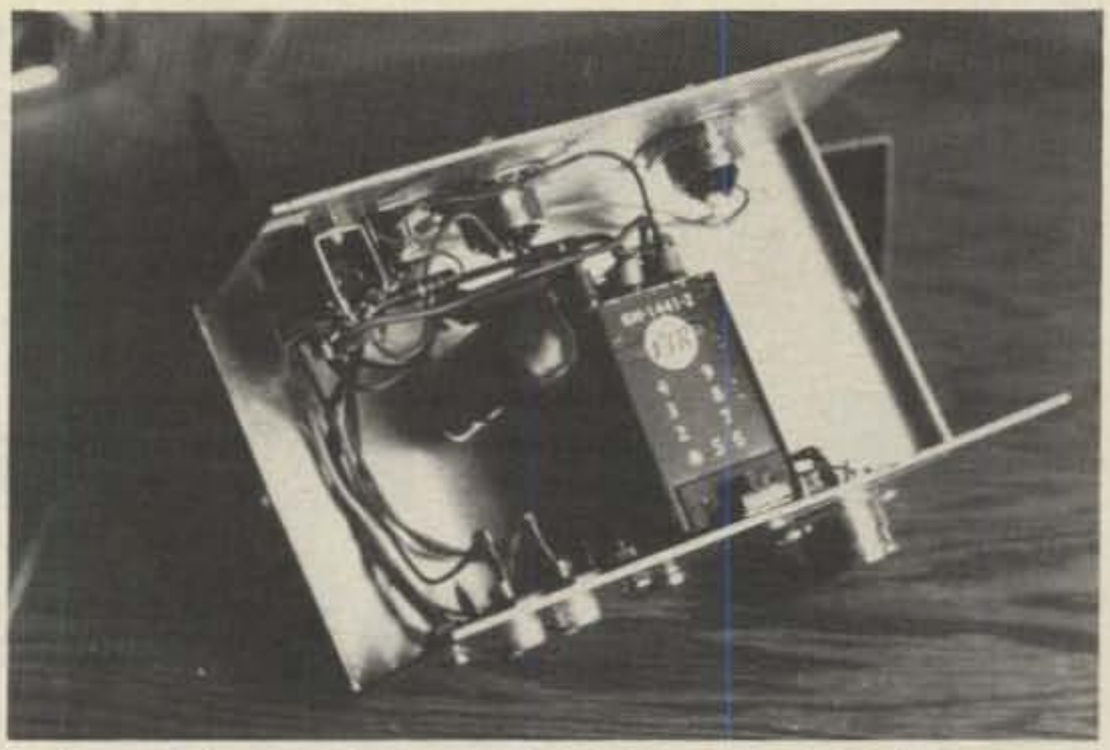
Fig. 2 – Hybrid patch for VOX operation (2 transformers).

Notes and Tips on Setting Up

To make a high-quality phone patch you already have the key ingredient—a transformer flat within ¼ dB from 200 to 4000 Hz. When setting up the patch, you should be particularly attentive to the audio levels you're pumping into the phone lines. The audio level should be normal into your handset—no higher and no lower—for a natural sounding patch. The best thing to do is set up a mock patch on 10 meters some evening (when the band's dead) with an amateur 15 miles away or so, and with another local ham on the phone to listen to the levels. Once you have the transmitter mike gain and receiver audio gain set, just make a mental note of their control positions. It's really very simple—what sounds natural and normal in the handset is right for the patch. The only *caveat* is to guard against overdriving the phone lines and making Ma Bell unhappy.

Stay away from speech processors when running your patches. They sound terrible over the phone, especially to a non-ham who doesn't have "s.s.b. ears."

It's also a good idea to get the patch running as soon as you establish communications. If things sound slightly marginal,



Insides of the patch shows clean layout and straightforward wiring.

go ahead anyway. Conditions are just as likely to improve (in which case you've had a successful patch) as decline (nothing lost for your efforts). Do your dialing and initial introductions (telling the party to say "over," etc.) with the patch switched out, then start right in. The less you fool around, the better it is.

My experience with weekly cross-country patches over the last two years has shown me that high power is not necessary, but a good antenna certainly is. If you don't have a rotatable beam, try a wire beam fixed in your favored direction. It really makes a difference. Check the rules and regulations to see if third-party agreements exist between the U.S.A. and the country you want to patch. A phone patch involves a third party and many countries don't allow it. In the U.S., Canada, and much of South America, however, you can phone patch all you want, but observe these guidelines: do not facilitate business affairs of any party, i.e., no commercialization; use the upper portion of the band when on 20 meters; and don't patch just to avoid toll charges.

If you like the fun of building a simple but useful station accessory with minimum expense and maximum enjoyment you'll like this phone patch project. In fact, the more you use it, the better you'll like it. And, there's a special, quiet thrill in connecting two people *via* your amateur rig who would never ordinarily be able to communicate on h.f. radio. It's a service they won't soon forget—an activity which does much for the public image of the amateur radio service. I know. I've had patches run for me dozens of times and the thrill and gratitude never wears off.

My thanks to Bob Baum, W6BFH, for the photography. ■

Easy connections to HW-101.

Scanners have become very popular accessories for the v.h.f. f.m. buff. In this article Robert Glaser describes how to incorporate a scanner into the well-known GLB synthesizer.

A Scanner for the GLB Synthesizer

BY ROBERT GLASER*, WA3MSW

With the increasing popularity of two meter f.m. operation, the use of frequency synthesizers is becoming quite commonplace. One of the more versatile synthesizers available is the Model 400B Channelizer from *GLB Electronics*. This channelizer is not as fancy as others, but it is possible to choose any transmit/receive frequency pair desired, something which is difficult, if not impossible, with some other synthesizers and synthesized rigs. The GLB Channelizer has

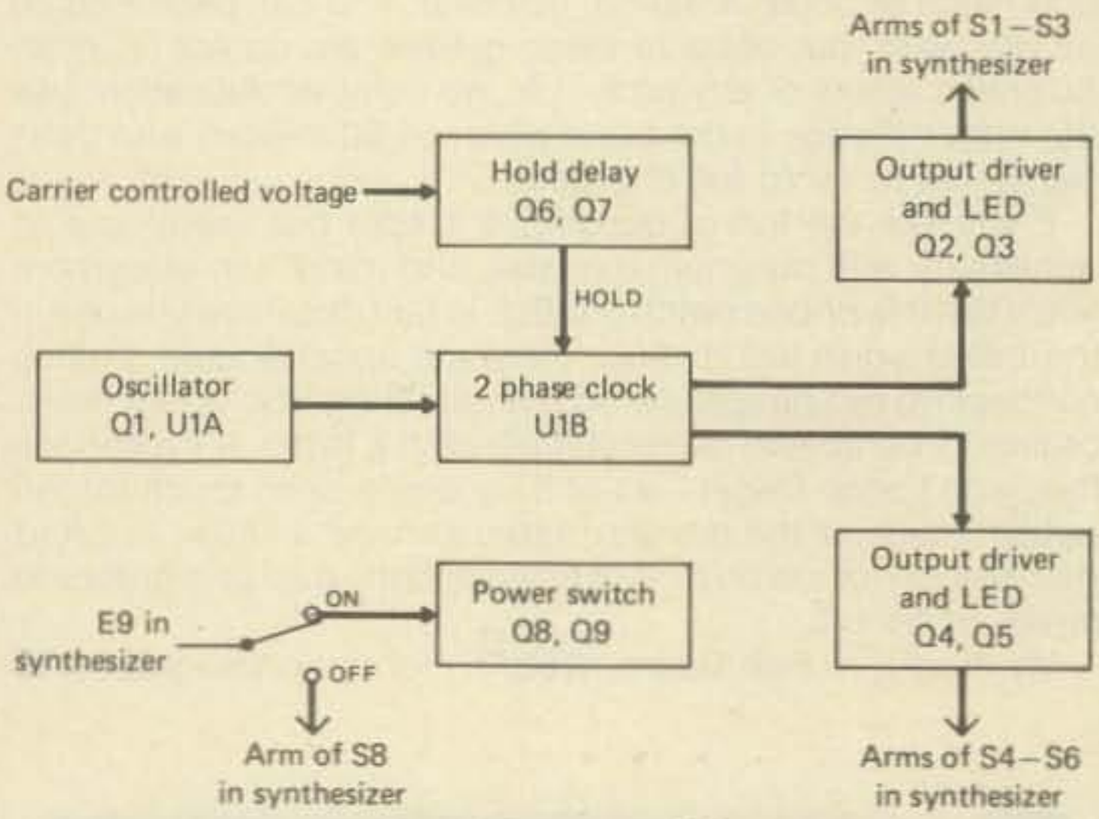


Fig. 1 – Block diagram of the scanner.

two banks of BCD switches which are used to select the operating frequencies. It is useful, when listening, to set the banks to two popular receive channels, allowing the operator to monitor either frequency with the flick of a single receive select switch. It is convenient to monitor local two meter activity while busily occupied on the workbench. However, while so doing I often found myself scurrying over to the rig to flip the receiver to the other bank of switches when one channel dropped. This constant attention the channelizer took time away from the project on the workbench, a completely intolerable situation. I (being of the type who has no aversion to spending three weeks on a gadget which will save one week's time over the next year and a half) scratched my head and thought, "There must be a better way!" Being of sound mind I quickly reached a simple solution—I would get married and have the XYL sit at the synthesizer attending to the switches. Unfortunately this attack on the problem had some undesirable attributes, so the search for a better way began. The result is a simple two channel scanner circuit for the GLB synthesizer.

A multichannel scanner could certainly be added to the channelizer. However, if more than a few frequencies are to be monitored, it would become necessary to have lockout switches for each of the scanned channels, and the scanned channels themselves would most likely be hardwired. It would take a considerable amount of front panel space for the switches and lights, to say nothing of the circuitry. I didn't wish to add another box to the collection, and it is not feasible to fit the switches and lights on the front panel of the GLB. The synthesizer already has two banks of frequency selection switches, so why not just automate the simple task of switching the receive bank selector switch? This gives a two channel scanner which has the flexibility to allow any desired pair of frequencies to be monitored. I use the same synthesizer at home as in the car, so placing a scanner in the channelizer has the added advantage of having a scanner on two rigs with only the effort of building one scanner.

The scanner circuit had to:

1) implement the desired scanner function.
2) require no unusual switches.
3) entail little modification to the synthesizer.
4) be small enough to fit into the channelizer box.

The implementation satisfies the above and uses one single pole double throw switch.

How It Works

A block diagram of the scanner is shown in fig. 1. The oscillator generates a square wave and feeds the two-phase clock generator. This provides two complementary outputs. Each output goes to an output driver stage which includes a light emitting diode. The LED indicates which bank of frequency selection switches is active. The output of these stages is high enough to drive the synthesizer circuitry in the normal fashion. With the aforementioned stages the synthesizer will switch alternately between the two switch banks at a rate determined by the oscillator.

It is necessary to have a carrier operated relay in the receiver being used, or a point in the receiver where there is a voltage present only when an incoming carrier is being received. The voltage output should be between five and twelve volts. This voltage is fed to the *hold delay* stage. The function of it is to stop the two phase clock generator from toggling, and to wait a certain length of time after the received signal drops before letting the scanner resume scanning. This

*3922 Algiers Rd., Randallstown MD 21133

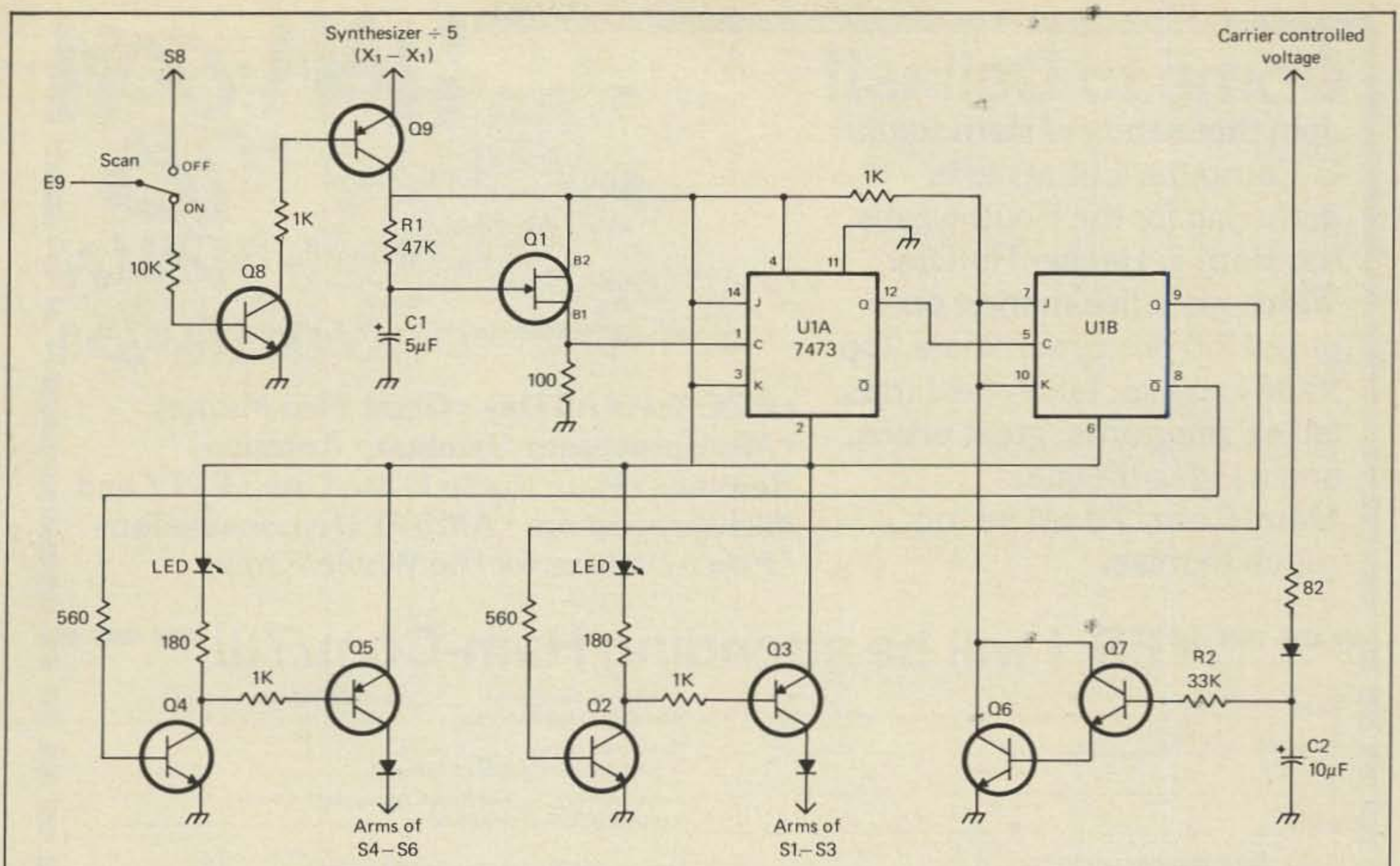


Fig. 2 – Schematic diagram of the scanner.

allows complete conversations to be heard. Otherwise, the scanner flips back and forth between two conversations whenever one repeater drops. For simplex operation this is even more important. The voltage from the output driver stage is fed to the switch bank through diodes, and the original internal connections are retained. This allows normal circuit operation when the output drivers are powered down. In normal operation, when the synthesizer is in receive mode, E9 which goes to the arm of S8 (the receive selector switch) is at plus five volts. Instead, E9 goes to the arm of the scan enable switch, and when the scanner is off E9 is fed through to the arm of S8. When the scan switch is on, the voltage is fed to the power switch stage, which detects the input voltage and provides Vcc to the entire scanner circuit. Therefore when the scanner is off it draws no power and does not affect the receive bank. Additionally, when the push to talk line is activated on the synthesizer, the voltage at point E9 goes low, disabling the scanner. Operationally, this means that you cannot "scan" on *transmit* because the transmit selection switch is then activated and will choose the transmit frequency. Normally this would not be done, but at least you cannot bother two conversations at once by switching frequencies on transmit by mistake.

The schematic is shown in fig. 2. Q8 and Q9 constitute the power switch. When the scan switch is in the *off* position, Q8 receives no base drive current and is cut off. This causes Q9 to be cut off as well, and the plus five volts applied to the emitter of Q9 does not get fed through to the rest of the circuit. The entire scanner is powered down, and the channelizer operates normally. When the scan switch is on and the synthesizer is in the transmit mode, E9 is low and the power switch is still turned off. When the synthesizer is in the *receive* mode and the scan switch is in the *scan* mode, E9 goes high, turning Q8 on which in turn turns Q9 on which powers the rest of the scanner circuitry.

Q1 is a unijunction transistor obtainable from Radio Shack. R1 and C1 determine the frequency of operation which sets the scan rate. This rate has purposely been set relatively slow when compared with normal scanners. This is because it is necessary to allow time for the synthesizer to lock up, and this

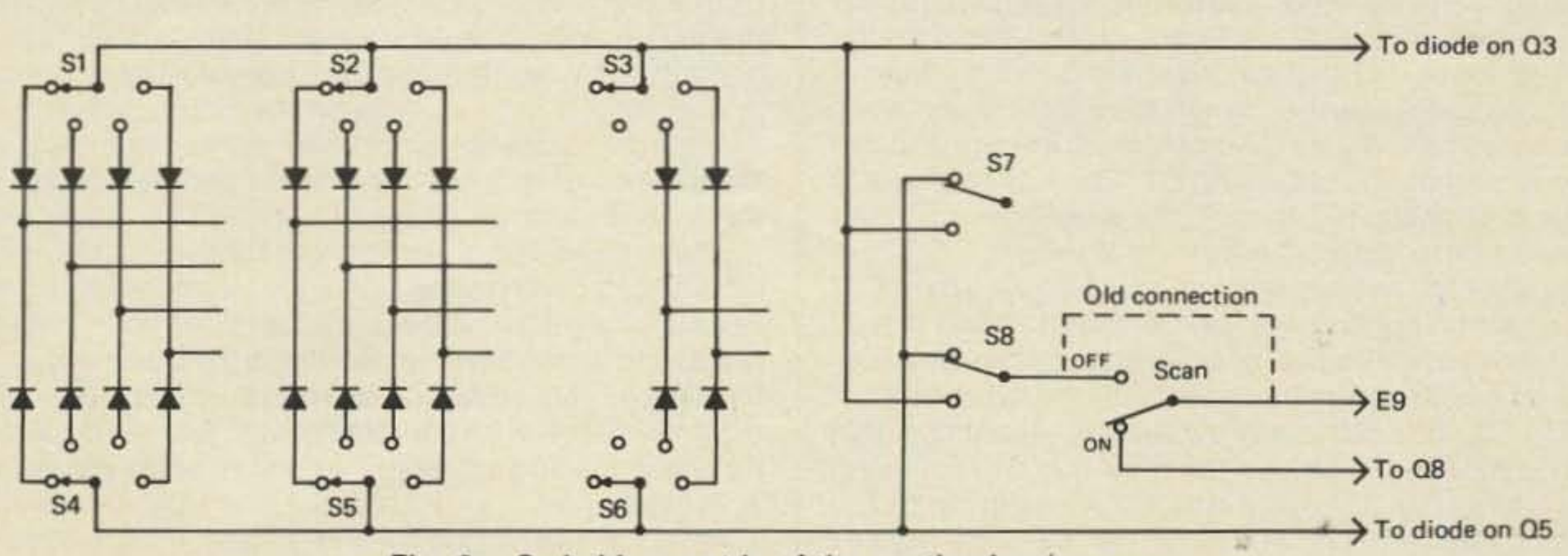


Fig. 3 – Switching matrix of the synthesizer/scanner.

may be a fraction of a second when the two banks are set far apart in frequency. With the parts shown, the scanner switches channels about twice per second. The output of the unijunction oscillator is not a square wave. It is fed into half of a 7473 dual master—slave JK flip flop which divides the frequency in two and generates a square wave. This signal is then sent to the second half of the 7473. When the J and the K inputs of the flip flop are high, the flip flop counts and divides the frequency of the input signal in half and gives complementary outputs. If the J and the K inputs are both low, the flip flop stops toggling and remains in the state it was in at the time the J and K inputs went low. We wish the scanner to stop on a channel when it has a signal present, so it is necessary to force the J and K inputs low when a signal is received. A carrier controlled voltage is brought out from the receiver which has the characteristics of being high when a signal is present and low when the frequency is unoccupied. When this point goes high, C2 is charged. This turns on the Darlington pair Q6 and Q7 which drives the J and K inputs of U1B low, stopping the scanner. When the carrier disappears the scanner stays halted until C2 discharges through R2 and the base emitter junctions of Q6 and Q7. This has been set to a several second delay, but by suitable selection of R2 and C2 any desired drop delay can be established.

The Q output of the two phase clock goes to Q2. When Q is high, Q2 conducts, lighting the light emitting diode (which indicates which channel is being received), and turns Q3 on. When Q3 is on a high is sent through the diode to the arms of switches S1, S2, and S3 in the synthesizer, enabling that switch bank. Likewise the other bank of switches is activated when Q bar is high. Fig. 3 shows the switch wiring in the GLB.

Parts are not critical. Q2, Q4, Q6, Q7, and Q8 are general purpose silicon NPN transistors. Q3, Q5, and Q9 are general purpose silicon PNP transistors. The scanner circuit can be built on a piece of perforated board small enough to fit inside the synthesizer unit. The connections to the channelizer are simple. The plus five volt connection may be made to the X1 - X1 jumper on the main board. The connection of the switch banks to Q5 and Q6 requires no breaks. Remove the wire connected to the arm of S8 (this is E9) and place it on the arm of the added scan switch. Connect the arm of S8 to the scan switch as shown. The light emitting diodes and the scan switch must be mounted on the synthesizer box. An extra jack and, preferably, a feedthrough capacitor should be mounted on the rear of the unit for the carrier controlled voltage input.

A point must be located, in the particular receiver being used, which is high when a signal is being received and low otherwise. With solid state receivers such a point usually exists and careful perusal of the receiver will indicate the proper point. With tube-type receivers there may be no such place. In any case, a carrier controlled voltage can be generated by installing a carrier operated relay in the receiver and putting a plus voltage on the normally open contacts. Circuits are around for adding carrier operated relays to many types of receivers and these can be used to generate the required carrier controlled voltage for the scanner.

I have been using the scanner for two years with no problems. Often I find myself putting the synthesizer in the car not because I want to use frequencies I don't have in crystals, but to be able to use the scan feature in the channelizer. The light emitting diodes have a pleasant side effect—they tell you the power is still on in an interesting way. Also, in troubleshooting rig problems, the lights should go out when the transmitter is activated.

Have fun listening to 67 and 94 (at the same time). Thanks go to K3RUQ for his help in construction. ■

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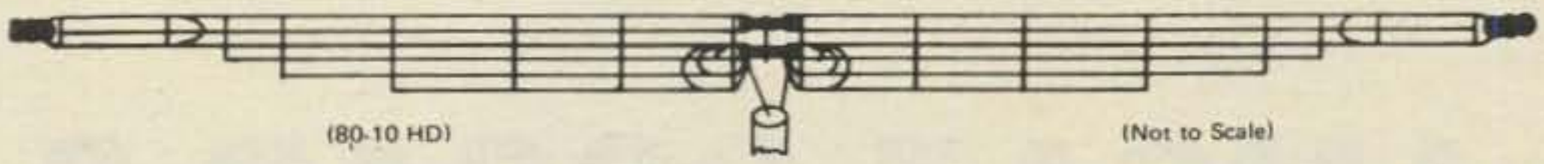

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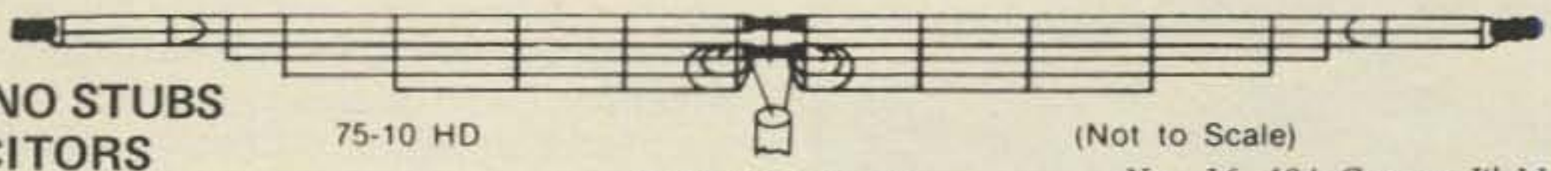

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80-40 HD	80/40 ⅓ 15	57.50	41/1.15	69/21.0
75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
75-10 HD (SP)	75/40/20/15/10	74.50	48/1.34	66/20.1
80-10 HD	80/40/20/15/10	76.50	50/1.40	69/21.0

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CIRCLE 31 ON READER SERVICE CARD

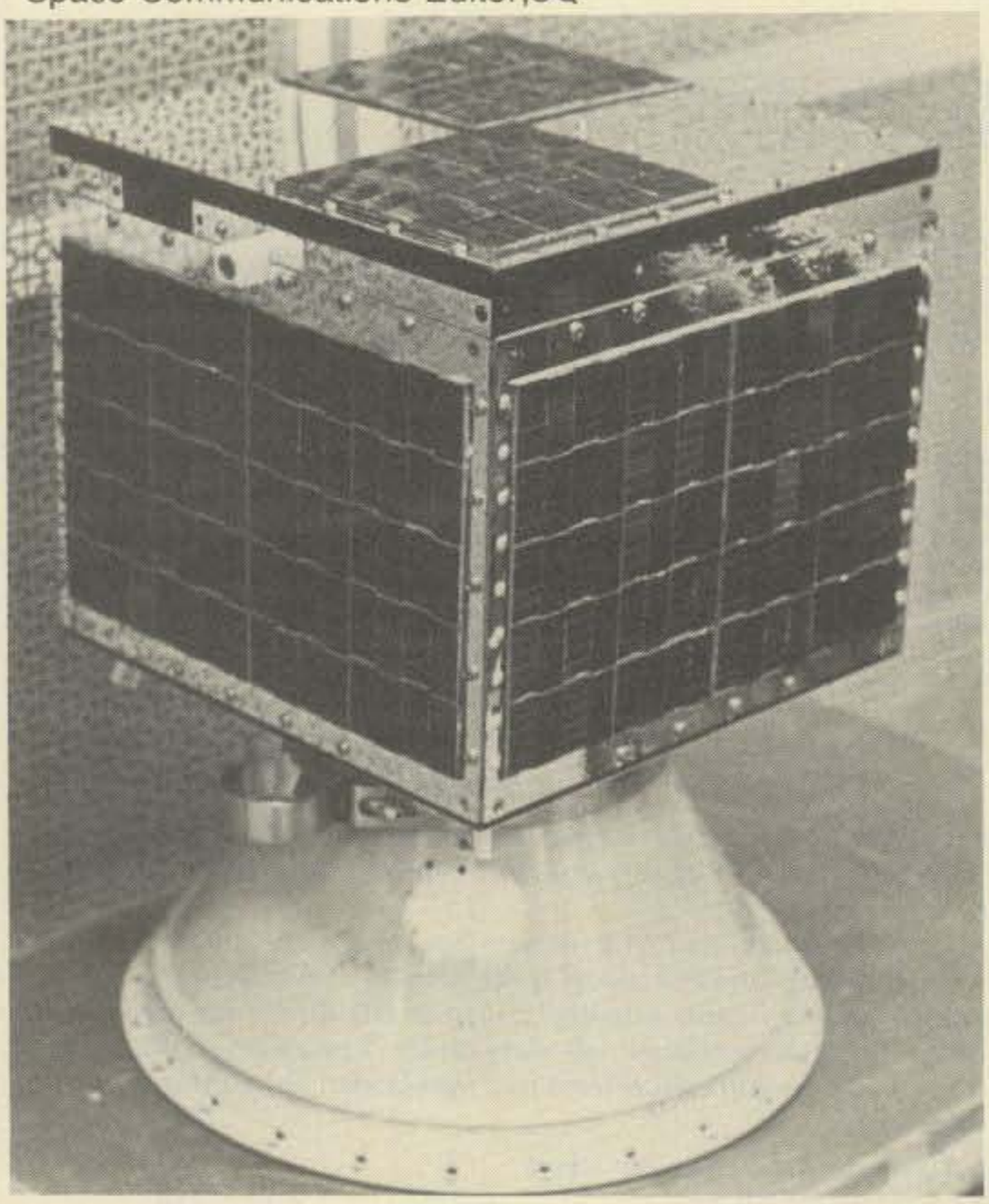
The future is now! George Jacobs describes the launch of amateur radio's newest satellite and explains its uses and implications.

AMSAT-OSCAR 8 Successfully in Orbit

BY GEORGE JACOBS*, W3ASK

Amateur radio has done it again. AMSAT-OSCAR 8 (A-O 8), the eighth in a series of satellites built by radio amateurs, is in orbit, and all on-board communication relay equipment appears to be functioning properly.

*Space Communications Editor, *CQ*



AMSAT-OSCAR 8 awaiting connection to its DELTA launch vehicle. Solar cells cover the satellite's outer surfaces. A-O 8 is now successfully in orbit providing radio amateurs throughout the world with reliable communications up to a range of 4,000 miles from its two on-board transponders. (AMSAT photo).

The latest radio amateur satellite was launched from NASA's Western Test Range near Lompoc, California at 1754 GMT on March 5, just at the deadline for this issue of *CQ*. We will have complete details about A-O 8 in a subsequent issue, but here are some of its highlights after nearly two weeks in space.

The 15-inch cubed solar powered spacecraft, weighing 60 pounds, was developed under the auspices of the Radio Amateur Satellite Corp. (AMSAT)[1] in cooperation with the American Radio Relay League, Inc. The satellite is the product of an international cooperative effort of which all amateur radio can be proud. Components were provided by groups of radio amateurs in the U.S.A., Canada, West Germany and Japan.

A-O 8 contains two transponders along with command and telemetry systems. Both transponders use the same *uplink* frequency passband in the 2 meter band, centered on 145.9 MHz, but employ different *downlink* frequencies. The Mode A transponder's downlink passband is centered on 29.45 MHz in the 10 meter band. The Mode J transponder's downlink passband is centered on 435.15 MHz in the 70 cm band. The satellite has two telemetry beacons which operate continuously on 29.402 and 435.095 MHz.

AMSAT-OSCAR 8 joins A-O 7, which has been in operation as a communication relay since November 1974 and continues to provide satisfactory services to radio amateurs throughout the world. A-O 8 also replaces A-O 6, which ceased operating early last summer after a successful lifespan of 56 months.

Amateur radio's newest satellite is in a sun synchronous polar orbit, with a period of 103.23 minutes. It completes fourteen orbits a day, and passes over the same place on earth at just about the same times each day. These are somewhat simpler orbital parameters, then, for previous amateur satellites, and it should make tracking A-O 8 a bit easier.

Table 1 list communication statistics for A-O 8, along with those for A-O 7. *Table 2* summarizes the important orbital parameters for both satellites.

AMSAT-OSCAR 8's launch and its deployment into space was a textbook operation. The satellite's 435.095 MHz telemetry beacon went into operation the instant the spacecraft

separated from its DELTA launch vehicle. Honors for hearing the beacon just after turn-on time at 1919:19 GMT go to G2BVN, G3ILD, and GM8BKE. The first U.S. station to hear the beacon during orbit #1 was W@LER.

The 2 meter-to-70 cm transponder and the 435.095 MHz telemetry beacon were built by JAMSAT, the Japan Amateur Satellite Assoc. The first Japanese stations to report hearing the beacon were JA1VDV and JA9BOH, both at 2258:30 GMT, during orbit #3.

Guided by telemetry data from the satellite and command signals from earth, the satellite's 10 meter antenna was care-fully unfurled during orbit #5, and the Mode A beacon was put into operation during orbit #6.

The new satellite's first two weeks in orbit were devoted entirely to extensive testing of on-board systems by selected stations throughout the world. It was planned to open the satellite for general, unrestricted use on March 19. By the time this article appears in print, thousands of radio amateurs in all corners of the world should have already communicated over distances up to about 4000 miles through A-O 8.

Although the satellite's communication horizon is just a shade over 4000 miles, it's Mode A 10 meter downlink signals can be reflected considerably beyond this range by the ionosphere. At least one report has already been received of the 29.4 MHz telemetry beacon being heard in the United States while the satellite was over Australia!

While AMSAT calculated that it would require at least 80 watts of *effective radiated power* to access the 2-to-10 meter Mode A transponder, WA4RID accessed it from horizon-to-horizon using a 1-watt transmitter and a simple dipole antenna. An *erp* at least on the order of 8 watts is estimated for accessing the 2 meter-to-70 cm. Mode J transponder.

Once in regular operation, AMSAT plans to keep the Mode A transponder in continuous operation Mondays through Fridays, with Wednesdays *reserved* for special experiments and educational projects. The Mode J transponder will operate continuously on Saturdays and Sundays.

For latest orbital data for both A-O 7 and A-O 8, tune to the regular phone and c.s. bulletins of W1AW. Check the latest issue of *QST* or write directly to ARRL[2] for W1AW schedules. Orbital data and up-to-the minute news about amateur satellites, right from the experts, can be obtained by joining the AMSAT nets every Wednesday on 3850kHz. Be sure to listen even if you can't transmit in this band. For East Coast stations the net meets at 0100 GMT, for Mid-States at 0200 GMT, and for the West Coast at 0300 GMT. Remember, this is *Tuesday* evening local time.

Data for computjng orbits, along with other announcements, are also transmitted via both satellites' telemetry beacons during the first orbit each day passing in a south-to-north direction (reference orbit).

If you're a beginner to radio amateur satellites and you want to find out how easy it is to set up your own OSCAR ground station for communication through them, order a copy of ARRL's new satellite booklet, *Getting to Know Oscar–From the Ground Up*. It covers everything the beginner needs to know about equipment, tracking and operating through radio amateur satellites, and it's a great review for old-timers as well. It is available from ARRL[2] for $3 postpaid in the US ($3.50 elsewhere). For an extra dollar ARRL will include the latest aids for tracking A-O 8.

There are more radio amateur satellites coming! The Russians plan to launch their RS-OSCAR satellite early this summer, and it may already be in orbit by the time that this appears in print. AMSAT is busy developing its first of the Phase III series of satellites, which is expected to be launched in about a year from now. Phase III satellites, in a high elliptical orbit, will provide reliable communications over paths of up to 11,000 miles for seventeen hours a day!

As many readers of *CQ* know, I was associated with the development of the first radio amateur satellite, OSCAR 1, nearly seventeen years ago, and I have covered every OSCAR launch to date. It is a most fascinating aspect of amateur radio, and I am still thrilled by each successful launch. The OSCAR program is a continuing demonstration that amateur radio is still at the forefront of modern technology. ■

Satellite & Mode	Uplink Passband MHz	Downlink Passband MHz	Telemetry Beacon MHz
A–O 8–Mode A	145.85-145.95	29.40-29.50	29.402
A–O 8–Mode J	145.90-146.00	435.20-435.10*	435.095
A–O 7 Mode A	145.85-145.95	29.40-29.50	29.502
A–O 7 Mode B	432-125-432.175	145.975-145.925*	145.972

*Inverted

Table 1–Communications parameters for A-O 7 and A-O 8 transponders and telemetry beacons.

Parameter	A–O 7	A–O 8
Period (Minutes)	115	103.23
Inclination (Degrees)	102	99
Equator Crossings (Westward progression, Degrees Long.)	28.7	25.8
Maximum Communication Range (Miles)	4900	4000
Maximum Communication Range (Kilometers)	7900	6400
Number of Orbits per Day	12½	14
Altitude (Miles)	910	545
Maximum Access Time (Minutes)	24	17

Table 2–Basic Orbital Parameters for A-O 7 and A-O 8 Radio Amateur Satellites

References

1. AMSAT is a non-profit organization dedicated to the development of radio amateur satellites. Membership in AMSAT, open worldwide, is important to the satellite program. The $10 per year or $100 for life dues will be a most significant contribution to the satellite program and the future of amateur radio. Members also receive the informative quarterly AMSAT Newsletter. For more details write directly to AMSAT, P.O. Box 27, Washington, D.C. 20044.

2. The American Radio Relay League, 225 Main Street, Newington, Conn., 06111.

Simplicity of construction and flexibility of use are the key ingredients of Gary Price's two-band vertical antenna.

Base Loading a Simple Vertical Antenna for Two-Band Use

BY GARY H. PRICE*, W6IRA

Operation here has remained low-key over the years. The station is modest by most any standards, until recently consisting of only a 25 year old ARC-5 transmitter running some sixty watts input on forty meters. A ground-plane vertical antenna graces the roof and an FET regenerative receiver completes the essentials. Awards have (perhaps understandably in light of the above) not stood high on the list of station goals, although a gradual approach to WAS has not gone completely unnoticed. Recently, however, the snagging (after a month's effort) of a ZS during their semiannual equinoctal influx produced, in addition to much celebration, the realization that only Europe remained for completion of WAC. Unfortunately, Europe (for the information of those inhabiting the eastern seaboard) is not noted in these parts for its cooperation on forty meters, and a period of patient listening confirmed the recollection of past experience: hearing them is still considered by some to be good form when working them. I wasn't!

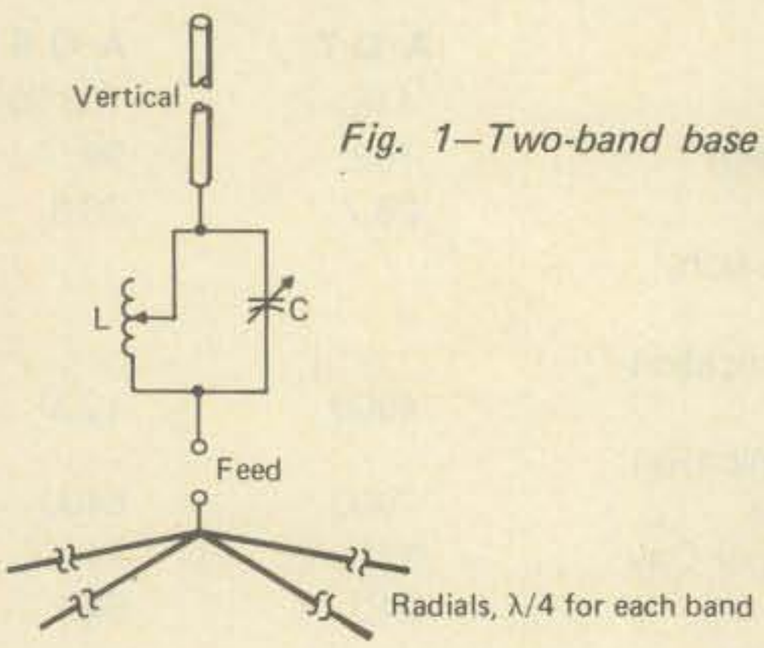


Fig. 1—Two-band base loading network.

It had become evident by this time that a crisis had finally arisen of sufficient magnitude to prompt serious consideration of station improvements. But what? Transmitter and receiver were fairly well matched in their capabilities, so increased transmitter power was not, in itself, the answer—I still wouldn't be able to hear them. Furthermore, I had been publically committed too long to the proposition that anything worth doing could be done, and with more satisfaction, using less than 100 watts. Installation of a sufficient antenna to make the grade on forty with the existing equipment was, although intriguing, also out of the question.

I had heard rumors for years that twenty meters was the DXer's fantasyland; perhaps multiband operation was the answer. Getting the gear on twenty seemed straightforward enough. The receiver was general coverage, and doubling the transmitter up to twenty would be, at least according to old articles found in the station archives, pretty simple. There remained the question of antennas. A beam, of course, would be the natural choice for one unfettered by other considerations. Not all agree, however, that beams are beautiful (I'm not so sure myself). The installation of a retractable tower was an option, but such a choice seemed, in addition to being more elaborate a project than had been intended, not altogether in keeping with the station image. The search for alternatives led to the conclusion that a vertical on twenty was not a completely hopeless proposition, albeit one not exactly enthused over by the club experts. Thought thus turned to how best to use the resources already perched on the roof.

Past experience suggested a number of guidelines. First, remote r.f. switching and/or antenna loading adjustments were best avoided. They could be counted on, oh yes, counted on to act up just when that rare one finally emerged from the pileup sending my call. My agility at erecting and ascending ladders, although considerable, would be sorely tried by such a challenge, to say nothing of my temper.

It also seemed worthwhile to eke out whatever gain possible from the antenna on twenty. Although not a great improvement, the use of the full length of the antenna would maximize to the extent possible its twenty-meter radiation at low angles. Finally, confusion when changing bands would be minimized if the tune-up procedure were similar for both the twenty and forty meter bands.

These characteristics were found to be attainable by

*733 Blue Sage Dr., Sunnyvale CA 94086

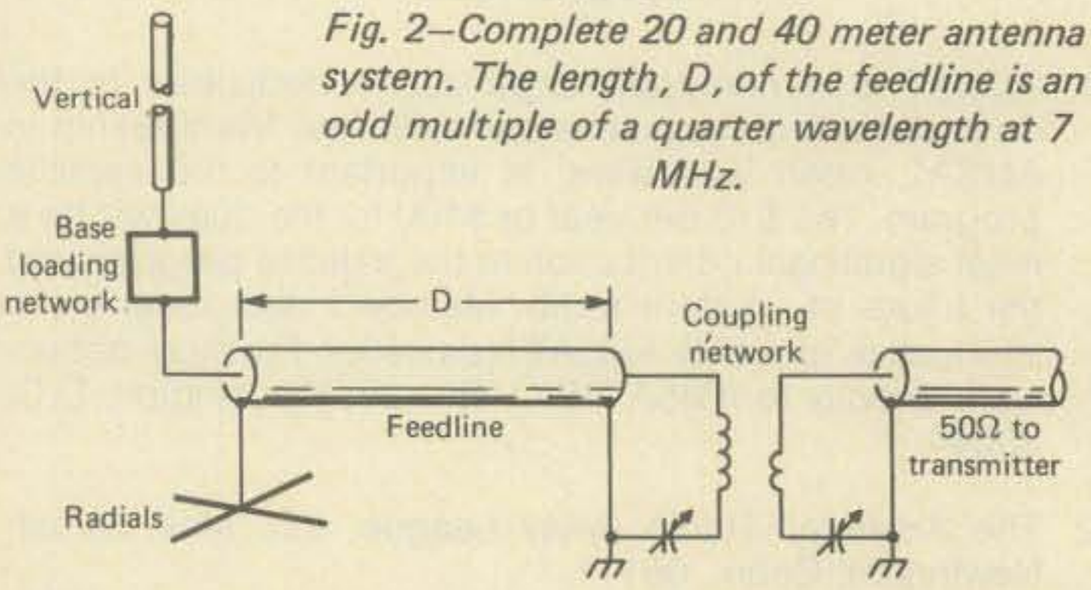


Fig. 2—Complete 20 and 40 meter antenna system. The length, D, of the feedline is an odd multiple of a quarter wavelength at 7 MHz.

modest elaboration of the forty-meter base loading network used with the existing antenna and a judicious selection of feedline characteristics. The antenna length, 7 meters (23 feet), suited it well to multiband loading for a resistive termination on both bands. This length is short of a quarter wavelength on forty meters, and the antenna had always been operated with inductive base loading. On twenty meters, the antenna would be long relative to a quarter wavelength, and capacative base loading would be appropriate. These requirements could be met by a fixed network consisting of an inductor and a capacitor in parallel, as indicated in fig. 1. The lower-reactance component of the combination would always dominate in the parallel arrangement, making the pair inductive for frequencies below its resonent frequency and capacitive for frequencies above this frequency. By suitable choice of values for the inductance and the capacitance, with their resonant frequency between 7 and 14 MHz, the reactance at these frequencies should be adjustable to provide the desired reisitive load on both bands without the need for any switching or tuning at the antenna.

Detailed calculation confirmed the initial analysis. The antenna reactance was estimated to be about -200 ohms at 7 MHz and about +200 ohms at 14 MHz.[1] Solution (see Appendix) for the network L and C gave 2.27 μH for L and 113 pF for C, and coil and capacitor were installed at the antenna base accordingly.

The reader should, however, not be lulled by the algebra of the Appendix into the conclusion that the job had been completed at this point. The paper analysis had provided a method and a starting point, but a working antenna remained to be produced. The actual reactance values of the antenna no doubt departed somewhat from those used in the calculation, and the L and C values were expected to require adjustment accordingly. A procedure for this adjustment was therefore devised.

Since two variables (L and C) were to be adjusted, some systematic approach was desirable. Unorganized trial and error could easily yield mostly error, a trial that seemed worth avoiding. It was reasoned further that the two components could best be adjusted alternately, while the antenna was switched back and forth between the two bands. On each band, the adjustment of one component should affect the antenna characteristics much more than would that of the other component. On forty meters, the net reactance of the loading network would be primarily that of the coil, and this reactance would be relatively weakly affected by changes in the higher-impedance capacitance in parallel with the coil. The converse would hold for twenty meters; the net reactance would be primarily that of the capacitor, and a relatively large change in the inductance would have only a secondary effect. Thus, adjustment for minimum s.w.r. on each band of the component whose effect was secondary *on the other band* should home in smoothly to the appropriate L and C values. This was indeed found to be the case.

The resistive component of the antenna impedance also varies with its length; a second reference to *The A.R.R.L. Antenna Book* provided values of 13 ohms at 7 MHz and 95 ohms at 14 MHz. The base loading network compensates only for the antenna reactance, and after optimization the minimum standing-wave ratio into a 50-ohm line was found to be about 3:1 on both bands, roughly consistent with the book resistance values. The matching network could have been elaborated to provide an impedance transformation as well, but the desire for two-band operation with a fixed network at the antenna complicates such an approach excessively.

The alternative to this procedure that was adopted is to complete the matching at the transmitter end of the feedline, which then operates with some standing wave on it. Although coaxial line is less immune to breakdown problems with high standing-wave ratios than is open-wire line, the relatively low power levels used here suggested that such an approach was feasible. Further consideration of the situation revealed a bonus. The impedance to be matched at the transmitter could be made nearly the same for both twenty and forty meters if the feedline were made an odd multiple of one quarter wavelength for forty meters. This length would provide a quarter-wave step-up transformer on this band. On twenty meters, the line would be a multiple of a half wavelength, thus presenting the antenna impedance unchanged at the transmitter end of the line. Moreover, a standard 25-foot length of RG-8/U coax, as was already in place, comes very close to an electrical quarter wavelength on forty meters. Clearly, further exploration of alternatives at this point would have been ignoring fate.

Although 50 ohms was not a necessary value for the impedance to be presented to my transmitter, it did offer certain advantages of standardization and also simplified the monitoring of antenna performance with an available s.w.r. meter. A matching network, using coupled series-tuned LC circuits, as befitted the estimated 100 or 200-to-50 ohm impedance transformation desired, was therefore built along standard lines[2] to join line and transmitter.

The completed antenna system is illustrated schematically in fig. 2. Adjustment of the final coupling network at the transmitter achieves s.w.r.'s of 1:1 on forty meters and 1.1:1 on twenty meters. Wet weather requires some readjustment of the tuning network, particularily on twenty meters, where the minimum s.w.r. deteriorates appreciably during downpours (not a problem of late) even with retuning. Ground radials on shingle substrate evidently possess electrical

(Continued on page 84)

[1] *The A.R.R.L. Antenna Book*, 10th Edition (1964), p. 61.

[2] *The Radio Amateur's Handbook*, 53rd Edition (1976), p. 583.

David P. Costa shows CQ readers how to quickly find insulation stress in a length of cable with the use of a nomograph.

Determining Electrical Insulation Dielectric Stress

BY DAVID P. COSTA*

The stress at any point in the electrical insulation of a single-core cable of circular cross section is given by the formula:

$$S = \frac{E}{(r+d)\ \log_e (R/r)}$$

where:

S = stress in electrical insulation material, kilovolts per centimeter.
E = effective voltage applied between conductor and sheath, kilovolts.
r = radius of conductor, centimeters.
d = radial distance from surface of conductor to point where stress is required, centimeters.
R = radius over electrical insulation, centimeters.

The nomogram solves the above equation if any four of the five variables are known.

Example: What is the maximum stress in the electrical insulation material (at surface of conductor, hence d equals zero) in a single-core cable if the effective voltage applied between conductor and sheath is 30 kilovolts, radius of conductor is 0.8 centimeter, and radius over the electrical insulation material is 1.2 centimeters?

Solution: 1) Project grid intersection of r and d through R.
2) Connect E through projection, intersect at 90°.
3) Find S equals 92 kilovolts per centimeter. ■

*Compartment 285, 217 W. 18 St., New York, NY 10011

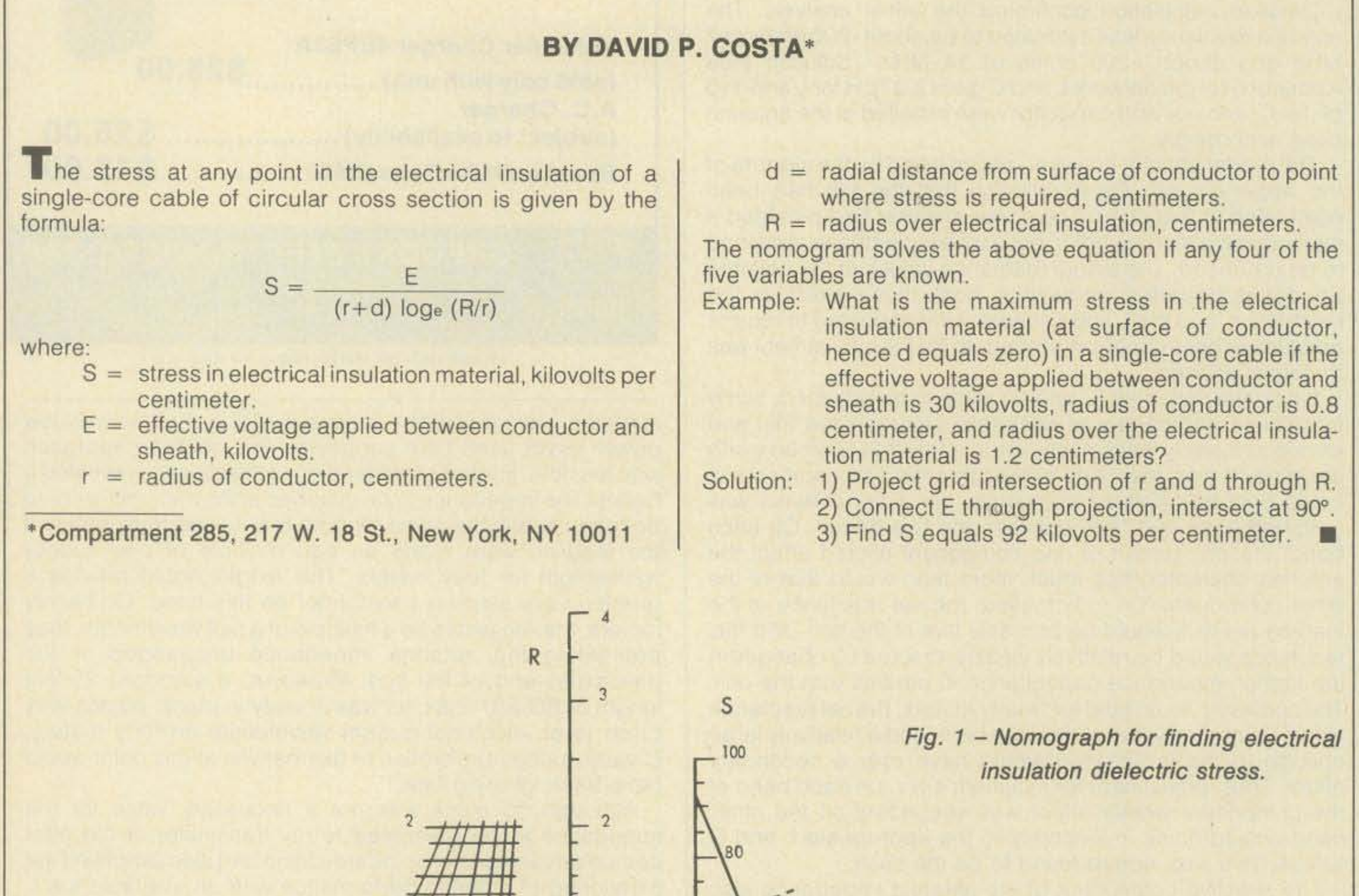


Fig. 1 – Nomograph for finding electrical insulation dielectric stress.

CQ Reviews: Radio Shack TRS-80 Microcomputer

BY ROBERT L. STITES*

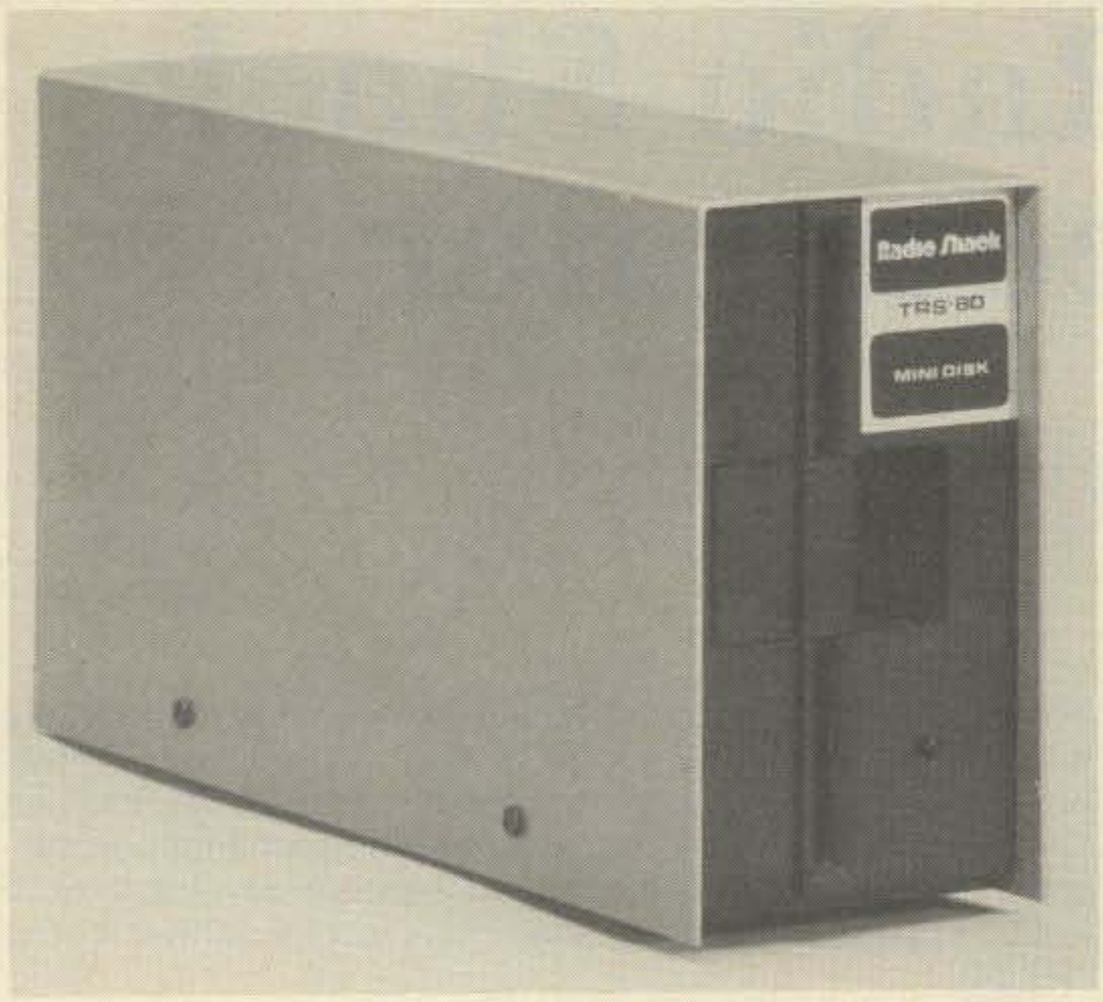
Many people were astonished when Radio Shack announced that it was going to enter the microcomputer market. In announcing the new TRS-80 Microcomputer, Lewis Kornfield, president of the Tandy Corporation Radio Shack Division, called the unit the "most important product" that Radio Shack has ever made. He also stated that the company was prepared to sell "quite a few thousand systems" during the first year. If sales are any indication, he may be correct. Sales have actually exceeded expectations. Sales have to be based on more that a gimmick . . . there has to be some reason, and that reason is the product itself.

This writer was impressed with the Radio Shack TRS-80 Microcomputer. The performance of the unit is comparable with units costing a lot more. When compared with similar pre-wired microcomputers in the same price range, this unit easily holds its own. With good price/performance, an emphasis on service, and continued product development, it would appear that Radio Shack has a real winner in the TRS-80.

It should be noted at the outset that no computer, micro or not, is going to be all things to all people, that each has to be judged on its merits relative to some objective. Radio Shack has suggested, as have others, that computers "are about to become a part of everyday life in American businesses, schools, and homes." It is with respect to these "business, schools, and homes" that this article shall attempt to view the TRS-80.

*Ikonix Inc., 13708 Smallwood Ct., Chantilly VA 22021

Radio Shack's complete TRS-80 Microcomputer System, consisting of a 53-key professional-type keyboard and microcomputer plus regulated power supply, computer-controlled data cassette recorder and 12" video display monitor.



The TRS-80 mini-disk.

This review will attempt to look at the hardware and software to see if they meet Radio Shack's claims. Do they perform and if so how well, is service available and lastly, what does the future hold for system expansion?

Hardware

The Level I TRS-80 system consists of four components: the TRS-80 Microcomputer with 4k (4096) bytes of random access memory (RAM) and Level I BASIC, a twelve inch video monitor, power supply, and cassette recorder. In addition, our evaluation system included several software packages (available at additional cost) including: Payroll, Math I, and Personal Finance.

The initial reaction to opening the boxes containing the TRS-80 system is to wonder whether the containers were empty. The use of an ABS plastic case for the microcomputer and video display has resulted in a stylish and lightweight system. ABS plastic has long been known as a material which is capable of accepting a great deal of abuse.

The 16½ × 8 × 3½ keybord unit actually contains the microcomputer, audio cassette interface, and refresh memory for the video monitor. It even contains what Radio Shack refers to as the Level I BASIC language, and the 4096 bytes of RAM memory. And, believe it or not, the unit is capable of expanding to 16k of RAM (optional) and triple the amount of ROM (12k), all internal to the keyboard unit.

The Z-80 microprocessor chip is the heart of the TRS-80 Microcomputer. For those familiar with the more abundant 8080 CPU, the Z-80 is generally regarded as a more powerful processor with approximately twice the instructions of the 8080A. The Z-80 instruction set actually contains all the machine codes of the 8080A. While faster versions of the Z-80 are possible, Radio Shack opted to use a slower existing 2 MHz (approximate) rate. According to Van Chandler of Tandy Advanced Products, this was dictated by the cost of the chips and interfacing. The clock timing is actually derived from the video timing.

The Read Only (ROM) is used to contain the Level I BASIC and routines to drive the keyboard, video, and cassette interfaces. Initially provided with 4k of ROM, the system may be expanded (as an option) to 12k bytes with the addition of Level II BASIC.

The Random Access Memory (RAM) is available to either a 4096 byte or a 16k version (option). Our evaluation system was the minimum 4k system. While this does not sound like a large amount of memory, it is important to remember that the ROM contains the elementary monitor and editing software in addition to the BASIC interpreter. The result is that the RAM is almost completely available to the user for program space.

The keyboard is a full size 53 key unit. The layout is the same as a typewriter making it easy to adapt to its use. The tactile response of the keys is not as good as the best commercial keyboards but it is certainly better than many of the hobby grade units and at least equal with bottom of the line commercial units. The larger than normal ENTER (return), and SHIFT keys, similar to better typewriters, make the operation of the unit a lot easier. While these items may seem rather trivial, it is important to remember that the keyboard is generally the primary method for the input of information. Many hours of usage without one or all of these can lead to considerable frustration. Any reader doubting this should try typing on Commodore's PET computer for an hour or more.

The video monitor has a 12 inch screen driven by a 75 ohm output from the microcomputer chassis. The video logic generates all of the signals necessary to provide 16 lines of 64 characters each. In addition it is possible to directly position at any location on the screen for printing purposes. This is useful when updating only one variable without having to rewrite the entire line of text preceding it. The video generator also provides the ability to set, reset and test smaller 2 × 3 units of the display. This provides the ability for graphics of a coarse but very acceptable nature. Perhaps the output speed to the display is one of the nicest features of this video unit. Since the microcomputer transfers information to the video memory at bus speeds, a listing of 12 lines of a BASIC program requries less than one second.

The cassette is, as had become common in the hobby market, a standard Radio Shack audio cassette recorder. Any audio cassette recorder of reasonable quality with jacks for REMOTE, EXT Speaker, and Microphone will work. The REMOTE input to the recorder allows the TRS-80 to turn the recorder on and off during READ and WRITE operations. This provides some limited ability for handling cassette data records. The cassette interface, again an integral part of the TRS-80 microcomputer, transfers information to the cassette recorder at approximately 300 baud. While the base system will support only one tape recorder, independent *read* and *write* REMOTE lines for the cassette interface would have been nice. This would have allowed the connection of two recorders, one to be used for recording and the other to be used for playback. This would greatly enhance the file handling ability of the base system. The new options include an expansion chassis which will make it possible to address two different cassette units. If this is the only expansion desired, it is a pretty steep price to pay for the feature ($299.00).

The power transformer is housed in a separate unit in order to reduce the heat and space problems that would have been encountered if the unit were mounted in the microcomputer chassis. It is interesting that the single problem which has been predominant, out of all those encountered, has been with inadequate fusing for the power supplies. These problems have been corrected and anyone receiving a TRS-80 should not be concerned.

An expansion port is provided on the back of the microcomputer chassis to allow continuation of the TRS-80 bus. This will enable the addition of peripherals and memory at a later time. As of the time of this writing, the only documentation available describing the port was a list of pin connections and term names. It is also not clear at this time whether any strain relief will be provided with the expansion cables. The bus is unique to the TRS-80. It is not the more common S-100 bus with which most hobbyists are familiar. This limits the availability of other special peripherals which abound for the S-100 bus. One point that should be made here is that Radio Shack feels they will soon become a "standard" by virtue of the number of units sold. If this occurs then alternate sources will develop for add-ons.

BASIC

Radio Shack is currently offering two levels of BASIC, a rather easily learned language, with the TRS-80. Our evaluation system contained the Level I Basic in 4k of ROM. By placing the BASIC in ROM the system is "ready to use" as soon as power is turned on. This is a floating point BASIC with a stated 7.1 digits of accuracy and an approximate range of $10^{\pm 38}$. This lower level BASIC, in addition to its 20 odd standard commands, includes commands for graphics functions (4), and cassette handling (4). String variables are limited to 2, each a maximum of 16 characters, with no string functions inncluded. The user is limited to 26 simple variables and one single dimensioned array. While there are limitations imposed by this version, it is still possible to do a lot with Level I BASIC. This is evidenced somewhat by the applications software available under Level I, some of which are discussed later in this article.

For those who have no experience with the BASIC language the TRS-80 Level I comes with an *excellent* 232 page "User's Manual." This is a "programmed instruction" manual with examples and problems which allow the reader to learn at his own speed. Sample answers to problems are given in the back of the manual along with a group of sample programs. If the lack of the more advanced math functions cause some concern, one appendix contains subroutines for many of the more common functions.

A shorthand notation for most BASIC statements is also supported. For example, this allows the user who is limited on memory to enter *P.* instead of PRINT. The option to use this type of notation can save considerable space in memory if used consistently in larger programs, but does not preclude the use of standard terms.

The most serious limitation encountered with the Level I BASIC was the 7 digits of significance, of which only six are printed. For example, consider a program:

```
10 A = 5000.011 + 5000.051 + 5000.021
20 PRINT "A ="; A
30 END
```

The TRS-80 will display

```
A = 15000.1
```

instead of 15000.083. This limitation may not be of any concern to an individual who is learning to program but it may be of great importance to the small businessman or his employee if the problem involves dollars and cents or perhaps in some complex statistical analysis.

The limitation of sixteen characters for the two string variables might also be rather limiting for some applications. These two problems may leave little alternative in some programs - at least under Level I BASIC. The alternative is provided, however, with the Level I BASIC option.

Service

Service is generally not considered by most purchasers until something happens. It is unfortunate that repairs may often take several weeks for some equipment . . . but not the TRS-80. Radio Shack has established service centers around the United States to repair most of their products. According to David McClay, manager of a Radio Shack regional service facility in Arlington, Virginia, it is Radio Shack's policy to turn all TRS-80's around within 48 hours after receipt at the repair facility. An owner with a problem can take his unit to his local store where it will be sent to the service center. Of course this type of turn-around has been primarily for warranty coverage. As non-warranty service becomes more prevalant and begins to cover a wider range of peripherals it may become more difficult to maintain this level of support. Mr. McClay indicated that the entire Radio Shack organization is placing a great deal of emphasis on their ability to provide service for the TRS-80 in an expeditious manner now and in the future.

The TRS-80 line printer.

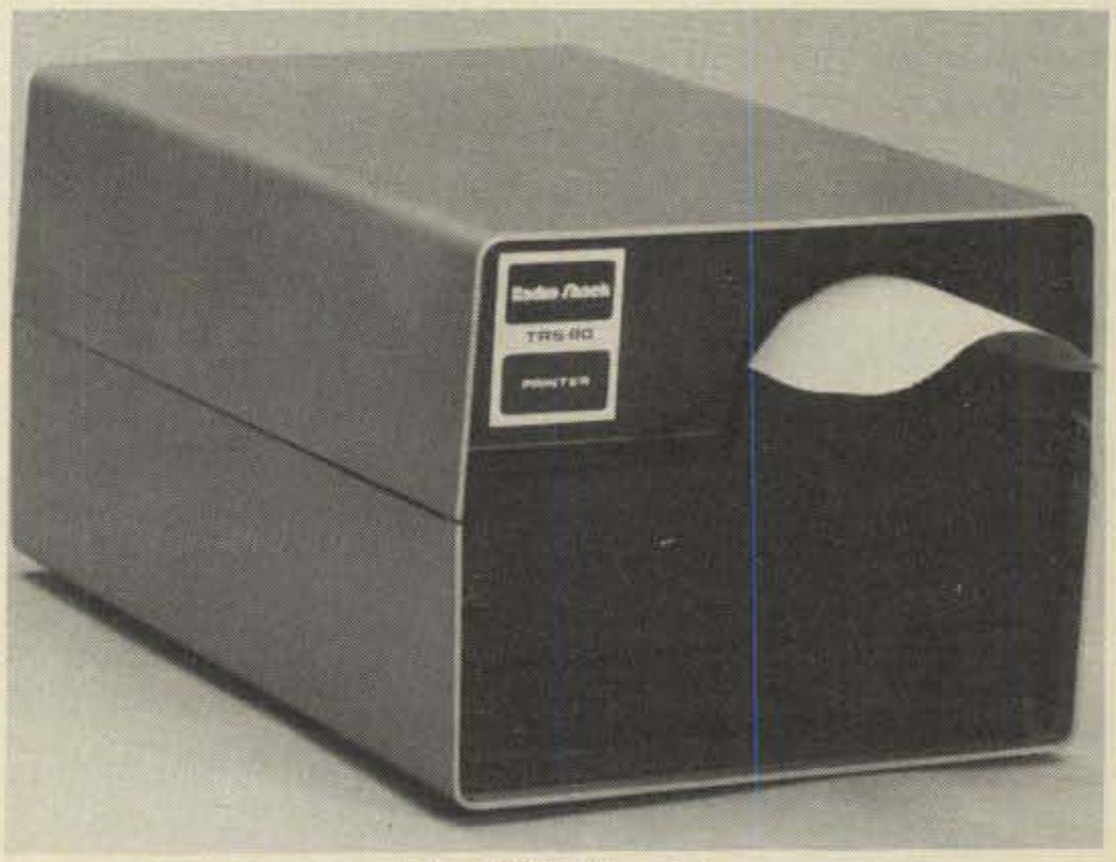
While it is nice to know that service is available if needed, it would be nice to know how often it is needed. Reliability statistics, as such, are not yet available. However Mr. McClay indcated that his center had serviced less than forty units by mid-February. That is a pretty good record for a region which has accounted for a large percentage of TRS-80 sales.

Software is not warranteed in any manner by Radio Shack nor will they accept any liability or responsibility to the user. They do state that testing and parallel operation with previous methods are "good" procedures to follow. This is certainly an excellent recommendation, warranty or not. It should be noted that while no software service is implied, Radio Shack has distributed corrections for several packages through its "Microcomputer Newsletter."

Software

The TRS-80 is distributed with one game cassette containing Blackjack and Backgammon. These are both intriguing games as presented on the TRS-80. They both utilize some of the graphics commands, particularly Backgammon. Because they are both written in Level I BASIC it is possible to list the programs providing useful programming examples for the novice programmer.

In addition to the games cassette, our evaluation system included some of the optional software products. The *Home Recipe* cassette and three applications software packages; the *MATH I Program*, the *Personal Finance Program* and the *Payroll Program*. Each of the last three software packages is



The TRS-80 printer.

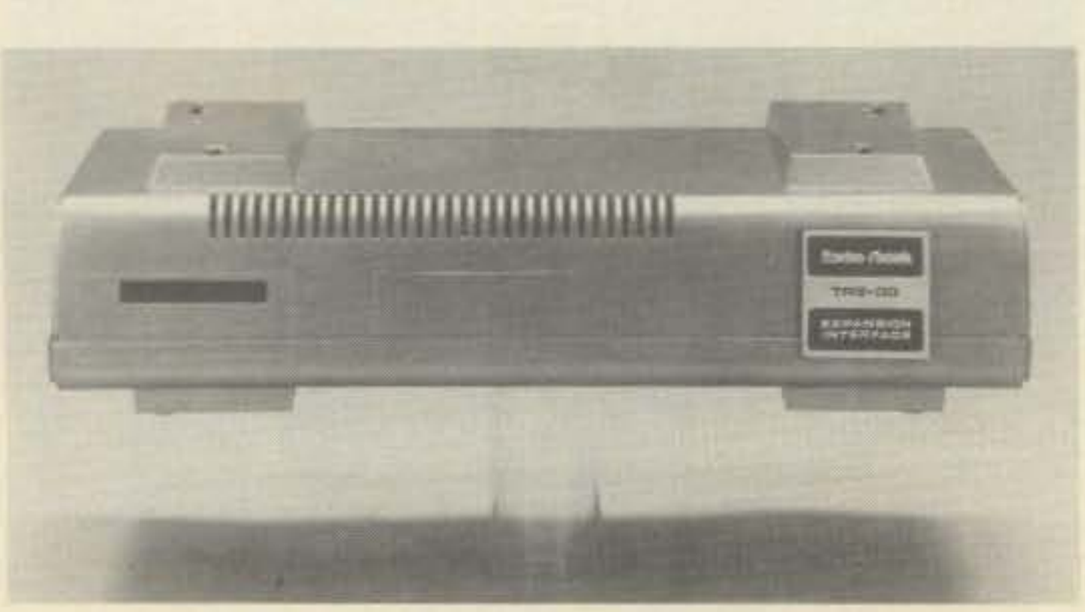
delivered with multiple cassettes and operating instructions in a loose leaf binder.

The Home Recipe Program's advertisement says "... Menus, directory, message center ... with this program kitchen chores can be organized, simplified, and 'computerized.'" This cassette was honestly a disappointment! What it actually contains is two programs, one to convert a receipe for a given number of servings, and another to provide a message center, rather like an electronic blackboard for the kitchen. This writer's wife considered the Recipe program an affront to her intelligence. It actually requires more time to load the cassette or to type in the entries than it does to use a pad and pencil to compute the amounts. As for the message center it will record up to 32 lines of messages but if you turn off the power you lose all information contained in the machine. The program will not allow you to do anything else while it is storing these messages. It might have been a nice example in the programming manual but it is doubtful if many purchasers will find a use for this package. It is sincerely hoped that Radio Shack will come up with some better products which are truly "useful" in the home.

The *MATH I Program* is a three cassette package ($19.95) which provides review and reinforcement of basic addition, subtraction, multiplication, and division facts. An evaluation tape is also included for testing purposes. This package will be most appreciated by those parents who have had difficulty with their children in reviewing very basic math facts. While the problems tend to be rather trivial even for a a second or third grader it is possible to modify the programs to use different sets of problems requiring greater skills.

The *Personal Finance* software is an interesting collection of four programs to assist in tracking household budgets and balancing the checkbook. Budget preparation can be assisted by summarizing monthly or to-date expenses in up to 32 catagories. For those who would like to monitor their expenses and attempt to budget same this could be a worthwhile investment at $14.95. Four blank tapes to record outstanding and canceled checks along with the monthly budget are provided. The documentation is brief but the instructions given by the programs are adequate and self explanatory. These programs are also written in Level I BASIC so the user who has additional requirements may make modifications where desired. Although these packages will summarize on an annual basis if desired, do not expect to have summaries with cents included if dollar amounts exceed $9999.99 (for example, salary). This is due to the maximum number of digits which Level I BASIC will print.

The *Payroll* package for small businesses has real potential for $19.95. The literature says that the system will handle up to 12 employees on a 4k system. As delivered, and without modifications (provided), it will actually support only 11 employees. The package includes documentation for alteration of the tax tables as needed and the method to correct a data tape. The payroll Quarterly Summary program (and all cumulative totals) may encounter problems with the lack of significant digits for large totals. Due to the limit of six printed digits all information recorded on tape is rounded and truncated to the most significant six digits. Errors of this type can become cummulative so caution is advised. While it is a relatively minor item it would have been nice to include provisons for computations of Federal Unemployment Tax (FUTA). This could always be added by the purchaser with some attendant loss in the number of employees covered.



The TRS-80 expansion interface.

What About Future Expansion?

When one purchases any major item it is natural to be concerned about the future of the product. What can you add in the future that will allow your system to expand in capability? The three primary areas for expansion are software, memory, and peripherals. The TRS-80 has each available now and more on the horizon.

Software expansion is availiable in the form of a more capable BASIC and numerous software packages in addition to the one previously mentioned. Radio Shack has announced Level II BASIC as an option at $99.00. This option, contained in ROM, replaces the Level I ROM. The Level II BASIC offers 16.8 digit double precision and integer declarations, 255 character string variables, two character variable names, along with improved graphics, print formatting, 500 baud cassette transfer, and named cassette files. This new version offers 8 string functions, over 20 new intrinsic arithmetic functions, more program statements and commands (including PEEK and POKE), along with a full set of disk I/O statements. Level II BASIC is required in order to support the line printer and mini disc peripherals. The Level II BASIC can be ordered with a new system or as a retrofit at one of Radio Shack's service centers. While this writer has not yet used the Level II BASIC, based on specifications it looks to be a good option. It should definitely be considered by anyone involved in a serious data processing application.

Among the list of software products there are several worth mentioning. An *Editor/Assembler* program is available for the TRS-80 at $29.95. This assembler offers no conditional or macro capabilities but will run on any TRS-80 with 16k of RAM. For those who wish to use the Z 80 in machine language a T-BUG program is offered at $14.95. A *Statistical Analysis* program offering linear regression and simple correlation among many other routines is available at $29.95. Another educational package *Algebra I* has also been added to the software products. There are several more currently available and according to Bob Kubala, of Tandy Advanced Products, Radio Shack is looking seriously at a number of special engineering, laboratory, and business applications for the future.

In the area of hardware, the optional 16k RAM memory has already been mentioned but it should be noted that with the addition of the Expansion Interface it is possible to add two more 16k RAM options for a total of 48k of RAM. Two printers are available, one which copies the video screen on electrostatic paper at $599.00 and the second a dot matrix impact printer at $1299.00. A mini-disk offering 86 to 96k bytes of storage is another option at $499.00. The more expensive line printer and disk both require Level II BASIC and the Expansion Interface options.

Van Chadler, also of Tandy Advanced Products, indicated that future hardware options under consideration by Radio Shack include an RS-232 interface, an EROM programmer, modem, and a complete line of peripherals. When asked about complete hardware documentation for maintainence of and interfacing to the TRS-80 it was indicated that this type of documentation is under development but currently has no scheduled release date.

(Continued on page 84)

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Ohmmeters have many commonly known uses on the amateur's test bench. In addition to these, John Schultz discusses others which are not so well-known.

An Ohmmeter Potpourri

BY JOHN SCHULTZ*, W4FA

The standard ohmmeter scales on the usual VOM or VTVM satisfy most needs. But, they do have limitations. For instance, that ¼ inch separation between the 1 kilohm and 50 kilohm markers on the upper scale of the 50k range can prove to be mighty frustrating if one is trying to measure any resistance between 1k and 50k with any degree of accuracy. Also, the low end of the ohms scale usually leaves a lot to be desired. A typical low ohm range on a VOM may have markers down to 2 ohms but it is totally impossible to evaulate really low resistances on the order of ½ ohm or less. The measurement of such low resistances can be quite useful if one is trying to measure the effectiveness of a ground or the metallic connection in a cable. Lastly, the usual VOM or VTVM (even a digital multimeter) requires that one glance away from the point where one is placing the test probes to check the meter reading (or digital display). On a complex p.c. board it doesn't require in many cases more than that glance away to lose one's orientation on the p.c. board.

The "potpourri" of ohmmeter circuits described in this article includes circuits that will solve inexpensively and easily each of the limitations described above for the usual ohms scale on a VOM or VTVM. Not every amateur will require all the circuits described in this article but surely one or more of them will be found useful in the average case to eliminate some of the usual ohmmeter frustrations.

The usual "crushed" scale at the upper end of a resistance range of a VOM or VTVM results because a linear relationship does not exist between the meter deflection as caused by the current passing through it and the unknown value of the resistance being measured. The reasons for this lie in the current equations for the usual ohmmeter circuit. A battery in the VOM or VTVM is used to pass a current through an unknown resistance and the meter is used to measure the division of current through it and the unknown resistance or the voltage across the unknown resistance in a form of bridge circuit. So the VOM or VTVM manufacturer has to reach a compromise between the number of ohmmeter ranges on a given instrument and the price of providing those ranges while still covering all commonly encountered resistance values with reasonable accuracy.

The solution to this problem is, of course, a linear direct-reading ohmmeter. That is, an ohmmeter utilizing, for instance, a basic 0-1 mA meter used in a special circuit so that an unknown resistance of zero to 1k ohms provide a *linear* deflection on the meter from 0-1 mA. A similar resistance range of 0-100 kilohms could also be displayed *linearly* on such a meter. A circuit that will do this is shown in fig. 1. The circuit has a number of interesting features besides its simplicity, which is apparent. It operates by making a comparison between an unknown resistor and a standard resistor in the circuit. The unknown resistance value is simply the arithmetic product of the value of the standard resistor times the current reading in milliamperes. So, for the circuit shown, since a 1k standard resistor is used, a "1" reading on the meter indicates 1 kilohm, a "0.5" reading is 500 ohms, etc. The ohmmeter requires no calibration, as such, if a 1% tolerance resistor is used as the standard resistor. However, if it is not convenient to obtain such a resistor a multiturn trim potentiometer can be used instead. Then, of course, it will be necessary to do a one-time calibration of the ohmmeter using a known resistance. Various standard resistors can be switched in the circuit so one can have multiple ranges such as 1k, 10k, 100k, etc. There is also no need to zero-set the circuit as with the usual ohmmeter. When the test leads are shorted together the meter will always read zero. Various supply voltages from about +18 volts on up (two or three 9-volt transistor radio batteries in series) can be used.

The circuit, in spite of its many useful features, still does not provide good enough resolution for measurements below 1 ohm. A circuit that will provide such a capability is shown in fig. 2. It can be assembled as a complete, portable instrument or it can be used as an accessory with an existing VOM by utilizing the microampere range on a VOM in place of the meter shown.

The circuit is just a simple bridge arrangement with the component values chosen so it is useful for low ohms measurement down to a fraction of an ohm. R1 balances the bridge and should be a multi-turn potentiometer, if possible, for ease in setting the meter reading to zero when the R_x terminal (or test leads) are shorted. A regular potentiometer can also be

*Box L, FPO, NY 09544

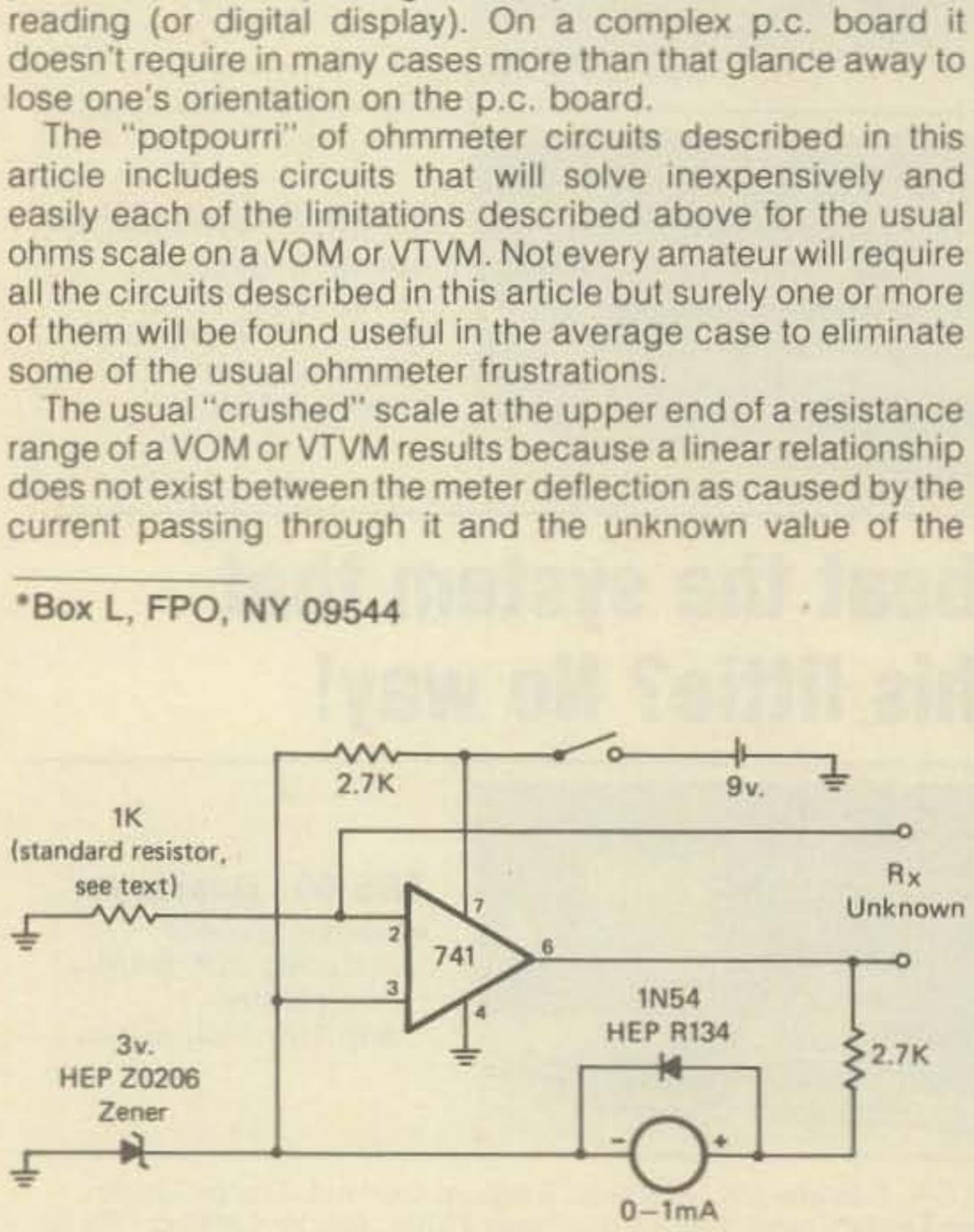


Fig. 1 – This unique ohmmeter has a linear reading scale, requires no calibration and requires no zero adjustment. It may be made multi-range by switching in different "standard resistors."

used if one doesn't mind the "touchiness" of the zero adjustment. R2 is used to calibrate the meter and this can be either a comparative type of calibration or a full, absolute calibration. For instance, if one were checking low resistance transformer windings and trying to sort out various windings, a comparative sort of calibration could be made. That is, one winding is chosen as Rx and R2 adjusted so the meter reads some value such as half-scale. Then, other windings are checked and if their resistances are lower, the meter will read lower. If their resistances are higher, the meter will read higher. A simple one-point calibration can be made using a known, low resistance and setting the meter to some convenient scale marking *via* adjustment of R2. Then, one can tell if unknown resistances are above or below a known value. A fuller calibration can be made if one has a series of known resistances. R2 is adjusted only once with a known resistance of mid-range value to approximately half-scale meter reading. Then other known resistors are used for Rx and a calibration curve made up for the meter scale. The meter readings are not linear with respect to resistance and so this is the only way the scale can be fully calibrated.

There are two handy sources of known resistance values. One is meter shunts and power resistors. Often surplus houses will have these items in low resistance ranges at very low prices due to their having been designed for specific uses and having little general applicability. One surplus house, for instance, was selling power resistors in the .06 to 5 ohm range for an average price of 20 cents. Another source of known, low resistance values is small gauge annealed copper wire. At room temperature, it requires 49 feet of AWG #23 to produce one ohm or 9.7 feet of #30 to produce one ohm.

Note that the battery is inserted in the circuit using a push-button type switch. This is to prevent continual meter pegging if the Rx points happen to be open. Many audible ohmmeter circuits have appeared over the years but probably none can beat the simplicity and versatility of the circuit shown in fig. 3. The circuit is built around a 555 timer and can be powered by a 9-volt transistor radio battery. The resistance detection range is from zero ohms to 10-plus megohms. At the high resistance value the output is a series of slow spaced clicks from the speaker. At zero ohms, the circuit oscillates with a high pitched tone. Intermediate resistance values produce different tones. It is quite easy after one uses the device a bit to distinguish between broad resistance ranges as one goes through the checking of a circuit. The current that the Rx terminals pass through the unknown resistance is very low (in the microampere range) so the device can be used to check semiconductor junctions without damage. R2 sets the frequency of oscillation for zero ohms and one could make this resistor variable, if desired, for different tone ranges.

The circuit of fig. 3 has a few other interesting uses which fall out of the ohmmeter function but still are worth mentioning. With the Rx terminals shorted, one can key the ground lead of pin 1 and have a code practice oscillator with a good, clean sound. Since the Rx terminals respond to such a broad resistance change range, the circuit can be used as an alarm circuit. A moisture detector can be formed using two wire tips for Rx. With a suitable photocell as Rx, the circuit will "sound-off" when a light beam hits the photocell. But, probably, the most useful ancillary use for the circuit is as a battery checker. Two fully charged ni-cad cells in series will not cause the circuit to "sound-off" when connected at Rx. If the cells are discharged, they will cause the circuit to "sound-off." One can confirm the circuit action by substituting a variable voltage for Rx and varying the voltage over the 1.8 to 2.4 volt range. The point at which the circuit turns on is quite sharply defined and it is independent of the exact voltage of the 9-volt battery powering the circuit. If one wanted to tailor the turn-on voltage for a particular value, this can be done by the adjustment of R1 and R2. ■

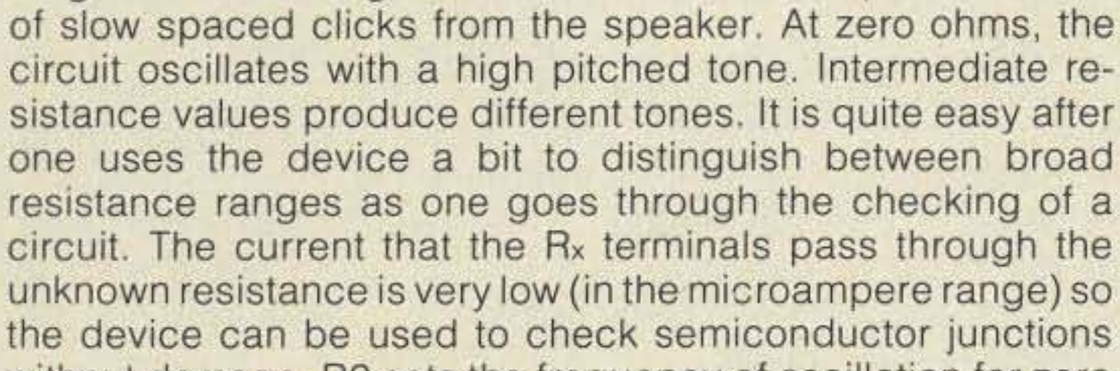


Fig. 2 – A bridge circuit designed for the measurement of resistances from about 5 ohms down to about 1/10 ohm. There must be a good, firm connection to any unknown resistance, of course, if valid measurements are to be made.

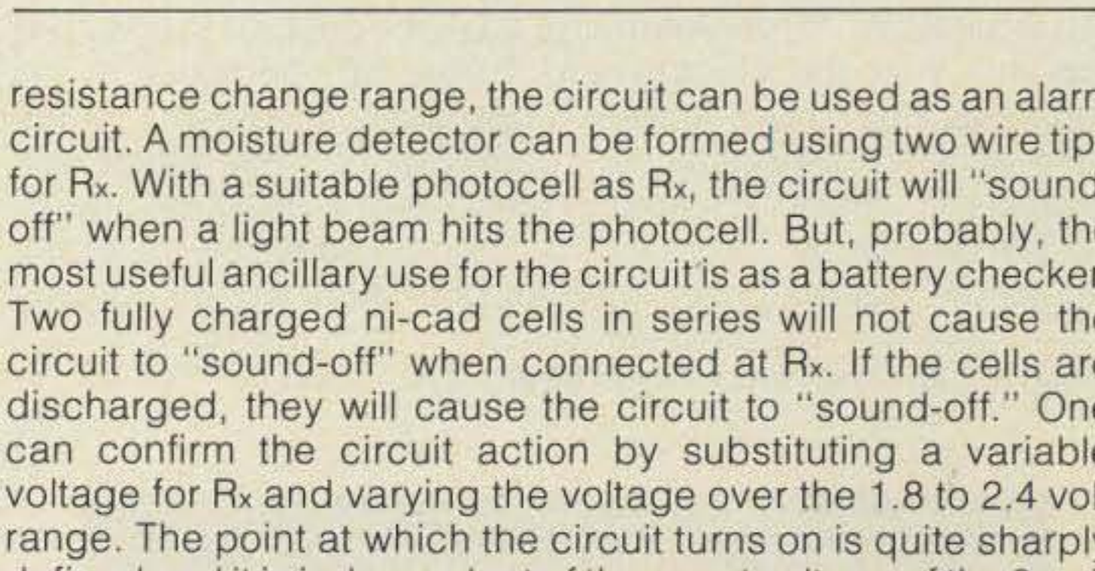


Fig. 3 – An extremely simple but very versitile audible ohmmeter. The circuit may be even further simplified by replacing the transformer/speaker with a high impedance speaker.

Richard Klinman shows our readers how to modernize and improve the venerable CDE control box.

How to Update Your Ham-M Rotor

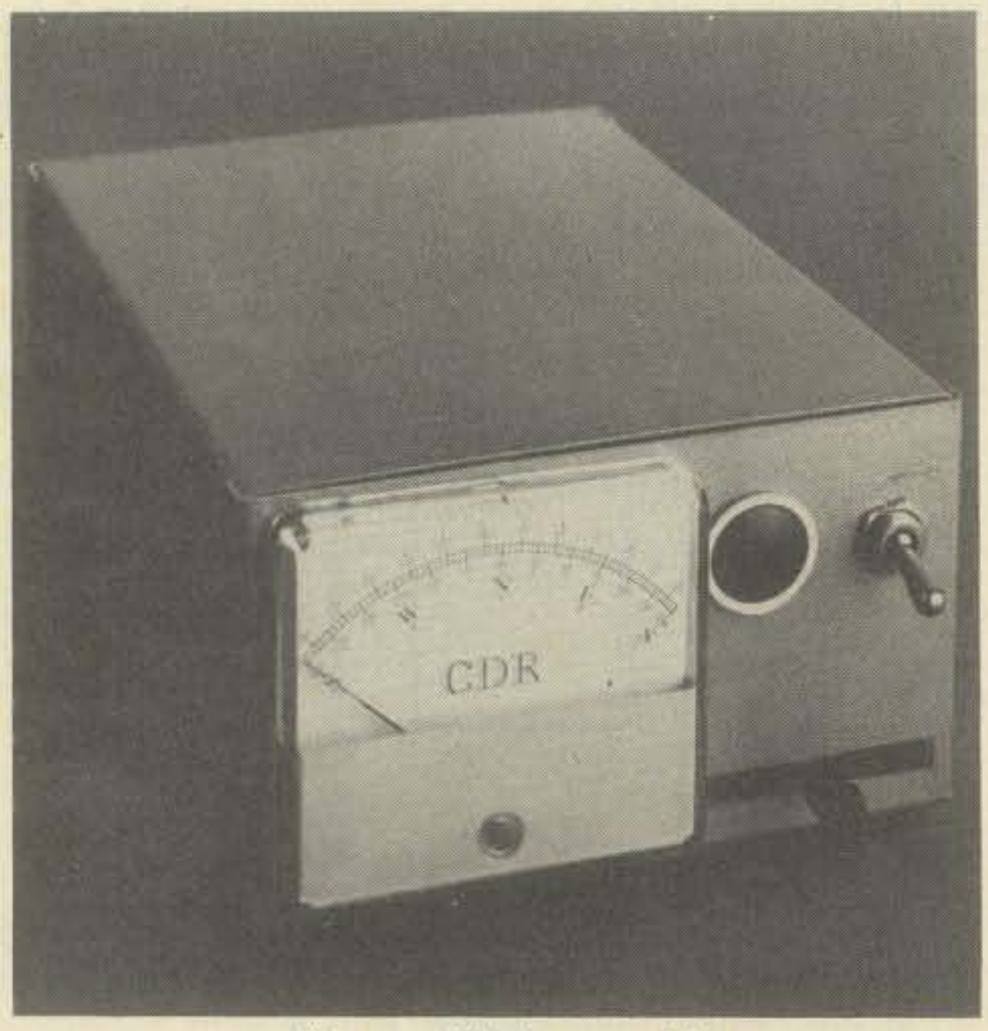
BY RICHARD KLINMAN*, W3RJ

Introduction

Without a doubt the most popular and successful amateur antenna rotor was, and is, the Cornell-Dubilier Electronics[1] (CDE) Ham-M series. This rotor has been around since the early nineteen fifties. CDE has been continually refining the rotor in the way of adding and modifying small components to the basic mechanism. Today the rotor is marketed as the Ham-III.

The original Ham-M Series 1 through 5 are all basically identical with the exception that by the series 5 version CDE implemented an improved terminal connection sequence to minimize possible damage to the rotor in case of accidental shorts, and an improved grounding scheme for the position indicating potentiometer strip to eliminate intermittent position indication. Three years ago CDE introduced the Ham-II and this year the Ham-III and Tailtwister, originally to be marketed as the Ham-X, were brought out. The latest models have enhanced mechanical specifications. This article will explain the differences among these rotors, describe how to modify all Ham-M rotors to the Ham-III, and how to easily modify the Ham-M control unit for both more operating convenience and to eliminate potential abuse of the rotor mechanism during operation.

*RD 1, Flint Hill Rd., Coopersburg PA 18036



The modified control box.

Up-date and Modification of the Ham-M Control Box

Control units and components for all Ham-M, -II and -III rotors are essentially identical. The primary problem with the original control scheme for the Ham-M is the immediate engagement of the brake solenoid and wedge when the power is removed from the motor. The impulsive tortional forces created by rapidly stopping the rotation with the brake, is often sufficient to crack the brake teeth in the brake housing when turning even a moderately sized array. This repeated stopping impulse may also be damaging to the antenna. The problem has been discussed by others who have implemented solutions that are either inconvenient or technically complex. See references 1, 2, 3, 4.

In the referenced articles the stopping problem is overcome by resorting to electro-mechanical or electronic delay circuits to assure that the rotor and antenna have coasted to a stop before the brake is applied. CDE has partially corrected this problem in the Ham-II and -III by using separate finger actuated micro-switches for the brake and rotation controls. However, in the heat of battle an inadvertent slip of the finger or too rapid a release of the brake switch could lead to disaster. In addition, it is my opinion that these switches are difficult to manipulate.

I have found a very simple and operationally convenient method of overcoming this difficulty. All you have to do is to add a single s.p.s.t. toggle switch to the Ham-M front panel to control the brake. CDE has already provided a pair of holes in the steel panel of the control box for such a switch and an indicator lamp to shine when the brake has been released and the rotor may be turned. The brake may be continuously disengaged, or electrically energized, without harm. The power transformer has a built-in thermal protection switch so that continuous operation of the brake should be entirely safe. To operate the rotor with this modification you must throw the toggle switch to disengage the brake and then start rotation by pushing the lever on the control box as usual. When the rotor nears the desired direction, release the lever and let the rotor coast to a stop. At any convenient time thereafter, throw the toggle switch back to the *off* position to lock the antenna in place. Reaching over one inch to use this toggle switch does not take enough time to be a bother, even during a contest. As a matter of fact, I find this arrangement easier to use than the switches on the Ham-II and -III.

A modification for the Ham-III introduced by CDE, but used for years by many amateurs with the Ham-M, is the addition of

a voltage regulator in the position indicator power supply. This regulator makes the position indication independent of line voltage, eliminates the need for periodic recalibration and eliminates the annoyance of seeing the meter jump around when the station final amplifier is driven. CDE has selected a resistor and zener diode combination to regulate the meter supply. I have found it both easier and less expensive to use one of the new single chip, three terminal, monolithic integrated voltage regulators. The metering circuit is also prone to be affected by r.f. currents induced in the long control cable wires. This problem can be cured by by-passing the leads running from the rotor potentiometer strip to the control box at the control box terminal strip (connections 3 and 7) with disc capacitors.

The shape of the original Ham-M control box is not very useful for integration into most amateur radio stations. With the odd shape and sloping surfaces, the box can not be easily stacked with other equipment. Beginning with the Ham-II rotor, CDE corrected this situation and put the control circuit into a standard rectangular box.

As you have gathered from the preceding discussion, there is no real difference between the control box of the Ham-M and the Ham-III. Almost all parts are interchangeable. The schematic diagram of the control box as I have modified it is shown in fig. 1. It is almost the same as the Ham-III control box. All parts are taken directly from the original Ham-M unit. To complete the up-date I removed all parts from the CDE plastic case and rebuilt the unit in an inexpensive 6" × 3½" × 8" Bud minibox. The results are shown in figs. 2 and 3. In order to fit the power transformer into the box, it must be turned on its side. The original mounting strips are easily removed, redrilled for the transformer's short dimensions and cut to length.

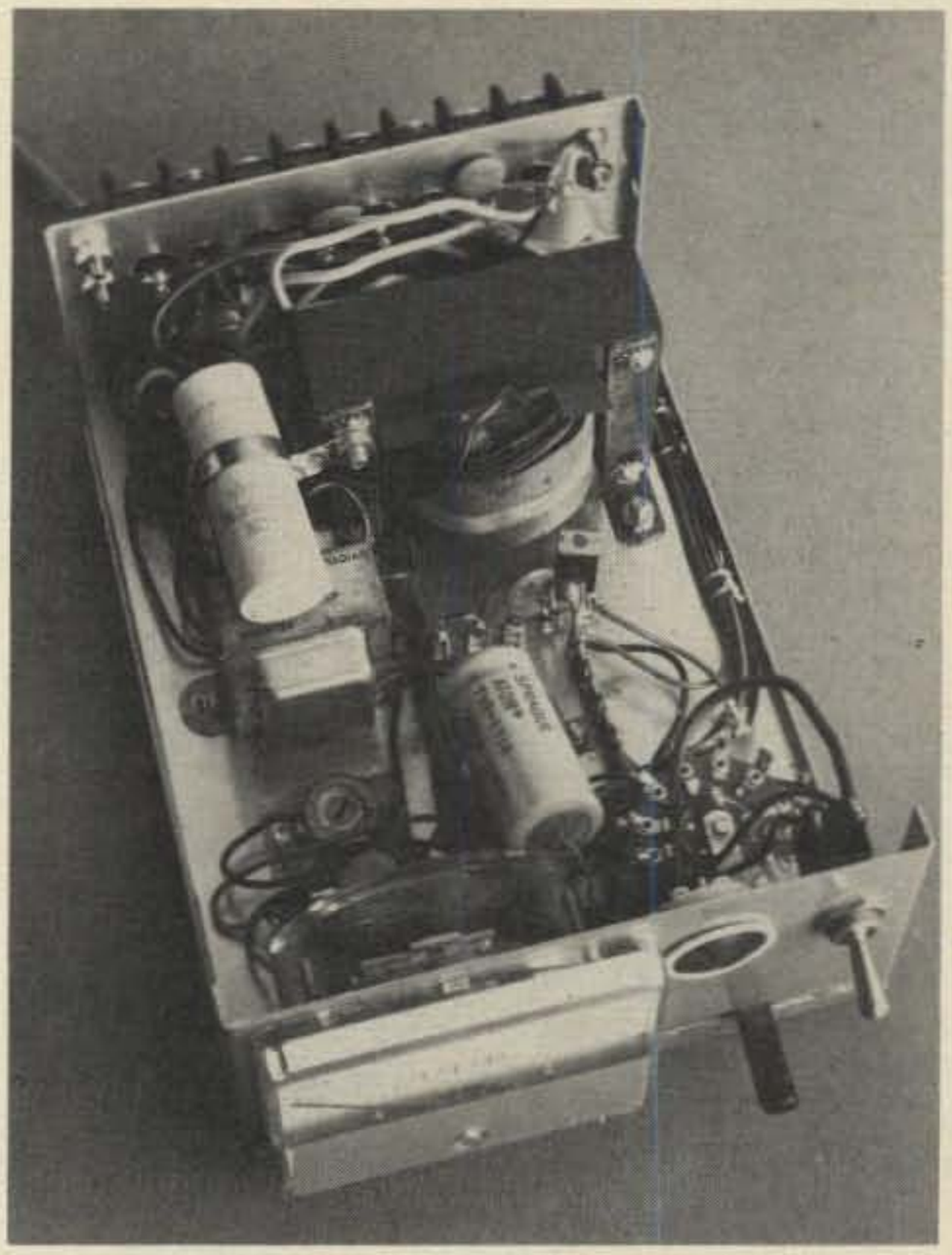
In keeping with modern safety practice a three wire grounded power line cord is used and the control box case is grounded. CDE grounds the metering circuit and motor/solenoid common to the rotor case inside the rotor and to the control box case. I have found that this results in a ground loop with the grounded tower and can induce hum in the station receiver. To avoid this, the a.c. motor supply and the d.c. meter supply are not connected to the control box case.

The last modification to the control box that I have made is the replacement of the original CDE 8-terminal board assembly (TRA-2, B00-50399-00 or 51465-10) with a large size, 8-terminal barrier strip with 8-32 screws, TRW-Chinch Series 142-Y. This facilitates the use of heavier wires in the cable to the rotor as recommended by CDE for all but the shortest cable lengths.

If you are faced with the problem of long cable reins to the rotor, you can save money and wire by mounting the motor starting capacitor, (130μF, 50 v.a.c.) at the base of the tower instead of inside the control box. Since these capacitors do not last forever, it is necessary that it can be replaced easily. I run eight heavy wires from the rotor to a large terminal strip at the base of the tower. The capacitor is connected between pins 4 and 8 of this barrier strip and the remaining six wires are continued into the shack.

Update and Modification of the Rotor Unit

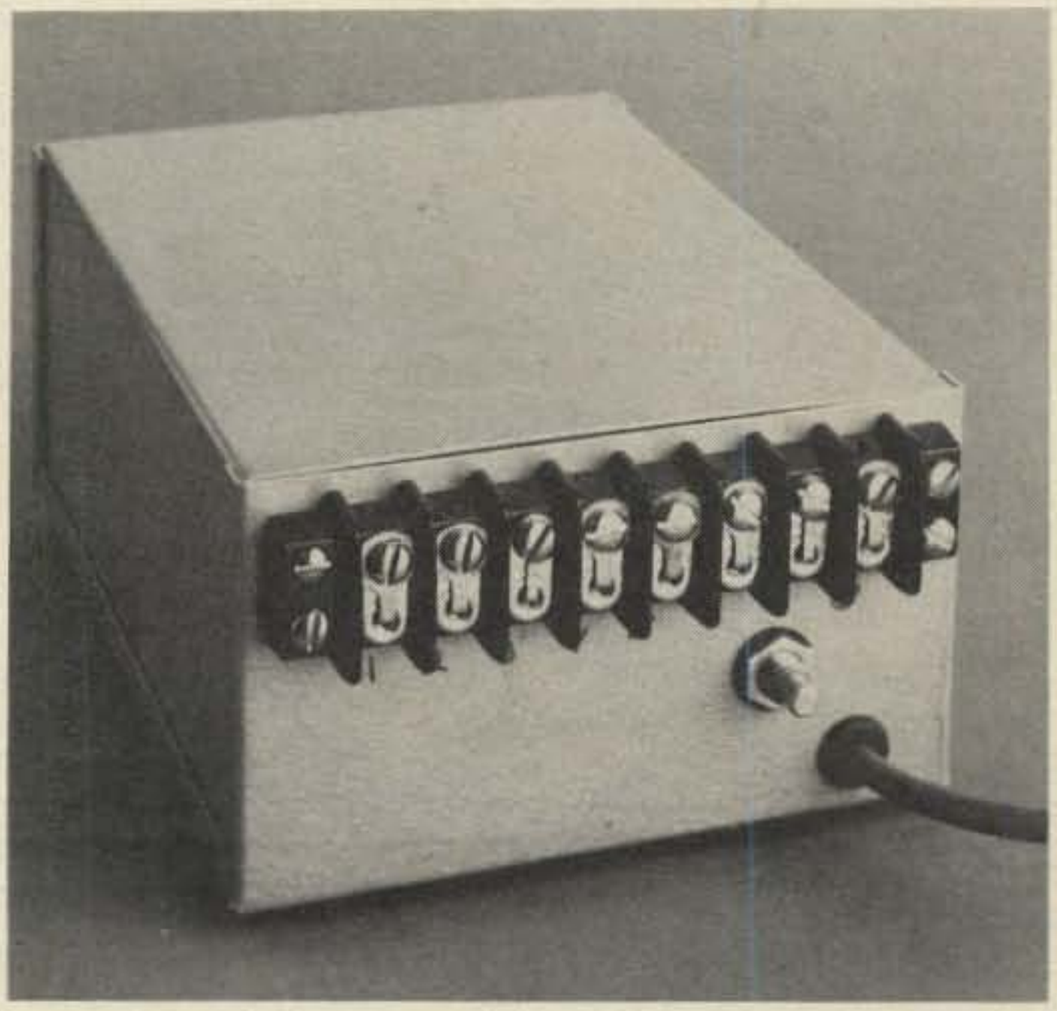
After looking over the owner's manuals and discussing the various rotors with the CDE engineering staff, as far as I can tell no fundamental change has been made to the rotor unit since the original Ham-M was introduced. All units use the same motor, gear train and brake mechanism. If your present Ham-M will not turn your antenna easily, none of the newer models, including the Tailtwister (*alias* Ham-X) will do better. The only changes of interest have been a slightly strengthened brake casting and wedge and a change in the final ring gear material for the Ham-III. The Tailtwister is the same rotor in a much strengthened case.



A look inside the modified control box.

No mechanical change at all occurred in the rotor unit between introduction of the original Ham-M and the Ham-II. However, two electrical improvements were made. Early Ham-M rotors (Series I and II) had a different cabling sequence from the later models (Series III, IV, X and Ham-II). The current connection arrangement is shown in fig. 1. In addition, early Ham-M rotors (Series I and II) used only the hinge plate of the position indicating potentiometer strip that bears against the inside of the upper bell housing as the ground connection for the indicating circuit: Potentiometer modification kit RK-10 may be purchased from CDE to correct this problem as explained in the Ham-M owner's manuals.

One mechanically weak spot in the rotor is the brake. In heavy winds or with a large antenna it is possible to break the teeth in the brake housing. In the Ham-III CDE has



Rear view of the control box. Note the eight-terminal connector.

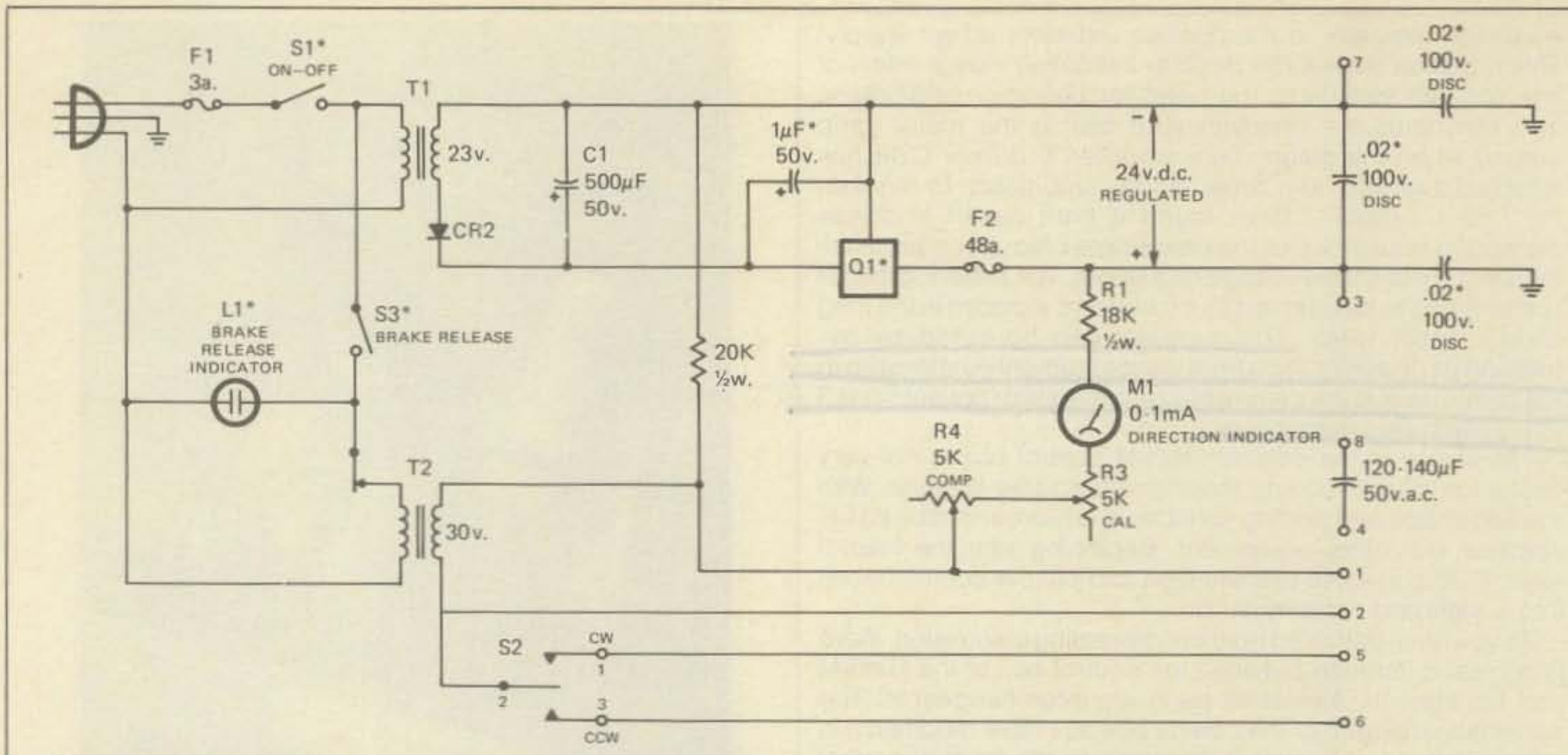


*Fig. 1 – Schematic of the updated and modified Ham-M control box. * denotes parts not found in the original Ham-M circuit. The case of R4 should be isolated from the control box ground as should connection 1 to the rotor. This is to eliminate hum induced by a possible ground loop consisting of the rotor cable, the tower ground and the a.c. power ground.*

Parts List For Figure 1

S1	SPST Power on/off switch (optional)
S2	SPDT Center off, momentary contact (CDE part #MCU-103 or B35-50178-00
S3	SPST Brake release switch
L1	110 volt neon indicator lamp (CM Drake part #HR117-603, Leecraft part #32-2111, or equivalent)
T1	Instrument/meter transformer (CDE part #MCU-102, or C52-50177-00, or 51442-10)
T2	Power transformer (CDE part #MCU-101, or C52-50176, or 51441-10)
CR2	1 amp., 100 v. p.i.v. silicon diode (1N4002, or equivalent)
Q1	7824; 24 v. positive voltage regulator, TO-220 case (no heat sink required)
R3	5k pot, calibration control (CDE part #MCU-108-1, or A54-50182-01)
R4	5k pot, compensation control (CDE part #MCU-118, or A54-50189-00)

redesigned and strengthened the lower (brake) housing and wedge. The improved brake housing, or lower casting, CDE part number 51453-10, priced at $8.50, and its mating brake wedge, CDE part number 51464-10, priced at $8.00, may be purchased and used in place of the corresponding Ham-M components. The final drive gear, previously made of white metal, has been replaced by a dimensionally identical steel gear. The final steel drive gear, or ring gear (CDE part number 50313-10, priced at $2.50) may be purchased from CDE and used in the Ham-M. I have also been told that motors being supplied to CDE are now arriving with a metal drive gear. Previous units had a plastic gear. There is very little forge on this gear and the original plastic gears have held up very well. Therefore, it is not worthwhile to change this part. As you can see, your present Ham-M rotor can be updated to the Ham-III for $19.

I have found that the four #12-24 × ¾" self-tapping screws, CDE part number 51465-10 or SL-5-2, that hold the rotor together are not adequate. They tend to loosen and fall out under the constant vibration a rotor is subjected to. I have replaced these screws with ¼" bolts in all my Ham-M rotors. This modification is easy to do and may be accomplished in two equally satisfactory ways. One is to drill out the existing #12 holes with a number 7 drill and then tap the hole with a ¼-20 tap. For ease in future disassembly, use four stainless steel hex head bolts and lock washers to bolt the unit together. Alternatively, the existing #12 holes in the upper mast casting can be drilled out and clear through the casting with a ¼-inch drill. Use ¼-20 cap head screws, lock washers and nuts to bolt the rotor together. Insert the cap head screws from the upper casting side. The reason for the cap head screws is that there is very little clearance for the screw heads on the upper casting. A little filing of the upper casting will allow the cap head bolts to fit properly against the casting.

In modifying the rotor unit, I suggest that you refer to the Ham-M owner's manual. This booklet does an excellent job of describing exactly how to take apart and reassemble the rotor.

The CDE Tailtwister (alias Ham-X)

Some time ago word got around that CDE was going to market a much improved and huskier rotor called the Ham-X. Evidently, they were overcome by the CB market frenzy and decided that the CBers would be more likely to buy a rotor called the "Tailtwister." This, fellows, is the rumored Ham-X.

The control unit for the Tailtwister is part-for-part identical with the Ham-III except for the addition of a few irrelevant bells and whistles taking the place of direction indicating LED's. The rotor itself has a much heavier walled case and a strengthened brake casting. There is a third set of ball bearings added to the Tailtwister to help it support additional weight. A total of 138 balls in three races are used in the Tailtwister as opposed to 98 balls in two races in the Ham-M, II and III. The two halves of the Tailtwister case are held together by six 5/16 inch stainless steel bolts. Lastly, the rotor mounting bolts are six 5/16 inch mounting screws as opposed to four ¼ inch bolts in the Ham-M, II and III. The case and construction is very similar to the other CDE rotors. All other internal workings of the Tailtwister, including the motor, gear

(Continued on page 84)

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100 watts	100H	100A	100C	100D	100E
250 watts	250H	250A	250C	250D	250E
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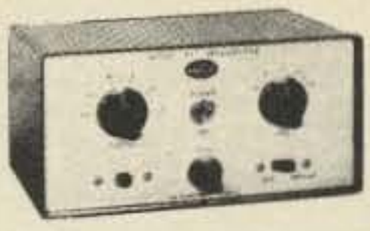

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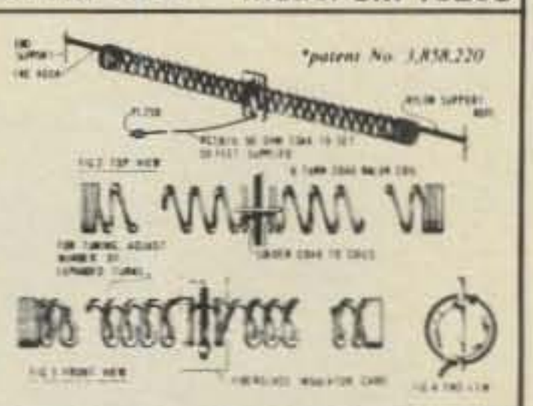

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As an added convenience to his Q-Key design, Albert H. Jackson presents CQ readers with a suitable power supply (in his usual "small" way).

A Plug-in Supply for the Curtis Kit Keyers

BY ALBERT H. JACKSON*, VE3QQ

Here is a miniature a.c. power supply for the Curtis 8043/8044 keyer kits. It will also handle an additional touch-key or the combination Q-Key, both described in previous articles.[1] Its basis is a Realistic (Radio Shack) No. 14-854 6-volt 150 mA calculator a.c. adapter, modified to give a regulated output of 8 to 9-volts at 60 mA maximum. The unit is smaller than the *Curtis* suggested supply, measuring only 2¼" by 2⅛" by 1⅝" high, and plugs directly into a 115-volt receptacle. If you've already constructed the Q-Key, some of the surplus parts can be used in this accessory.

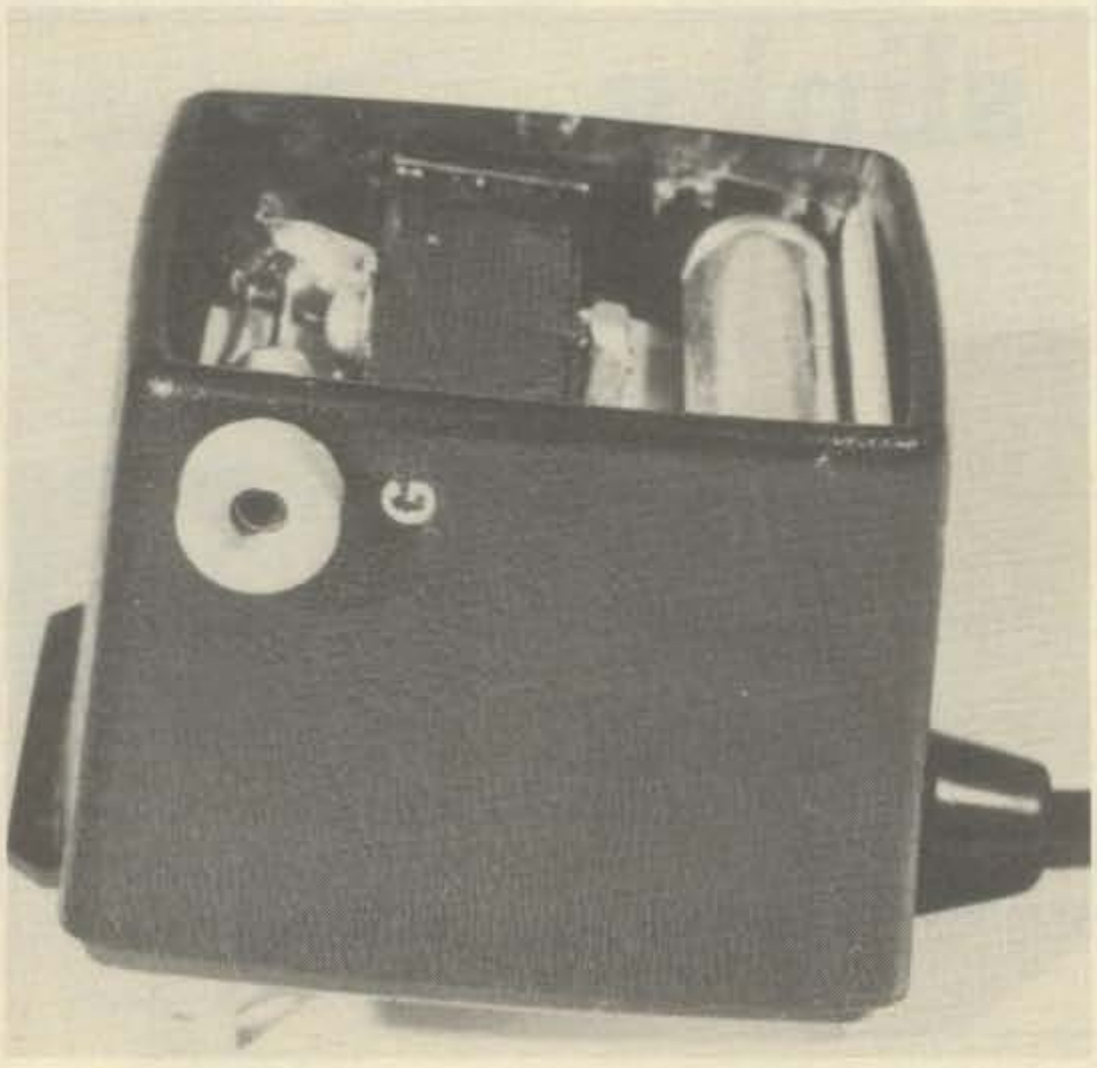
Beginning the Modification

Set or clamp the little adapter solidly, carefully drill around its top perimeter and cut through the bridges between holes using a sharp knife or chisel. Watch your hands and the components to prevent an accident, and lift out the "innards" when you have sufficient clearance. Remove the separating Scotch tape and disconnect all parts, including the output cord. Discard the 800 μF capacitor to the junk-box, and put the diodes and transformer aside temporarily.

Smooth the rough edges of the case and cut a new cover from the black portion of the *Curtis* kit box, if it's still on hand, or use another cementable plastic. Drill a ¼" hole for the ground tip-jack above the transformer windings and in front of its core, as shown in the side-view photo.

*90 Fox St., Penetanguishene, Ontario, Canada LOK 1PO

[1]*The Q-Key, CQ*, April, 1978, p. 32



This shows the a.c. line r.f. filter and connections.

Printed Circuit Board

With the exception of the line filter, all items were mounted on a small p.c. board produced from Radio Shack copper-clad material, using their resist pen and etchant according to directions. See fig. 1 for particulars.

Circuit and Construction Details

As originally built, the 14-854 supply employs two silicon diodes and a large capacitor in a standard full-wave center-tap rectifier circuit. Referring to the schematic, fig. 2, this was changed to a bridge arrangement followed by a Zener reference and series transistor regulator. The latter removes much of the ripple and permits the use of a smaller filter capacitor.

Resistors R1, R2, R3 and the 2N4124 can be excess parts from the *Curtis* section of the Q-Key, or they may be obtained elsewhere. Mount C3 in the board cut-out, allowing it to protrude about 1/32" on the foil side, and finish the p.c. assembly with the exception of VR1. This diode will be installed later.

Line Filter

The line filter shown in the schematic attenuates r.f. entering the unit. Manufactured chokes can be used, but the ones in the photo were made from two stripped down 2.5 mH,50 mA powdered-iron-core types. Solvent helped unwind five or six feet of wire per choke, and the remaining pie sections were removed with hacksaw and cutters. Each was

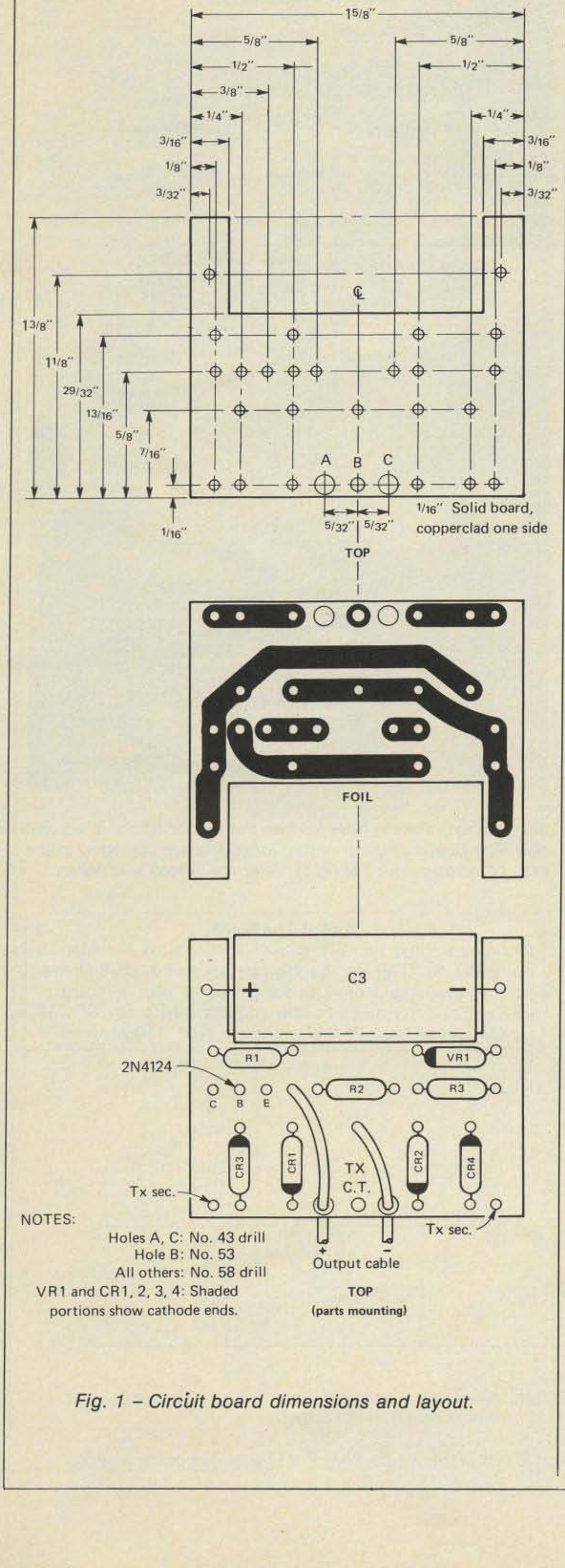
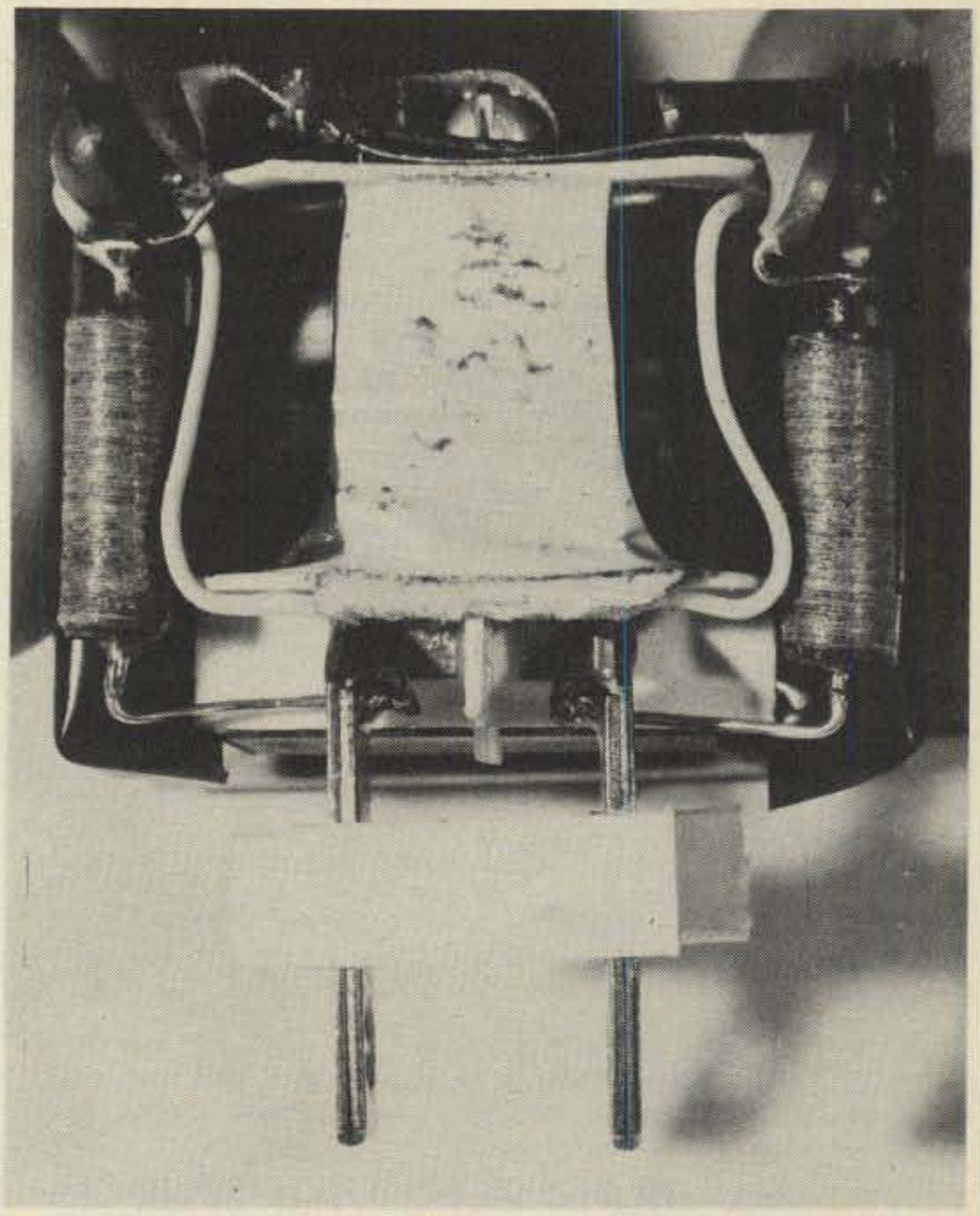


Fig. 1 – Circuit board dimensions and layout.



Side view of the modified adapter, before the cover was installed.

then close-wound with the salvaged wire in a single, doped-over, layer the length of the form. The specified inductance is approximate.

Cover the transformer core and windings with a double thickness of plastic electrical tape in the choke positions. Pry off the 115-volt plug casing, carefully cut the hair-like primary wires from the prongs with a sharp knife, and solder the bottom choke leads to the projecting lugs instead. Connect the primary ends to the tops of the chokes with light insulated wire. Surround and cement the primary joints to the insulating plate with 5-minute epoxy. The fine wires make things a bit tricky; take your time and don't break them! Notch the casing to clear the leads and replace it on the prongs.

Install the two by-pass capacitors, avoiding the tip-jack location on that side, and ground them to a lug bolted through the top of the transformer core; this connection is completed below. Dress the parts and wiring away from the core and windings.

Final Touches

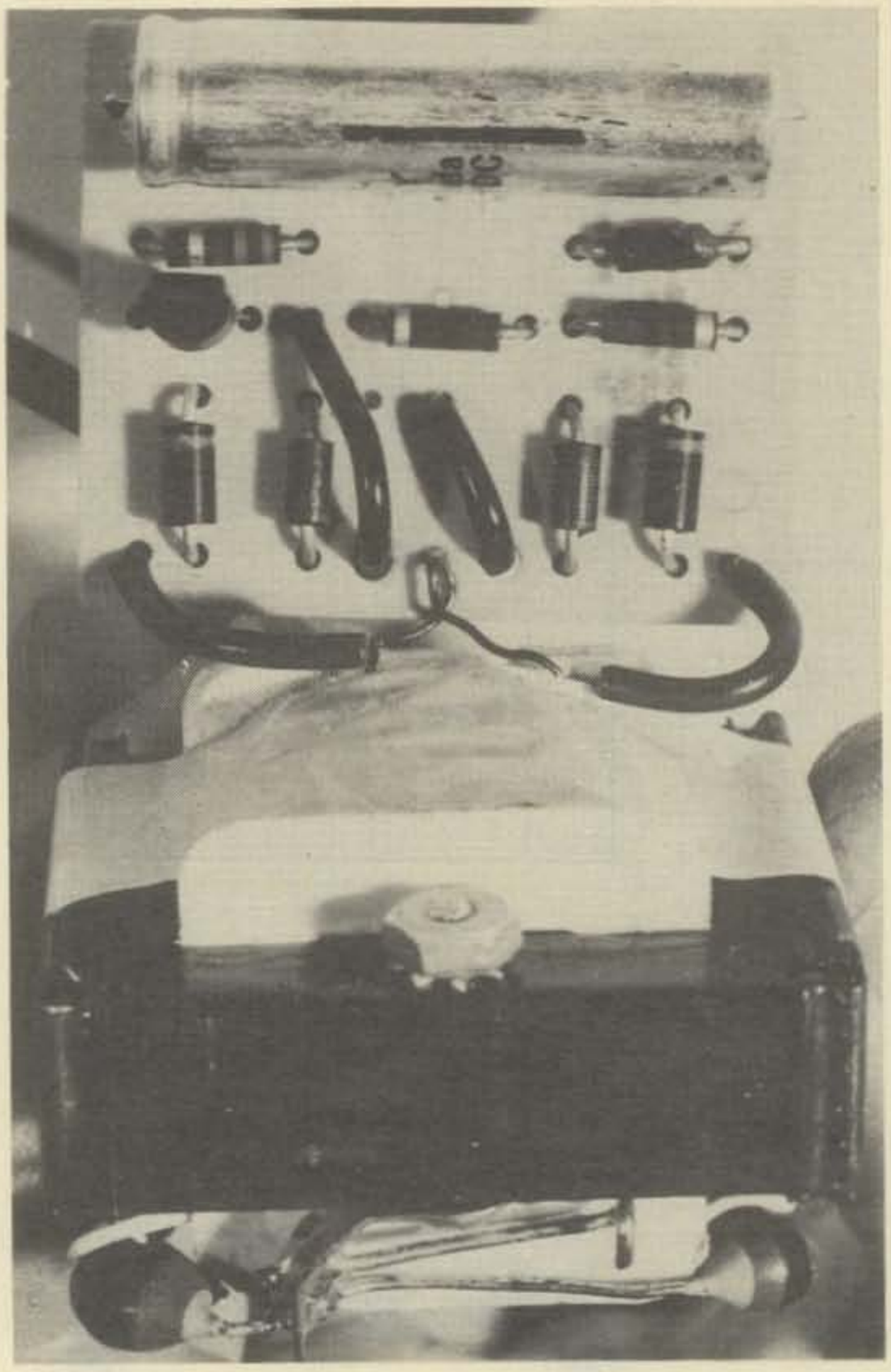
Observing its polarity, correctly orient the output cable (no anchor knot necessary) in the case exit slot, pass the separated wires through holes A, C (fig. 1) and solder them in their circuit positions. Slip a ⅜" length of 3/16" spaghetti over the plug sleeve, leaving ⅛" of the metal exposed near the tip. With the capacitor at the top, turn the foil side of the board away from the transformer, and attach the trimmed secondary leads.

Since the output voltage is governed by the reference VR1, and Zener tolerances are rather wide (±5%, and up to ±15% for Radio Shack types) check the operation of this component in the circuit. Treat the r.f. chokes with respect (115 volts); select a diode which produces an output in the 8 to 9 volt range, and install it permanently. Regulation should be good with line voltages from 105 to 125 under load or no-load

conditions, and there is a fail-safe feature: even with an open Zener, output should not exceed 12.5 volts.

Space the circuit board from the transformer windings and ease the entire assembly into its container. Insert the tip-jack and run a #18 solid wire from it to the core ground lug; this will hold the jack in the small space left, without a retaining nut. You may, or may not, need an actual ground connection at this point.

Now press the cover into position against the top of the transformer, sealing its edges with CPVC plastic pipe cement. Use the cement sparingly and keep it about ⅜" from the corners to facilitate opening for service if required. Place a new data label over the original output figures on the prong side of the case, and your keyer supply is complete. ■



Bent away from the transformer, the circuit board looks like this. The board and top capacitor (C3) were changed to the cut-out arrangement of fig. 1, after the photo was taken.

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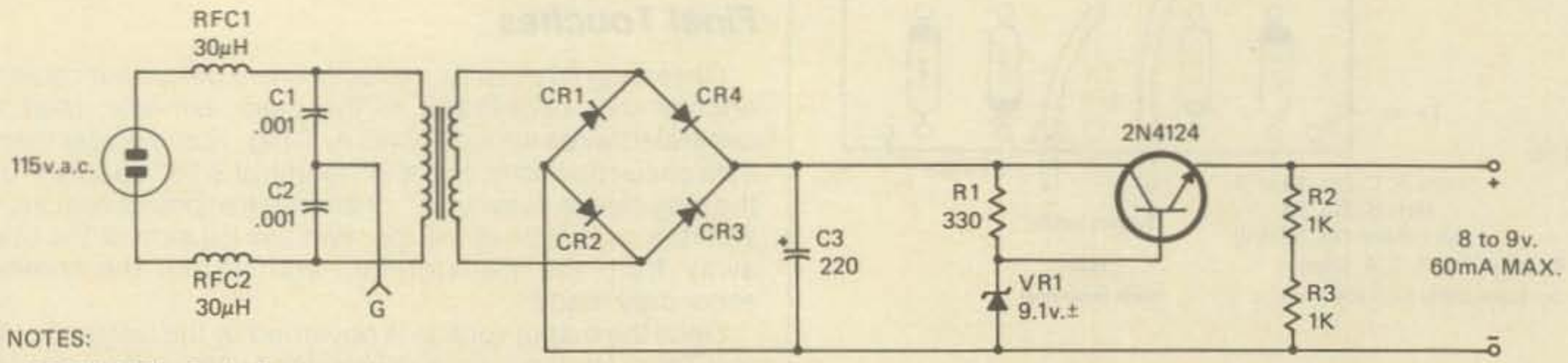

NOTES:
(RS 000-000) = Radio Shack part No.
Resistors: ¼w. 10%.
CR1, 2, 3, 4: 2 original, 2 1N4003 (RS 276-1102)
VR1: Zener diode 1N4739A (RS 276-562)
RFC1, 2: See text
C1, 2: .001μF, 500v. ceramic (RS 272-126)
C3: 220μF, 35v. miniature electrolytic (RS 272-1017)

Fig. 2 – Modified power supply schematic diagram. The basic unit is the Radio Shack #14-854 calculator adaptor.

W4MB discusses techniques for adding flexibility to frequency synthesizers in this interesting article.

Synthesizer Tricks

BY R.P. HAVILAND*, W4MB

Various forms of frequency synthesizers are becoming common, both in manufactured gear and in home designs. However, few designs take full advantage of the flexibility of the technique. In most designs, a little work will add one or more features of considerable use, including

—All channel operation
—Quick-Set to selected channel
—Priority channel set
—Variable frequency operation
—Scanning operation
—Remote control

In addition, many synthesizers can be set up to give deviation calibration, and can serve as part of a test set-up.

The detail design of these features will vary somewhat, depending on the particular synthesizer design. The principles which are reviewed in what follows are for the most common type of synthesizer, the phase-lock loop, as used in common 2-meter transceivers. Detailed electrical and mechanical design should be easy to develop from these principles and the basic synthesizer design.

Lock-Loop Principles

The basic elements of a phase-lock loop synthesizer are shown in fig. 1. The loop is formed of the variable voltage-controlled oscillator and the locking circuit. The accuracy and stability is almost completely determined by the fixed, or reference oscillator. The output frequency is determined by the design of the variable frequency oscillator and the locking circuit; and the resolution, or channel spacing, by the design of the locking circuit.

In most designs, there will be a pair of frequency dividers, one for the reference frequency, and one for the v.c.o.

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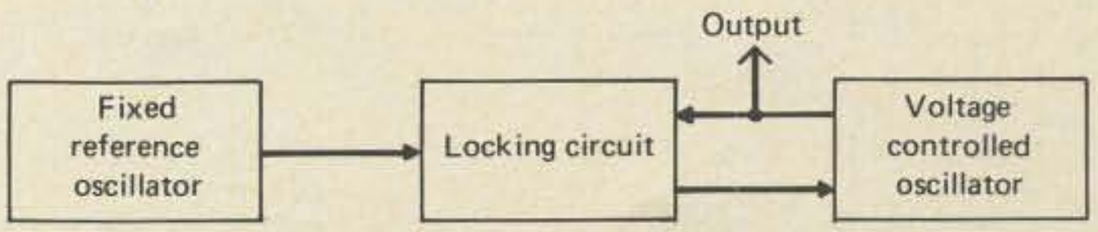

Fig. 1 – The basic phase-lock loop.

frequency, as shown in fig. 2. The outputs of these are compared, and the frequency of the v.c.o. is error-signal adjusted until the two divider chain output frequencies are equal. Suppose M is the divider ratio for the reference oscillator, operating at a frequency f_r, and N is the ratio for the variable oscillator operating at a frequency f_o. Then the locking circuit causes

$$\frac{f_r}{M} = \frac{f_o}{N} \quad \text{and} \quad f_o = \frac{N f_r}{M}$$

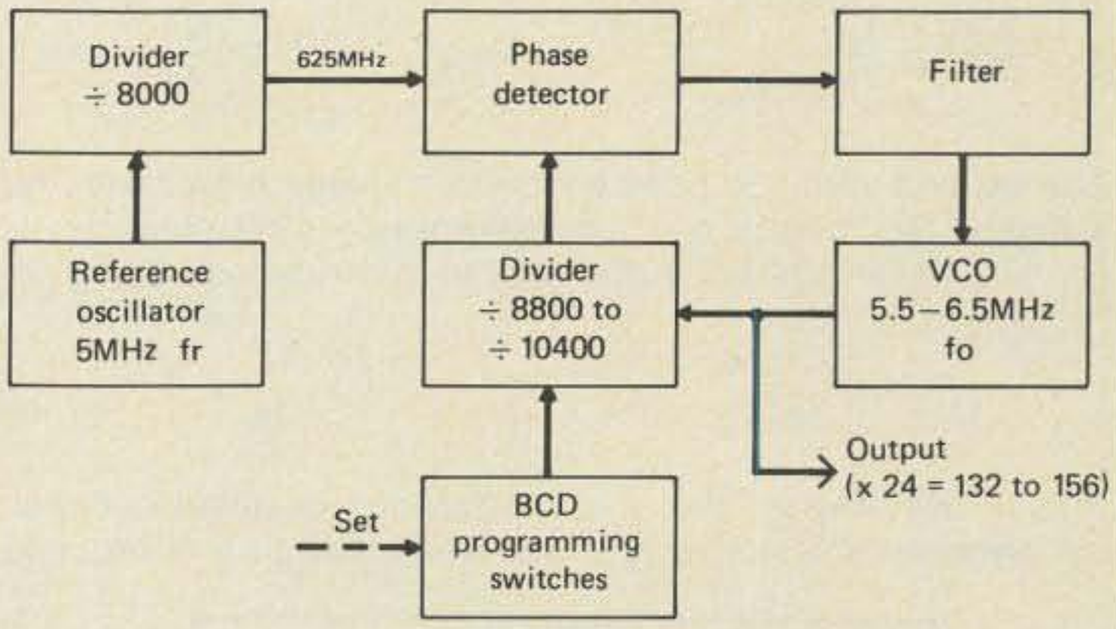

Fig. 2 – Block diagram of the K2CBA synthesizer.

Design	IF Freq.	Xmtr Offset	f_r,MHz	M Ratio	f_o,MHz	N Ratio	f_x, MHz	Ø Measure, Hz
HW-2036		0	10.0	12000	24.33	1200max 800min	23.33	833.3
		+600					23.43	
		–600					23.23	
	10.7		10	12000	22.55		21.55	833.3
WA4DSY		0	9.10222	16384	16.22	1599max 1200min	15.55	555.5
		+600					15.62	
		–600					15.48	
	16.38						13.68	
	10.7						14.36	

Table 1 – Frequencies and divider ratios for two synthesizer designs.

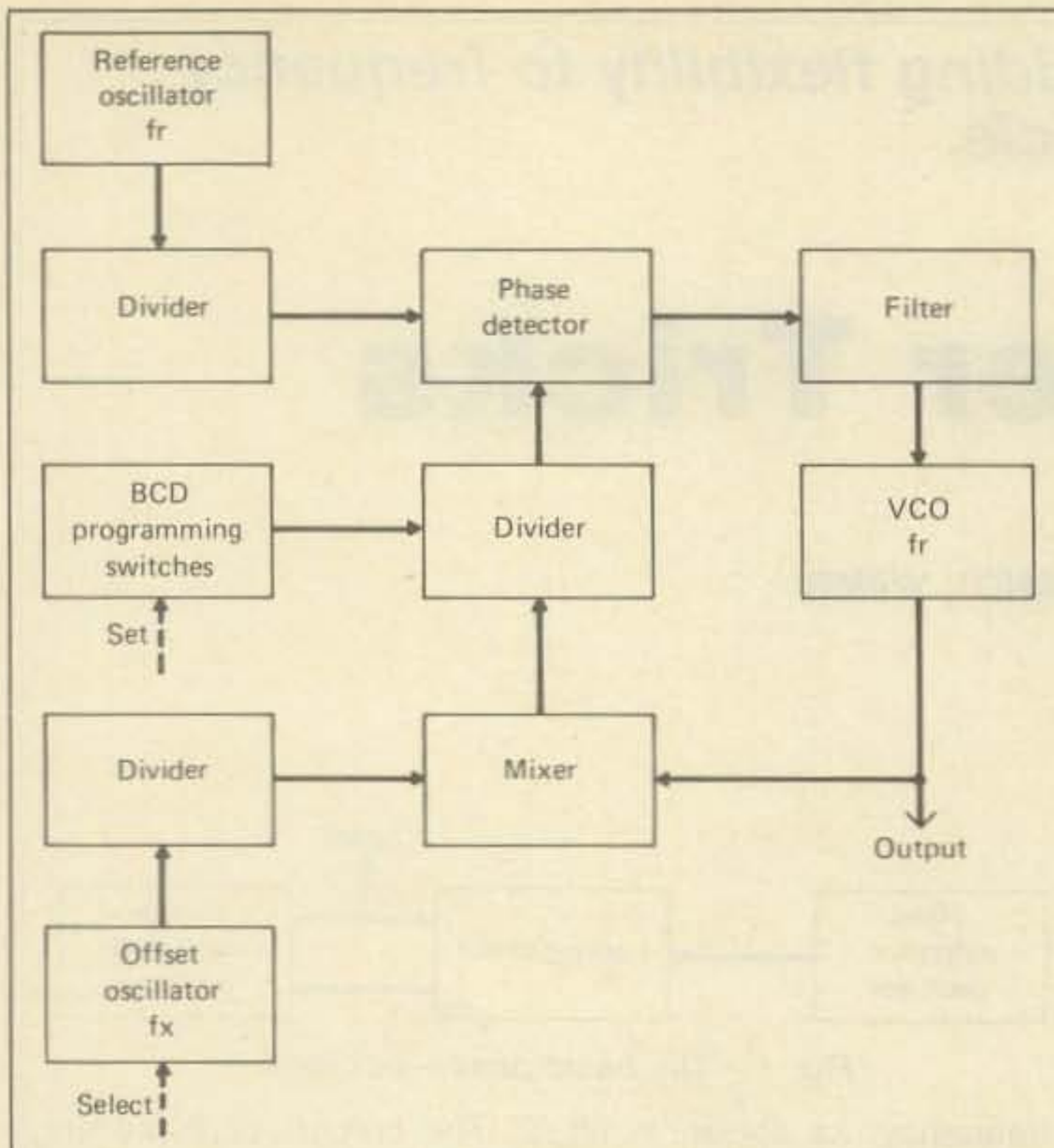

Fig. 3 – A synthesizer with an offset oscillator.

The output frequency can be changed by changing either N or M. In synthesizers operating over a restricted frequency range, as for the 2-meter band, the divider for the variable oscillator will have the changeable ratio.

There are two major variations in this basic scheme. One divides both the frequencies by another constant, say K. The result is not really different, since

$$\frac{f_r/K}{M} = \frac{f_o/K}{N} \quad \text{and} \quad f_o = \frac{N \cdot f_r}{M}$$

The second variation usès another oscillator, mixed with the output of the variable oscillator to produce a frequency $f_o - f_x$ (or $f_o + f_x$). This is fed to the divider, the relations being

$$\frac{f_r}{M} = \frac{f_o - f_x}{N} \quad \text{and} \quad f_r = \frac{N}{M} \cdot f_r + f_x.$$

This is useful when there is a difference or offset between frequencies on receive and transmit: changing f_x requires switching only one circuit, whereas changing the divider ratio N may require two switch banks, of some 12 poles each.

A typical circuit for this offset oscillator design is shown in fig. 3. This is used in the design of WA4DSY, described in the Feb. 1977 *CQ*. This is nearly the same as the basic design of the HW-2036, the difference being that the offset oscillator frequency is used directly in the latter instead of being divided before use.

Both of these synthesizers are designed to give channel spacings of 5 kHz. The switching techniques differ, but the essential element is a change in the division ratio by unity as the frequency is shifted to the next adjacent channel. See Table I for the major elements of operation. The frequency offset between receive and transmit (including compensation for the i.f. frequency) is provided by changing the offset frequency. These synthesizers give all-channel operation by switch selection, with offset selection by another switch, but they have limited offset capability.

Another method of handling the frequency offset problem was described in June 1973 *QST* by K1ZJH and WB2MBI; a similar approach by K2CBA is described in the ARRL *FM and Repeaters Handbook*. These designs do not use the offset oscillator, but obtain the same result by providing two sets of divider selector switches, one to set the transmit frequency, the other the receive frequency. This gives full flexibility in offset choice as well as in channel selection, at the expense of having to change both sets of switches when changing channels.

Some commercial transceivers eliminate the full freedom of channel choice in favor of simplification in switching. A single channel selector switch is provided, which changes the division ratios by applying a voltage to a bank of diodes used as **OR** switches. The diode bank is installed (or changed) to fit the desired channel plan. This technique gives faster channel selection while retaining a part of the flexibility of synthesizers.

There are some other types of synthesizers and some other variations in synthesizer design. However, these basic types are the most common, so let us look at the ways of taking advantage of the full flexibility of synthesizer operation.

Fast Set to Frequency: Remote Control

If your synthesizer rig is the type which requires moving three to six lever switches to change channels, plus perhaps a toggle switch, you would probably find fast-set to the more common frequencies useful. Here fast-set is used in the sense of a single operation, such as pushing a button or turning a single knob. Of course, this should not disable the regular method of frequency selection, so that the full channel capability is retained.

This fast-set requires two actions:

—disconnect the regular selector switches

—connect the divider set lines in the proper code.

These operations could be done with a mechanical switch, but this typically would require a 12-pole, 4-position switch to give three preset channels plus normal operation. Usually it will be simpler to use a single-pole switch and a diode matrix to perform the switching and channel select operations.

In laying out the diode net, the counter chain design must be kept in mind. If a down-count connection is used, the counter is preset to the number indicated on the selector, and counts down from this point to zero. With up counters, the preset will be to the complement of the number indicated, or to 9-N. Also, there are two major switch variations. One uses a single-throw switch, with a pull-up resistor connected to the positive supply to assure that a *high* is entered if the switch is open. The second uses a double-throw switch, connecting the preset lead to ground for a *low* or to positive for a *high* input.

The basic switching circuits for the single-throw switch design is shown in fig. 4, for one decade of the divider. A

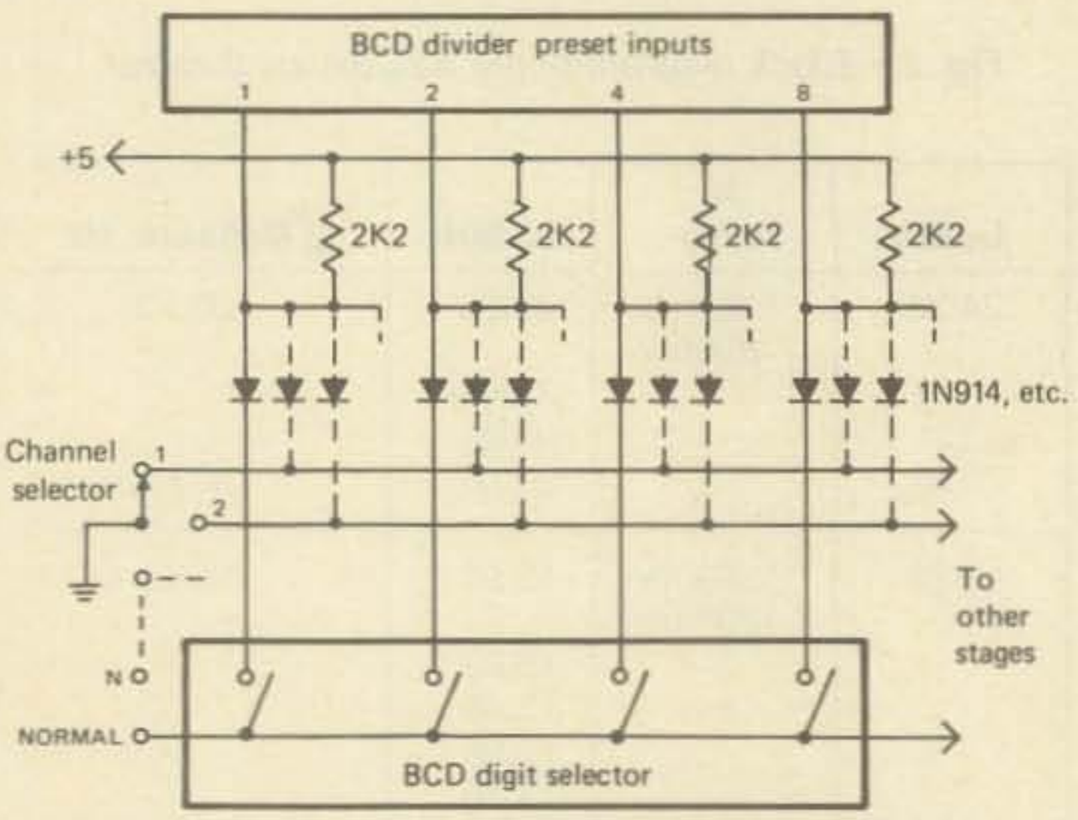

Fig. 4 – Adding fast selection to a synthesizer.

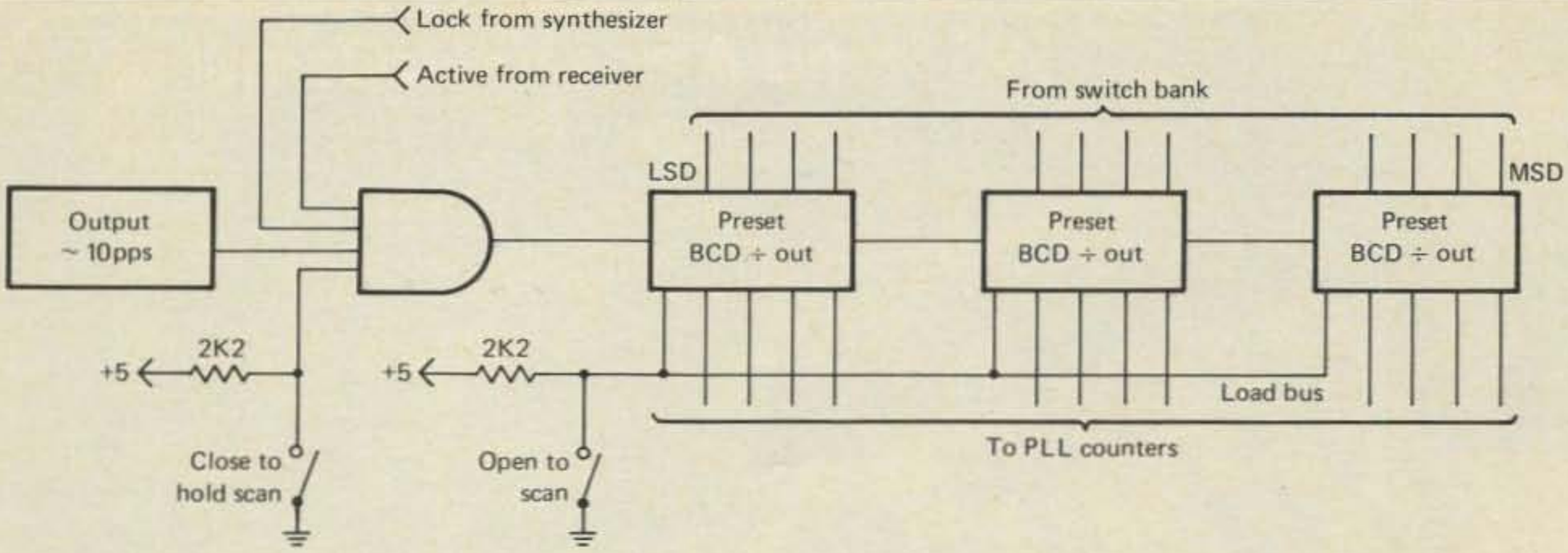

Fig. 5 – Addition of a scanner to a P-LL synthesizer. This is an all channel type.

diode bank is needed for each such decade, usually a total of three banks. In assembly, diodes are installed at the positions indicated by dotted lines, to suit the preset code of the selected channel. Any switching diode is usable, but slightly better noise immunity will be secured with germanium diodes. Double-throw switch designs will need a second set of diodes, with polarity reversed. It may be easier to change to pull-up resistors.

It is not necessary to have the channel switch on the diode bank directly at the synthesizer, if reasonable precautions against noise are taken. This opens the way to remote channel selection, which is one way to stop the rip-off problem.

The simplest remote arrangement is to place the diode bank at the synthesizer, and the channel selector switch remotely. One lead is needed for normal operation, and one for each channel provided. A return lead should be provided: use of a chassis ground as common is asking for noise problems. Best practice would use double shielded cable, with the inner shield being the return.

A variation of this type of remote operation is full remote selection, with a second selector at the remote location. This requires one remote lead and two diodes for each preset lead, typically 12 leads plus common and 24 diodes. Fast channel selection can also be provided.

A further variation of full channel selection is to provide a selector bank for independent setting of the receive frequency, to permit other than standard offset operation. This will require some method of changing from one selector bank to another, which may be by relay contacts or by a logic circuit. Study of the synthesizer diagram will show the simplest approach.

All-Channel Operation

For some synthesizers, the problems are just the opposite of those above. Fast channel selection is built in and the problem is to make all channels available.

The principles are exactly the same. The switching must now permit choice of any division ratio. In fig. 4, the switch bank at the bottom must be added to the fast selector diode bank. This may be combined with remote selection, or the remote selection may be used without all-channel provision.

Increased Resolution

Either synthesizer type may have been laid out to give a relatively wide channel spacing, say the standard 30 kHz spacing on 2 meters.

It is no great problem to increase the resolution, that is, to decrease the spacing which can be set. To do this it is necessary to add another counter stage and selector switch. The counter input is connected to the output of the last stage provided, and the clear and strobe lines connected to the existing busses. Typically, this counter stage would be connected to divide by any number from 0 to 5, to give 5 kHz steps.

Scanner Operation: Priority Channel Set

A scanner steps from one channel to another, halting only if the channel is active. Much of the circuitry needed for such operation is already present in synthesized rigs, and it is not difficult to provide scanner operation.

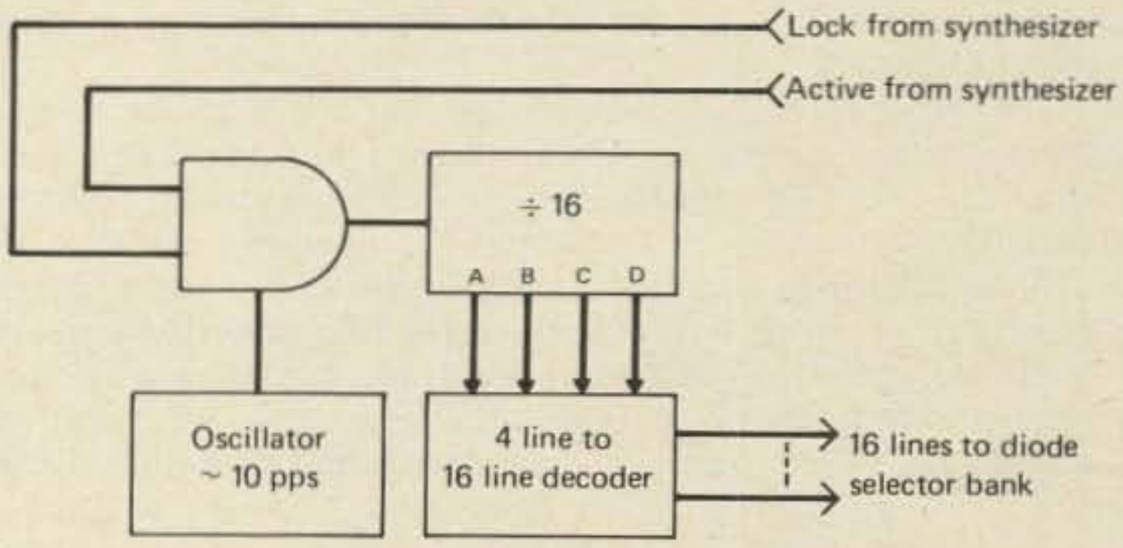

Fig. 6 – A scanner for a fast-set synthesizer.

In planning such an addition, a decision must be made as to the number of channels to be scanned. The all-channel synthesizers, without addition, lend themselves to all-channel scanning. However, since the phase-lock loop requires a finite time to settle down after a frequency change, perhaps a tenth of a second, a complete scan can take a long time. This can be reduced only by restricting the number of channels. One way to cut down the number of channels is to scan only part of the band, or to skip channels. Another is to provide

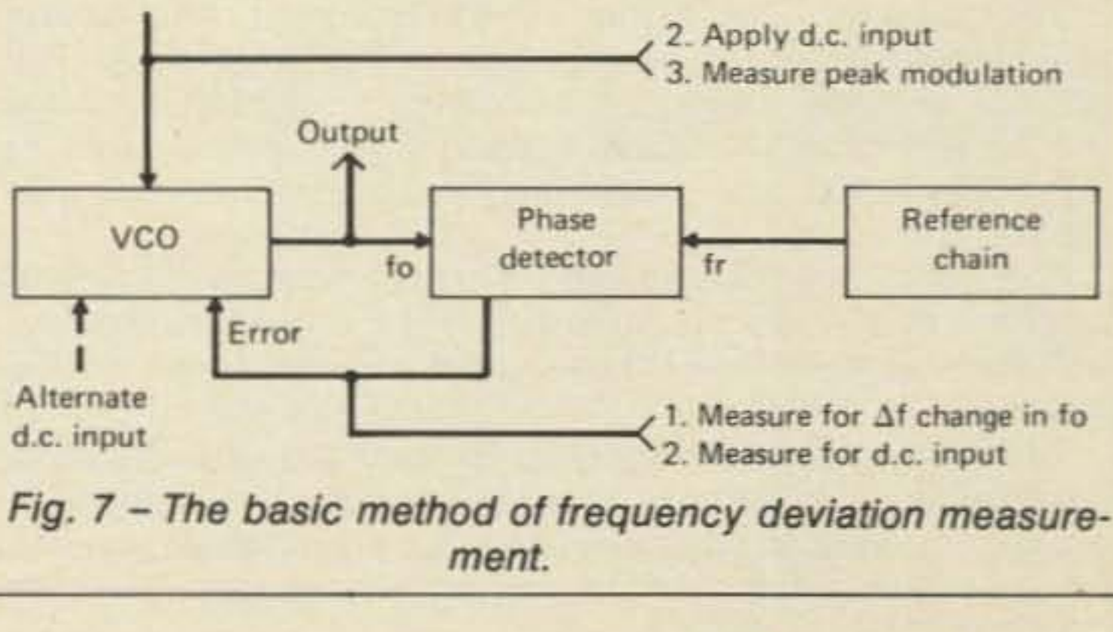

Fig. 7 – The basic method of frequency deviation measurement.

fast-set capability, as described above, and to scan only these channels.

The type of rig which uses a single switch to select channels has just the opposite problem. It is easily set up to scan the channels provided, but the scanner must provide additional capability if all-channel scanning is desired.

An approach to scanner design for the all-channel synthesizer is shown in fig. 5. The scan rate is determined by a pulse oscillator, operating at a speed which will allow the phase-lock loop to stabilize on each new frequency. Its output is gated, the LOCK gate input stopping further action if the

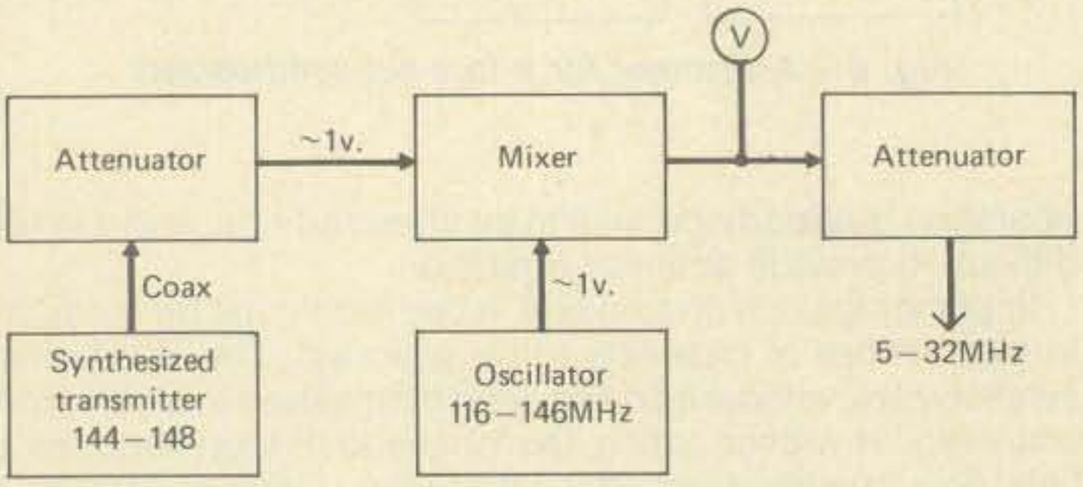

Fig. 8 – Using a synthesized transmitter in a precision signal generator.

synthesizer goes out of oscillation, and the **ACTIVE** input if a signal is present on the channel: If an activity survey is the only purpose of the scan, the **ACTIVE** signal would be recorded, and the lock-out disabled.

The gated oscillator signal is fed to a counter chain having one decade stage for each stage in the synthesizer. The outputs of these stages are fed to the preset inputs of the synthesizer counters. **LOAD** is used to give either normal or scan operation. Other gates could also be connected to give fast-set capability.

The same circuit can be used with the single-switch type of synthesizer. It should be connected to the dividers directly, with the external diode bank and selector fed to the added dividers.

There are several approaches to scanners which cover a small number of channels. One is to arrange the counters to count by a number other than one. For a synthesizer having 10 kHz capability, counting by three would cover the normal 30 kHz spacing.

Another approach is shown in fig. 6. A single counter is used, its output being fed to a 4-line to 16-line decoder. These lines select the diode bank corresponding to a particular channel, replacing the selector switch of fig. 4, for the all-channel type synthesizer, or the regular selector of the single-switch type. A greater number of channels is possible, but the complexity increases.

If a fairly large number of fast-set channels is needed for some reason, it may be worthwhile to replace the diode bank with one of the read-only memories. The *address* of the memory cell may be selected by the scanner, or by a coded switch.

Returning to fig. 5, the circuit used to transfer from scanner to normal operation can also be arranged to transfer to a particular channel on signal, this action overriding any other. This gives a "priority set-to-channel" system. The control could be by clock, or from a separate receiver, etc.

VFO Operation

Rigs which use the offset oscillator technique use crystals to set the offset spacing. Crystal control is not a necessity—any oscillator of suitable frequency and level can be used. This opens the way for a v.f.o. using the oscillator as a buffer. Rigs using diode switching of crystals may require special precautions in buffering. Also, some switching rearrangement may be needed to secure v.f.o. operation on both receive and transmit, or on receive only or transmit only.

The v.f.o. should follow good design principles, to secure stability and rapid start-up.

Measurement of Deviation

A phase-lock loop frequency synthesizer which secures f.m. by modulation within the loop has most of the elements needed to measure the transmitter deviation. The principles of such measurement are shown in fig. 7. It is first necessary to calibrate the instrument by measuring the change in loop control voltage for a small change in frequency. This is typically several hundred kHz per volt, or a fraction of a kHz

(Continued on page 84)

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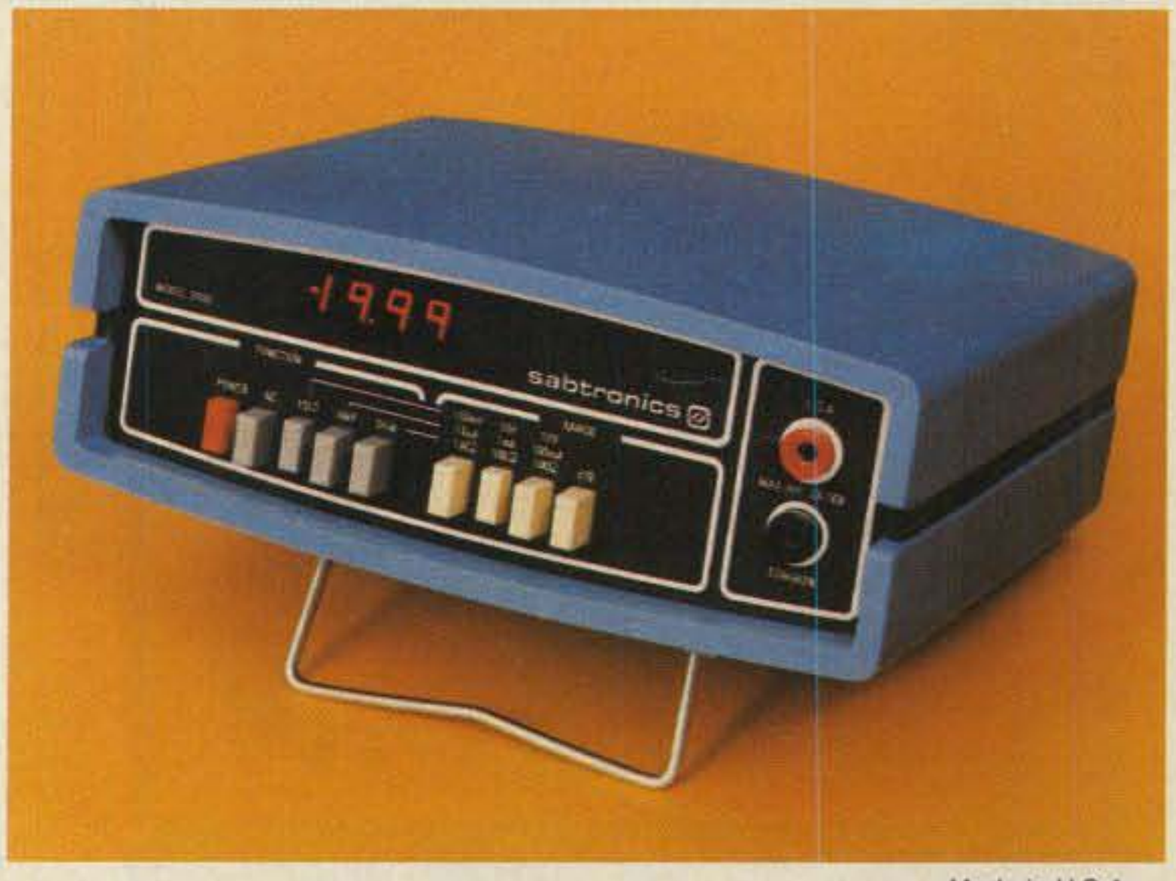

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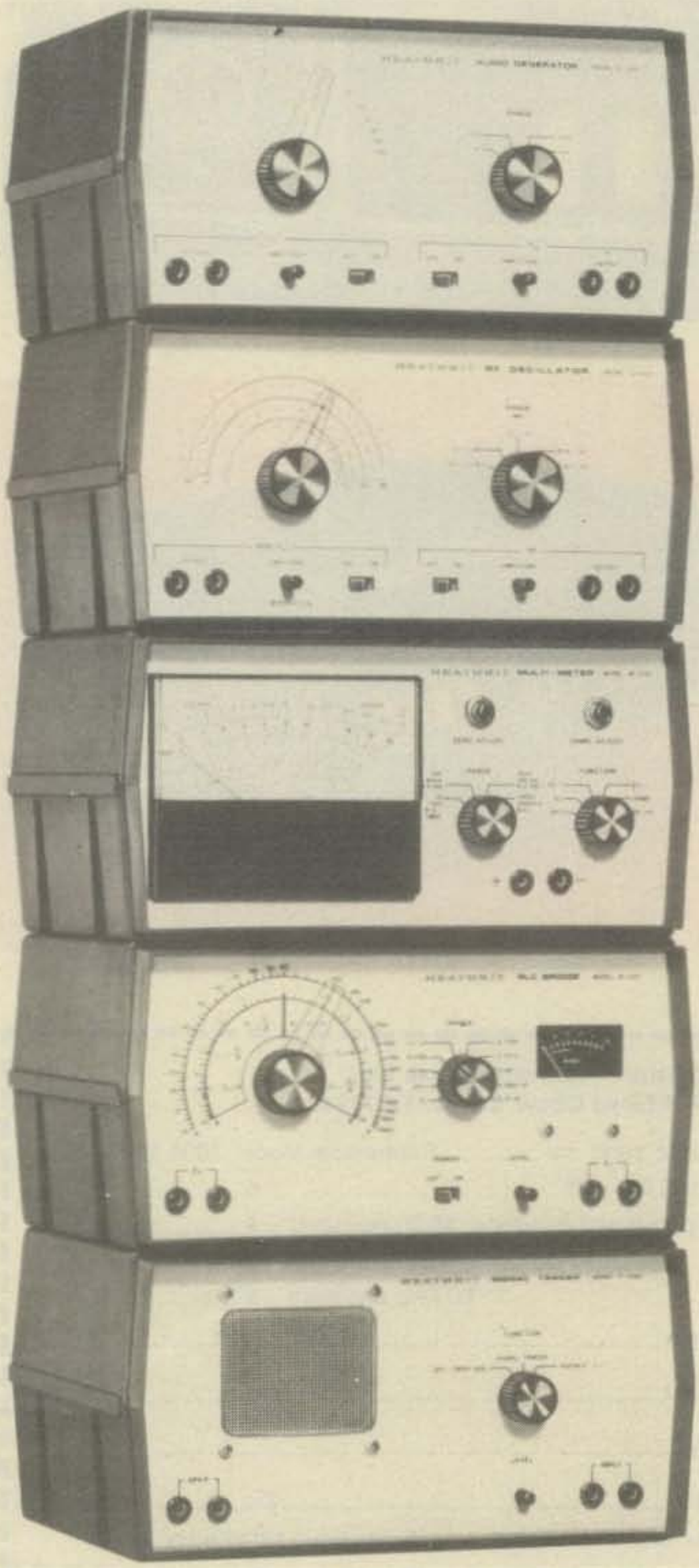
CIRCLE 38 ON READER SERVICE CARD

CQ Reviews: The Heathkit Series 5280 Test Instruments

BY IRWIN SCHWARTZ*, K2VG



Introduction

In the April issue of *CQ* we announced a new product line from Heathkit. The new releases from Heath Co. consist of five pieces of test equipment. Under the umbrella of the "5280 Series," the kits are the IG-5282 audio oscillator, the IG-5280 r.f. oscillator, the IM-5284 multimeter, the IB-5281 R-C-L bridge and the IT-5283 signal tracer. As an accessory piece of gear, Heath offers the IPA-5280-1 power supply which can be used to power all five units simultaneously.

All of the kits are built into similar high-impact plastic cases which can be nested one on top of another. The cabinets measure 11" wide by 5¾" high by 7¾" deep.

In addition each of the cabinets has a pull-up compartment on top for convenient storage of probes.

The test instrument kits sell for $37.95 each.

The Power Supply (IPA-5280-1)

The power supply is dual regulated at +9 volts d.c. and –9 volts d.c. Regulation is advertised to be within 9%. I measured no more than 5% deviation with a calibrated Tektronix 535 oscilloscope.

The supply is protected by a 1/16 A., 3AG, slow-blow fuse.

Either 110 volts a.c. or 220 volts a.c. can power the supply. The choice is made by use of a slide switch. Maximum output current is 100 mA.

The price of the power supply, in kit form, is $24.95.

The Multimeter (IM-5284)

The multimeter was the first of the five kits I built. I did this at Heath's suggestion since it would come in handy should I experience problems with the other kits (I didn't). It took me six hours to build the multimeter, including the time necessary to check if all the components were in the package.

I was immediately struck by the size of the front panel meter. It is a full five inches across.

As an a.c. or d.c. volmeter the 5284 features ranges of 0-1, 0-10, 0-100 and 0-1000 volts. As a d.c. milliammeter the ranges are 0-1, 0-10, 0-100 and 0-1000 mA. Finally, as an ohmmeter, the ranges are ×1, ×100, ×10k and ×1Megohm.

The unit can be powered either by the IPA-5280-1 power supply or by two 9-volt batteries and one "C" cell. If the power supply is used, the "C" cell must also be used.

The kit includes a needle probe and an alligator clip ground probe.

The electronic innards of the multimeter lie on a single circuit board. As is the usual case with Heathkits, the instructions are clear, concise and very easy to follow. This kit, like the others in the series, can be built by beginners with little or no trouble at all.

*Technical Editor, *CQ*

The wiring is rather direct, with no special pit-falls or unusual techniques required.

The unit is calibrated by using a 1.5 volt cell and 110 v.a.c. line voltage as standards.

Choice of power supply (either the IPA-5280-1 or batteries) is made by use of a slide switch on the back of the unit.

The Signal Tracer (IT-5283)

The signal tracer was the simplest of all the kits to construct. It went together inside of three hours.

Featured on the 5283 are a three-position switch (to be described later), a level control, a pair of input jacks and a and a pair of jacks which connect to the internal speaker.

The probe supplied with the tracer is switchable for audio frequency or demodulated radio frequency use.

This kit required five hours of construction time.

When the tracer is in its *off* position, it can be used as an external speaker for a receiver, for example. Simply patch the receiver's audio output to the speaker input of the tracer and you have a fine accessory for listening to radios which have no speaker.

In the "signal tracer" position the 5283 does just that. Using the switchable probe you can take a trip through a receiver from its r.f. input to its audio output. (After I had finished construction of the tracer, for want of anything better, I traced the signal through an old-fashioned crystal receiver. I was easily able to hear the signal at each "stage," even the very low audio output stage).

The third switch position is labled "audible v/ohm." In this position, the tracer can be used to compare both resistance and voltage by use of an audible tone. As the voltage or resistance input to the tracer is varied, so is the audio output tone of the tracer. This is a very nice feature of the unit.

The Audio Generator (IG-5282)

The audio generator supplies sine and square waves in frequencies continuously ranging from 10 Hz to 100 kHz. In fact, however, these limits can be exceeded at both ends if the frequency control is moved off scale.

The audio generator is divided into two discrete parts: that for generation of sine waves and that for generation of square waves. Each part has its own set of output jacks, amplitude control and "off/on" switch.

The variable tuning dial is calibrated from 10 to 100 for use against the "range" switch which has four positions: ×1, ×10, ×100 and ×1k.

The 5282 comes with a set of probes (red and black) on one end of which is a banana plug and on the other end, an alligator clip.

I fed the output of the generator into a digital frequency counter at several frequencies. On average the accuracy of the generator's output was within about 4% of the dial frequency. However, I was surprised by its stability. After twenty minutes the generator varied by no more than 1 Hz in either direction at 1000 Hz.

The R.F. Oscillator (IG-5280)

The r.f. oscillator is a very versatile piece of gear when judged against its price.

Its frequency range (sine wave) is from 310 kHz to 110 kHz in five bands. If it is used in its calibrated harmonic mode the range of the instrument can be extended to 220 MHz.

The open-circuit output voltage is approximately 100 mV. The unit has an internally generated 1000 Hz sine wave which can be used as an audio frequency standard or to modulate the r.f. frequencies. The open-circuit output voltage of the 1 kHz a.f. output is about 2 volts r.m.s.

The front panel features a variable frequency control, a band switch, an r.f. attenuator control, a modulation or a.f. output amplitude control and, of course, "on/off" switches for both the r.f. and a.f. functions.

It is interesting to note that the five frequency range positions overlap. The range positions are (in MHz) .31 to 1.1, 1.0 to 3.2, 3.1 to 11, 10 to 32 and 32 to 110.

When used in its modulated r.f. mode the "amplitude" control can be used to vary the percent modulation.

Heathkit includes a very instructive section in its construction manual for those who have never used such an instrument.

The R-L-C Bridge (IB-5281)

This kit is my personal favorite in the series. Pound vs. dollar I have not seen a bridge which measures resistance, capacitance and inductance as well as well as this one in a price range within most amateurs' reach. I must admit that I spent more time playing with this toy than with any of the other four. I measured a myriad of different components (all marked so I could compare my "standards" against the dial reading) and found the bridge to be accurate to the point that belies its price.

The calibration procedure consists of turning a few trimpots against voltage readings and comparison of the dial reading with a 100 ohm resistor which Heath includes as part of the kit. (This is one kit where it is *de rigeur* to have a part left over!)

The range switch features ten positions. (Incidentally, wiring the range switch required fully half the time to construct the kit). The positions are divided equally among resistance, inductance and capacitance (three each), plussistance, inductance and capacitance (three each), plus one Z_s (standard impedance) position. The ranges are R × 1, R × 100, R × 10k, L × 1 μH, L × .1mH, L × .01H, C × 1pF, C × .0001 μF and C × .01 μF.

(Continued on page 84)

KENWOOD

. . . pacesetter in amateur radio

The TS-820S . . . still the Pacesetter. It has proven itself to be the performer we promised, proven itself through thousands of hours of operating time, world wide and under the most difficult conditions. Unique features, superb specifications and top quality construction . . . all hallmarks of Kenwood amateur products are eminently displayed in the TS-820S. But then, you've probably heard all that on the air by now.

TS-820S

The TS-820S puts out probably the cleanest signal on the bands. The third order products are at least −35 dB due to Kenwood's unique RF Negative Feedback (RFNFB) circuit. State-of-the-Art PLL and single conversion design are combined for superb spurious characteristics far exceeding today's FCC requirements . . . the non-harmonic spurious emissions are better than −60 dB and the harmonic spurious are better than −40 dB.

The receiver boasts outstanding sensitivity . . . better than .25 uV for 10 dB S/N. And when it comes to dynamic range, it's tough to beat the TS-820S. These are impressive numbers. That's why so many prominent DXers are using the Kenwood Pacesetter . . . the TS-820S.

The man to see . . . your local Authorized Kenwood Dealer. He can give you all the information you need and the best deal.

TS-820S VFO-820S SP-820

Kenwood's unbeatable combination. The VFO-820 solid state remote VFO adds greatly to the versatility of your TS-820S. It has its own RIT circuit, control switch and is a perfectly matched accessory. The SP-820 deluxe external matching speaker includes audio filters for added versatility on receive and two audio inputs.

IT'S NEW . . . IT'S UNIQUE . . . AND IT'S TRULY USEFUL. IT'S KENWOOD'S SM-220 STATION MONITOR. THE SM-220'S UNEXCELLED VERSATILITY ALLOWS YOU TO MONITOR YOUR TRANSMISSIONS, MONITOR INCOMING SIGNALS, AND MONITOR THE AMOUNT AND STRENGTH OF BAND ACTIVITY* AND PERFORMS AS A GENERAL-PURPOSE 10 MHz OSCILLOSCOPE, AS WELL.

Kenwood offers this totally unique unit as a perfect compliment to your TS-820S or TS-520S station.** The SM-220 permits you to monitor your transmitted signals, thus assuring optimum linearity and maximum performance. With the addition of the BS-5 or BS-8 Pan Display option you will be able to determine visually the location and strength of adjacent signals without tuning your receiver off frequency. The choice of options allows you to adapt the SM-220 to either the TS-820S or TS-520S, depending on which rig you now have or may acquire.

The SM-220 has a built-in two-tone audio generator with full provisions for tuning your exciter and linear amplifier (160 m through 2 m).

All this costs little more than a general-purpose oscilloscope. And, of course, it's pure Kenwood quality.

*With BS-5 or BS-8 option

**For other models check with appropriate manufacturer for compatibility.

SM-220

Function: Selects operation mode: OSC/RTTY: General testing of station equipment, experimental design of new equipment, or troubleshooting; display of receiver IF output allows you to give "signal quality reports"

Power ON indicator.

Power switch.

Intensity: Controls brightness of 'scope display.

Band Scope: (Pan Display) With BS-5 or BS-8 option, allows you to "see" the signals on both sides of your operating frequency without tuning your receiver off frequency. Useful for determining "band conditions", band crowding, source of interference from adjacent stations . . . a visual display of what you would hear if you tuned across the band, without having to touch your receiver's dial.

Focus: Controls sharpness of 'scope display.

Vertical Attenuator: Precision step attenuator (gain control) switch adjusts vertical input level.

Vertical Input: Accepts IF input, RTTY input or oscilloscope input.

Vertical Gain: Potentiometer to fine-adjust vertical input level.

↕ Adjusts display along vertical axis.

◄► Adjusts display along horizontal axis.

RF Attenuator: Level control used in MONI/TRAP mode.

Tone: Step switch selects Wien bridge tone generators: 1000 Hz, 1575 Hz or both tones simultaneously.

Out: Output of the audio generator can be connected to the transceiver's microphone input for "two-tone test"; Also for trapezoidal test of transceiver linear amplifier.

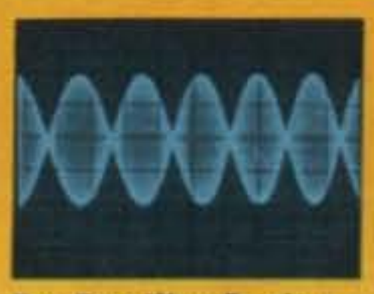
Synchronization Marker: Selects internal or external sync (similar to horizontal hold on TV. Turns On or Off the built-in marker which shows operator where his receiver is actually tuned.

Scan Width: Selects width of "window" or receive band display when using the Pan Display option. (100 kHz or 20 kHz)

Variable sweep control/External gain: Controls (1) sweep speed of display in any sweep range; (2) optional Pan Display (Band Scope) speed of display; (3) level of horizontal input/external syncronization input when sweep range is in RTTY/Ext or Trap.

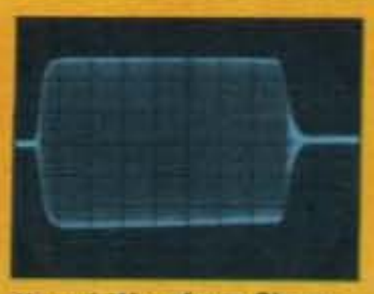
Horizontal Input/External Sync: Accepts either (1) RTTY input for tuning, (2) external sync input for test (oscilloscope functions), (3) external oscillator for Lissajous display.

Sweep Range: Step switch controls sweep band width or switches horizontal input/external sync terminal "ON"

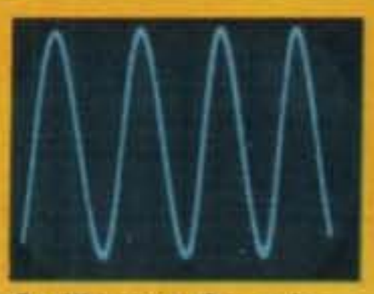


Two-Tone Wave Envelope For "performance" tune-ups or checking proper tranceiver operation.

Pan Display Use to check source of interference during "QSO" without moving off-frequency. Also determines location and strength of adjacent frequencies. (Requires BS-5 or BS-8 option)



Keyed Waveform Shows detail of CW keying. Use to monitor the quality of your CW note. (Photo shows ideal waveform produced by TS-820S.)



Oscilloscope Operation (1 kHz) Oscillator function allows Sine, square wave, Lissajous patterns for testing or design work.

Trapezoid (TS-820S w/ TL-922) Shows linearity of power amplifier. Used primarily for testing.

Wave Envelope shows full SSB voice modulation, with processor on (full compression), and "clean signal" at full power.

arma
amateur radio manufacturers association

TRIO-KENWOOD COMMUNICATIONS INC.
1111 WEST WALNUT/COMPTON, CA 90220

CQ looks at some of the latest equipment and accessories of interest to amateurs.

New Amateur Products

The Science Workshop ATVC-10 ATV Converter

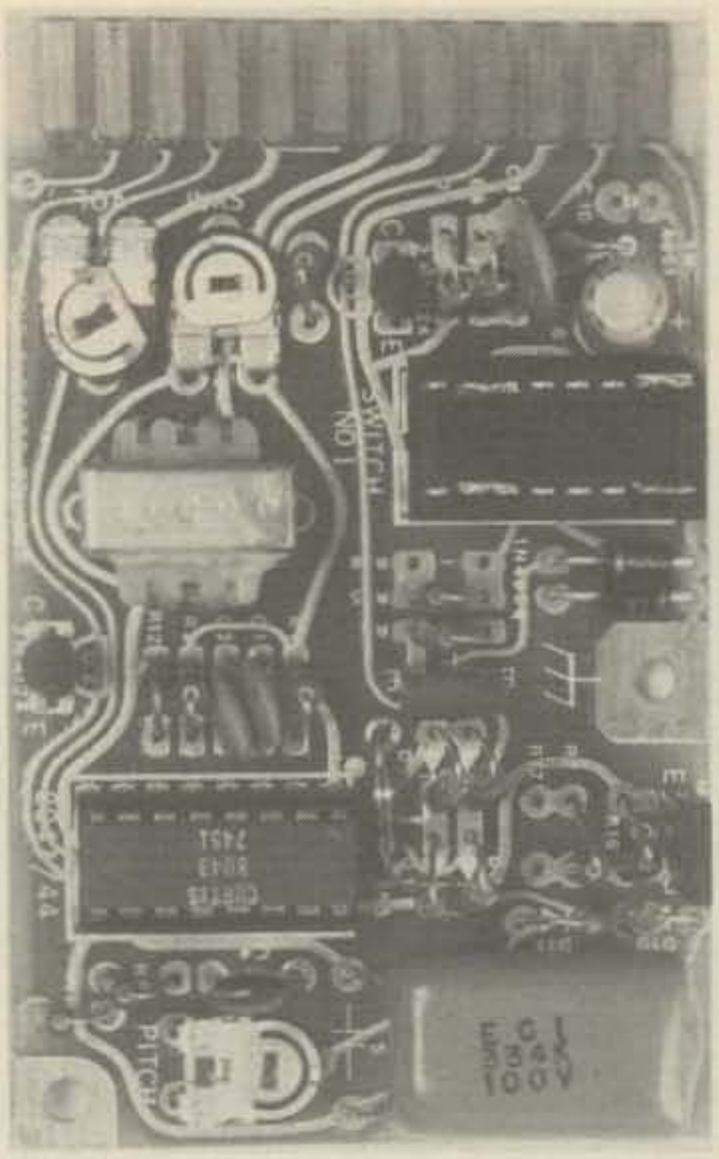
By connecting a u.h.f. antenna to the input of the Model ATVC-10 converter and the output of the converter to the v.h.f. antenna terminals of any TV set, the user can see what the local amateurs are doing on fast-scan.

The circuit of the converter consists of a low noise, high gain r.f. amplifier stage with Varactor tuned input and output, an active mixer stage with Varactor tuned input and a Varactor tuned oscillator stage.

The unit comes with a built-in a.c. power supply.

Prices are as follows: factory wired, $49.95; semi-kit (critical circuits pre-wired and aligned), $39.95. Full instructions are included.

For additional information write to Science Workshop, Box 393, Bethpage NY 11714.



The Curtis 8043 IC Keyer Kit

An improved model of the popular 8043 single IC Morse Keyer Kit has been announced by Curtis Electro Devices. This new kit features the 8043 integrated circuit which offers self completing dots, dashes and spaces; dot memory; iambic operation; key debouncing; built-in side tone; plus weight, pitch volume and speed controls.

The 8043-3 kit containing the 8043 IC and printed circuit card is priced at $24.95; a more complete kit, called the 8043-4, is priced at $54.95.

For more information write Curtis Electro Devices, Inc., P.O. Box 4090, Mountain View CA 94040.

The ICOM IC-701 Digital Transceiver

Inoue Communication Equipment Corp. (ICOM) has entered the high frequency transceiver market with the introduction of its IC-701 digital transceiver.

The unit is synthesized and ranges from 160 meters through 10 meters. Special features of the transceiver include a continuously electronically variable filter width in s.s.b. and RTTY operation, built-in standard and narrow filters for c.w., digital readout, two v.f.o.'s, all solid-state construction, continuous duty on SSTV and RTTY and a light chopper v.f.o. dial.

The IC-701 sells for $1499, including the transceiver, an a.c. power supply/speaker console and the SM-2 microphone.

For more information contact ICOM at 3331 Towerwood Dr., Suite #307, Dallas TX 75234.

The Barker & Williamson Model AT-200 Antenna Matcher

Barker & Williamson announces the Model AT-200 antenna matcher for matching 2-meter amateur mobile transceivers to automobile AM/FM receiver antennas.

To use the AT-200 with a 2-meter transceiver, place the selector switch in the *2M* position, key the transmitter, and adjust the tuning knob for maximum brightness of the LED tuning indicator.

B & W says that, for most vehicle antennas, the VSWR can be adjusted to 1.2:1 or lower.

The unit sells for $24.95 from Barker & Williamson, Inc., 10 Canal St., Bristol PA 19007.

Catalogs, Catalogs, Catalogs . . .

The following suppliers announce new catalogs.

Siliconix, Inc.
2201 Laurelwood Rd.
Santa Clara CA 95054

ETCO Electronics, Dept. ET
183G Hymus Blvd.
Pointe Claire, Quebec
Canada H9R 1E9

Atlantic Surplus Sales
3730 Nautilus Ave.
Brooklyn NY 11224

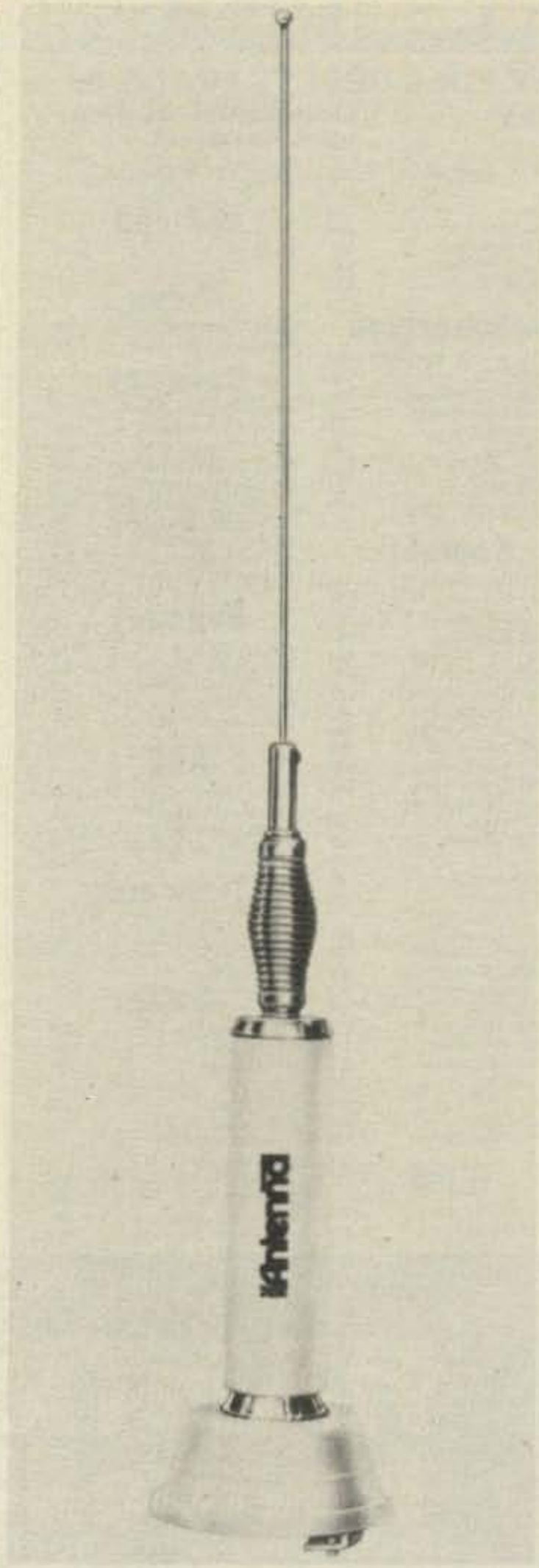
Continental Specialties Corp.
44 Kendall St.
New Haven CT 06509

B & K-Precision Dynascan Corp.
6460 W. Cortland Ave.
Chicago IL 60635

Exact Electronics, Inc.
455 S.E. 2nd Avenue
Hillsboro OR 97123

Simpson Electric Co.
853 Dundee Avenue
Elgin IL 60120

National Semiconductor
2900 Semiconductors Drive
Santa Clara CA 95051



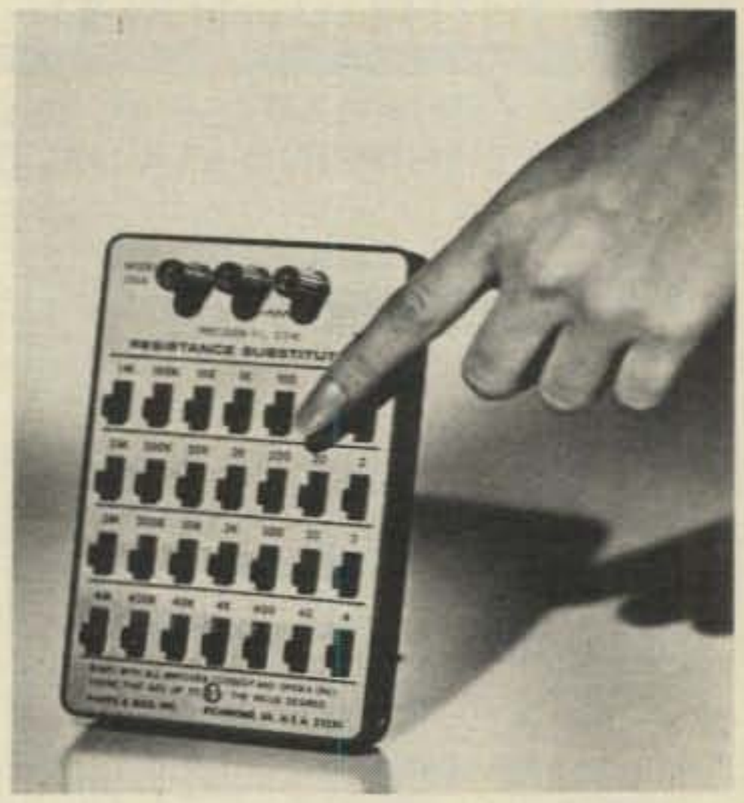
Antenna, Inc.'s 2 and 6 Meter High Power Mobile Antennas

A line of high power (up to 200 watts) mobile antennas covering the two and six meter amateur bands has been announced by Antenna Incorporated.

The six-meter antennas feature 200 watt loading coils and the two-meter models are available with either 150 or 200 watt loading coils. The antennas come with a variety of mounting hardware.

Each antenna comes with a 49-inch plated stainless steel whip, a stainless steel impact spring, a shock resistant and weatherproofed PVC-wrapped loading coil and 17 feet of coaxial cable with a soldered PL-259-type connector.

For further information, contact Randall J. Friedberg at Antenna, Inc., 23850 Commerce Park Rd., Cleveland OH 44122.



The Phipps & Bird, Inc. Model 236-A Resistance Substitution Box

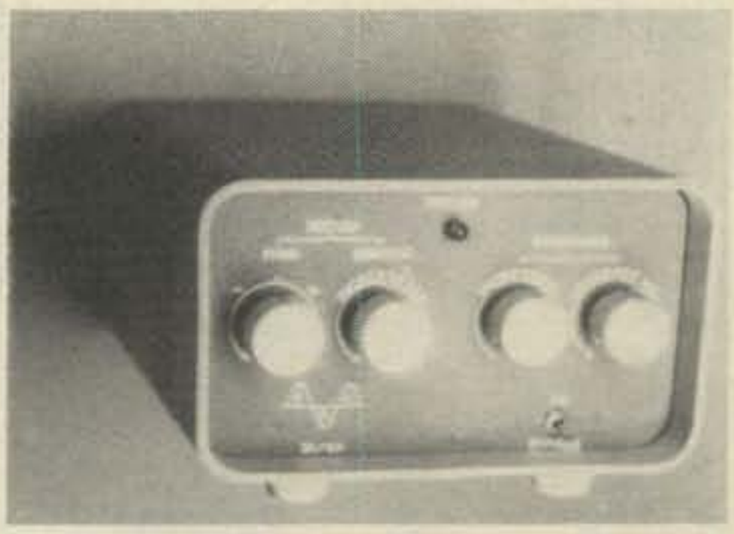
From Phipps & Bird comes a slide-switch resistance substitution unit which provides over 11 million resistance steps.

The unit is pocket-sized (4" x 6" x 1-3/16").

The 236-A features three binding posts, one to the ground case.

The slide-switch unit uses one-half watt resistors with 1% tolerance and gives accurate resistances in one ohm steps.

The resistance substitution box is available from Phipps & Bird, Inc., Richmond VA 23261 for $58.



Electronic Research's SL-55 Active Audio Filter

Just announced is Electronic Research's new SL-55 active audio filter. The filter is designed for both the s.s.b. and c.w. operator.

Featured in this unit are continuously variable notch and bandpass filters. The filter is all solid-state.

The SL-55 can be used with either headphones or a speaker and measures a trim 5½" x 3½" x 7½".

For more information, contact Tim Hulick, W9QQ at Electronic Research Corp., 1280 Southfield Pl., Virginia Beach VA 23452.

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Boonton "Q" Meter	$295
Tektronix 5140	249
Tektronix 545A	950
5 3/54A Plug-in wide band preamp	75
Hickok 695 Generator	69
Bendix BC221 Freq Meter	39
Polarad Spectrum Analyzers A84T	1695
Hewlett Packard 400C	75
Precision E-400 Signal Generator	125
Electro Impulse Spectrum Analyzer	395
Dyna/Sciences Model 330 Digital Multimeter	195
Hewlett Packard 4905A Ultra Sonic Detector	550
Hewlett Packard 120A Scope	250
TS-323/UR Frequency Meter	175
Hewlett Packard 4910B Open Fault Locator	650
Bird Mod 43	80
General Radio 650A	150
Measurements Mod 80	195
Nems Clark 1400	495
Ballantine 300H	175
PACO Scope Mod-S-50	75
Singer FM-10C	3495
Simpson 260 V.O.M.	49.50

Allied

AX-190 Receiver	$159

Ameco

PV-50	$ 9
CN-50	29
CN-144	39
TX-62	79
621 VFO	45

B&W Waters

Nuvertor 2+6 Conv.	$ 75
6100 SSB Xmitter	395
670 SSB Adaptor	39
Co-Dax Keyer	95

Central Electronics

100V Transmitter	325
MM-2 Scope	69
20-A SSB Adaptor	79

Clegg

22'er FM	$129
66'er 6M Xcvr	115
99'er 6M Xcvr	59
Interceptor BRCUR	275
Ant Pre Amp	22
All Bander	69
HT-146	125
2 Vess	259
FM-27-B Xcvr	325

Collins

75 A4 Receiver	$395
75S3B Receiver	695
75S1 Receiver	349
KWM-2 Xcvr	595
32S1 Xmitter	349
PM-2 AC Supply	95
516 F2 AC Supply	139
312B5 Console	425
361D2 Mount	29

Drake

2A Receiver	$149
2B Receiver	189
2AQ SPKR QMULT	29
R4 Receiver	289
R4-B Receiver	349
R4-C Receiver	399
MS-4 Speaker	19
2NT Transmitter	125
2NT Transitter	99
TR-6	695
TR-22 2 Meter	140
T-4X Transmitter	339
TR-72 2 Meter FM	225
SX-146 Receiver	175
HT-44 Transmitter	159
SX-111 Receiver	149
SX-122 Receiver	249
S-36 UHF Receiver	125

Hammarlund

HQ-110 A VHF Receiver	$189
HQ-110C Receiver	119
HQ-110AC Receiver	149
HQ-145X Receiver	169
HQ-170C Receiver	159
HQ-180 Receiver	379
HQ-215 Receiver	259
SP-600 Receiver	179
HX-50 Transmitter	169

Heathkit

SB-300 Receiver	$199
SB-301 Receiver	229
HR-10-B Receiver	69
SB-303 Receiver	269
SB-220 Linear Amp	449
SB-102 Trivcvr	379
DX-60B Transmitter	69
HW-32 Transmitter	85
HW-100 Transceiver	249
SB-100 Transceiver	299
SB-401 Transmitter	249
SB-101 Transceiver	349
SB-650 Digital Freq. Display	149
HW-30 Twoer	29
Also Sixer	29
H-10 Monitor	69
VHF-1 Seneca	79
HW-12 Transmitter	75
HP-23 AC Supply	49
HP-23B AC Supply	59
HW-202 2M FM Xcvr	159
SB-620 Spectrum Analyz	120
SB-102 Xcvr	369
SB-610 Scope	95
HA-20 6m Linear	125
SB-634 Consule	175
SB-604 Spkr	29.50
SB-644 VFO	129.50
SB-230 Linear	359
SB-104 Transceiver	625

ICOM

IC-21 2M FM Xcvr	$299
IC-230 Demo	369
IC-22A 2M FM Xcvr	185
IC-30A 432 MC FM	269

Johnson

1-KW Matchbox/SWR	$195
Courier Linear	139
Ranger I Transmitter	85
Ranger II Transmitter	139
Valiant I Transmitter	129
Invader 2000 Xmitt	495

Kenwood

T-599 Transmitter	$289
R-599 Receiver	289
TS-520 Tranc	429
QR-666	259
QR-666 Receiver	239
TV 502 Transvertor	179

Knight

T-60 Transmitter	$ 39
r-100 Receiver	59
TR-108 Trancur 2M	79

Lafayette

HA-800 Receiver	$ 89
HP-350 Receiver	149
HE-45 Transceiver	49
AC-4 AC Supply	95
TR-4-C Transceiver	449
CC-1 Console	
CPS-1 Supply	
SC-2 Conv	
SC-6 Conv	
SC-1 Calibrator	
The above all assembled complete pkg.	Only $200

Dycomm

10-0 2 M Ampl	$125
35-0 401N 110 Out	130
470-25 450 MC	120
P-1416 16 Amp Supply	95

Eico

720 Transmitter	$ 49
722 VFO	39
730 Modulator	39

Elmac

AF-67 Transmitter	$ 45
PMR-8 Receiver	79

Genave

GTX22M FM	$165
GTX-200 2M FM	149

Globe/Galaxy

VHF 6+2 Transm	$ 39
Chief Transmitter	39
Galaxy III Xcvr	159
Galaxy V Xcvr	189
Galaxy V Mk II	239
GT-550 Xcvr	279
GT-500A Xcvr	329
AC-400 Supply	79
FM-210 2M FM	95

Gonset

Com II 2M	$ 75
Com II 6M	69
Com IV 2M	129
GC-105 2M	115
G-28 Xcvr	149
G-50 Xcvr	149

Hallicrafters

S-108 Receiver	$ 99
SX-101 Receiver	159
HT-32 Transmitter	179
HT-32B Transmitter	269
SX-99 Receiver	79
SX-115 Receiver	349
HT-37 Transmitter	159
HT-40 Transmitter	49
SX-99 Receiver	99
SX-117 Receiver	189
SR-150 Xcvr	259
SR-160 Xcvr	159
350 Transceiver	269
350C Xcvr	299
600R Receiver	339
600T Transmitter	399
410 VFO	79

Tempo

Tempo one Xcvr	$299
AC One Supply	79
FMH 2M H.T.	149
CL-220 Trncur 220 MC	179
FMH 2M w/Talkie	149

Ten Tec

PM-3 Trnsur	$ 49
Argonaut Xcvr	199
KR-40 Keyer	79
RX-10 Receiver	49
S-30 Signalizer	29
Triton II	479

Yaesu

FT-401 Xcvr	$499
FRDX 400SD Rec	325
FT 2 Auto 2M FM	249
FT-101B Xcvr	549
FL-2100B Linear	295
FV-101 VFO	79
101E Xcvr Demo	695

Midland

509 H.T.	$149

Millen

92200 Transmatch	$149
90651-A Grid Dipper	95

National

NC-270 Receiver	$119
NC-300 Receiver	129
NCX-5 Transceiver	279
NCX-5MKII Transcvr	299
NC-303 Receiver	199
AC-500 AC Supply	69
NCX-500 Transceiver	199
NCX-3 Transceiver	169
NC-190 Receiver	149
NC-105 Receiver	69

Regency

HR-2B 2M FM	$169
HR-220 FM 220 MC	185
AR-2 2M Amplifier	85
HR-25 2M FM	225
HR-6 Meter FM	189

SBE

SB-34 Transceiver	$249
SB-33 Transceiver	189
SB-144 2M FM	175
SBZ-LP Linear	179

Standard

SRC-146 HT	$149
826 M Trnscvr	195
SRC-144	395
SRC-851T	250

Swan

700-CX Xcvr	$459
260 Cygnet	289
279 Cygnet	329
500 Xcvr	299
500 CX Xcvr	389
117-XC AC Supply	95
14X DC Module	39
MK II Linear	475
KK VI 6 Meter	550
250 C 6M Xcvr	349
FM 2X2M Xcvr	169
FM-1210A 2M	249

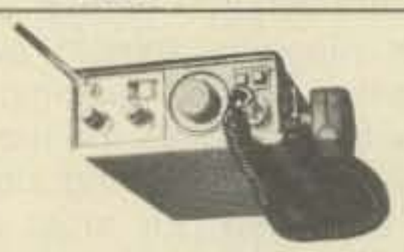
ICOM IC22S

Regular $299, save $50; buy an ICOM IC22S for $299 (no trades) and take a $50 credit for another purchase.

KENWOOD

TS 820 — $919.00

TS 820S — $1098.00



KENWOOD TR-2200A

Regular $229, save $30; buy a Kenwood TR2200A for $229 (no trades) and take a $30 credit for another purchase.

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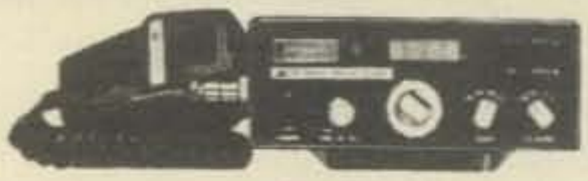

MIDLAND 13-510

Regular $499, save $100; Buy a Midland 13-513 for $399 (no trades) and take a $100 credit for another purchase.

BEARCAT 210

Bearcat 210 Scanner $349; now $259. Super synthesized receiver, scans and searches over 16,000 different frequencies. Covers 32-50, 146-174 & 416-512 MHz.

Due to early closing dates for magazine ads, some items may be unavailable when you receive this publication. We will attempt to accommodate all orders whenever possible.

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CQ REVIEWS

ARRL's new membership service, an insurance program to cover your Ham Radio equipment against direct physical loss or damage caused by fire, theft or other named perils, is specifically designed to meet your need for adequate coverage at a low cost.

Compare your present insurance coverage with the program we offer outlined on the following pages. We believe that you will find our new program to be less expensive, and with coverage that meets or exceeds your present coverage.

Eligibility

The program is available to all members of the American Radio Relay League. During the CHARTER ENROLLMENT PERIOD, (February 15 through April 15, 1978) coverage is guaranteed to all ARRL members regardless of past claims experience. Coverage is limited to residents of the United States, its territories and possessions, and Canada.

Outline of Coverage

All mobile and base station equipment will be covered for "Named Perils" including fire, theft, lightning, collision, overturn and other non-excluded perils. The essential exclusions will be the standard ones of loss of use, inherent vice, intentional damage, damage occasioned by repairing or tuning, etc., electrical charge (not lightning). *Loss or damage to antennas, towers, or rotors not covered.*

Additionally Acquired Property:
If the insured purchases additional or replacement property or has custody of equipment of a type already insured by this policy, such property shall be insured (without any additional premium required during the current policy year) for its replacement cost (but not to exceed 25% of the total amount of insurance then in force or $1,000, whichever is the lesser as an additional amount of insurance). This additional coverage shall cease at the expiration of this policy. Coverage may be continued in future years for an additional annual premium computed at regular premium rates. Changes during the policy year should be coordinated with the administrator on a by-case basis.

Premium Cost

The rate will be $1. per $100. of replacement cost value. (Minimum premium is $10, regardless of coverage in amounts less than $1000 replacement cost)

Claim Settlement Basis

Covered claims will be settled on a "Replacement Cost" or equivalent basis.

Deductible

Ten percent (10%) of the insured value, subject to a $50.00 minimum per loss.

Policy Year

Policy will become effective on the first day of the month immediately following receipt of premium and application. (Please allow at least thirty (30) days from the date the application and check are mailed for the policy to be issued.)

Program Administration

The program will be administered by Bonn A. Gilbert, Jr. President of G & H Insurance Administrators, Inc., with Marketing Offices at 4000 Park Road, Charlotte, North Carolina 28209, and Services Offices located at 649 North Virginia Avenue, Azusa, California 91702. Toll-free IN-WATS lines are provided for your convenience. Please call 800/423-6597, should you need assistance or additional information.

(Sorry, WATS service is not available to members in Alaska, California, Hawaii and Canada. Please call direct 213-967-6597.)

How to Enroll:

A. List on the application *all* radio equipment owned or leased. The member must insure *all* of his equipment valued at more than $50. He may not be selective. (Excluding antennas, towers and rotors)

B. List a total "replacement" value for each piece of your equipment both in the home and automobile.

C. After arriving at the total replacement cost, compute annual insurance premium based on the rate of $1 per $100 of total replacement value. Minimum premium: $10.

D. Make check or money order payable to G & H Administrator and return with completed application using the enclosed postpaid envelope.

The ARRL Insurance Program

While heading for home one evening a few weeks backs, I happened to be monitoring the local LIMARC repeater. There were two fellows talking about something that I hadn't heard about yet, and it really peaked my interest. The discussion was about a brand new insurance policy just made available by the ARRL to protect hams' equipment from theft, fire, and various other possible calamities. It struck me that here was a real honest-to-goodness great service being offered by the League. We all know how tough it is to get insurance on radios in our cars because of the tremendous theft increases in recent years. The insurance companies could care less that it's CB radios that the burglur is after. The ham equipment is all lumped into the same category.

I was all set to urge every ham I know to immediately sign up for the ARRL insurance program. Then I sat down and read the actual proposal. When I finished reading I came to this conclusion. The ARRL insurance program is a terrible investment. Now before you decide that this is just another example of Cowan taking off on the League with an irresponsible, unfound criticism, examine the facts for yourself and make your own judgment. Here's the actual League prospectus as offered to members through the Mail:

Okay, let's analyze what we've got. The $1 rate per hundred of insured value is a bit high to begin with. Most floaters on collectibles such as art collections, antiques, and other miscellaneous high-risk possessions should cost about 75 cents per hundred. But I won't quibble with that so much because even though the percentage is 33% too high, the actual excessive cost in dollars isn't all that bad. What is bad is that the amateur **must** list and insure every radio item in his possession, not just the items in the car or boat that really need the coverage. In other words, the items already covered by your homeowner's policy must be covered by a duplicate policy. You can't collect twice if your shack is stolen, then why should you have to insure it twice. And what's worse, the minimum premium for any individual is $10. But the radio system in your car might be worth only $200, $300 or even $500, so you still have to pay a rate based on a station that would be insured for a full $1,000. And on top of that, the deductible clause in the policy is also very high. You have to deduct 10% of the value of the equipment stolen, with a minimum deduction of $50.

One thing these policies never spell out is exactly how much actual coverage you're going to get. True, you're equipment might have cost you $500 when

purchased, but insurance companies seem to have a habit of adding in depreciation as an extra factor. So the radio you paid $500 for two years ago might only be worth $300 today. Subtract from that the $50 deductible and you're actually collecting only $250 on a radio that cost you twice as much.

Now consider this. A typical amateur radio station including both mobile and home equipment might have cost you $2,500 over a period of time. Your premium under the League policy will cost you $25 annually. The coverage on the home equipment is virtually useless, as I covered in the beginning. So you're actually carrying a policy that'll pay you $250 or $300 if your mobile rig is ripped off. The insurance company needs just ten policies at $25 each to break even on the average single claim that they pay. But the odds of your station being robbed aren't one in ten. They're more like one in fifty or one in a hundred. The insurance companies love odds like that. They amass fortunes from such group policies.

And for crying out loud, don't sell yourself a bill of goods that "it's only $10 or $20 or whatever, so what does it mean in the long term scheme of things?" Your tens and twenties multiplied by thousands of hams add up to millions of dollars.

All right, I've taken the liberty to criticize the ARRL program, so what alternative can I offer. Nothing this week. But we do have some pretty sharp insurance companies looking into a group policy that'll be a much better deal for the hams. I visualize a policy that should cost just 75 cents per hundred, require no coverage on your home equipment unless you really need and want it, and have a far more realistic minimum premium of say, $5 instead of the ridiculous $10 figure on the other program. We hope to have something conrete to

(continued on page 84)

Martin R. Kramer explains that a standing wave ratio of 1:1 is not necessarily the solution to all antenna loading problems. In addition, he explores some myths associated with the mechanics of wave reflections along transmission lines.

Reflected Waves and Mismatched Loads

BY MARTIN R. KRAMER*, K2KGF

One of the more enduring controversies among amateurs surrounds the explanation of what actually happens to the reflected power in a mismatched transmission line. Some authors have insisted that no real power is actually reflected and that the issue was a tempest in a teapot. Oddly enough, the technically correct explanation has been available in amateur journals for some time but the confusion nevertheless lives on. It is in the hope of dispelling some of the old conundrums that this article is written.

Being mindful that most readers are more interested in straightforward physical explanations, I will leave the more complex math to the references wherever possible.

Historically, standing waves became a concern sometime following the Second World War when coax and the s.w.r. bridge came into wide use. At the risk of a gross oversimplification, I would say that before that time little thought was given to matching the transmission line to the load, and most probably no one was the poorer for it.

Before we proceed to the subject of standing waves, some comments about r.f. final amplifiers are required. You will appreciate the significance of these later on. Nearly everyone knows the fundamental engineering theorem that maximum power is transferred from a generator to a load when the internal impedance of the generator is equal to the load impedance. From this it follows that maximum power is transferred from a transmission line to a load having an impedance equal to the line's surge impedance. However, designers seldom design a power amplifier to maximum power transfer alone. Rather, some consideration is given to the matter of power transfer efficiency because most power output tubes are capable of delivering a great deal more power than can be safely dissipated at the plate.

A simple illustration of this principle is shown in fig. 1.

*295 Mace St., Staten Island NY 10306

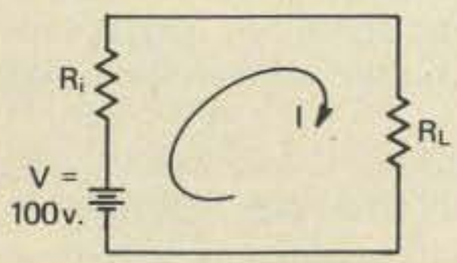

Fig. 1 – Illustration of power transfer efficiency.

Assume that R_i represents the internal impedance of the generator (this is the same as plate impedance for our purposes) and R_L represents the load. Arbitrarily assigning values of 5 ohms to both R_i and R_L *(the matched condition)* we find from Ohm's Law

$$I = \frac{V}{R_i + R_L} = \frac{100}{10} = 10A.$$

The power dissipated at the load is:

$$P_L = I^2R_L = 10^2(5) = 500 \text{ W.}$$

But note that although we have delivered 500 watts to the load, we have also dissipated 500 watts at the generator itself:

$$P_i = I^2R_i = 500 \text{ W.}$$

Thus, when maximum power is transferred, maximum dissipation also occurs. Using the values derived above, we can calculate the power transfer efficiency of this circuit to be:

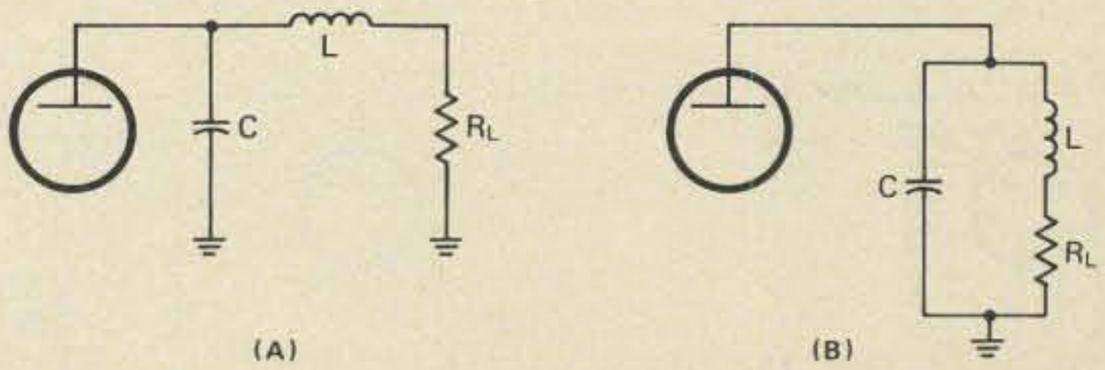

Fig. 2 – In (a), an L-network. In (b), the network in (a) rearranged to show that the load, R_L, is part of the network itself.

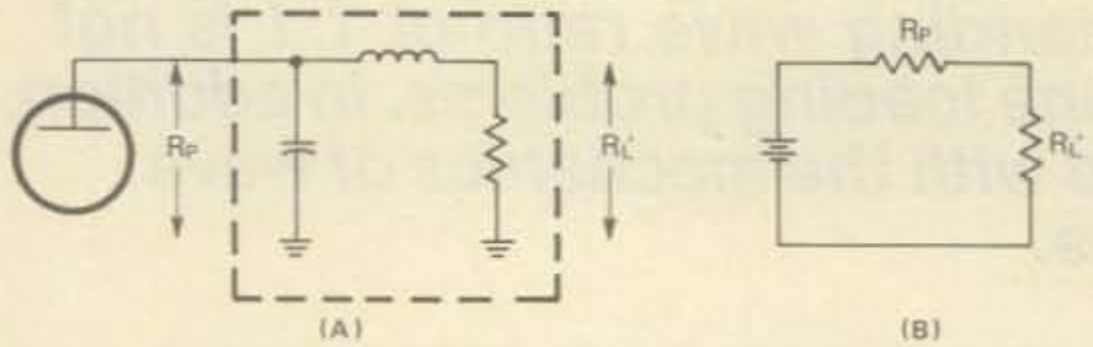

Fig. 3 – The L-network in (a) is equivalent to the simple circuit in (b).

$$P_{eff} = \frac{P_{OUT}}{P_{TOTAL}} = \frac{500}{1000} = 0.5\ (50\%)$$

Now, using the same circuit but raising the load impedance to a value of 15 ohms we find that we now deliver 375 watts to the load—but more importantly, we dissipate only 125 watts at the generator itself. The power transfer efficiency of this circuit takes a dramatic rise:

$$P_{eff} = \frac{375}{500} = 0.75\ (75\%)$$

From all of this we can make the general observation that the higher the load in relation to internal impedance, the higher the efficiency of the circuit. There is, however, a practical limitation here since power output falls to an unacceptably low level if the load impedance gets too high.

A more important consideration in our discussion involves how the plate impedance of an r.f. final amplifier is matched to the transmission line. Remember that plate impedances for Class B amplifiers (typical in s.s.b. rigs) are of the order of 1000 to 5000 ohms and that loads are commonly of the order of only 50 to 75 ohms; indeed a rather great disparity.

One of the earliest and simplist networks used for this purpose is the L network shown in fig. 2.

By simply redrawing the L network into the form shown in fig. 2(b) you can readily see that what we are describing is actually an LC tank circuit which, however, cleverly includes the load R_L as one of its components. Thus, the amplifier plate circuit "sees" a very high load impedance at resonance while simultaneously loading into a low dissipative impedance represented by R_L. The equivalence of the L network to the simple circuit shown in fig.1 can be appreciated by referring to fig.3. R_p represents the plate impedance of a final amplifier and R'_L represents the lumped equivalent of the entire L network. In order to insure good power transfer efficiency, R'_L is usually made several times greater than R_p.

The popular pi-network used in almost all modern transmitting equipment can be thought of as simply two L networks back to back as shown in fig.4(a). This network can similarly be reduced to an equivalent LC tank as is shown in fig. 4(b), where the load R_L has been included. The advantage offered by the pi-network is its ability to match into a much wider range of load impedances, but the principles of operation are similar.

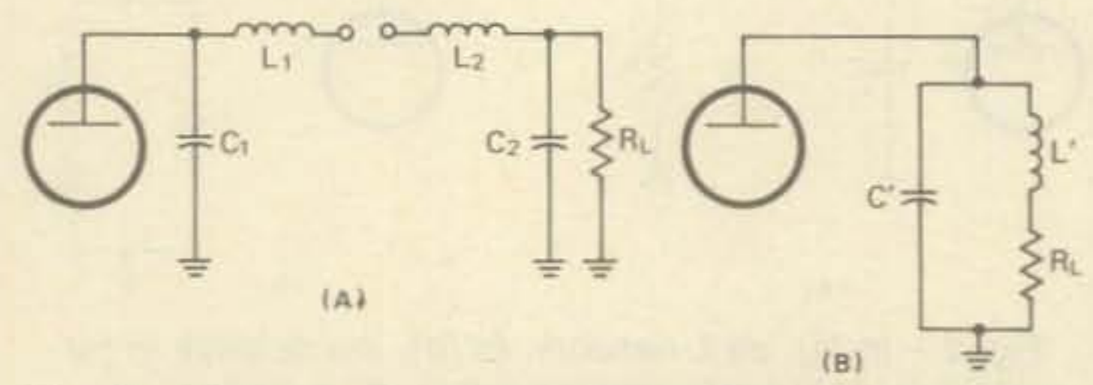

Fig. 4 – (a) shows that the pi-network is composed of two "back-to-back" L-networks. In (b), a circuit equivalent of (a).

A signal coming from the transmission line will "see" a tuned series LC circuit, which if properly tuned will act as a totally reactive, non-dissipative load.

This is, by the way, the major significance of our prior discussion, and accounts for the fact that an electromagnetic wave will undergo a total reflection at the amplifier matching network. The mechanics of reflection will be discussed after we describe the nature of the waves involved.

The networks used in my examples are more or less typical of the kind used in vacuum tube circuits. Solid state matching networks take a slightly different form because of the low impedances involved, but I believe that the same principles apply. However, because impedance ratios are fairly low in solid state circuits, the networks cannot accommodate the wide variations in load conditions.

It is well understood by most amateurs that the radio waves dealt with are more accurately described as electromagnetic waves. Such waves exhibit both electric and magnetic fields; a component of each field oscillating about a common axis at right angles to the direction of propagation. I show a symbolic representation of such an electromagnetic wave in fig.5.

While fig. 5 clearly depicts a sinusoidal wave form in prospective having an electric and magnetic component, it should be understood that this view is somewhat inadequate to describe the wave fully. Using the familiar analogy of ordinary alternating current as our guide we can appreciate that the EM wave propagates along its longitudinal axis and although the E and H components are displaced spacially by 90°, both components are in time-phase.

When our EM wave begins its journey along the transmission there is, for a time, a suspension of information concerning the true nature of the load. At first, only the transmission line's surge impedance is manifest to the signal, and this remains true until something happens, i.e., until the signal reaches a discontinuity. A discontinuity is a termination at the far end of the line impedence. In short, a mismatch.

Let us first dispose of the ideal case, namely the matched load. This is almost never realized in actual practice, and for a variety of good technical reasons cannot be realized across an entire band, but has taken on the color of the holy grail for many. If there were a perfect match, the forward going EM wave will be completely absorbed by the load. There are no reflections and no standing waves.

Our concern, however, is with the mismatched termination, and it is with this case that a reflection occurs. Let us take the extreme case of an open line (infinite impedance termination). It can be shown through the application of Maxwell's equations (which describe the detailed mechanics of electromagnetic waves) that when a wave reaches the open termination, the magnetic component reverses phase and the electric component remains unchanged. Referring to fig. 6, we have a representation of both the forward and reflected wave front. The phase reversal of the H component upon reflection produces a zero net field when the H components of the two waves are *added*. This sudden collapse of the magnetic field induces a current of equal magnitude but of opposite phase to the current induced in the line by the forward wave. Thus, at the point of reflection the net current is zero. The electric fields, which do not undergo any phase reversal, simply add producing a maximum net voltage at that point.

Note that I have previously referred to the fact that the net changes produced at the point of reflection are described in terms of both the forward and reflected waves. Fig.7 shows a

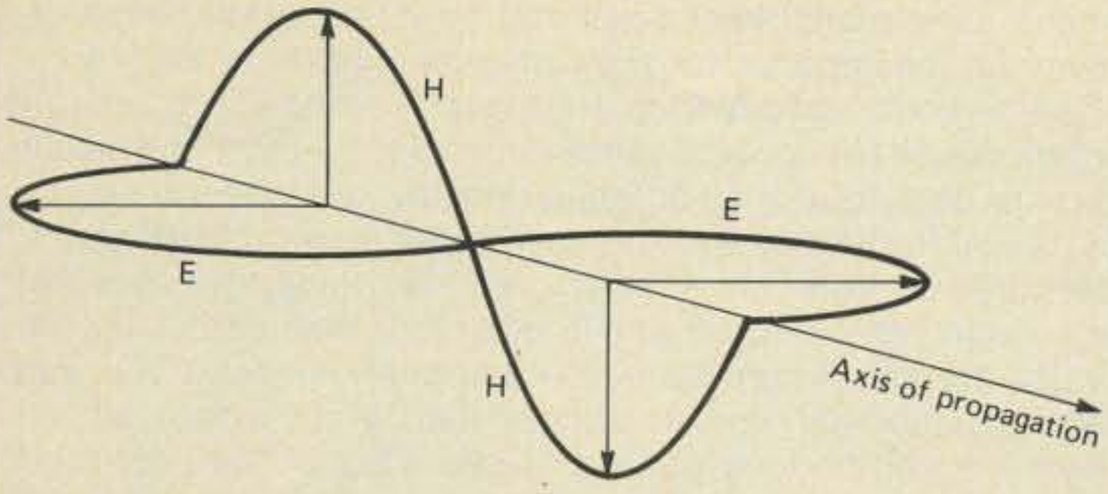

Fig. 5 – A perspective view of a sinusoidal waveform showing the electric and magnetic components. The electric component is the "E wave" and the magnetic component is the "H wave."

wave representing such net effects, and is, in fact, a *standing wave*. This wave would not exist were it not for the fact that a reflection had occured. It is simply the instantaneous addition of both waves, and it has some interesting properties. Because the termination is (in this example) an open circuit, it intuitively follows that current must be zero and voltage must be at a maximum. Fig.7 actually represents the very beginning of the standing wave, depicting the relationship between the E and H components at the point of reflection. It is possible to describe such a standing wave in terms of the net voltage and current on the transmission line, as in fig.8. The wave shape of a standing wave is a rectified sinusoid (because it takes the form of full-wave rectified a.c.) where the maxima and minima occur at $\lambda/4$ intervals. Also, and most important to this discussion, note that a 90° phase difference exists between the current and voltage.

The existance of standing waves can be likened to the situation where two long railroad trains are passing each other in opposite directions. An observer standing off to one side will see cars from each train momentarily overlap in his field of vision. This overlapping is equivalent to the maxima (or minima) of the standing wave pattern on the transmission line. In both cases there is an interference pattern created which does not represent new energy to the system. One other important fact can be deduced by this analogy. If both trains are travelling at exactly the same velocity but in opposite directions, the apparent closing speed of the trains will appear to be twice the speed of either. In the case of EM waves, there is no change in apparent velocity but there is a change in wavelength. The resulting interference pattern (standing wave) thus appears with a wavelength equal to one half the wavelength of the original signal.

While it may be tempting to think of the standing wave as a new third signal on the line, it is really only good evidence that a reflection has occured in the presence of other forward going waves. The apparent doubling of frequency is not a first

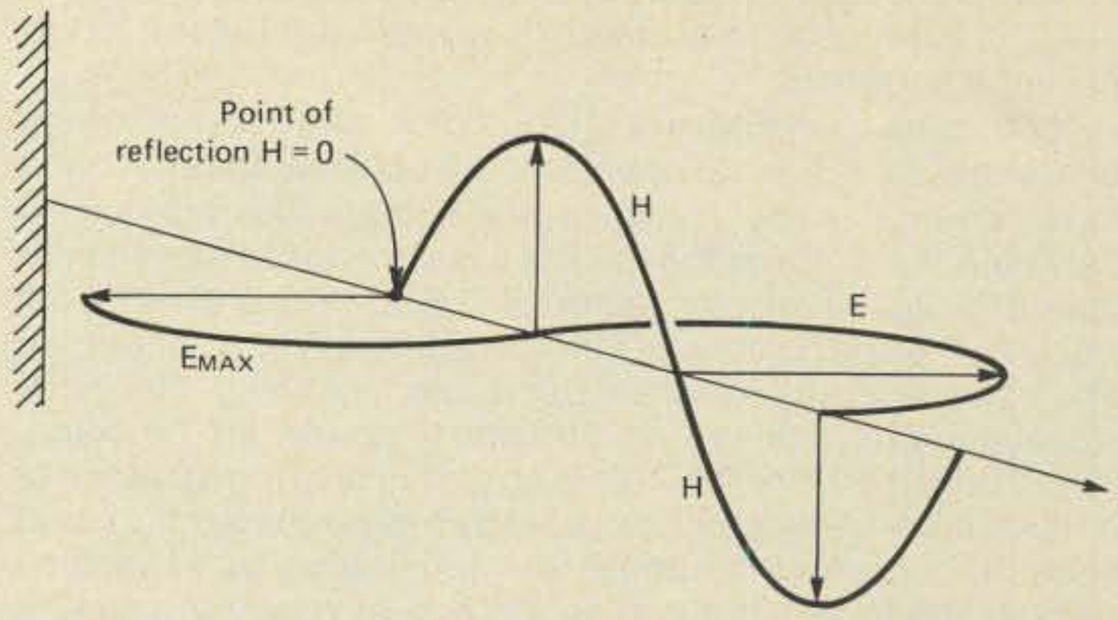

Fig. 7 – A standing wave formed at a point of reflection. At a point of reflection at an open termination the components of the forward and reflected waves add in phase. The H components, because of phase reversal, add to zero so that the standing wave shown undergoes a 90° phase shift between the E and H (voltage and current) waves.

harmonic because this wave *stands*, it does not travel. And since it does not travel it does not radiate. Because there is a 90° phase difference between the voltage and current components of the standing wave, the power factor is zero as is the total power.

$$P = EI \cos \Theta$$
$$= EI \cos 90° = EI(0) = 0$$

Although there is no real power in a standing wave, the forward and reflected waves which form it are real in every sense. Real power is indeed flowing from the point of reflection back toward the transmitter; however, for several good reasons this should cause no alarm.

You will recall that a signal propagated back along the line will see an extremely low termination impedance at the transmitter loading network (assuming the network is properly adjusted to resonance). Therefore, the reflected wave is re-reflected at the transmitter end of the line, to begin its journey all over again. There is something else of significance occuring when the reflected wave reaches the rig. This event represents the first occasion the transmitter has to know that a reflection has occured. The effect of a reflection is to create a distribution of voltage and current on the line (the standing wave) which alters the line's surge impedance. Unless something is done to the matching network, this new impedance condition may prevent the amplifier from loading all available power into the line. In practice, the problem is not usually too severe since such adjustments to the loading network are

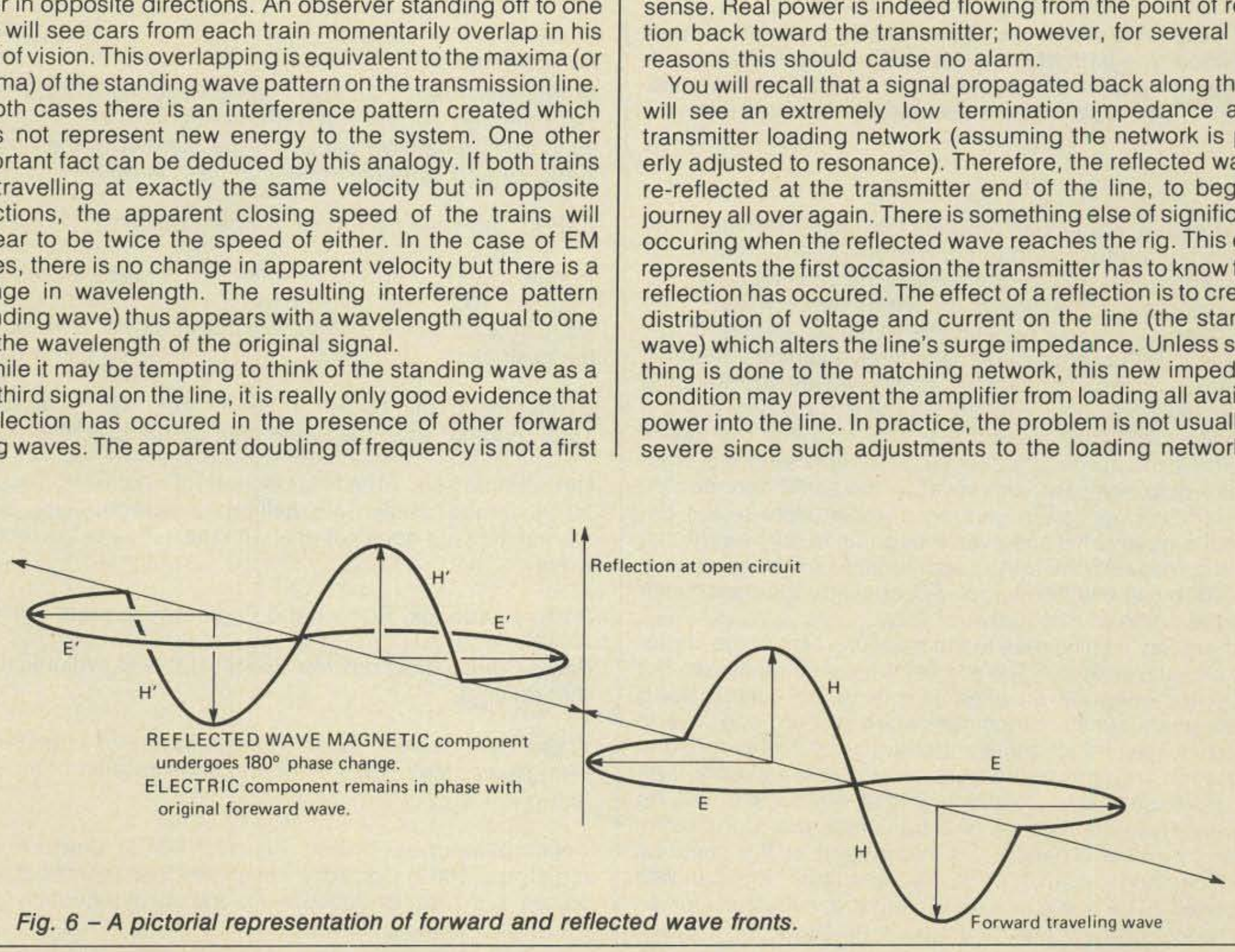

Fig. 6 – A pictorial representation of forward and reflected wave fronts.

made in the presence of standing waves—not before, as my example suggests.

In the case of an open (or shorted) line, and in the absence of any losses, the initial wavefront will continue to reflect and re-reflect indefinitely. However, the lightest loss will quickly dissipate the signal since the EM wave travels at close to the speed of light (velocity factor of 0.6 for RG-8/U) and will traverse the line millions of times in a fraction of a second. In this special example of an open line, following the initial wavefront propagation, no additional power will be transferred from the amplifier. This is so because in the absence of a dissipative load, additional energy has no place to go; and second, because the open circuit termination is "reflected" back to the transmitter preventing further power transfer.

If we replace the open termination with a load having an impedance somewhere between zero and infinity (but also assuming a mismatch) some energy will immediately be absorbed as the initial EM wave reaches the load. The remaining fraction will constitute a reflected wave which will be further diminished upon reaching the load on the next reflection cycle. Therefore, if the mismatch is great, it will necessarily take more reflection cycles to fully dissipate the initial wavefront (and each succeeding wavefront) but this "ringing" effect is not noticable with the narrow band transmissions used on the amateur bands. The practical result is to build up large voltages and currents on the line which, in the case of coaxial cable, can produce losses. A mismatch may also require a transmatch to supplement the pi-network.

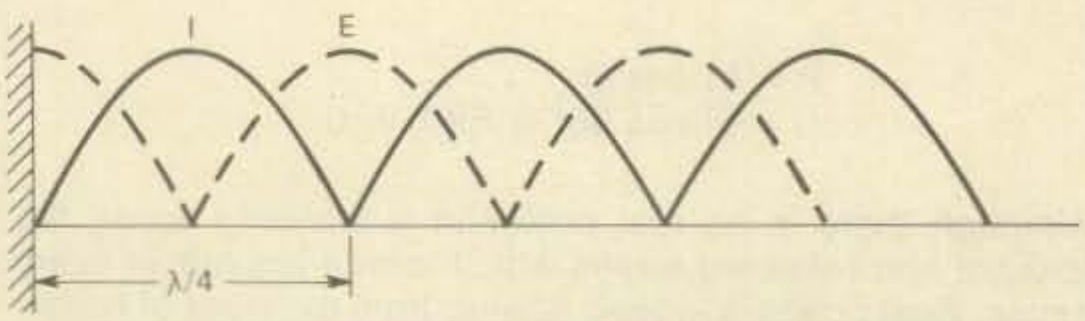

Fig. 8 – Standing waves on a transmission line with an open termination. The pattern formed is called a rectified sinusoid. *Note the 90° phase shift between the E and I (voltage and current) waves. Note also the λ/4 spacing between minima.*

Standing waves do not interfere with the antenna's ability to radiate, and this is true regardless of the mismatch which may exist. If we can safely neglect the matter of losses for the moment, it is a fair statement that entirely too much attention has been paid to the subject of standing waves and standing wave ratios. Some operators are reluctant to load into any line where the s.w.r. may exceed 3:1, believing that the power reflected at the mismatched termination represents a danger to their equipment. Yet, inexplicably, the same operator will have no compunction in utilizing a transmatch device between the rig and the line even though he is fully aware that the s.w.r. following the transmatch remains unchanged. I am tempted to call this the *Ostrich Effect* where the transmatch takes the place of the bucket of sand.

Is there any significance to the measurement of the standing wave ratio on a line? The answer is most certainly *yes*. But it must be carefully qualified if it is to be useful. S.w.r. measurement is most significant when you are sensitive to possible losses (much more important at v.h.f. than h.f.) and to possible changes in the transmission line—antenna system. Solid-state finals working into a high s.w.r. will be incapable (without the use of a transmatch) of transferring maximum power. Therefore, a knowledge of the standing wave condition is correspondingly more important than with tube finals. The s.w.r. bridge is never a substitute for an impedance bridge, and this use represents its greatest abuse. How many times have you heard (or read) someone describe the impedance of an antenna in terms of the s.w.r.? There is some validity to this approach if one starts with an antenna built to known physical dimensions—in other words if you are dealing with an antenna constructed to resonate at a particular frequency and known to suffer no ground effects or interference from other structures. However, the general application of this approach is often less than useful. It can, under certain circumstances, completely mislead you into believing that you have a matched load when, in fact, all you have are tremendous ground losses. One of the best (and cheapest) dummy loads you can use is a long length of very lossy transmission line. The s.w.r. is flat because the forward going wave is completely absorbed before it ever gets to the load. Another important point to remember is that a good match between line and antenna is never a substitute for an efficient radiation system, i.e., simply because your match is good doesn't mean that the antenna is really doing its job. This can only be determined by radiation field strength measurements, and this is not as easy as it sounds.

It is my hope that this article will promote a better understanding of the physical processes taking place in the transmission line. I have deliberately avoided using complex mathematical expressions wherever possible, although a purely physical description of the effects of reflection leaves much to be desired. Those readers wishing a more rigorous discussion are referred to the references. I believe that much (but certainly not all) of the previously published material may have relied excessively on mathematical rather than physical descriptions and in so doing may have left out many readers.

Your comments concerning this effort will be appreciated.■

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a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

Pendergast held the glass up to the late afternoon sunlight and noted the light, straw-yellow color with approval.

"This was a good year", he said happily, as he sipped the wine. "I just love these white wines from the Sonoma and Napa valleys in California . . . dry and flinty".

"Do you realize all the good DX you are missing while you are wine tasting?", I asked. Pendergast smiled and replaced his glass, picking up a second one which he sipped slowly. "Ah-h-h-a-a!", he said. "What bouquet! This one is beautiful".

I watched my friend as he slowly emptied the glass. "Wine tasting is a lot better than working DX, isn't it?"

Pendergast returned the glass to the table and said thoughtfully, "No, it isn't. It's just *different*. A nice change. I've been working so much good stuff on 10 meters these days that I can hardly believe it. Yesterday, 10 meters was open to Japan, Europe, Australia and South America all at the same time. Fantastic! And such strong signals!"

"Yes", I replied. Now that the sunspot count is rising, happy days are here again. "I haven't heard 10 meters so good for a decade! And you don't need a lot of power to work the DX."

48 Campbell Lane, Menlo Park, CA 94025.

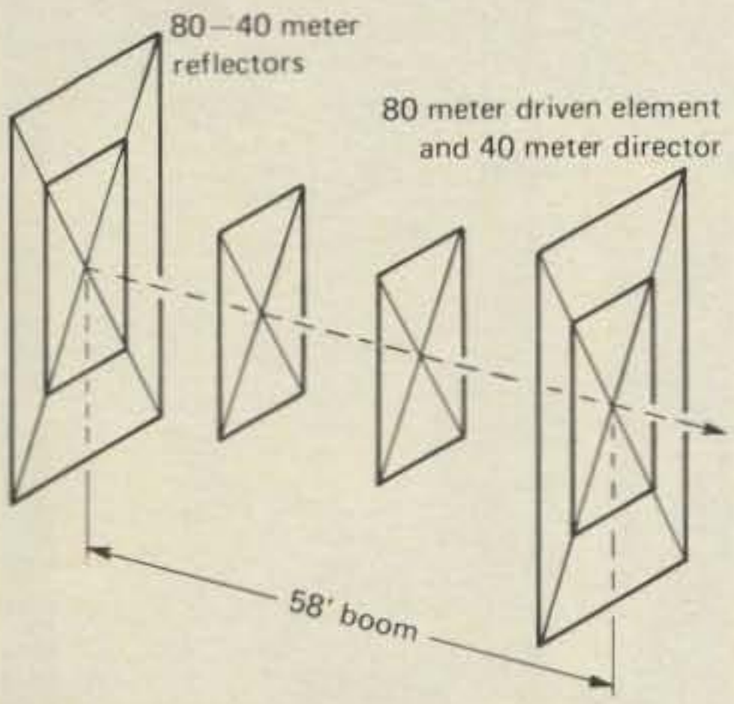


Fig. 1 – Layout of K5DUT Monster Quad. Element spacing is 19 feet. Forty meter Quad arms are 26 feet long. Quad arm for 80-40 meter reflectors is 50 feet long.

"Right", replied Pendergast. "I'm just using my transceiver and a little three element Yagi. Do you know where I got the Yagi? Well, I found a sale at one of the local CB outlets. A three element CB beam for less than twenty five dollars! You can't even buy the aluminum tubing that cheaply. So I bought it, cut about four inches off the tips of the elements and . . . *voila!* A first-class 10 meter beam! I have it up on a 30 foot high push-up t.v. mast and an inexpensive t.v. rotor. The whole works were erected in

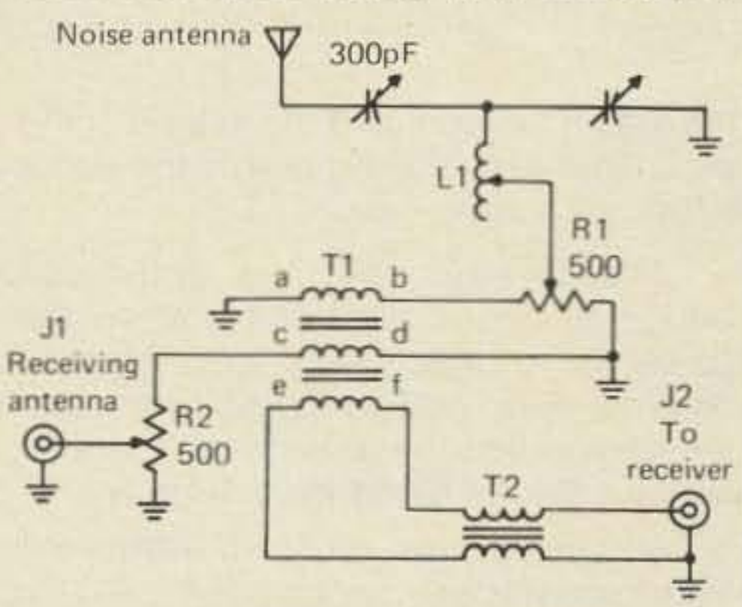


Fig. 2 – The VK3XU anti-noise bridge. Coil L1 is 50 turns, 1" diameter, 3" long with alligator clip for tap. Potentiometers are carbon type with "A" taper. See text for balun transformer data.

one afternoon in about two hours. You can't beat that for an inexpensive beam antenna!"

"Yes, there are plenty of CB antennas that can be modified for 10 meter operation. And I hear a lot of reworked CB transceivers up at the high end of 10 meters. You can work plenty of DX with a few watts of s.s.b."

Pendergast looked at his empty glass and sighed. "Well", he said slowly. "Have you gotten anything interesting in the mail?"

"Yes", I replied. "Do you remember my column in the March issue of *CQ* that featured the "Monster Quads" in McKinney, Texas? John, K5JA, sent the photos to me just to show that the amateurs in "Cow Town" (Fort Worth) had lost their title of *Quad Antenna Capitol of the World*. Well, I got a quick letter from Don, K5DUT, in "Cow Town." He says that the McKinney Quads shown in the March column really don't qualify as Monster Quads, as they aren't big enough! He says that to Qualify, the Quad has to have a boom at least 50 feet long and should have come down at least once in a bad storm! Furthermore, the 40 foot boom at K5JA is just a toy!"

"Wow!", yelled Pendergast. "What does K5DUT have up in the air?"

"According to Don, he just took down his Monster Quad. It was too small. And now he's working on a new one (fig. 1). This Monster has a 58 foot boom with four elements on 40 meters and two elements on 75 meters! He will switch the reflector element electrically to go from 3800 kHz. to 3500 kHz."

Pendergast stared at the drawing. "That baby has *fifty foot cross arms*", he gasped.

"That's right", I replied. Each 80 meter arm is made up of a center section of aluminum tubing 12 feet long, then a 10 foot section of special fiberglass tubing. The end sections are 14 foot lengths of fiberglass pole vault poles. Each section, of course, is a little longer than that because of overlap.

"The boom has a center section of 3½ inch tubing and it tapers down to 2½-inch tubing at the ends."

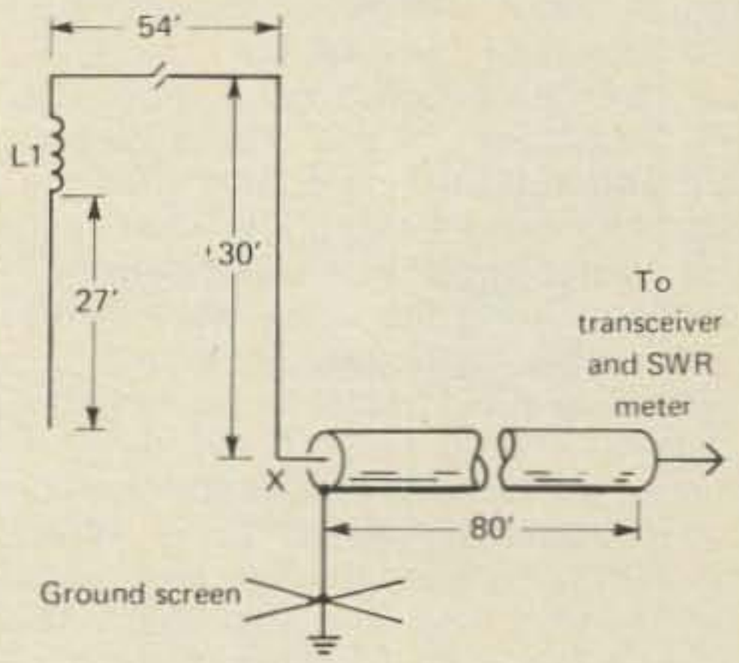


Fig. 3 – The multiband antenna at W7TO. A 500pF variable capacitor at X, aids loading in the high section of the 160 meter band and at the high end of the 80 meter band. Multiturn adjustable coil L1 is 40 feet of no. 14 enameled wire on 3-3½" diameter form. It is adjusted for lowest s.w.r. at 1805 kHz.

"That should make a lot of noise on 80 and 40 meters when K5DUT gets it working," said my friend. "Maybe they'll hear him in McKinney, Texas!"

"This discussion of Monster Quads is pretty heady stuff", I said. "However, you can't work the DX if you can't hear it. A lot of fellows have plenty of trouble hearing the exotic signals because of power line noise which can be pretty bad if you are unfortunate enough to live near a noisy line with leaky insulators and poor hardware. You might be interested in a short dissertation on an anti-noise bridge by VK3XU which appeared in a recent issue of *Amateur Radio*, the journal of the Wireless Institute of Australia. Drew took the old idea of using a noise antenna and a phasing network and brought it up to date (fig. 2). He uses the regular station antenna, plus a special "noise" antenna which is placed near the power line to pick up the maximum amount of noise. The circuit consists of two baluns, T1 and T2. The noise antenna (a short length of wire) is tuned to resonance by the network and coupled into balun winding *b-a*. The signal plus noise from the main antenna is propagated along winding *c-d* in the opposite direction. The net field from these two windings appear in winding *e-f*. Ideally, if the noise and signal fields are equal in amplitude and phase, only the signal component appears in winding *e-f*, which is coupled to the receiver via balun T2."

"This doesn't sound like a possibility", said Pendergast.

"Right", I replied. Thus some balancing controls are required. Potentiometers R1 and R2 are for this purpose.

"The whole unit is built in a small aluminum minibox. The tuning capacitors are midget ones from a transistor radio and the coil is a section of air-wound stock. The coil tap and capacitors are adjusted for greatest noise pickup.

"The baluns are wound on small ferrite toroids about ¾-inch in outer diameter (Q2 material). They are not critical except the connections must be right. For T1, three lengths of #22 enamelled wire are wound on the core. The wires are each twenty inches long. The three wires are twisted together by clamping one end and fixing the other ends in the chuck of a hand drill. They are then twisted up about two twists per inch (not critical). When twisted, wind them around the toroid as one, keeping spacing constant as you go along. When finished, determine the matching ends with an ohmmeter and mark them. Toroid T2 is wound in a similar fashion.

When things are wired up, the noise network should be peaked for maximum noise with the main antenna potentiometer (R2) turned down for minimum input signal. Then both potentiometers are adjusted for minimum noise. Juggling the tuning network and the setting of the potentiometers should permit the noise to be attenuated.

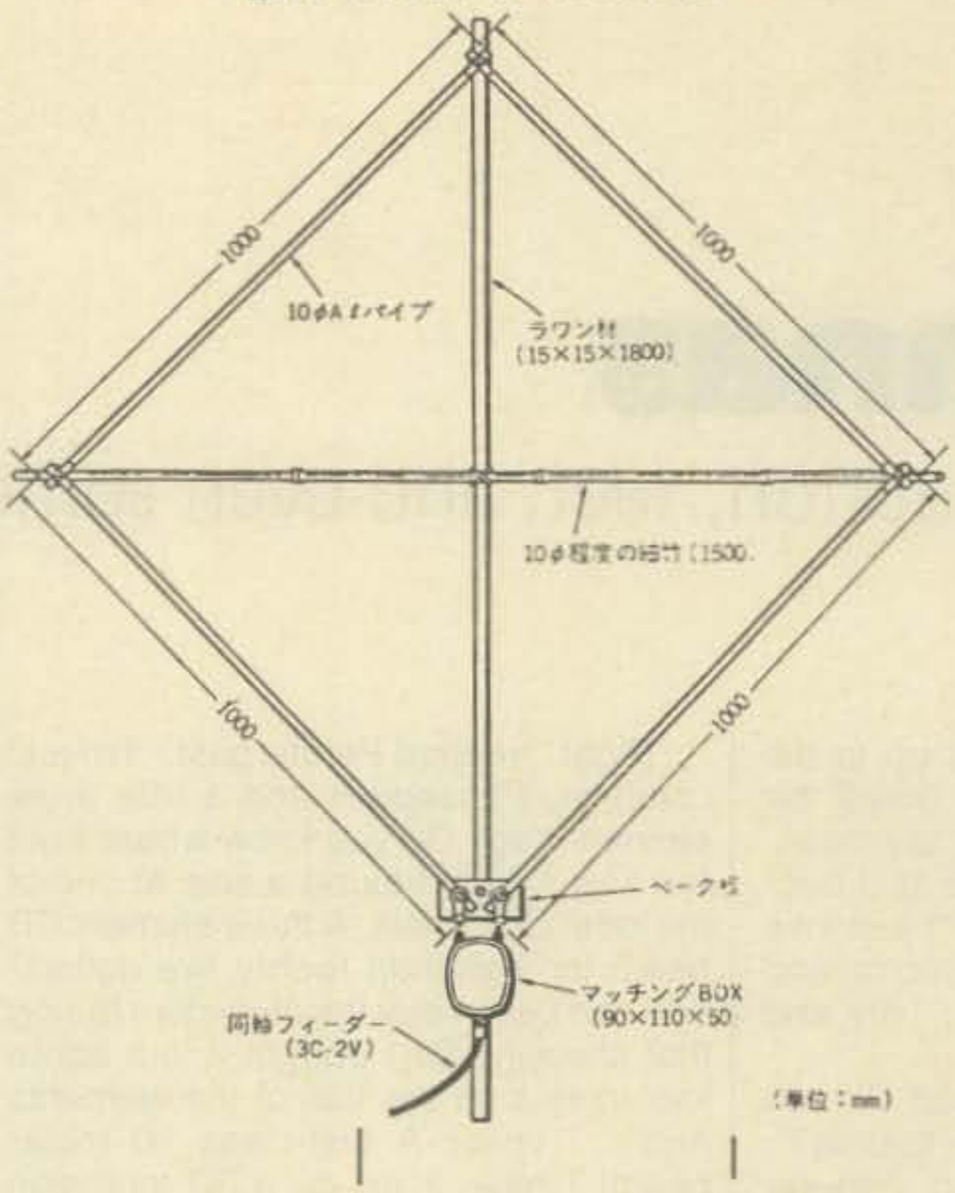
"VK3XU says that the anti-noise bridge is especially helpful when the power line noise is very loud. He can obtain a deep null on the noise most of the time, unless the noise is coming from several places along the power line".

"An interesting device", remarked Pendergast, busy copying the circuit in his notebook. "Sometimes my power line noise just wipes me out on 40 meters".

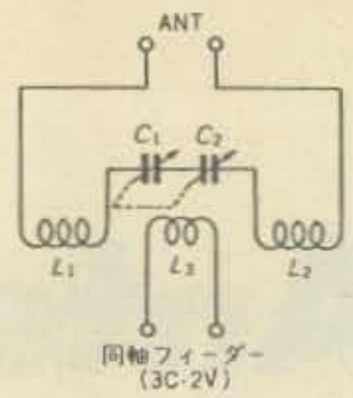
"Noise can be a bad problem," I agreed. I picked up a letter and handed it to my friend.

"Here's a note from Dave, W7TO, describing his new multiband antenna (fig. 3). He uses this from the low end of 160 meters up through the 10 meter band with excellent results. The flat-top is about 30 feet high and is fed at one end with a vertical wire also about 30 feet long. This far end of the antenna is loaded with a coil and a 27 foot loading wire. The coil is adjusted for lowest s.w.r. on the transmission line at 1805 kHz. Under the feed point, Dave has about 400 square feet of chicken wire laid out for a ground screen. The antenna is adjusted at 3.9 mHz. by trimming the wire length a bit, just at the connection to the coaxial line. A large variable capacitor can be placed in series with the antenna wire at point *X* for adjustment, if desired."

第1図 マイクロループ・アンテナの構造



第2図 マッチング回路



C_1, C_2：150pF（2連）
L_1, L_2, L_3：エアーダックス#301015
L_1, L_2：各3回
L_3：2回

Fig. 4 – The mini-loop antenna of JG1UEA for 20 and 15 meters. Antenna is coax-fed via small tuner located in the plastic box at base of loop. See text for dimensions. (Drawing courtesy of "CQ-ham radio").

"Pretty tricky", said Pendergast. "Very few antennas function from 160 meters clear through 10 meters without some kind of tuner".

"This one seems to accomplish the task", I said. "Anyway, W7TO is having a lot of luck with it working plenty of DX".

"How about mini-antennas?", queried my friend. "There seems to be a lot of interest in small antennas. A lot of the boys can't put up a full size job, even for 20 or 15 meters".

(Continued on page 89)

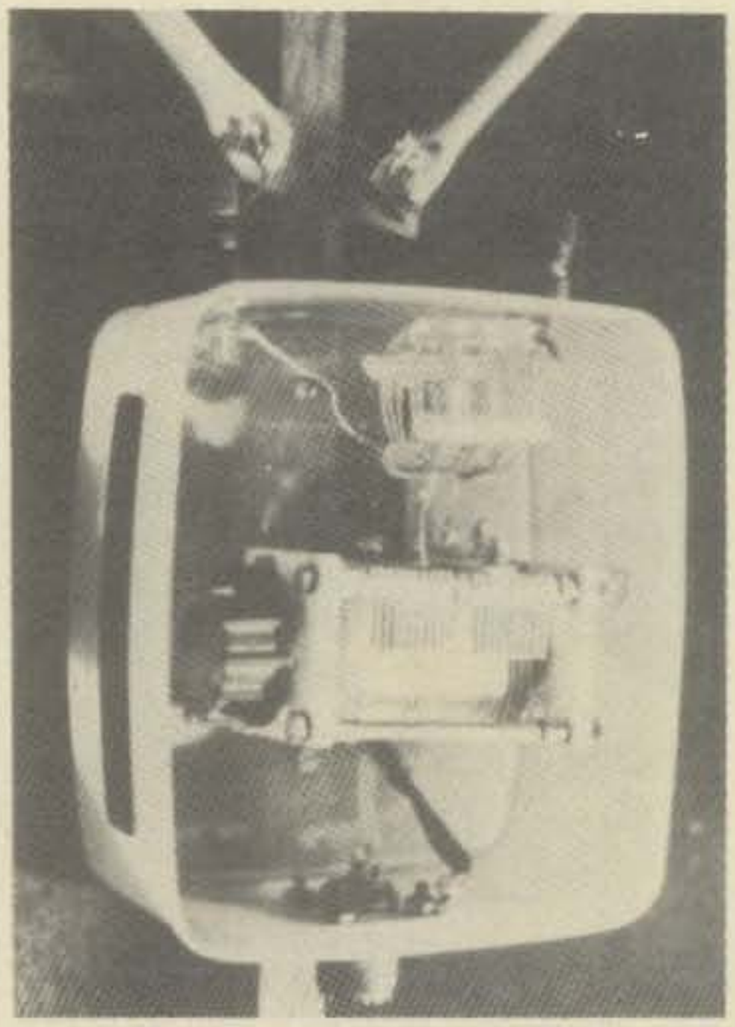


Fig. 5 – Tuning network for mini-loop antenna.

a monthly feature by

BILL DEWITT, W2DD

In Focus

Television on the Amateur bands

News from "Down Under" via VK3LM

I was beginning to think that all of my friends and correspondents "down under" had fallen off the other side of this mixed-up world, but no, thank goodness, that is not so.

A newsy letter from John Wilson, VK3LM covers just about every phase of SSTV activity in Australia. What a pleasure it is to open up a six-page letter with lots of photographs!

Development Action in VK-Land

There are currently 19 VK amateurs building fast-to-slow, slow-to-fast scan converters. They are using 2107B-4 memories. These scan converters will be about the same size as a Robot 400. For further details I suggest that you contact John directly. His address is 14 Merrilong Street, Ringwood East, 3135, Victoria, Australia.

Other VK Development Action

John also reports that Doug, VK3VM, (ex 8KK) who imported the first Robot 400 into Australia, is following Clay Abrams' (K6AEP) work with the Southwest Tech. Products Computer. (See recent issues of In Focus.) Doug imported a 6800 computer kit and has interfaced it with a SSTV keyboard, cassette recorder, RTTY, CW, and SSTV character produced video. Doug's first computer-generated video was received by VK3LM.

Other stations working along the same line with VK3VM are Geoff, VK2-AIT, and Roy, VK2RO. Mike, VK6TV, is using a Robot 400 and 5050 microprocessor unit. Lots of computer action taking place down under!

Active Slow Scan Stations in VK and ZL-Lands

If you are trying to run up your SSTV country score, this list of active VK/ZL stations supplied by VK3LM may be useful to you:

VK3AQP—Tony
VK3AHB—Adrian
VK3BHZ—Stan
VK3LM—John
VK3NEV—John
VK3VM—Doug
VK3TE—Stan
VK3ZY—Steve
VK2AIT—Geoff
VK2RO—Roy
VK2KK—Ted
VK5PV—Peter
VK5BS—Barry
VK6TV—Mike
VK7CCC—Mac
ZL1BLV—Derick
ZL4PS—Bronk

VK3LM, A Well-Appointed SSTV Station!

As you can see in figs. 1 and 2, VK3LM's hamshack contains an impressive array of equipment! The attractive little lady at the right of fig. 1 is John's daughter, Karen, who was exactly twelve years old at the time this photograph was taken.

Fig. 2 shows a close-up of VK3LM's home-brewed P-7 monitor at the right. At the upper left is a recently constructed control panel that provides rapid switching for all in/out TX and RX facilities. I hate to say this John, but people who have everything so well organized make me feel like a hill-billy spark operator!

Japanese Copy of a Robot 400

The Japanese magazine called *CQ-Ham Radio* (!!) carries an advertisement for a digital scan converter called the SC-77. If I could read Japanese I could offer more information on this. Would anyone care to bring me up to date? (English or French please.)

VK3BHZ's SSTV DX-Pedition to Cape York

Belated but fascinating is the way I'd describe the news of Stan Mudford's SSTV expedition to Cape York in the most northern part of Australia!

Last Fall, Stan, whose call is VK3BHZ, and four SWLs (identified to W2DD only as Reg, Les, Col, and Steven) set up camp on the Jardine River at Cape York, 600 miles north of Cairns. The purpose of the trip was to transmit the first-ever SSTV video from the Cape.

The expeditioners accomplished their purpose, but not until they had experienced an exciting and dangerous encounter with a brush fire. A thick wall of smoke rising about five miles away gave warning of the fire being driven toward the Cape by strong winds. Stan, his SWL friends, and other campers saved their lives, vehicles, etc. by back-burning an area between the campsite and the on-

Fig. 1 – Pretty Karen Wilson poses with VK3LM's amateur gear on her twelfth birthday. John's equipment includes receiving capability from long wave to the UHF range, some neat items like a frequency meter that goes to 1 GHz., a CRO, wattmeters, waveform indicator, and all the SSTV gear you've ever dreamed of!

Fig. 2 – At the lower right is VK3LM's homebuilt EXACT copy of a Robot 70 monitor. At the upper left is a homebrewed control unit described in the text.

*2112 Turk Hill Road, Fairport, NY 11450

Fig. 3 – VK3LM's call to VK3BHZ/4 during the latter's stay on Cape York. Photographed off fast scan monitor via scan conversion.

coming brush fire. Quick action was needed and they managed with only minutes to spare. Not exactly the kind of happening you envisage while on a DX-pedition!

DX-Peditioning De Luxe!

In addition to the HF gear, a tri-bander beam with rotator, and a 2.5 KVA alternator, the expedition station sported all the SSTV gear one could ask for! An SSTV keyboard, fast scan camera, 14 inch monitor, and a Robot 400 scan converter. (How many trucks, Stan?)

Video Galore

The first video contact was made with John Wilson, VK3LM of Melbourne, 2000 miles away. The accompanying photographs of VK3BHZ/4 picture exchanges were supplied by VK3LM. See figs. 3, 4, and 5. Video contacts were made with most of the VK states, JAs and ZLs.

Fig. 4 – VK3BHZ/4's video as received by VK3LM. Photograph is of P-7 monitor screen display.

Everything Worked!

Technically, the expedition was a great success. Every piece of gear worked perfectly. Most of the picture exchanges were of good to closed circuit quality.

Thanks for the Pictures!

Thanks to Stan, VK3BHZ, and John, VK3LM for the information and the photographs.

Early, Early SSTV–Macdonald Contacts the ARRL

Continuing the story of slow scan TV's early days: It was in July of 1957 that amateur slow scan's inventor, Cop Macdonald wrote to George Grammer, then Technical Director of the ARRL in regard to publishing an article describ-

Fig. 5 – Stan, VK3BHZ televised these Aboriginal children as they watched his portable operation on Cape York. This is how the picture was received by VK3LM.

ing his SSTV system. Reproduced below is Grammer's encouraging response to Macdonald's letter:

Dear Mr. Macdonald:

That's an interesting idea you have, and we'd be very much interested to see an article on the equipment you have in mind making. We feel quite sure that the system would be appealing to quite a considerable number of amateurs, especially those who might like to experiment with television techniques on a less elaborate scale than is required for using commercial standards.

Although the method probably isn't permissible under the FCC regulations on the lower frequencies, as a matter of regular amateur operation, it is not difficult for competent experimenters to obtain special authorization for projects of this sort.

We'll certainly be interested to hear of any further developments.

Sincerely yours,
George Grammer
Technical Director

In spite of Grammer's helpful procedural guidance and encouraging words, it was clear that the ARRL had no intention of furthering the progress of what we now call slow scan television by experimentation with Macdonald (on the air) or by the assignment of a technical staff to develop equipment for demonstrating this new amateur communication mode. This was spelled out in an October 1957 letter from Grammer to Macdonald which stated in part: "Much as I would like to, I cannot hold out much hope that we would be able to do any significant amount of experimental work with the system here in the near future. We are almost always working at full capacity on *QST* and other publications, and with the extra activities resulting from the International Geophysical Year we find ourselves in a chronic state of wishing it were possible to have more time and more people! It should be possible though, to arrange for the tape transmission back to you, since that does not appear to be a major undertaking." *Note from W2DD:* It seems to me that although the ARRL have at times been willing to publish what someone else has done in regard to SSTV, they have been unwilling to devote any staff effort to technical development of this mode.

What's in a Name? Image Transmission, Facsimile, Television!

By January of 1958, the correspondence between Macdonald and Grammer had begun to deal with *what* to call Macdonald's television system. The ARRL (Grammer) contacted the FCC to find out what regulations might apply to this picture transmission system. The FCC said that if the system were called "slow scan television", it would be necessary to apply for special permission to transmit it in the regular amateur bands. Technical data such as an outline of the system, bandwidth, and other information would have to be supplied. However, if the system were to be considered as a facsimile system (described as a "record" type of communication as compared to television which is specified as transmission of "transient" images) then it could be used without restrictions in the 27 MHz. (now CB!) band where facsimile was already permitted. (Blessed be the workings of the legal mind!) As a result of this exercise in semantics, virtually all of Macdonald's early on the air tests were conducted in the 27 MHz. band. George Grammer probably saved Macdonald several months of bureaucratic gymnastics by getting that point settled!

Macdonald goes Public

The publication of Macdonald's articles; "A New Narrow-Band Image

Transmission System" (*QST*, Aug./Sept. 1958) and "S.C.F.M.—An Improved System for Slow Scan Image Transmission" (*QST*, Jan./Feb. 1961) launched a new mode of communication for amateurs. At the start, only a few brave (and extremely capable!) souls ventured into the realm of building monitors and flying spot scanners.

Numbers! Numbers!

It is difficult to estimate the total number of amateurs actually involved in slow scan during the years from 1958 to say, 1969—but my guess would be from a dozen or so in '58 to perhaps several hundred in 1969. Homebrewing gear for a brand new mode of communication just isn't everybody's cup of tea.

The advent of commercially built monitors and kits gave SSTV its biggest boost, hiking slow scan's population into the thousands by the mid '70s. The availability of commercial monitors had a cynergistic effect too—because with more slow scan activity—more builder types homebrewed their own monitors in order to join the action. No one seems to have a firm estimate of today's slow scan population. My guess would be in the 15,000 range, worldwide.

Want More About Early, Early SSTV?

The story of slow scan's early days is indeed a fascinating one. However, this month's vignette of Cop Macdonald's efforts to get his system tried will conclude our review of "the beginnings". If some of slow scan's other early birds will write to me and supply pictures and information regarding the first dozen or so slow scanners on the air, I'll be happy to continue this review of SSTV's early history. There must be pictures and perhaps actual pieces of original SSTV gear in hamshacks around the world. Why not drop me a line and let me know what you have. Those who have just recently entered the ranks of SSTV are eager for this kind of information, and the sad truth is that much has happened that really hasn't been set down for the record—as it should be. Pioneering effort shouldn't be left to just fade away. I repeat, if *you* have information on this subject *please* drop me a line!

Final-Final

So far, I have not heard from anyone who has tried the VE3BSZ modification of the Robot 400 discussed in this column recently. Other 400 owners will be interested to know whether you consider the proposed change worthwhile or not. If you have tried this "mod", please drop me a line giving your opinion. In Focus

(Continued on page 88)

a monthly feature by

IRWIN MATH, WA2NDM

Math's Notes

A look at the technical side of things

Using CMOS Chips

Often we get inquiries from readers for specialized circuit elements such as schmitt triggers, multivibrators, delay circuits, odd transistion sensing networks, and the like, and usually don't answer these in the column as the particular uses end are too specific.

By understanding a relatively new logic family known as CMOS, however, the implementation of a wide range of these types of circuitry is well within the range of most experimenters. Since CMOS is also short circuit proof, wrong

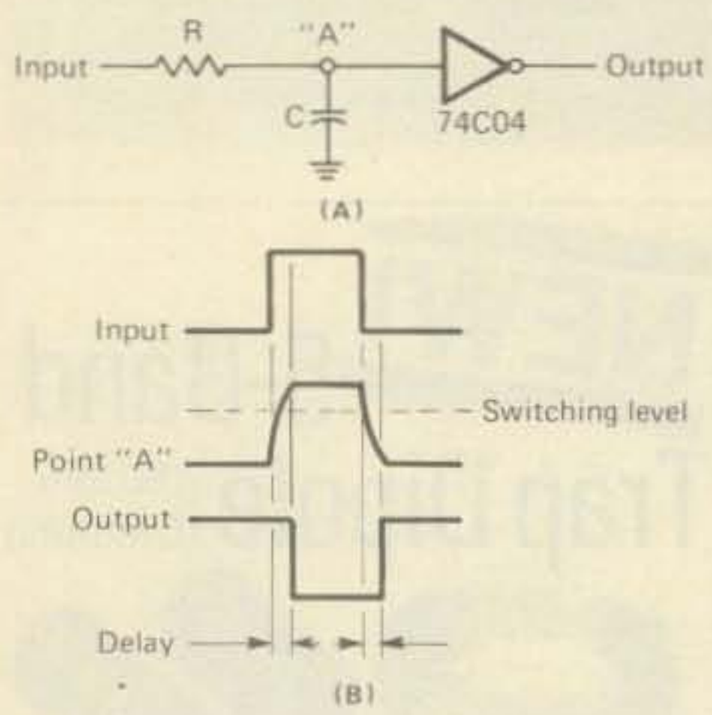


Fig. 1 – Simple Pulse Delay Circuit.

connections will usually not damage anything.

The CMOS logic family consists of a wide range of inverters, gates, flip-flops and the like—very similar to TTL functions. In fact, there is a 74COO family that is pin-for-pin equivalents of the very popular 7400 TTL family. Here, however, the similarity ends. CMOS chips are made with FET transistors, not bipolar ones. As a result, impedances are very high and this is why implementation of specific circuitry is quite easy—loading effects of the transistors can be virtually ignored. Also, power supplies are not limited to 5 volts, but can go all of the way up to 15 volts if desired. By the way, if the power supply voltage is chosen to be 5 volts, the 74COO CMOS chips will directly interface with standard low power TTL.

To see how these high impedance devices can be used, let us refer to fig. 1. Here we are using a simple 74CO4 inverter as a pulse delay circuit. When the input pulse goes from 0 to 1, the

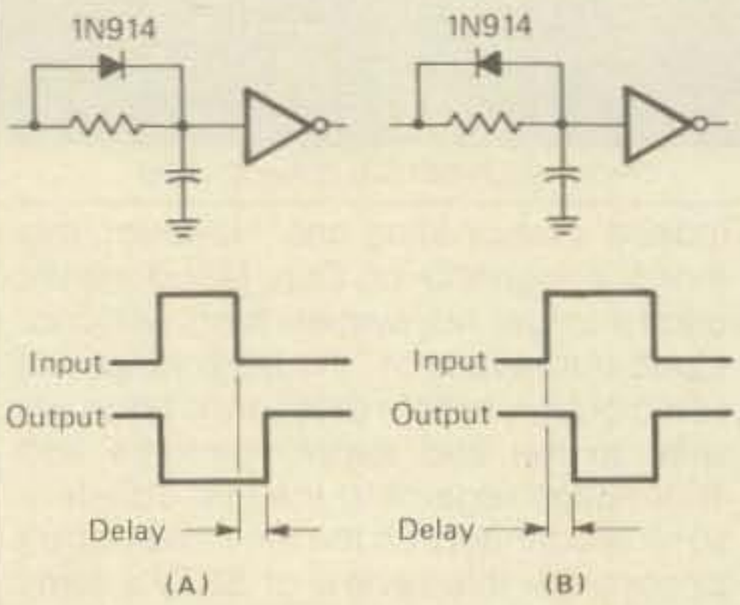


Fig. 3 – "Stretching and Reducing" Circuits described in text.

capacitor begins to charge. Since there is no loading caused by the inverter's input, as soon as the charge on the capacitor reaches the "1" level, the inverter switches. When the input now drops back to zero, the inverter will not switch back until the capacitor now discharges. The delay time of this circuit is purely a function of the value of R and C and can easily be as long as a second with a low leakage capacitors.

One practical application of this is as a "bounceless" push button as shown in fig. 2. Since the capacitor must charge, any noise or switch transients occurring during this charging time are effectively eliminated. When the switch is released, the capacitor must then discharge before the inverter switches. Again, transients are effectively removed.

If we were to now place a diode (a 1N914 is fine) across the resistor, the delay will only occur on the rise or fall depending on the way that the diode is

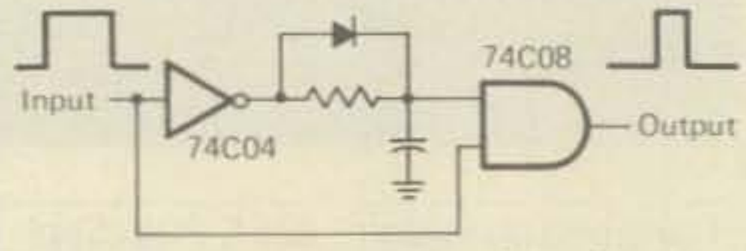


Fig. 5 – Logic Signal One Shot Circuit.

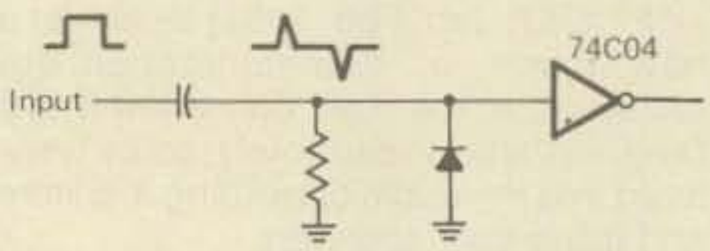


Fig. 6 – Rise Time Sensor. Note that the Diode will effectively short circuit the negative output. To sense Fall Time simply preceed the RC Network with another inverter.

connected. In this case, the diode actually short circuits the resistor eliminating the delay. A careful look at the output pulse from fig. 3A will also show that this circuit makes a very effective pulse "stretcher" since there is always a delay

(Continued on page 88)

*5 Melville Lane, Great Neck, N.Y. 11020.

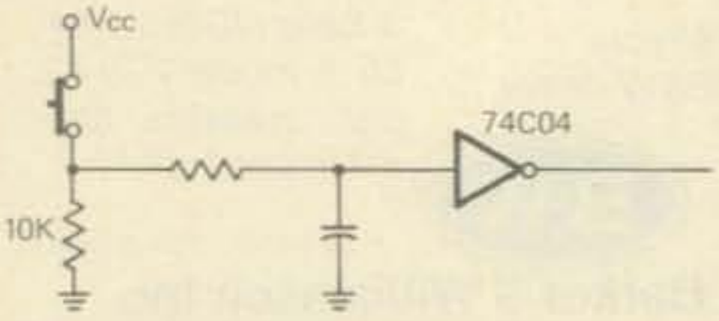


Fig. 2 – Bounceless Push Button.

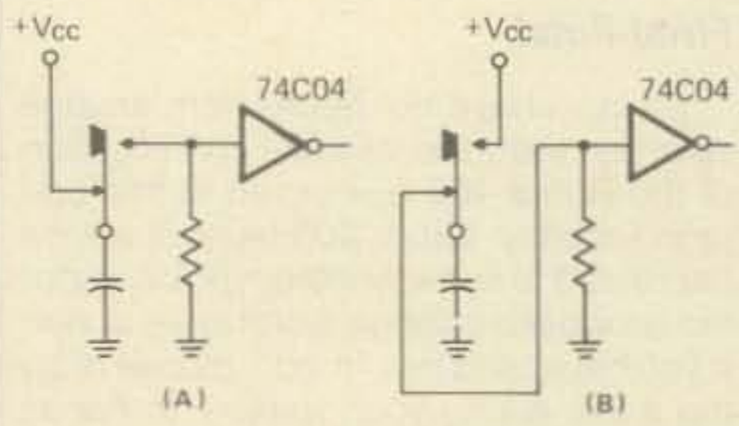


Fig. 4 – One Shot or Single Pulse Generating Circuits.

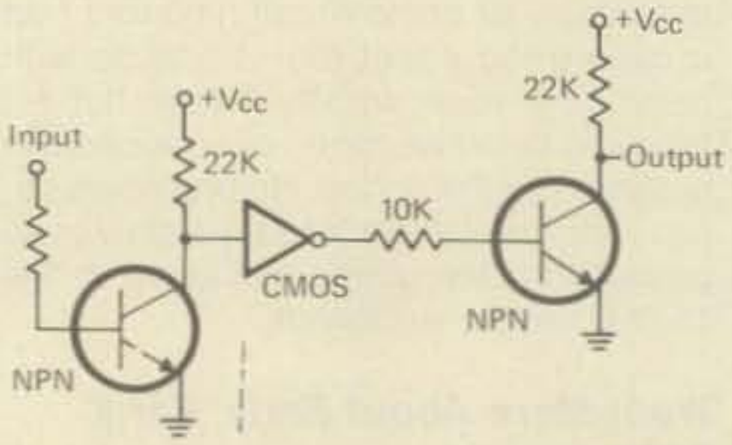
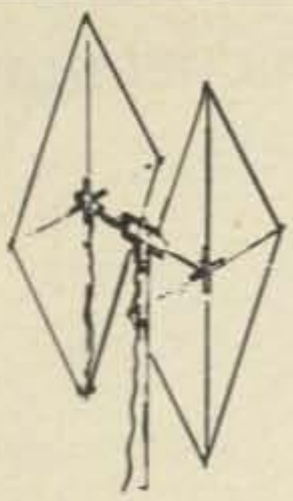


Fig. 7 – Method for interfacing CMOS with Bipolar Transistors.



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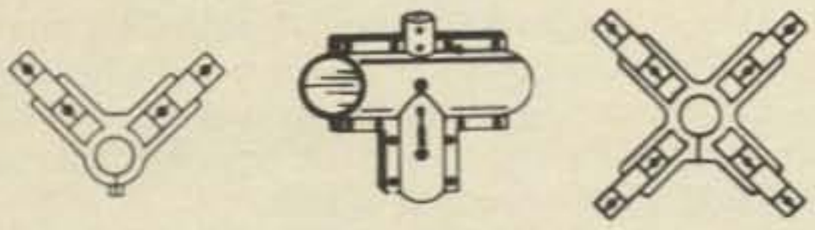

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	(1)	1¼" Boom to 1¼" Mast T-Mount	$15.12
QM-3	(2)	1½" Hub Spiders	
	(1)	1½" Boom to 1½" Mast T-Mount	$16.10
QM-4	(2)	2" Hub Spiders	
	(1)	2" Boom to 1½" Mast T-Mount	$24.69
QM-5	(2)	3" Hub Spiders	
	(1)	3" Boom to 2" Mast T-Mount	$40.64

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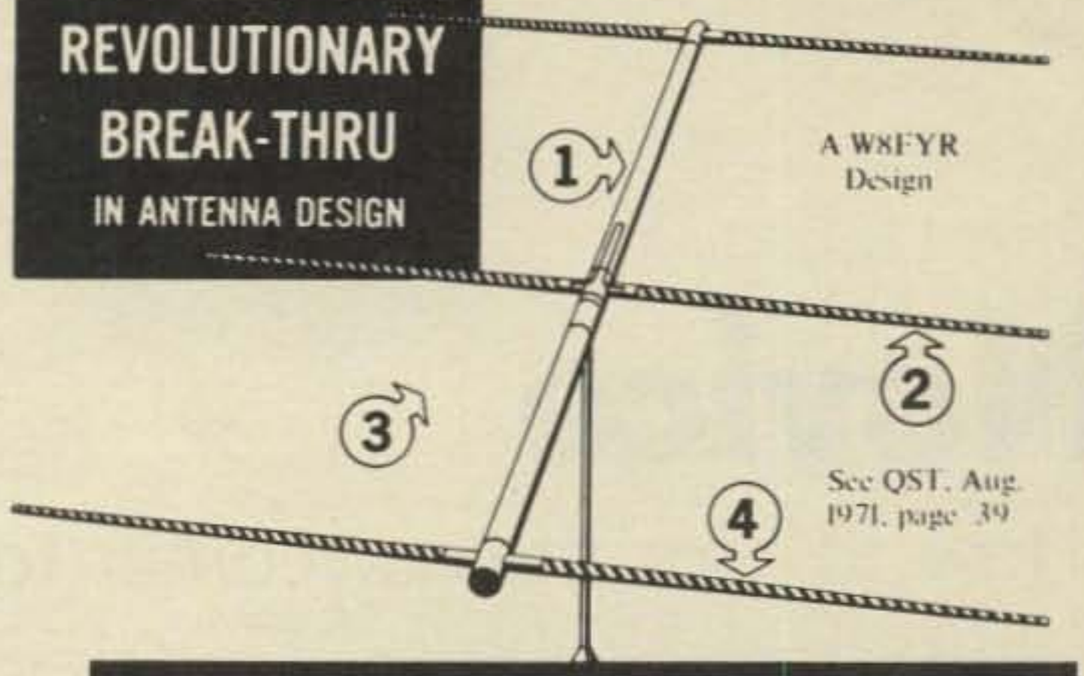

A W8FYR Design

See QST, Aug. 1971, page 39

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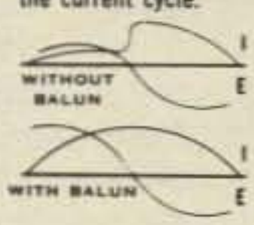

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CIRCLE 35 ON READER SERVICE CARD

a monthly feature by

BILL WELSH, W6DDB

Novice

"How to" for the newcomer to Amateur radio

Advantages of Starting as a Novice

If you are just getting interested in amateur radio, or if you know someone who is about to take the plunge, this article should be read to fully understand the reasons why new amateurs should start as Novices. Very few beginners know how good Novice privileges really are, nor how much they can benefit from Novice operating experience. If you are not a licensed amateur, help yourself by reading this column very carefully. If you are a licensed amateur, which is more likely to be the case, urge prospective amateurs to read this month's column.

It is common to have a prospective amateur decide to work directly for a General class (or higher) license without first becoming a Novice. These people mean well but they don't know the benefits that can be obtained from Novice operation. Ex-students who have upgraded to renewable FCC licenses often tell me that they enjoyed their Novice operating experiences more than anything else they have done as amateurs.

*2814 Empire Ave., Burbank, CA 91520

Here is 15 year old Steve Strauss (WB3GTT). Steve has already worked 46 states and 12 countries. His biggest operating thrill occurred the day he worked 4 European countries plus ZS6BQT in Africa on the 15 meter Novice band. In addition to the gear shown in this picture his station includes an 80 meter dipole, a vertical for 40 and 15 meter operation, and a 10 meter beam. Steve has a 15 w.p.m. code proficiency certificate.

The Novice license was established in 1951 to provide an easy entry into the amateur radio service. This class of license has been successful since it came into existence and changes have made it much more useful during the past 27 years. The code proficiency requirement is still just 5 words per minute, which is simply a matter of being able to recognize required code symbols at a slow pace. Obviously, the prospective amateur must know the applicable portions of FCC part 97 (amateur radio service rules and regulations) and current FCC Novice examinations have more questions about rules and regulations than were in previous ones. The beginning amateur is just required to have a basic knowledge of electronic and communication fundamentals and this requirement has always been reflected in FCC Novice written examinations. The Novice license still provides a highly effective but simple way for people to become amateurs.

Code aids are available in several forms now from many sources. There are booklets detailing proper code receiving and sending techniques, practice code groups, and correct operating procedures. Tapes and records can be used to take one from no knowledge of the international morse code to any desired code receiving proficiency. There are also many sources of code receiving practice on the air that can be used by newcomers. The older inked paper tape code senders (TG-10, TG-34A, etc.) and the punched paper tape code senders (Instructograph, Gardiner, etc.) are not as popular as taped instruction but they are still effective. It is now easier to learn code than ever before.

Establishment of the ARRL Club and Training Department led to more amateur radio clubs conducting licensing courses than ever before. In most parts of the country, prospective amateurs can now find courses being held when and where they can easily be attended. Naturally, training opportunities are more plentiful in heavily populated areas than in areas with few inhabitants, but there are licensing courses in more areas now than ever before. If a prospective amateur cannot attend a formal licensing course, he now has an excellent variety of license manuals and text books to provide the required information. Also, programmed self-study manuals provide an effective way for an isolated student to develop an in-depth understanding of electricity, electronics, communications, and associated subjects. The October 1977 CQ Novice column advises use of amateur radio magazines to increase understanding of any subject associated with amateur radio.

Today's beginning amateur can attain the Novice license with just reasonable effort. Once licensed as a Novice, he has better equipment, more opportunities, and greater privileges than Novices enjoyed in the past. Modern amateur radio equipment is more sensitive, lighter, more efficient, requires less input power, is smaller, and has operating features which are far superior to equipment used by Novices of previous years. Amateur radio equipment and station considerations are covered in detail in the November 1977 through March 1978 *CQ* Novice columns.

There was a time when Novices had to do a lot of calling and listening to locate other stations to work, since very few amateurs other than Novices operated on the Novice bands. This situation has changed dramatically and I now find that about half of the amateurs I work on the Novice bands are not Novices, despite the fact that I seldom call anyone who sounds too proficient to be a Novice.

It is now common practice for Technicians to take advantage of the 1977 rule changes which permits them to use the Novice bands. I often work Technicians operating in the Novice bands to build up their code proficiency to the point where they can pass the 13 w.p.m. General/Advanced code receiving comprehension test. Some of these Technicians have not operated code in years, and many last used code more than two decades ago. Technicians

often need as much help and patience as the rawest Novices on the bands. Nevertheless, Technicians increase Novice band activity and I am very pleased to hear them preparing to upgrade to a General license. Since Technicians now have full credit for having passed the General theory exam, whether they took their exam with an FCC or volunteer examiner, they just have to pass the 13 w.p.m. code receiving test to upgrade to the General class license. I am more than mildly interested in the success of this Technician upgrading effort since I submitted the proposal to the FCC requesting that Novice code privileges be extended to Technicians to help them upgrade.

Novices and Technicians are joined on the Novice bands by other classes of American amateurs. Some of these Conditional, General, Advanced, and Extra class licensees operate the Novice bands just to give the newcomer some code practice, advice, and a QSL card. However, many of them operate the Novice bands because they need the code practice. Do not assume an operator with a Conditional (or higher) license is sending slowly just for the benefit of the Novice or Technician being worked on the air; that slow speed may be his top speed.

Another very welcome source of Novice band activity is the large contingent of foreign (DX) amateurs who patiently provide newcomers with the thrill of talking to new countries.

The patience and understanding that are common on the Novice bands are often lacking on the other amateur segments. Sending errors, incorrect spacing between letters and words, and the use of improper procedures are all expected and understood on the Novice bands. The more experienced amateurs offer corrections and advice to the newer operators but everything is usually done in a sincerely helpful way. Tolerance and togetherness are unique features of the Novice bands.

In addition to more American and foreign amateurs making normal two-way contacts on the Novice bands, it is becoming more common for contest operators to shift into the Novice bands to work Novices and Technicians during contests. Contest operation is very beneficial to beginners because it provides excellent code practice with amateurs in many other states and countries. There are contests in progress every week and a glance at the excellent contest section in this magazine will show you the wide variety of activities. It is advisable to participate in contests and Novices should not miss a Novice Roundup, Field Day, or Sweepstakes contest. Novices can work a lot of states and countries in a hurry during a contest.

The contacts you make and the QSL cards you receive during your Novice operation continue to apply towards operating awards after you upgrade in license. This magazine provides very good coverage of amateur operating awards. There are hundreds available and new amateurs usually try to progress at least through the sequence of the TAD (Ten American Districts), RCC (Rag Chewers Club), WAS (Worked All States), WAC (Worked All Continents), and DXCC (100 countries) awards. Even if you upgrade so quickly that you did not get enough Novice band operating time to earn awards, your accomplishments as a Novice will give you a headstart towards getting awards as a General (or higher) licensee.

Novice band operation provides the best way to increase code proficiency. Frequent and regular contacts build up code speed faster than anything else. In addition to being the most effective way to increase code proficiency, on the air contacts are more interesting and are not at all like the drudgery associated with other forms of code practice. Even when a student has excellent theory and regulation knowledge, I advise him to operate on the Novice bands to develop the 13 w.p.m. proficiency needed to pass the General/Advanced code receiving test. It is definitely an advantage for the beginner to operate on the Novice bands as much as possible.

Amateurs use a system of 3-letter Q signals to make statements and ask questions. These signals have several advantages which make them worth knowing and using. For one thing, it is faster to use a Q signal than to spell out the entire equivalent question or statement. Another obvious advantage is that Q signals have known meanings to communicators in all countries. Consequently, amateurs who do not speak each others' languages do understand statements and questions transmitted as Q signals. Each Q signal can be used to make a statement or ask a question. As an example, QRU? asks, "Do you have anything for me?", whereas QRU states, "I have nothing for you". It is also common practice on code to use a phonetic abbreviation system known as the Phillips code. These abbreviations are used to minimize transmitting time and effort. If one just tries to pronounce the received abbreviated material, the meaning becomes obvious. As an example, "HW R U?", means, "How are you?". Both phonetic abbreviations and Q signals should be used very little with new Novices because the new operator cannot be expected to be fully familiar with either one. However, another advantage to Novice band operation is the opportunity one has to learn these operating shortcuts in a relaxed environment.

While operating as a Novice, the new amateur also becomes familiar with equipment, accessories, and antennas. Experience is a great teacher and Novices have opportunities to benefit from the operating experiences available to them. A newly licensed General who was previously an active Novice is in a much better position to fully appreciate and intelligently use the General class operating privileges than a newly licensed General who has not had this type of operating experience.

Continued regular Novice band operation will prepare a Novice to pass the 13 w.p.m. General/Advanced code receiving test. This operating experience also helps the Novice develop communication capability that can be put to good use in real emergencies.

Active amateurs naturally develop interests in some of the things related to their operation. When working amateurs in foreign countries, it is natural to become interested in their geography, history, and currency. As some foreign QSL cards are received directly, the attached stamps may interest one in becoming a stamp collector as a side interest. Experimentation with antennas, radio wave propagation, and solid-state devices increases one's desire to dig deeper into related physics, science, and mathematics. Just a fundamental working knowledge of electricity and electronics requires one to develop a good ability to apply mathematics to solving practical problems. A wonderful aspect of amateur radio is that the knowledge acquired to earn a license is fundamental and it also applies to non-amateur devices used throughout life. Amateur radio continues to lead people into exciting and interesting careers. Another nice thing about amateur radio is that it is not overly demanding of one's time. It is common for people to decrease or stop their amateur activity during busy portions of their lives and to later return to a high degree of amateur activity. As examples, young people usually minimize amateur activity while in college and when first married. It is nice to note that these retreads come back on the air with more enthusiasm than ever after they have been inactive for a while.

Novice operating opportunities and privileges have improved a lot since 1951. The 80 meter Novice band (3700-3750 kHz.) is the only original Novice band that remains unchanged. This band provides good communication under much better conditions than are encountered on the 40 meter Novice band. A problem most Novices have with 80 meter operation is the relatively large size of antennas. If one does not have enough room to erect a full size dipole, there are special smaller antennas available which may be short

enough to fit. However, it is usually simpler to install a longwire and an antenna tuner to operate 80 meters in a limited area.

The 40 meter Novice band was originally 7175-7200 kHz. and it was later expanded to 7150-7200 kHz. This 50 kHz. wide band was shifted down to 7100-7150 kHz. a few years ago to permit the 40 meter phone (voice) band to be expanded to 7150-7300 kHz. The present 40 meter Novice band suffers from nightly interference from extremely powerful foreign broadcast shortwave stations. These stations appear at every 5 kHz. point (7105, 7110, etc.) in the Novice band whenever long range communication conditions are good on this band. Although 7000-7300 kHz. is the 40 meter amateur band in ITU Region II (the Americas), this amateur band is just 7000-7100 kHz. in ITU Region I (Europe). Europe and Region III (mainly the southern hemisphere) use 7100-7300 kHz. as part of their shortwave broadcast frequency spectrum. Since these powerful broadcast stations are just heard here during the night, they are not a source of interference during the day, when most are transmitting on higher frequencies. Simply stated, the 80 and 40 meter Novice bands provide good communication opportunities for distances of 300-600 miles during the day and are usually good for 1500-3000 miles at night.

The Novice 15 meter band did not exist when the Novice license was established. There was an 11 meter Novice band on 26.96-27.23 MHz. and 21.1-21.25 MHz. use was added to the Novice privileges when 11 meters was no longer used on a shared basis by amateurs. The 15 meter Novice band was recently shortened by 50 kHz. to be 21.1-21.2 MHz. This band provides worldwide communication opportunities during most daylight hours and becomes useful for just local contacts at night, the same as 10 meters.

The 10 meter Novice band is 28.1-28.2 MHz. and it was just established a little more than a year ago. Novices orignially had a 2 meter band on 146-148MHz. with code and voice operating privileges. Novice voice privileges were eliminated first and the band itself was later removed from Novice use. I am particularly pleased that Novices are allowed to operated on 10 meters. I submitted 10 meter Novice band proposals to the FCC several times since 1952 and it is good to have this band finally available for Novice use. The 10 meter band has several very real advantages for Novices. Antennas for 10 meters are relatively small, light, and inexpensive; they look just like a slightly large t.v. antenna. A Novice can easily erect a monoband (one band only) 10 meter directive antenna (beam, quad, etc.) on an inexpensive push-up telescoping t.v. mast and control its direction with a relatively inexpensive good t.v. antenna rotator. Despite its relatively low cost, this type of antenna installation will provide worldwide communications. Conditions are rapidly improving on this band and it is common to hear very strong signals from foreign countries. The 10 meter band is not open to long distance contacts as much of the daytime hours as 15 meters, but there is no better band than 10 meters while it is open.

Novices have adequate frequency spectrum and can contact nearby or distant stations at any time. Remember that all amateurs are restricted to a maximum of 250 watts d.c. input power to the final amplifier when operating in the Novice bands, regardless of license class. In other words, even an Extra class licensee must limit input power to 250 watts when transmissions are made in Novice bands. The Novice input power maximum was 75 watts for about a quarter of a century and the recent increase to 250 watts is beneficial because it allows Novices to operate a wide assortment of common equipment at their designed operating levels.

The Novice requirement to control oscillator frequency with a crystal was finally removed after a quarter of a century. Freedom to use variable frequency oscillator (VFO) control is a major improvement in Novice operating privileges.

Prospective amateurs often ask why one has to be able to communicate by International Morse Code to get a license. Amateurs are required to know code by international agreement. Even without this requirement, amateurs should learn how to communicate by code because it is still the most efficient long range method of radio communications. The transmitted code signal occupies less bandwidth than any other system that can be used to transmit intelligence by radio. More stations can operate code than any other communication mode (such as voice, radioteletype, or t.v.) in the same amount of frequency spectrum. The narrow width of a code transmission packs the output power at one point, instead of spreading it out. This single-frequency power concentration provides extremely good communication capabilities even at maximum distances. A code transmission will often be received at an acceptable level in situations where a voice transmission is buried in background noise and cannot be heard. The minimum width of code signals allows receiving operators to use extremely narrow band reception (high selectivity) which eliminates noise and other stations outside the narrow spectrum being heard. It has been my experience that both amateur and commercial radio messages have less errors when they are handled by code instead of voice. In addition to all the other advantages of code, the equipment requirements are simpler and less expensive for code operation than for any other communication mode. Code is truly an oldie but a goodie. Develop good code operating capability and you will always enjoy code operation.

Incidentally, code is commonly called c.w. but c.w. is not code and this terminology is incorrect. A c.w. signal is a continuous wave, one which is not interrupted or modulated and conveys no intelligence. The designations of c.w. are A0 (amplitude), F0 (frequency), and P0 (phase). The designation of code is A1 and modulated code is A2. Simply stated, A0 (c.w.) is not A1 (code) and the two terms should not be interchanged.

If you had not made up your mind whether or not you would travel the Novice route to the General (or higher) license, I hope this article convinced you to become a Novice. I was a commercial operator for several years before I became an amateur. When I picked up my first amateur license, there was no Novice class license. I have always been sorry that I missed the wonderful experience of being a Novice.

Remember that Novice code privileges are no longer lost when one upgrades to a Technician license. Since technicians now have full use of the Novice bands, it is wise to upgrade from Novice to Technician and to later upgrade to General. The new Novice should attend courses or study on his own to prepare to pass the General class FCC written exam. A trip to the FCC should then result in a Technician license which involves a Novice code requirement (5 w.p.m.) and a General written examination. You retain the same callsign when you upgrade to a Technician license but you now have a 5-year renewable license with additional privileges, as compared to the 2-year non-renewable Novice license. Once you've upgraded to Technician, all you have to do is to devote more time to your code operation. When your code proficiency reaches the point where you can pass the 13 w.p.m. code receiving comprehension test, take that test at your local FCC office; it is all you have left to pass to upgrade to General. It is extremely important to avoid using Technician voice privileges and to concentrate on code until you upgrade from Technician to General. If you make the mistake of operating voice modes, you may join thousands of other Technicians who never upgraded to General due to lack of concentrated code practice.

(Continued on page 87)

a monthly feature by
JOHN A. ATTAWAY, K4IIF
& A. JAAP DIJKSHOORN, PAØTO

DX

News of communications around the world

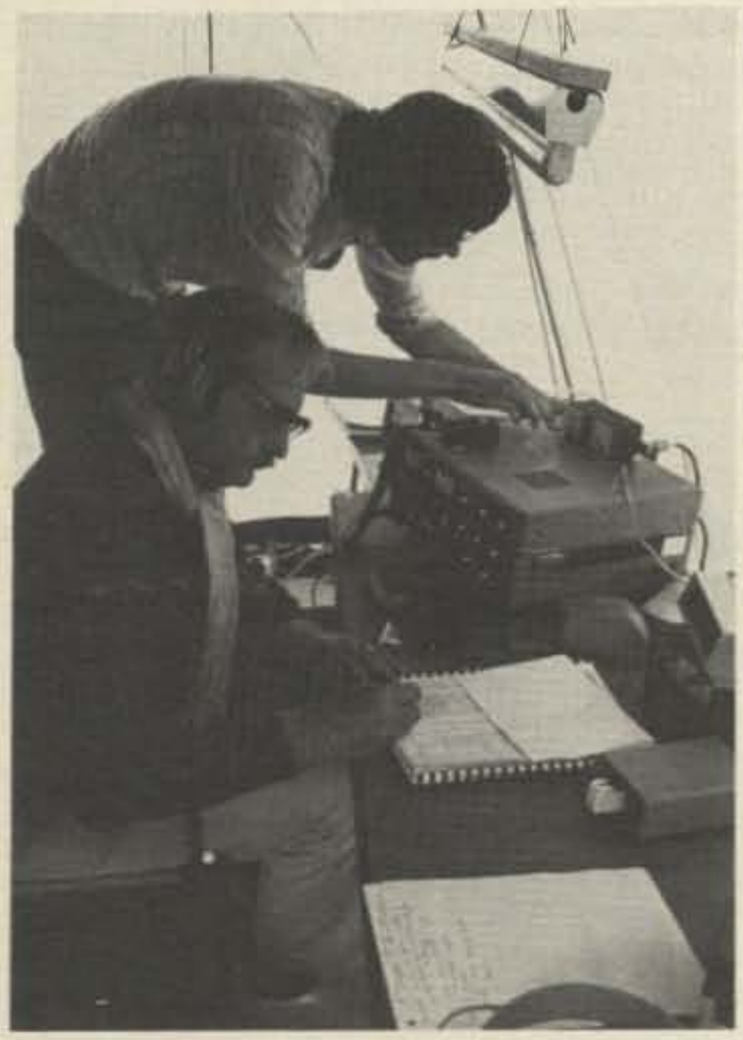
News Flash
EA8BK Scores First Single Band WAZ on 10 Meters

Just at press time the first 28 MHz. WAZ application was received at Box 205, Winter Haven from Julian Ramos Alonza-Ezcurra, EA8BK. It is a c.w. entry and retires the plaque for 10 meter c.w. Congratulations to EA8BK for this superb achievement during the sunspot low.

Special Announcement

As a result of an unusually heavy workload, John, K4IIF, has relinquished the duties of WAZ Manager. The WAZ operation is now under the able direction of Leo Haijsman, W4KA. John will continue to serve as DX Editor and to coordinate the overall activities of the CQ DX Department. *Effective immediately*, all

A. Jaap Dijkshoorn, PA0TO
Editor *VERON's "DXPRESS"*
Jan van Gelderdreef 11, 2253 VH Voorschoten, Netherlands



Geert, C31NM, and Enno, C31NN, operating the TS520. For sharp onlookers, see Geert wearing the famous dutch wooden shoes.

That's Len and Barb Prescott, KM6FC and KM6FD respectively who will operate from Midway Island until October 1978. Photo courtesy of Jack, W2LZX

WAZ applications should be sent to Leo, W4KA, at 1044 Southeast - 43rd Street, Cape Coral, FL 33904.

There has also been an important change in the WAZ rules. As a result of recent FCC rulings it is no longer feasible to enforce the requirement that all contacts be made from within 250 miles of the initial location. In the future, contacts from any QTH within the same country will be accepted.

Introduction

This month's column is written by a distinguished guest columnist, Jaap Dijkshoorn, PAØTO, the editor of *VERON's "DXPRESS"*.

Jaap is employed as a civil engineer by the Dutch Government. His specialty is designing reinforced concrete and steel towers for microwave communication and TV/FM broadcasting. In the little spare time left he edits one of Europe's oldest DX-magazine, *VERON's "DXPRESS"*. VERON stands for Vereniging voor Experimenteel Onderzoek in Nederland (Society for Experimental Radio Research in the Netherlands), Netherlands Section of the IARU, and is one of the two major radio clubs in Holland.

DXPRESS was started in 1958 by PAØFX, PAØLOU and PAØVDV. Jaap joined the staff in 1965 and, except for a short interruption, it has been his operation since that time.

Jaap says that "as a result of time limitations and producing more paper than RF, my DXscore is a modest 238 countries confirmed for DXCC, both CW and SSB. For a look at the PAØTO station, see the picture elsewhere in this column.

"I am married to a very understanding wife, and have three children around the house, fighting for the time left for the family."

European DXpeditioning

Jaap was invited by John, K4IIF, to write a column oriented to and from Europe. He hopes to give you an impression of DXing and DXpeditions from the European point of view, mostly oriented to western Europe.

According to the latest list for the Worked All Europe award, issued by the DARC (German Amateur Radio Club), Europeans are blessed with 66 countries within easy reach on 80, 40 and 20 meters plus, thanks to improving conditions, you can add 15 and 10 meters,

The exterior of IJ7EX. On the upper floor of this military tower, the operations took place. The TH3 was fixed on top of a small tower tied to the staircase.

The operators of IJ7EX/IJ7ONU with the commander of the Italian Navy's Taranto Department just after the landing. From left to right: Jan, I7PHH, Enzo, I7VCA, Commander Cantinella, Joe, I7DPO, Vince, I7DLV.

also, making this area a paradise for 5BDXCC hunters. Add to those "the nearby West Asia and North African countries and DXCC is in your hand. This looks easy to the W/VE amateurs who have to jump over the Atlantic first to reach the old World, but some of the rarer ones in Europe are not densely populated by amateurs. To bring these rare ones on the air, DXpeditions are organized, varying from one-man-shows up to big groups consisting of 10 or more operators.

Andorra (C31) and Liechtenstein (HB0) are very popular targets, as trips to these countries can be easily combined with a family-holiday. Other popular spots are Vatican City (HV), San Marino (M1 or 9A1) in the south, Aalands Islands (OH0) and Market Reef (OJ0) in the north. The most difficult ones are Mount Athos (SY) and Albania (ZA).

For the prefix hunters and IOTA (Islands on the Air) collectors, some Italian amateurs spend their holidays on one of the many beautiful little islands in the Adriatic and Ionian Seas.

Depending on conditions, the European DXpeditions give many W/VE's new ones for the CQ c.w. and s.s.b. DX Awards, DXCC, 5BDXCC, WAZ and the WAE awards.

The greatest European event last year

The crew of the dutch DXpedition to Andorra. From left to right: PA0BRO/C31NK, PA0OOM/C31NL, PA0GIN/C31NM, PA0ERA/C31NN, PE0JWM/C31NO PA0OOS/C31NX, PA0RKP/C31MY, NL-4891/C31.

was the San Pietro Island DXpedition by I7DLV, Vince; I7DPO, Joe; I7PHH, Jan and I7VCA, Enzo. The story of this successful DXpedition, which follows later in the column, was taken from the local amateur magazine and talks with Joe, I7DPO; and Enzo, I7VCA

A big event by Dutch Amateurs was organized by the Groningen Contest Group who made a trip to Andorra to bring this country on the air on 5 bands, chiefly c.w. Some countries are rather easy to catch on s.s.b., but rare on c.w., especially Andorra, San Marino and Monaco. The latter one was on the air during the FOC contest, c.w. only, by DL1PM, DL1RK and PA0XE, all signing . . . /3A. Even some prefixes are in demand. Your scribe had this experience when signing F0BAK from Southern France during the holidays. Many times I was told to be the first F0 c.w. QSO. This may be a hint for the readers/holiday callholders to use the key (and headphones, remember the family).

Another island hopper, especially for the WPX and IOTA is Bert, I2CBM, who

The powerplant of IJ7EX, when the island's main power aggregate was stopped during the night, this little machine was responsible for your midnight QSO.

activated, Ustica (IE9CBM) and Ventotene (IB0CBM) in 1976 and 1977. The following two accounts will give you an impression of how European style DXpeditions are organized.

The Flying Dutchman operating from Andorra

As mentioned before, Andorra is one of Europe's "DX-countries", so the Groningen Contest Group planned a DXpedition to this mountainous spot between France and Spain.

The Groningen Contest Group is a group of contest and DX-minded amateurs, who bundle their powers to avoid QRMing each other during contests. Groningen is the capitol city of the Province of Groningen, the most northeasterly part of the Netherlands.

The group consisted of Peter, PA0BRO/C31NK; Enno, PA0ERA/C31NN; Geert PA0GIN/C31NM; Nanko, PA0OOM/C31NL; Jaap, PA0OOS/C31NX; Reinder, PA0RKP/C31NY (chef de cuisine); Job, PE0JWM/C31NO; and SWL Bert, NL-4891/C31.

The first item to be obtained was the amateur license. The application was sent to the "le De'legue' Permanent pour l'Andorre, Pre'fet des Pyrene'es Orientalles" at Perpignan in France. Within 6 weeks the license was granted. Do not forget to apply for a French license also. It was unusual that one of the calls issued was C31NL, as the letters NL are the same as on the nationality plates for Dutch automobiles.

June 10, 1977 at 0400 AM was the starting moment. Three cars and a trailer, plus a second trailer with enough food to supply a small town grocery shop, turned their noses south. At the frontier between Belgium and the Netherlands, there was a four (4) hour delay due to customs formalities, but after paying a security deposit of $1250 the trip could be resumed. No further problems were encountered until the Andorra frontier was reached at Saturday evening, 10:00 PM local time. The custom's office was closed for the weekend, so another delay, but after some paperwork and the help of a professional transport firm the final destination was reached. This was La Rabassa near the Spanish border at 2200 m (6600 ft.) above sea level. On Monday, June 14th at 1600z the first signals of C31NM were on the air with a dipole and TS520. The first QSO was with PA0TA. Next day the more definite antenna farm was erected consisting of a rotary dipole for 10 meters, Quad for 20, and a dipole for 80 meters, Quad for 10, and a dipole for 80 meters. Also some OSCAR operations were planned with 10 elements on 144 MHz. plus 20 elements on 432 MHz. By Tuesday evening everything was ready for the pile-ups. The quad worked fine and there was no need for continuous use of the linear. It was only used to start a pile-up or to punch through unusual QRM. During the six days of operations about 4500 QSO's were made, chiefly using the call signs C31NM and C31NN. Eighty percent of the QSO's were on c.w. Eighty meters was not used frequently due to QRN (my own experience too, when signing F0BAK in S. France, PA0TO). Forty meters could be used only during the daytime as this band is filled up with high power intruder broadcasters during the night. The only band usable 24 hours a day, was 20 meters, as 10 and 15 were daytime bands due to band conditions. Short skip on 10 and 15 was very good, so many Europeans could add C31 to their 5BDXCC records. During evenings and nights the pile-ups were caused by the North-American and Japanese DXers. On June 20th, the conditions on 10 were extremely short skip, so s.s.b. was used again for Europe. That evening the C31 crew closed down, and the (whis)key make the last QSO's between the crew

members to toast a successful week. In addition to the HF operations, the VHF equipment was tried out on OSCAR-7. The QSO's were made, with a FY7AS contact as the highlight.

In contrary to the outward journey, the trip back home was made somewhat faster, as the grocery trailer was empty Those awaiting the QSL's are requested to have patience, because at the time this story was being written, some problems with the printer remained to be solved. However, when you read this in June the QSL's should be under way through the usual channels.

The IJ7EX Story

After having tasted a little DX when operating from Tremiti Island as IL7WTI in 1976, the Bari-group looked for another rare spot for a DXpedition.

In the Bay of Taranto lies the Cheradi group consisting of two islands, San Pietro and San Paolo (St. Peter and St. Paul). There had never been any amateur operations from this group, and it had no prefix allocated. The idea to operate from San Pietro came from Joe, I7DPO, and Enzo, I7VCA.

The Cheradi group is a military base forbidden to civilians and under strict administration of the Italian Navy, Department of the Ionian and lower Adriatic Sea. Consequently it was quite a challenge to put these Islands on the air, especially because of the possibilities of a new DXCC country due to their separate administration. Thanks to Gianpaolo, I8KDB and Rosario, I8KRV, the door was opened to direct negotiations with the Navy Commander for the area, and as a result of the resoluteness of Enzo, I7VCA, and the indispensable help of Admiral Alberto Belforti, who conquered much bureaucracy, a license was granted to operate IJ7EX from San Pietro Island with permission of the Italian Navy. On July 22, 1977, the group landed on San Pietro. Antonio, I7DSN and Vito, I7JVB, spent the morning and afternoon running up and down the 73 steps of the watch tower, where the station was installed. As the island power was shut off during the night, the group used its own generator. The commanding officer told the group to behave themselves and they could "borrow" gasoline for the generator. There appeared to be difficulties with the food supply, but thanks to the same commander, everything was obtained from the military base. *DXPRESS* was able to report to the minute when I7DPO, I7DLV, and I7VCA brought IJ7EX on the air *(DXPRESS* no. 22, Vol. XX). On July 22nd, late afternoon, the first QSO was made on 80 meters with I8KDB, followed by a JA station on 20. This was the start of a nearly continuous pile-up, which lasted till August 2nd. Announced as being a possible new one, the IJ7EX pile-up looked bigger than the one some kHz. lower where ZM7MM in the Tokelaus had a beehive of activity. During the night when the main generator on the Island was stopped, IJ7EX switched over to its own small generator, found on a building site by I7DLV. Apparently it was left behind by a contractor as worthless junk, but it did its duty all the 11 nights of operation.

On July 28th another call sign was used to commemorate the ARI-UNICEF day. QSO's that day were made as IJ7ONU, and a special QSL was printed for the occasion. After numerous QSO's, the s.w.r. in the feeder of the beam increased suddenly and like a game of the devil right in the middle of the night. Lighted by a small emergency torch, I7DLV climbed to the top of the mast but the defect couldn't be located immediately and a wire dipole was erected so that the show could go on. A QSO with a VU2 showed the dipole was working and the next day a defective gamma match was repaired and the beam was returned to use.

Site of the C31 DXpedition, 6,600 ft. a.s.l. Left the quad, in centre the mast for the dipoles, and the mast with the 10 meter dipole plus 10 elements on 144 mHz at right.

During the last few days of IJ7EX a second tragedy occurred. A sudden wind storm destroyed the lattice tower supporting the beam. The entire array, including beam and rotor collapsed to the ground. This was the reason why IJ7EX suddenly went off the air. The emergency dipole, used for the first emergency, was put into use again, and IJ7EX was back on the air.

During the last two days the news of IJ7EX reached every corner of the world and the help of Bert, I2CBM, in making lists, was much appreciated. On August 3rd, the last QSO's were made and IJ7EX went QRT from San Pietro Island. The first operations from the Cheradi group are now amateur history. Thanks also goes to Prof. Ugo Monaco, director of the Italian P.T. and T, and Mrs. Binetti, who were responsible for issuing the call sign IJ7EX. It is hoped that as a result of the efforts of the group from Bari on the air, and those of I8KDB at the ARRL, many amateurs can add a new country to their score.

One of the three 5BDXCC holders in Holland, IARU region 1 chairman, Louis v.d. Nadort, PA0LOU. Equipment, FL/FR500, SB200, plus home made gear for 160m. The radiated RF comes from A TH3, inverted V plus an 18 AVQ when everything fails. You may find Lou in the c.w. part of every big contest, where 40 w.p.m. exchanges are no exception.

Some DX Info

A7—A7YXX works c.w. as well as s.s.b. He is found near 14220 and 14250 kHz. as early as 0700z for EU and 1600z for W/VE, also on c.w. around 14030 kHz. at 0700z. QSL to DF4NW or direct to Will Rass, P.O. Box 3967, Doha, State of Qatar, Arabian Gulf.

A7XAH mostly s.s.b. between 14200 and 14225 kHz. around 1300z. QSL to DJ9ZB.

BY—BY1AO has been worked on s.s.b., 14232 kHz. at 0745z, in Japan. QSL to P.O. Box 707, Peking. The name of the operator is Shin. On 14030 kHz. three BY0 were worked with beam headings right from the States. BY0SA, Fong, BY0SF, Tank and BY0SS, Tse. QSL to P.O. Box 1, Linchow. Could be the start of a new amateur population?!

C31—The Dutch Group from Groningen is planning another big effort in June or July. Main operations again on c.w., all bands plus OSCAR.

KC6—Western Carolines, KC6CV found on 14250 kHz. around 0700z, and on 28580 kHz. around 0830z. Operator's name is Don, QSL to A.R.S. KC6CV, op. Don, Yap, Western Carolines, 96943.

VK9—P29JS will be on from Cocos Keeling this month, if the license he applied for in February is granted. Jim will make as many contacts as possible.

The interior of IJ7EX. Enzo, I7VCA and Joe, I7DPO trying to handle the pile-ups.

VK9—Charlie on Norfolk Island, VK9NI, can be found on 14220 kHz. around 0700z. QSL Box 27, Norfolk Island.
VP8—South Orkneys, VP8PL works c.w. around 14060/70 kHz. also s.s.b. around 14127 kHz. and 14195 kHz. from 1600z till 2100z. QSL to G3LIK.
SU—SU1MI, YL Moona can be found around 28050 kHz. a few kHz. from 1300z. Apart from this the VE./SU are found on various frequencies.
ZB2—ZB2AV works on the 3508, 7008, 14008 and 21008 kHz. c.w. Times for the lower bands around 0100z.
ZD9—Ian, ZD9GG, will be active until the end of November 1978. He checks into the ISSB at 14332 kHz. but also around 14275 kHz. at 1730z and later.
8Z4—Saudi Arabian Neutral Zone. The planned DXpedition by HZ1TA, DJ9ZB and others will take place this month.

Addresses of some European QSL Managers

DB7KM—G. Neubauer, Im Bendchen 80, 5158 Horrem, W. Germany
DF1FU—H. König, U. Sommerbahc strasze 18, D-3501 Baunatal 4, W. Germany

The WPX Program

Mixed

633 . . . JA3CJO
634 . . . I8RFD
635 . . . SL3BG
636 . . . W1AGA
637 . . . OK2BJU
638 . . . WA4TLI
639 . . . W1YK

S.S.B.

1023 . . . WA8PWZ
1024 . . . PA2TMS
1025 . . . I8KUT
1026 . . . VE7VT
1027 . . . HM1EJ
1028 . . . EA7TV
1029 . . . JH1IAQ
1030 . . . HI8EJH
1031 . . . EA7ABV

C.W.

1669 . . . DF2ME
1670 . . . DK7XX
1671 . . . SL4BP
1672 . . . SMØGMG
1673 . . . SM5FDD
1674 . . . DK8NM
1675 . . . W3OGY

WPNX

108 . . . WB3GOC
109 . . . WN4CMW
110 . . . WB1CEG

Endorsements

Mixed: 400 WA4TLI, W1YK, DF7FH, 450 SL3BG, 500 OK3IF, 550 W1AGA, 600 HI8MOG, 650 WA5ALB, I8RFD, N4UF, 700 YU1NGO, 800 OK1IQ, ON4XG, 900 HE9ILN, 1100 N2AC, 1550 K6XP.
SSB: 300 WA8PWZ, I8KUT, VE7VT, JH1IAQ, EA7ABV, W3OGY, 350 EA7TV, 400 IØPSB, OK2BJU, HM1EJ, HI8EJH, 500 G3XPO, PA2TMS, 550 ON4XG, 600 CX9CO, OK1IQ, 650 WA5ALB, YV1KZ, 800 WB9EBO, 900 OE2EGL, 1000 W8GKM, 1100 HB9AAA, 1300 K6XP.
CW: 300 DF2ME, DK7XX, SL4BP, SMØGMG, SM5FDD, DK8NM, 450 EA2OP, 500 JH1VRQ, 600 JA2IU, 650 OK1IQ, ON4XG, 750 K9UE, 1250 DL1QT.
15 meters: ON4XG
20 meters: WA5ALB, VE7VT, JA6-9330
40 meters: N4WX
80 meters: PA2TMS, OK2QF.
Asia: K4RDU, ON4XG.
Europe: N4WX, PA2TMS, SMØGMG, OK2QF, DF7FH, ON4XG.
No. America: WA5ALB, LZ1XL, ON4XG.
So. America: HE9ILN, WA5ALB.

Complete rules for WPX can be found in the May 1976 issue of CQ Magazine. Application forms may be obtained by sending a business-size, self-addressed, stamped envelope to "CQ WPX Awards", 5014 Mindora Dr., Torrance, Calif. 90505. U.S.A.

The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ master prefix list. Scores are based on the current prefix total, regardless of an operator's all time count.

Mixed

W4WV	1700	K2VV	1300	W8CNL	1030	G3DO	849	K8UDJ	750
K6JG	1630	DJ7CX	1297	W6ISQ	1028	I3ANE	848	WA5LOB	749
F9RM	1608	N4MM	1290	N4NO	1025	WØSD	844	CT1LN	749
YU2DX	1501	WB4KZG	1250	I6SF	1024	JA1AG	831	PY4AP	735
VE3GCO	1436	K5UR	1191	WAØKDI	1019	W9WHM	811	KØBLT	733
ON4QX	1429	W9FD	1184	SM6DHU	1000	YU3EY	811	K7NHG	719
W2NUT	1424	W8ROC	1181	K4KQB	960	W6NJU	811	WA6EPQ	713
YU1BCD	1419	N6AV	1175	W4IC	950	W9ZTD	807	PAØVB	706
W3PVZ	1381	N6CW	1162	WA6TAX	949	IØJX	803	UA3FT	705
W7LLC	1380	WB4SIJ	1152	K5DB	923	W6ANB	793	OE6RP	622
W2NC	1377	WØAUB	1107	YU1ODS	918	IT9AGA	791	WB9CGL	600
W8LY	1368	YU1AG	1089	WØSFU	908	K8LJG	782		
W9DWQ	1365	K6ZDL	1070	W3YHR	906	K2ZRO	782		
W4CRW	1358	N2AC	1063	SM7TV	905	YU4EBL	782		
W4BQY	1319	YU2OB	1055	DL1CF	872	PY4OD	758		
PAØSNG	1302	N6JV	1035	W4BYU	859	WA2AUB	757		

S.S.B.

W4UG	1507	W9DWQ	1089	CT1PK	923	W3DJZ	818	WB6DXU	708
F9RM	1506	HP1JC	1086	IT9JT	916	OK1MP	817	IØMBX	702
IØAMU	1432	DL9OH	1033	N4NO	913	PY3BXW	808	CX2CN	702
K6JG	1357	DK2BI	1031	F2MO	904	W4IC	800	W4BQY	654
IØZV	1289	ZL3NS	1022	WB4KZG	900	YU1AG	794	I4LCK	653
I8KDB	1233	WB4SIJ	1000	WØYDB	884	K8SQE	783	N2AC	640
I8YRK	1200	K2VV	1000	K2POA	883	G3DO	765	JH1VRQ	636
N4MM	1149	WA6TAX	975	N4UU	863	WA5LOB	747	CR7IK	613
YU1BCD	1137	DL1MD	948	DJ7CX	852	W2NC	730		
PAØSNG	1124	K5UR	942	N2SS	850	W6YMV	720		
I4ZSQ	1102	WB2NYM	941	OE2EGL	839	YU1ODS	719		

C.W.

W8KPL	1362	N4UU	1104	K6ZDL	953	VK3AHQ	809	OK2DB	693
W8LY	1350	W9FD	1091	VO1AW	932	I6SF	801	DL1MD	660
K6JG	1253	G2GM	1022	K5UR	909	VO1KE	800	KH6HC	649
ON4QX	1245	WA2HZR	1006	N2AC	906	SM5BNX	790	K2ZRO	649
DL1QT	1232	W4BQY	1003	N4MM	905	W4BYU	768	PY4OD	646
W2NC	1204	N6JV	992	YU1AG	885	W4IC	754	K1LWI	629
YU1BCD	1165	W3ARK	990	K2VV	850	YU1ODS	716	LZ1XL	604
K6XP	1164	DJ7CX	988	W6ISQ	824	WB4KZG	700	OK2QX	600
W2HO	1126	W2AIW	972	K7ABV	812	OK2BLG	698	VE4OX	600

DF2GO—H. Rhmann, Gartenstresza 21, D-7895 Klettgau, 1-Erzingen, West Germany
DJ1TC—O. Blankenheim, Dreisamstrasze 13, D-7530 Pforzheim, West Germany
DJ7BG—E. Freutag, Lessingstrasze 13, D-8011 Anzing, West Germany
DJ9ZB—F. Langner, Carl Kistnerstrasze 19, D-7800 Freiburg i. Breisgau W. Germany
DK1PD—K. Möllmann, Schaphausstrasze 25, D-4300 Essen, West Germany
DK3GI—R. Mensch, Mauerheimstrasze 3, D-8751 Stockstadt, West Germany
DK3KD—W. Daub, Solingerstrasze 79, D-4018 Langenfeld, West Germany
DK3MO—O. Mayer, Im Brückle 14, D.7209 Gosheim, West Germany
DK8QN—H. Hätmann, Margaretenstrasze 6-8, D-4835 Rietberg 2, West Germany
DK9KE—W. Berker, Geilenkirchenerstrasze 356, D-5120 Herzogenrath/Merkstein
DL1HH—H. Groh, An de Bahn 5, D-6236 Eschborn/ Niederhöchstadt.
DL1PM—E. Manske, Ansgarstrasze 13, D-2091 Ramelsloh. West Germany
DL1RK—K. J. Döring, Hegewiese, D-6381 Arnoldshahn, West Germany
DL6IC—H.-G. Siebert, Kennedystrasze 32, D-2900 Oldenburg, West Germany
DL7FT—F. Turek, Petunienweg 99, D-1 Berlin 47, West Germany
DL7HM—G. Marx, Karl Schumacher strasze 1, D-6078 Neu Iseburg, West Germany
DL7NS—K. G. Gramowski, Kaiserin Augusta Allee 91, D-1 Berlin 10
DL7ON—F. Littmann, Elisenstrasze 6, D-1 Berlin 41, West Germany
DL7SI—R. Siegel, Benekendorffstrasze 13, D-1 Berlin 28, West Germany
F3DV—A. Desbonnets, Cheerio, Ave. Herelle, 64 Bayonne, France
F3OA—M. Lagrot, Villa 1121, Domaine de Pyanet, 83 Hyères, France
F5DV—M. Dacerat, 19 rue d'Aulan, F-40100 Dax, France
F5VU—J. Brunner, Savigne, France
F6APG—M. Bontemps, Le Bois aux Lièvres, 27 Prey par St. André L'Eure, France
F6BBJ—J. Billaud, Rue Roland Champenier 11, F-5800 Nevers, France
F6CVE—S. Tcheremkhovitch, Résidence du Parc, Bt. B, Esc 5, Rue St. Denis F-93120 La Courneuve, France
F6DYK—R. Muscedere, B.P. 561, Rouen, France
F8JL—P. Doche, Rés. Beau Site 219, Esc E2, 33 Merignac, France
F8US—R. de Paix de Coeur, Rue des Poilus 28, 78 Mesnil-le Roi, France
G3FXB—A. J. Slater, Wychwood, Park Lane, Maplehusrt, Horsham, England
G3LIK—M. Puttick, 21 Sandyfield Cross, Cowplain, Portsmouth, Hampshire.
G3STP—P. S. La Pierre, 31 Ryefield Road, London SE 19, England
G3SYP—H. Parker, 49 Brood Road, Wickham Market, Woodbridge, Suffolk
G3VKW—K. Evans, Fairwinds, Faris lane, Woodham, Weybridge, Surry KT15, 3DJ
G3VMO—Via G.E. Fenner, Box 1134, Rabul, New Guinea
G3VZT—R. K. Johnston, Church Farm, Wickmere, Norwich, Norfolk, England
G3XCS—C. J. Squires, 5 Frith Road, Saltash, Cornwall, PL12 6EL England

Guest column writer of this month, Jaap, PAØTO. Equipment used TS520 plus KW500 Linear. On the roof a 2-element Fritzel beam and longwire.

The WAZ Program
Single Band WAZ
10 Meter C.W.

1 . . . EA8BK

20 Meter C.W.

39 . . . W6PN

20 Meter Phone

96 . . . WB9BGJ
97 . . . WA4ENJ
98 . . . VK2JK
99 . . . K4KFH
100 . . . K4FWY

All Band WAZ
S.S.B.

1436 . . . SM0CER
1437 . . . SM3AGO
1438 . . . OZ7XU
1439 . . . P29JS
1440 . . . W8NZS
1441 . . . WA9GXL
1442 . . . WA9JCO
1443 . . . I6TIH
1444 . . . WA2EAN
1445 . . . DK5AT
1446 . . . DJ0UJ

C.W.-Phone

4210 . . . SM7BIP
4211 . . . SM5EZE
4212 . . . SM5DD
4213 . . . SM6CNX
4214 . . . SM3EVR
4215 . . . PA0PAH
4216 . . . DK7XX
4217 . . . DK7AA
4218 . . . DK2QL
4219 . . . WA3JZR
4220 . . . W4QCU
4221 . . . K9HQM
4222 . . . W0NS
4223 . . . G5BEF
4224 . . . ON4XG
4225 . . . OK1WV
4226 . . . WA2EAN
4227 . . . DK6ED
4228 . . . DL9PA
4229 . . . W5DMM

Phone

537 . . . WB2VEG
538 . . . F5BV

The complete rules for all WAZ awards are found in the May, 1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to the WAZ Manager, Mr. Leo Haijsman, 1044 Southeast 43rd. St., Cape Coral, FL 33904

G3XVY—P. D. L. Coull, Anenue House, Littlestone, New Romney, Kent, England
G4BUE—C. J. Page, 58 Dale Ave, Hassocks, West Sussex, BN6 8LS, England
G6RC—R. P. Cole, 13 Dene Tye, Worth Park, Pound Hill, Crawley, West Sussex RH10 4TS, England
G8AUU—C. G. Partridge, 2 York Crescent, Babbacpmbe, Torquay, Devon TQ1 3SH
GD300K—J. Penderleigh, 24 Baldrie Park, Baldrine, Isle of Man

The CQ DX Awards Program

S.S.B.

542 . . . KL7AGU
543 . . . WB9DWG
544 . . . W6ORD
545 . . . W4MNZ
546 . . . SM7RS
547 . . . SL3BG

C.W.

301 . . . KL7AF
302 . . . HI8LC
303 . . . JA2TK
304 . . . EA2OP
305 . . . SM5FDD

S.S.B. Endorsements

310 . . . WA2EOQ/311
300 . . . EA4LH/303
275 . . . I6PLN/275
250 . . . JH1VRQ/274
150 . . . SM7RS/154
150 . . . W6ORD/150
150 . . . WA2FKF/197

C.W. Endorsements

300 . . . K6JG/302
150 . . . G3JZG/150

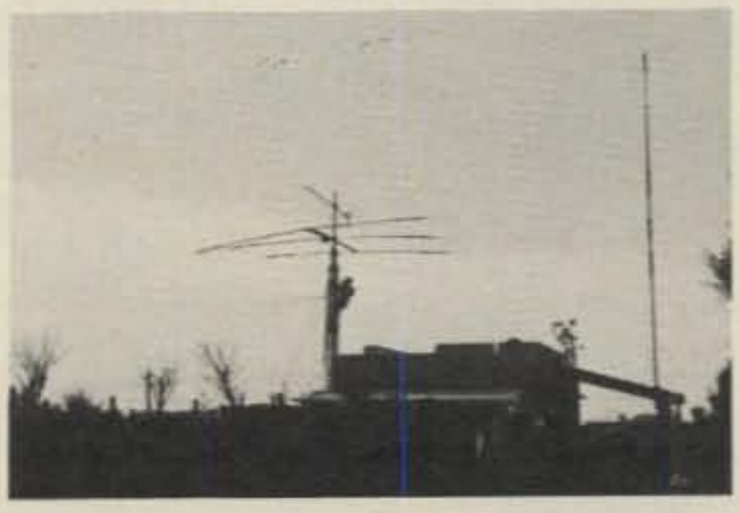
Complete rules and applications forms for the CQ DX Awards Program can be obtained by sending a business size, No. 10, envelope, self-addressed and stamped to: "CQ DX Awards", 5632 47th Avenue S.W., Seattle, Washington 98136 U.S.A.

GW3WBZ—D. H. Facer, 35 Myretown Gate, Alva, Clackmanshire, Scotland
HB9AQL—W. Kirst, Moserstrasze 32, CH-3014 Bern, Switzerland
HB9BHA—H. Henning, In de Wyssechen, CH-3853 Niederried/Interlaken
I1IMC—O. Trulli, Via S. Francesco Assisi 1o, I-10093 Collegno Italia
I2JL—G. Calzano, Via Zelasco 1, I-24100 Bergamo, Italy
I2VGM—G. Mercanti, Via Seminario 2, I-27029 Vigevano, Italy
I5BDE—F. Cartia, Via Garigiliano 69, I50047 Prato, Italy
I7VCA—V. Chiarello, P.O. Box 1, I-70100 Bari, Italy
I8JN—G. Mauro, Via Tiberio 72-B, I-80124 Napoli, Italy
LA2AD—H. Torgersen, Tyholtvegen 106, N-7000 Trondheim, Norway
LA5NM—M. Bjerrang, P.O. Box 210, N-9401 Harstad, Norway
OE3GSA—F. Schweidler, Wolfsbach 103, A-3300 Amstetten, Austria
OE2DK—H. Donik, Haupplatz 14, A-8720 Knittelfeld, Austria
OE7UU—K. Kerschbauer, A-6235 Reith/Brixlegg 173, Austria
OH2BFJ—T. Jansson, Bergstrask, SF-02400 Kirkkonummi, Finland
OH3ZH—K. Koskela, Kolarink 21 E 40, SF-33560 Tampere, Finland
OH9RJ—A. Hyvarinen, Aarnintie 5-C, SF-95420 Tornio 2, Finland
OZ1VY—H. Feldthaus, Højlandsvej 4, DK-4400 Kalundborg, Danemark
SM3CXS—J. Svensson, Berghemsvägan 11, S-86021 Sundsbruk, Sweden
SM5AWO—G. Karlsson, Trollbecksvägan 47, S-13500 Tyeso, Sweden
SM6CSB—H. Lofhede, Nordgardsvägan 5, S-43050 Kallered, Sweden
SM7TE—K. Ekholm, Morkullevägan 16, Bunkeflostrand, S-23044 Vintrie, Sweden
SM0GMG—L. O. Mohlin, Granbacksvägan 15, S-17010 Ekero, Sweden
YU2CTF—Akademski R. C. Elektrotchniki Fakultet, Zgrada C, Unska 17/XII, YU-41000 Zagreb, Yuogslvia
YU3CAB—Radio Club DomzalemLjubljanska 69-A, Box, YU-61230 Domzale, Yugoslavia

QSL Information

A4FXV—P.O. Box 248, Muscat, or DJ7OM
EL2BS—via K9QXY
FH0BKZ—via F6BBJ
FK8CK—Box 1966, Noumea, New Caledonia
FK8CR—Box 42, Noumea, New Caledonia
FK8CU—Box 544, Noumea, New Caledonia
FR7BP—Box 237, Tampon, Reunion
FY7BC—via F9LM
F9LM—M, Etienne, 92 Bd de l'Entrepôt, Bergerac 24, Dordogne, France
F0BAK—via PA0TO
G3PPE/VE7—via RSGB
G5BFE—via PA0TO
HP2LT—Box 1988 Colon, Panama
HZ1HZ—Box 1999 Djeddah, Saudi Arabia
JT0DJT—Box 639, Ulan Bator, People's Rep. of Mongolia
JY5US—via DJ3HJ
KG1UX—via K3ZQ
KG6JIH—via K6TBQ
JW9UV—via LA5NM
KM6BG—via W2RLV
KX6BU—Box 444, APO, San Francisco, Cal., 96555
KX6DC—via W6ENE
LI2B—via NRRL

(Continued on page 87)



Operations from Ventotene Island, IB0CBM. I2CBM putting up the TH3, at right the 18AVQ used for lower bands.

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

Here is the June, "Story of The Month", as told by Tom:

Dr. Thomas E. Storm, Sr., DDS, WA0YJL
All Counties #164, 1-24-77

"I had always been interested in electronics and radios since I was a small child, but it was during the depression of the 30s, so no money was available to build equipment.

"I studied and knew all the theory, but high school, pharmacy school, marriage, a family, and finally dental school kept me from getting the code. Finally, a class was given in my home town of Leavenworth. I commuted a 50 mile round trip to class and passed my Novice test in April 1969. After coaching from W0OAQ I passed the General and Advanced in February 1970.

"When MARAC was founded, Mike, WA0KQQ talked me into taking a charter membership. I became MARAC C-32 and attended the next meeting where I heard about County Hunting, and from then on, I was hooked.

"I was always interested in mobile operation, had a Swan 270 in the car, so I was soon giving out to the Counties.

"Shortly I heard about WA0SBR, a pharmacist, having his rig on the prescription counter and working the Counties while running his drugstore. Immediately a vertical went up on the roof of my dental office and an FT101B into the laboratory. In between patients I'd pick off a County or two. I actually had some patients as anxious about my progress as I was.

"Finally on January 8, 1977, WB4FBS drove over snowy, icy, narrow mountain roads to get me Union and Hancock Counties in Tennessee, for the last ones.

"I am a dentist, have a lovely wife, Jean, who does not care for Ham radio one bit. We have three harmonics, Tom, Jr. in college, Diane in High School and Linda in Jr. High.

"I have been very active in MARAC having been elected a Director in 1972, Vice-President in 1973 and 1974, and just finished a two-year term as President.

"I can't express enough, my appreciation to all Net controls, assistant Net controls and mobiles who helped me down the path from 1971 to 1977. I am now on my second time around and have worked 1,580 Counties in six months. So keep listening, ole Yank'em, Jerk'em, Loose is still in there.

"There is a funny story behind Yank'em Jerk'em Loose. Bill, WA5YSC was Net control and running Mel, W5AWT/M. He announced his call as, Whisky 5 Abcessed Wisdom Tooth. I called Mel using Yank'em Jerk'em Loose. This shook Mel up as he was used to me saying Yankee Juliet Lima. He said, "Who's that?". I I said WA0 Yankem Jerkem Loose—what we do to Abscessed Wisdom Teeth. This put Bill, WA5YSC in stitches as he is also a dentist. We all had quite a laugh over it at the next convention.

"In the next photograph you will see "Sugar" our poodle with my FT101EE, FL2100B linear, FV101B External VFO, USA-CA Award and Plaque and my ARRL Life Membership".

*P.O. Box 73, Rochelle Park, NJ 07662

Tom Storm, WA0YJL and Poodle "Sugar".

USA-CA Honor Roll

3000		1000	
W2MCY	200	W2MCY	468
2500		VE1DI	469
W2LMT	255	500	
W2MCY	256	WB2GPN	1218
2000		WD8AXF	1219
W2MCY	298	W2MCY	1220
K7SE	299	VE1DI	1221
WB9RCY	300	WB5UKI	1222
1500		OK2BKR	1223
W2MCY	350	ZL1ADD	1224
VE1DI	351	WA5ZDZ	1225
W7ULA	352	N4UF	1226

Awards Issued

Frank Tracy, W2MCY hit the jack pot with USA-CA-500 through 2500 endorsed All SSB, All Mobiles, All 14. USA-CA-3000 endorsed All SSB, All Mobiles.

Chuck Henry, W9LMT added USA-CA-2500 to his collection, endorsed All 2XSSB.

Dr. John Irwin, K7SE was issued USA-CA-2000 endorsed All SSB. Among the calls John has used are: K6SE, K6SE/2, FG0AFA/FS7, PJ8SE, PJ8SE/PJ6, HC2YL, HK3BLD, WB8LSW/HK3, OA6BW and VP2EEB.

Dorothy Johnson, WB9RCY took time out from mobiling to obtain USA-CA-2000.

Mrs. Dirksen, Widow of the late Senator, at the Research Center, receiving the First Honorary Senator Dirksen Award, presented by Art, K9GBN. Gary, WA9VWX is in the center. Photo courtesy, K9GBN and the Pekin newspaper.

Harvey Epton, VE1DI picked up USA-CA-500 endorsed All SSB, All Mobiles, All 14. USA-CA-1000 and 1500 endorsed All SSB.

Don Skaife, W7ULA added USA-CA-1500.

Tommy Rodgers, WB5UKI acquired USA-CA-500 endorsed All SSB, All Mobiles.

Marge Moore, WA5ZDZ claimed USA-CA-500 endorsed All SSB, All 20.

USA-CA-500 Certificates endorsed Mixed, went to: Salana Jan, OK2BKR. Bob Hynes, WB2GPN. Billy Williams, Jr., N4UF. Jack Johnson, WD9AXF. Eric Irving, ZL1ADD. Congratulations to all!

Awards

Worked All Zones: (WAZ): Effective March 1, 1978, All requests for certificates and information regarding the *CQ* popular Award should go to: Leo Haijsman, W4KA, 1044 S. E. 43 Street, Cape Coral. Florida 33904.

California Award Hunters Club of 8807 Alondra Blvd., Paramount, California 90723 wish to state they are no longer associated with the National Award Hunters Club. They are in the process of issuing their own award certificates and will inform us as soon as all details are worked out.

Senator Dirksen Award: This new Award is offered by the Pekin, Illinois Chapter of the 10-X International Club. The Dirksen Net is affiliated with the 10-X International and is Pekin's local chapter commemorating the late Senator and the Everett McKinley Dirksen Congressional Leadership Research Center. The Certificate may be obtained by working 5 Senator Dirksen Award holders with 10-X numbers *or* by working any 5 Illinois stations on other bands. Send log data and $1.50 to: Arthur L. Oates, Jr., K9GBN, 122 Arrow Drive, Pekin, Illinois 61554.

Fraser Valley DX Club Award: The Fraser Valley DX Club, VE7DXC is happy to offer this new Award, for QSOs on and after May 1, 1978. QSLs are not required, but send log data including date, GMT, frequency, mode, stations worked, this to be certified by 2 other amateurs (GCR). The Award is available to all licensed amateurs in the world. All authorized amateur frequencies can be used on SSB, CW, SSTV, RTTY or Oscar. No repeater QSOs count. US and Canada work 15 members and the cost is $1.00 (U.S.) Rest of the world work 5 members and the cost is 5 IRCs or $1.00 (U.S.). The present membership includes: VE7s ADC, AAR, AFY, AIO, AKH, AQC, AUF, AUZ, AVA, AVM, AVW, AZA, AZC, AZG, BCP, BJM, BSM, BVF, BUS, CC, CEK, CBM, CGR, CGY, CIO, CJG, CKW, CMC, CMD, CMK, CMN, CML, CMZ, CNY, DXC, SZ, TB, TT, WJ, XQ, HV, and FY. It is interesting to note that already 33 member photographs are on the Award.

The Senator Dirksen Award

The International Short Wave League Awards Program: For the past three months I have been listing data on their Awards. Each Award is available to all, members or not. A GCR (General Certification Rule) list of QSLs with $2.00 U.S. or 10 IRCs for each Award (free to ISWL members) to ISWL Awards Manager, Clifford A. Tooke, 6 Chelmer Avenue, Rayleigh, Essex, SS6 7TB England. In the past, all these Awards have been issued on a "heard" basis, but new printed Awards are now available for heard or worked confirmations. Here is data on three more of their Awards.

VHF County Award: For working/hearing 10 Counties (English) on VHF. Stickers for 20, 30, 40, 50, 60, and 70 Counties.

5 Band DXCC Award: For working/hearing 100 Countries on 5 bands (500 contacts in all).

Short Wave Broadcast DX Award: Available to any BC listener for verified reception of Short-Wave Broadcast stations in all 6 continents with the number of Countries needed in each continent per this list:

No. of Countries in:	Europe	Africa	Asia	N.A.	S.A.	Oceania	Total
Class 1	35	40	35	12	10	8	= 140
Class 2	30	30	27	10	7	6	= 110
Class 3	25	22	18	7	5	3	= 80
Class 4	17	15	10	4	3	1	= 50

The 4 Awards will be issued in different colors.

Notes

Although we tend to blame everything on our postal service, this time apparently our printer lost most of Dave's letter in my March column. So I repeat: A nice letter from Dave, W6CCM to say that he is just about out of the Record Map Books, so may I suggest that you send s.a.s.e. to Dave, W6CCM at Box 146, Lakeside, California 92040 and request information on them and his Mobile QSL Bureau. Oh Yes, Dave is still working on the "Who's Who in Counters".

Yes, a QSL Clearing House is also operated by Robert C. Schmarder, WA2AEA, 4 Pinewood Circle, Corning, N.Y. 14830. Remember these bureaus are for County Hunters only.

Better yet, get even more data on the bureaus, QSL cards for County Hunters and much more data by sending 46¢ in stamps to MARAC, 2907 West 98th Street, Leawood, Kansas 66206 (That QTH is Walter Allen, W0DG). No SAE required.

The SSB County Hunters meet daily starting early morning until the band goes out on 14336. At times moving for short skip to 7243 and evenings on 3943.

The CW County Hunters meet Mondays of 3575, at 2400Z, Wednesdays 2300Z on 7055, Saturdays 1400Z and 2000Z on 14070 and Sundays 1430Z on 7055. They also have a CW CH Bureau and print a monthly CW *CH Newsletter*. For details send a s.a.s.e. to: Jim Hoffman, K1ZFQ, 42 Gresham Street, Milford, Conn. 06460. The 1978 CW CH Contest is July 29 to 31, see Contest Calendar by Frank Anzalone, W1WY for details.

Thank you, write and tell me, How was your month?

73, Ed., W2GT.

Fraser Valley DX Club Award

ISWL VHF (English) County Award

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

The first really big "kick" in the new sunspot cycle, Cycle 21, has finally taken place. The Swiss Federal Observatory at Zurich reports a mean sunspot number of 89.8 for February, 1978. This is the highest level of monthly mean solar activity reported in over seven years.

This surge in solar activity results in a *smoothed* sunspot number of 33, centered on August, 1977. The growth of a sunspot cycle is measured by the *smoothed* sunspot number. This number is derived monthly by averaging monthly mean values over a 12-month period.

A smoothed sunspot number in the range from the mid-to-upper 60's is predicted for June, 1978.

The Swiss Federal Observatory also reported the following definitive monthly mean sunspot numbers for 1977.

Monthly Mean Sunspot Numbers-1977

Jan.	16.4	July	21.4
Feb.	23.1	Aug.	30.1
Mar.	8.7	Sept.	44.0
Apr.	12.9	Oct.	43.8
May	18.6	Nov.	29.1
June	38.5	Dec.	43.2

The highest daily sunspot number recorded during 1977 was 75 on December 10. There were 25 days during 1977 when the sun's face was completely clear of spots. The annual mean for 1977 was 27.5, which is slightly more than twice the annual mean recorded during 1976, the year of minimum sunspot activity.

The progress of Cycle 21, since its inception in March, 1976, can be seen from the following smoothed sunspot numbers which have been recorded so far. Values predicted for the remainder of 1978 are also shown.

Sunspot Cycle 21 Smoothed Sunspot Numbers

Month	*1976*	*1977*	*1978*
Jan.	—	17	51*
Feb.	—	18	54*
March	12	20	57*
April	13	22	60*
May	12	24	63*
June	12	26	66*
July	13	29	68*
Aug.	14	33	70*
Sept.	14	37*	72*
Oct.	14	40*	73*
Nov.	14	44*	74*
Dec.	15	47*	75*

* Predicted Values

*11307 Clara St., Silver Spring, MD 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For June, 1978

Propagation Index	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 1, 11, 23, 28	A	A	B	C
High Normal: 4, 8-9, 12, 18, 21-22, 24, 27	A	B	C	C-D
Low Normal: 2-3, 5, 7, 10, 16-17, 20, 26, 29-30	B	C	D	D-E
Below Normal: 6, 13-15, 19, 25	C	D	D-E	E
Disturbed: None	C-E	D-E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and s9+30 dB., with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and 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 band opening for any day of the month. For example, an opening shown in the charts with a propagation index of 3 will be excellent (A) on June 1st, fair (C) on the 2nd and 3rd, good (B) on the 4th, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD. 20902.

June's Forecast

With a moderate level of solar activity expected this summer, DX conditions should be considerably better than they have been for the past several summer seasons.

Despite a seasonal decrease in DX propagation on *10* meters, some fairly good openings should be possible during June to southern and tropical areas. Expect the band to peak for DX openings during the late afternoon hours.

The best daytime DX band during June should be *15* meters. Worldwide openings should be possible, but conditions will be best towards southern and tropical areas. Expect the band to peak for DX signals during the late afternoon and early evening hours. Due to the increase in solar activity, DX should be possible on this band well into the evening hours.

While DX openings to one area of the world or another are forecast almost around-the-clock on *20* meters, optimum conditions are expected during the early evening hours, with good conditions throughout the entire period of darkness. During June and the summer months, expect *20* meters to be the best DX band during the nighttime hours. This also results from the increase in solar activity, and while it may take some getting used to, the signals will be there on *20* meters from sundown to sunrise, from all areas of the world, and often with exceptionally strong signal levels!

With fewer hours of darkness and a sharp seasonal increase expected in the level of static, DX conditions on *40* meters are not expected to be as good during June as they were earlier this year. Nevertheless, the band should open to many parts of the world from shortly before sunset and remain open to just after sunrise, often with exceptionally strong signals. This should be a good DX backup band to *20* meters during most of the period of darkness.

The shorter hours of darkness and seasonally high static levels are expected to adversely affect DX propagation on both the *80* and *160* meter bands during June and the summer months. DX openings to some areas of the world are forecast for *80* meters during the hours of darkness, but signals will often be weak and noisy. Not much DX expected on *160* meters until the fall, but an occasional opening may be possible during the hours of darkness.

Plenty of good *short-skip* openings are expected on the h.f. bands during the month. For distances less than 250 miles, try *80* meters during the day and *160* meters at night. For openings between 250 and 750 miles, *40* meters should be best during the day and *80* meters at night. *Twenty* meters should be optimum for openings during the day between 750 and 1300 miles, with *40* meters best from sundown to Midnight and *80* meters from Midnight to sunrise. Between distances of 1,300 and 2,300 miles, use *20* meters during the day and *40* meters at night. Frequent short-skip openings, resulting from sporadic-E propagation, are also expected on *10 and 15* meters over distances between approximately 600 and 1,300 miles. *Fifteen* meters should open over longer distances, up to 2,300 miles, during the afternoon hours.

This month's *CQ* Propagation Charts contain DX predictions for the period of June 15 through August 15, 1978. Short-skip Charts for June, for openings between 50 and 2,300 miles, and from Hawaii and Alaska, appeared in last month's column.

V.h.f. Ionospheric Openings

Sporadic-E propagation increases considerably during June and the summer months, and this is expected to result in fairly frequent *6* meter short-skip openings over a range of 1,000 to 1,400 miles. During periods of widespread and intense sporadic-E ionization, two-hop *6* meter openings may occasionally be possible up to distances of approximately 2,500 miles.

An occasional sporadic-E opening on *2* meters can occur, particularly when ionization is very intense, over distances between approximately 1,200 and 1,400 miles.

For the past two years there were several reports of trans-Atlantic *10* meter openings during the summer months, believed to have resulted from multi-hop sporadic-E propagation. It's likely that such openings will occur again this June and through the summer months, but they cannot be accurately predicted.

While sporadic-E propagation can occur at any time, and hence its name, it is most likely to take place between 10 a.m. and 2 p.m. and again between 6 and 10 p.m., local daylight time.

Meteors from the *Herculids* and *Scorpiids* showers are likely to enter the earth's atmosphere during the first half of June. Although classified as minor showers, some meteor-type propagation should be possible on the v.h.f. bands between June 3 and 5, when both showers are expected to peak in intensity.

Little auroral activity is expected during June, but some may be possible when h.f. conditions are BELOW NORMAL or DISTURBED. Check the "Last Minute Forecast" at the beginning of this column for those days during June that are expected to be in these categories. These are the days on which auroral and perhaps other types of unusual short-skip ionospheric propagation are most likely to occur on the v.h.f. bands.

New Trans-Equatorial VHF Propagation Record

With rising sunspot numbers a considerable improvement has already been reported in trans-equatorial openings. For example, LU8BF in Buenos Aires reports that the *6* meter band opened between Argentina and Brazil, Venezuela, Puerto Rico and other points in Central America and the Caribbean area on almost half the evenings last fall. Lucho runs only 75 watts s.s.b. on *6* meters, into a four-element Yagi antenna.

But the big news are the T.E. openings being reported on *2* meters for the first time. A new *2* meter DX record has been established between YV5ZZ in Venezuela and several stations in Argentina, the greatest distance spanned being just over 3,000 miles!

While there is usually a seasonal de-

cline in T.E. propagation during the summer months, some 6 and 2 meter openings may be possible during June. T.E. openings must cross the geomagnetic equator at or near a right angle, and the best time for such openings is between 8 and 11 p.m., local daylight time. Conditions favor openings into the southern countries of South America from the Central American and Caribbean areas in this hemisphere, as well as from the southern tier states of the USA. Openings can, however, extend into more northern states as well. Similar north-south openings occur in other areas of the world. Most openings occur on 6 meters, but more and more are being made on 2 meters as well, and some attempts are being made on 420 MHz. Many 2 meter T.E. propagation participants check 145.1 MHz nightly beginning at 0000 GMT for openings. This looks like another technical frontier in the field of telecommunications being opened by radio amateurs.

June 15–August 15, 1978
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

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

Time Zones: CDT & MDT (24-Hour Time)
CENTRAL USA TO:

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

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; **best times for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. 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) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days
Refer to the "Last Minute Forecast" at the beginning of this Propagation cloumn for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Time 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. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 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 10 db loss, it will lower by one level.

6. 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.

(Continued on page 86)

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

A few words to those of you who requested log forms, and are still waiting for them, or sent in 10 dollars for a year's subscription to *CQ*, and are still waiting for your first copy, or inquired about the certificate you won in last year's contest, and are still waiting for an answer.

Chances are that you did not address your communication in a separate envelope but included it in the same envelope with your contest log. These envelopes are *not* opened at the office but forwarded to the Committee members. It could be weeks before they get to see them, and additional weeks before your note gets sent back to the office. (If it doesn't get lost in the shuffle.)

So need I remind you to *never* include any extra communications with your contest log.

Requests for log forms should be sent separately to the office. Your subscription to the Circulation Department, of course. And if you've got any gripes about certificates and other contest matters, direct them to me, I've got a thick skin.

73 for now, Frank, W1WY

Michigan QSO Party

Two Periods GMT

1800 Sat. May 20 to 0300 Sun. May 21
1100 Sun. May 21 to 0200 Mon. May 22

This year's party is again sponsored by the Oak Park ARC. The same station may be worked on each band and mode, portables/mobiles in each county change. Contacts between Michigan stations are permitted for multiplier credit.

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

Scoring: For Michigan—One point for phone QSOs, 2 points if on c.w. Multiply total by states + countries + Michigan counties worked. KH6 and KL7 count as states, VE as a country.

Out-of-state—One point for phone, 2 points in on c.w., 5 points if its with Club station W8MB. Multiply total by Michigan counties worked. (max. 83)

VHF scoring same as above but add multiplier from each band for total multiplier. Oscar contacts are worth 5 points, repeater contacts not allowed.

Frequencies: C.W.—1810, 3540, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone—1815, 3905, 7280, 14280, 21380, 28580. VHF—50.125 and 145.025.

Awards: Certificates to top scorers in each state, country and Michigan county. There are also plaques and trophies for high Michigan score, out-of-state, VHF, and aggregate club score in Michigan. (Single operator only)

Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated.

A summary sheet is requested, showing the scoring and other pertinent information, and a signed declaration that rules and regulations have been observed.

Results will be mailed to all entries. Mailing deadline is June 30th to: Mark Shaw, K8ED, 3810 Woodman, Troy, Mich. 48084

*14 Sherwood Rd., Stamford, Conn. 06905

Calendar of Events

May	20-22	Michigan QSO Party
May	27-28	Franco Countries Contest
June *	2-5	CHC/FHC/HTH QSO Party
June	3-4	Minnesota QSO Party
June	3-4	6 Meter SMIRK QSO Party
June	3-4	VE - 10 Contest
June	10-11	ARRL VHF QSO Party
June	18	WAB LF C.W. Contest
June	17-18	West Virginia QSO Party
June	17-18	All Asian Phone Contest
June	24-25	ARRL Field Day
July	1-2	Venezuelan Phone Contest
July	1-2	SEVEN Land QSO Party
July	8-9	Radiosport Competition
July	15-16	VHF Space Net Contest
July	15-16	Ten - Ten Net QSO Party
July	22-24	Rhode Island QSO Party
July	23	WAB VHF Contest
July	29-30	Venezuela C.W. Contest
July	29-31	County Hunters C.W. Contest
Aug.	19-20	Can - Am Contest
Aug.	19-20	S.A.R.T.G. RTTY Contest
Aug.	26-27	All Asian C.W. Contest
Sept.	23-24	Delta QSO Party
Oct.	**28-29**	**CQ WW DX Phone Contest**
Nov.	**25-26**	**CQ WW DX C.W. Contest**

* Covered last month.

Michigan Achievement Award

All contacts with Michigan stations made during Michigan Week, May 20–27, as well as Party QSOs, may be used for this award if the following requirements are fulfilled.

1. Michigan stations—Submit a log with information, name and address of station worked if possible, of 15 or more contacts with out-of-state or DX stations, with information about Michigan.

2. Out-of-state including Canada—Submit a log with information, name and address if possible, of at least 5 Michigan stations contacted, who related facts to him about Michigan.

3. DX stations—Work at least one Michigan station, with log information, name and address, and relate fact about Michigan given him by the station worked.

4. Only contacts made during Michigan Week, May 20–27 are valid for this award.

Applications for certificates must be postmarked no later than July 1st 1978 and mailed to: Governor William Milliken, Lansing, Mich. 48902

Franco Countries Contest

C.W.-0000-2400 GMT Sat. May 27
S.S.B.-0000-2400 GMT Sun. May 28

Activity will be between Franco countries and non-French countries.

Only 18 hours out of the 24 hour contest period can be used for scoring by single operator stations.

The following areas are identified as Franco countries.

(a) 17 French provinces of the DPF Award. (AL, AP, AV, BG, BT, CP, FC, FT, GC, IF, LG, ND, NM, TR, PT, PV, VP. Identified by suffix after the call.)

(b) 4 overseas French departments and 11 territories. (FG, FM, FR, FY and FB8W, FB8X, FB8Y, FB8Z, FH, FK, FO, FO Clipperton, FP, FU/YJ, FW)

(c) 22 other countries of the DUF Award. (3A, C3, DA1, 2, French army in DL, CN, TJ, TL, TN, TR, TT, TU, TY, TZ, XT, J2, 3V, 3X, 5R, 5U, 5V, 6W, 7X)

(d) 11 other Franco countries. (ON, LX, HB, 4U, HH, VE2, OD, 3B8, 9U, 9X, 9Q.)

Exchange: RS(T) plus QSO number starting with 001.

Points: Two points per contact between stations on the same continent, 4 points if on different continents.

Multiplier: Each of the above (a, b, c, d) worked on each band.

Final score: Sum of QSO points X sum of multiplier from each band.

Awards: Certificates for winners in each continent, both single and multi operator, and to the three top overall scores.

Send your log and summary sheet to: REF "Francophone" Test, Square Tudaine 2, 75009 Paris, France.

Minnesota QSO Party

Starts: 1800 GMT Saturday, June 3
Ends: 2359 GMT Sunday, June 4

The Heartland A.R.C. is again sponsoring this party. Phone and c.w. are one contest. The same station may be worked on each band and each mode. Only one transmitter may be used at any one time, and crossband contacts are not allowed. Novices compete with Novices, and Techs with Techs.

Exchange: RS(T) and QTH. County for Minnesota, ARRL section or country for others. Novice and Tech stations must identify their license class.

Scoring: One point for phone QSOs, 2 points if it's on c.w., and 5 points if it's a Novice or Tech. QSOs with club station WBØTTZ are worth 10 points on each band worked.

Minnesota stations multiply total QSO points by ARRL sections and DX countries worked. Others, QSO points by number of Minnesota counties worked. (max. of 87)

Frequencies: C.W.—35 kHz up from bottom of each band. Phone—3910, 7235, 14280, 21365, 28525. Novice & Tech.—3725, 7125, 21125, 28125. Avoid net frequencies. (No freq. indicated in this year's announcement. Above are those used last year.)

Awards: Certificates to state, DX countries, Novice and Tech. high scorers. County awards to Minn. stations having 10 or more QSOs.

Stations making 50 or more contacts must include a check sheet for each band and mode used. Usual disqualification criteria will be observed.

Include a s.a.s.e. with your log and send to: Heartland A. R. C., c/o Steve Scott, WDØBPE, 801 6th Street, North Staples, Minn. 56479. Mailing deadline is June 30th.

VE–10 Contest

Starts: 0000 GMT Saturday, June 3
Ends: 2400 GMT Sunday, June 4

This is a new one sponsored by the Agassiz Chapter of the Ten-X International Net and the Tetrahedral Contest Circle of Manitoba and Saskatchewan.

All the action of course will be on 28 MHz. The same station can be worked on c.w., s.s.b. and Oscar with down-link on 28 MHz.

Canadians work all comers as well as each other, and vice versa.

Exchange: RS(T) and QTH. Provinces for VE's, ITU Regions for VEØ's. All others use state or country.

Scoring: Sum of QSO's X multiplier areas. (Provinces, ITU Regions, states and countries)

No cross-mode contacts allowed, and check sheets for all stations making 100 or more contacts.

There are awards for all top scoring stations.

Mailing deadline for entries is July 1st to:
Derrick Belbas, VE4VV, 505 Regent Ave. E, Winnipeg, Manatoba, R2C OE1, Canada.

6 Meter "SMIRK" QSO Party

Starts: 0500 GMT Saturday, June 3
Ends: 0500 GMT Sunday, June 4

The party is open to all but only scores of SMIRK members are eligible for awards.

Exchange: Call, state or country and SMIRK number if you are a member.

Scoring: Number of contacts multiplied by state + countries worked for final score.

It's not necessary to submit a log, just a summary sheet showing the scoring. A copy of your log may be requested later however.

Certificates to the winners in each state and each country. The SMIRK Trophy goes to the overall high scorer.

Include a s.a.s.e. for a copy of the Newsletter with the party results.

Mailing deadline is July 1st to: Ray Clark, K5ZMS, 7158 Stone Fence Dr., San Antonio, Texas 78227

Worked All Britain Contests

From 0900 to 2100 GMT
June 18 and July 27

We only have a brief outline of this activity. The L.F. 1.8, 3.5 and 7. MHz c.w. section is on Sunday, June 18th. The v.h.f. 30 MHz and above, all modes, is on Sunday, July 23rd. There was a l.f. phone section but that took place on May 7th.

Each contact is worth 5 points. The multiplier is determined by the WAB areas worked on each band.

We do not have a list of the counties but it is assumed that each station will identify his county.

The contest is also open to s.w.l.s,

using the same scoring as above.

A s.a.e. and a IRC will get you full details. Logs and requests go to: WAB Contest Manager, G3TWX, 13 Gannet Close, Haverhill, Suffolk CB9 OJL, England.

West Virginia QSO Party

Starts: 2300 GMT Saturday, June 17
Ends: 2300 GMT Sunday, June 18

This one is sponsored by the West Virginia State Amateur Radio Council. There are no time limits, the same station may be worked once on each band for QSO points, and W. Va. stations may work each other.

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

Scoring: W. Va. stations multiply total QSOs by (W. Va. counties + states + countries) worked. Multiply total by power multiplier if any.

Out-of-state multiply total W. Va. QSOs by W. Va. counties worked. (max. of 55) And multiply total by power if any.

There is a power multiplier of 1.5 for stations using 200 watts or less input.

Frequencies: C.W.—35 kHz inside each c.w. band. Phone—10 kHz inside "General" portion of each phone band.

Awards: To the 1st, 2nd and 3rd highest scorers in W. Va. and top scores in each state and each country. (Single operator only)

Logs must be received no later than July 15th and go to West Virginia QSO Party, P.O. Box 299, Dunbar, West Virginia 25064

All Asian DX Contest

Phone: June 17-18 C.W.: Aug. 26-27
Starts: 1000 GMT Saturday
Ends: 1600 GMT Sunday

This is the 19th year the JARL has run this contest. The exchange is between Asian countries and the rest of the world.

Classifications: Single operator, single and all band. Multi-operator, single transmitter, all band only. (no multi transmitter)

Exchange: For OM's, RS(T) plus age of operator. For YL's RS(T) plus 00.

Scoring: One point per QSO. Asians use non-Asian countries for their multiplier. (ARRL DXCC list) Non-Asians use prefixes of Asian countries worked for their multiplier. (CQ WPX list) Note: Ogasawara JD1 (Bobin & Volcano) are in Asia. Minamitori Shima JD1 (Marcus) is in Asia. (KA contacts do not count)

Final Score: Total QSOs from each band times the sum of the multiplier from each band.

Awards: To the highest scorers, both phone and c.w. as follows: Single operator, all band in each country and

1977 All Asian Phone Results

All Band

N6RT	**85,347**
W6OKK	84,560
W7OX	**62,100**
W6BIP	48,668
N7XX	34,967
N6AW	23,668
N7AM	6,321

21 MHz

WA6DKF	**2,646**

14 MHz

W6RJ	**24,768**
K1ZX	3,007
N8JW	1,034
WA4LZR	777
WB6BKN	399
LU1BAR/W3	108
WB9TDR	96

7 MHz

W6PAA	**11,190**
K7UR	1,197

3.5 MHz

WA6BMV	**84**

Multi Op.

W6NLZ	**125,204**
W6RDF	117,465

All Band

KH6IJ	**107,094**
WA0JRZ/KG6	**21,452**
KM6FC	**18,044**
VE2AQS/TG9	**21,197**

14 MHz

VA7BGK	**14,022**
VE1MX	704
HI8LC	**153**

each USA call area, up to the 5th rank where returns justify. Single band and multi-operator entries, in each country only. Continental leaders will receive a medal.

Logs: Keep all times in GMT, fill in country or prefix column only first time it is worked, and use a separate sheet for each band. A summary sheet showing the scoring and other information and a signed declaration is also requested.

Disqualification regulations are strictly enforced so check your log carefully. Non-Asians use prefixes for their multiplier, not countries. Club stations are classed as multi-operator. Each operator of a multi station will give his age in the exchange.

Logs must be *received* no later than Sept. 30th for phone entries and Nov. 30th for the c.w. section. Logs go to: J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan. Include an IRC and s.a.e. for copy of results.

Asian Country List
A4, A51, A6, A7, A9, AP, BV, BY, CR9, EP, HL/HM, HS, HZ/7Z, JA/JE/JF/JH/JI/JJ/JR, JD1, JT, JY, OD5, S21, TA, UA/UK/UV/UW9-Ø, UD6/UK6C-D-K, UF6/UK6F-O-Q-V, UG6/UK6G, UH8/UK8H, UI8/UK8A-G-I-L-O-T-Z, UJ8/UK8J-R, UL7/UK7, UM8/UK8M-N, VS6, VS9M/8Q6, VU, VU (Andaman & Nicobar) VU (Laccadive) XU, XV, XW8, XZ; YA, YI, YK, ZC4/5B4, IS (Spratly) 4S7, 4W,

1977 YV Contest Plaque Winners

	SSB	CW
Single Op. One Band	I2TTL	LZ1WI
Single Op. All Band	HI8LC	G3ESF
Multi-Operator	UK2GKW	SP9KRT

Medal Winners

Single Op. One Band	EA8OE	——
Single Op. All Band	YV5ADZ/OA4	6W8EX
Single Op. All Band	——	WA3MYA
Multi-Operator	YU1ELM	——
Multi-Operator	TG9HZ	UK4FAV
S.W.L.	NL-4276	DM8110/L

USA Certificate Winners

Single Op. One Band	——	N4NX
Single Op. One Band	——	W3VW
Single Op. One Band	——	WB2CKO
Single Op. All Band	N1NN	——
Single Op. All Band	K4IEX	——

Many high scorers were not certificate winners because they did not fulfill the requirements of working 15 YV's and 10 DX countries.

4X/4Z, 70 (S. Yemen) 70 (Kanaran) 8Z4, 9K2, 9M2, 9N1, 9V1.

Medals: To the highest scoring station in each of the following areas. North America, Central America, South America, Caribbean, Bolivarian Countries, Europe, Africa, Asia, Oceania, and s.w.l.

Certificates: To all stations having contacted the following totals. (a) 15 YV's plus 10 different countries for stations in the Caribbean, Bolivarian, North, Central and South America. (b) 10 YV's plus 10 countries for Europe and Africa. (c) 5 YV's plus 10 countries for Asia and Oceania. (d) S.w.l. report 50 complete QSO's including at least 10 YV's. (Both exchange must be reported.)

Log times in GMT, Indicate multiplier only first time it is worked on each band, and use a separate sheet for each band. Include a summary sheet showing the scoring, category and etc., the usual signed declaration, and your name and address in Block Letters.

Disqualification regulations for duplicate contacts in excess of 3%, logging irregularities and other violations will be strictly enforced.

A remittance of $2.00 or its equivalent in IRC's is requested with each certificate application. (Repeat certificate winners will be issued a colorful endorsement sticker).

Mailing deadline is Sept. 15th for phone, and Oct. 15th for c.w. entries. Mail to: Radio Club Venezolano, P.O. Box 2285, Caracas 101, Venezuela.

Venezuelan Contest

Phone: July 1-2 C.W.: July 29-30
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is a world wide type contest, therefore work other countries as well as YV stations.

There are four categories, single operator, single and all band, and multi-operator, single and multi transmitter. (also s.w.l.) Use all bands, 3.5 thru 28 MHz.

Exchange: RS(T) report plus a 3 figure QSO number starting with 001.

Points: Contacts between stations on different countries 2 points. Between stations in the same country zero (0) points but permitted for multiplier credit.

Multiplier: One for each country, each YV call district, and each USA call district worked on each band.

Final Score: Total QSO points from all bands multiplied by the sum of different countries, YV call areas, and USA call areas worked on each band.

Awards: There are a large variety of awards as follows:

Plaques: To the top scorers in each of the 4 categories.

CQ Reviews *(from page 54)*

offer soon. In the interim, keep in mind that this is another example of Cowan reminding you of what your League has done for you. Or should I have said to You? **Richard A. Cowan, WA2LRO**

Base Loading *(from page 25)*

attributes worthy of attention. Otherwise, operation of the antenna has proven straightforward.

Ah yes, you say, but does it *work*? Well, I can only speak with reference to my goal. Installation was completed with an upcoming European DX contest in mind and, in spite of the difficulties always experienced here during busy contests with overload of the receiver by local stations, several Europeans were worked that weekend on twenty meters. A WAC certificate thereby became the first award of substance to grace the shack wall. Never mind the bemused QSL from one German ham, returning my IRCs with the suggestion that I save them for some *really* rare DX. Or that I recently worked the Azores on forty meters for 'Europe' on that band (I think conditions were deteriorating fast by the time he came back with something that approximated my call).

Success! ■

TRS-80 *(from page 30)*

The Bottom Line

The Radio Shack TRS-80 Microcomputer is an impressive system at a low cost. There are some minor shortcomings with the base system. However these may be of no consequence to some potential users. It is important for anyone considering the purchase of a small computer to consider each unit with respect to *their* application. For those unable to live with these limitations, options are available which may alleviate their concern. There is little doubt that Radio Shack is a serious entry into the microcomputer market, and considering their short involvement in this area they have produced a product worth consideration by anyone interested in the purchase of a small computer. The company has placed its considerable resources behind continued support in service and product development. With the demonstrated performance of the TRS-80, it is reasonable to expect bigger and better things from the Tandy organization in the future. ■

Ham-M *(from page 36)*

train and position indicating potentiometer, are identical and interchangeable with those in the Ham-III.

CDE rates the Tailtwister for 28 square feet of antenna. While I can not argue that the Tailtwister could not hold that large an antenna, it is my opinion that the Tailtwister will never turn an array half that size in a small breeze. The Tailtwister delivers exactly the same turning torque as the Ham-M. If your Ham-M has trouble turning your array, the Tailtwister will do no better. However, it should hold up better than the Ham-M, II or III for large installations due to the increased case and brake strength of the Tailtwister.

Accuracy of the Ham-M Indicator

During this work I had the occasion to check the accuracy of the position indicating system of my Ham-M rotors. CDE specifies an accuracy of 5° for the Ham-M. Through laboratory measurement I have determined that the meter is accurate to 5°. There is an additional 3.5° worst-case error in the circuit accuracy. Therefore, there is a total maximum error of 8.5°. While this exceeds CDE's claims, it is more than adequate for all terrestrial amateur use.

References

1. A.B. White, K9CW, "A Delayed Brake Release for the Ham-II." *QST*, August 1977, pp. 14-16.

2. G. Ongum, "Ham-M Rotator Brake Modification." *QST*, February 1976, p. 45.

3. W.J. Short, WB4TBO, "Upgrade Your Ham-M With Delayed Braking." *QST*, September 1976, p. 40.

4. "Autobrake" by Kanpp Electronics, Inc., Box 43, Wheaton IL 60187.

Synthesizer Tricks *(from page 44)*

per millivolt. It is best to make several measurements, and take the average.

The second step is to apply a known d.c. voltage to the modulator, measuring the change in loop voltage as it is applied. Depending on modulation circuit design, the d.c. voltage may be applied directly to the modulation lead, or through a voltage divider, or it may be secured by adding a resistor across a bias circuit, thereby changing the voltage by a measurable amount. The modulation sensitivity is determined from these two measurements by proportion.

The final step is to measure the a.c. modulation voltage applied, at the same point the d.c. change was applied or measured. The input voltage to the modulator should be sufficient to cause limiter saturation. Proportion gives the peak deviation.

The Synthesized Transceiver as Test Equipment

A synthesized rig generates a stable high accuracy r.f. signal over a band of frequencies. These characteristics are major requirements of a whole family of test equipment. This immediately suggests—use your synthesized transceiver in test set-ups.

A simple approach to this is sketched in fig. 8. The output of the transceiver is reduced to appropriate level by a fixed attenuator, which also serves to protect the transceiver circuits. This reduced level signal is mixed with the output of a crystal controlled oscillator to produce output at the desired range. The oscillator could be a PLL type, with a single crystal. For example, a v.c.o. covering the range of 116-146 MHz, using a one or two MHz reference, would give complete coverage from audio to h.f. typically with a signal available each 5 kHz. ■

Heathkit *(from page 47)*

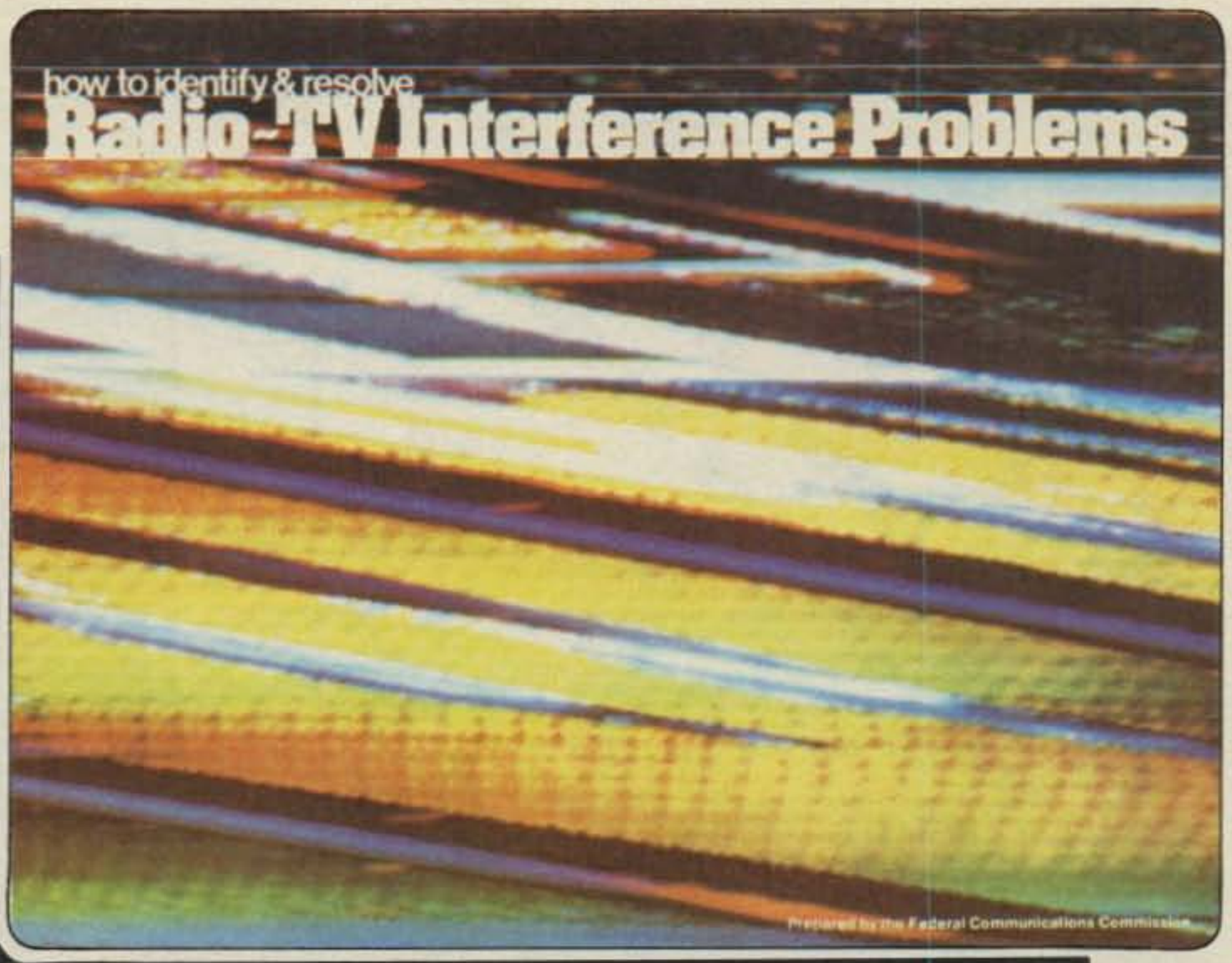
The instrument is incredibly versatile. The "Using the Bridge" section in the construction manual was quite an education for me and enumeration of all of its uses, subtleties and sub-subtleties would require an exposition in itself.

Summary

The Heathkit Series 5280 "kit of kits" instrument package is a worthwhile investment for any amateur looking to build a basic group of test equipment gear. The total price of the kits, including the power supply is $214.70. Careful thought will convince most amateurs that this is a small price to pay for a functional and reliable set of bench gear (not even considering the satisfaction gained by building it with your own hands.)

If you are interested write to Heath Co. at Benton Harbor MI 49022.

Let the FCC's own Radio-TV Interference booklet be your club's first line of defense on the TVI front.



For the first time here's an easy-to-read guide showing all of the classic TVI symptoms and their cures.

Use it as a "handout" by the local TVI committee, defuse tricky "irate neighbor" situations, help the local TV repair shop root out RFI/TVI problems in your area.

This top-quality booklet (40 pages 10¼ x 8") is available in quantities of 12 at $9.00 plus $1.00 shipping. Single copies are available for $1.25, postpaid. Note that the FCC offers the self-same booklet for $1.50 per copy with no quantity discount.

Prepared by the Field Operations Bureau of the Federal Communications Commission and reprinted at low cost by the Publishers of CQ, the booklet offers guidelines for the amateur, non-amateur and CBer alike in dealing with RFI and TVI. A dozen full-color illustrations show most interference patterns with descriptions and solutions for each problem.

The booklet should be on your "must" list for reading and your "do" list to help eliminate the problem. Order a dozen copies today!

CQ
14 Vanderventer Ave.
Port Washington, N.Y. 11050

12 copies $9.00
plus $1.00 shipping

☐ Enclosed is $10 for each 12 copies.
☐ Enclosed is $1.25 for each single copy.

Quantity ordered _____
Amount enclosed _____

Single copies $1.25 Postpaid.

Check One: ☐ Check ☐ Money Order
☐ Master Charge ☐ Bank Americard

My account number is ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Name _____ Call _____

Address _____

City _____ State _____ Zip _____

Propagation *(from page 78)*

Time Zone: PDT (24-Hour Time)
WESTERN USA TO:

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

McMurdo Sound, Antarctica	*Nil*	17-21 (1)	16-18 (1) 18-19 (2) 19-24 (3) 24-03 (2) 03-07 (1)	00-06 (1)

* Indicates best time for eighty meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2), or higher.

DX *(from page 73)*

OE6DK/YK—via OE6DK or bureau
PY7AAI/0—via PY7AZQ
SM0GD/S2—via SM3CXS
ST2SA—via DJ9ZB
SV1IT—via Box 1442, Athens, Greece
VE7CQX/SU—via VE1RU
VO3CC—via VØ1AA
WA4UAZ/HC1—via WA4QMQ
XT2AE—via DJ9KR, U. Bihlmayer, Schulweg 16, D-7451 Rangendingen
WB5LBJ/DU6—via K7LAY
ZB2DV—via G4EMR
ZD7SD—Box 16, Saint Helena, South Atlantic
ZS3AV—Box 11359, Windhoek, South West Africa
ZS6ABO—P.O. Box 19456, Pretoria, Tvl, 0117 R.S.A.
ZW5NW—Box 512, Asuncion, Paraguay
3B8CV—John Strtfull, Audit. Department, Port. Louis, Mauritius
3D6BP—via K1AGB
5N2NAS—via WB9MFC
5V7AR—via F6ABV
7P8BE—via VE3FXT
7P8BG—via VE3EUP
8P6FX—via WA4RRB
9J2CJ—via DK6XF

73, K4IIF and PAØTO

Novice *(from page 68)*

The Novice license was previously only available to those who had never held any class of amateur license. This restriction was removed several years ago and the Novice license is now available to anyone who does not currently hold any other class of FCC-issued amateur license. There must be thousands of people who still think they are not eligible to apply for the Novice license because they previously held a Novice, Technician, Conditional, General, Advanced or Extra class license.

When the FCC rules were changed to permit previous Novices (who had not upgraded) to apply again to become Novices, there was a delay of a year (or more) required between a person holding two concurrent Novice licenses. This delay has been eliminated and one can again apply for a Novice license as soon as the present Novice license term expires. You cannot renew an existing Novice license but you can get successive Novice licenses each 2 years, with a different callsign each time.

The term of the Novice license was one year for most of the past 27 years and this was often not long enough for Novices to upgrade to higher licenses. The present 2-year Novice license term provide adequate time for Novices to upgrade in license, if they make reasonable efforts. A few of the staions I've worked recently on the Novice bands are: WB1ALW Andy @ Meriden, Conn., WA2PYY Bob @ Bellerose, N. Y., WB3JUI Tom @ Wilmington, Delaware, WD4CZK Rick @ Huntsville, Ala., WD5GDA Jeff @ Starkville, Miss., WD6CSM Hessel @ Glendale, Cal., WB7SKO Kelly @ Port Ludlow, Wash., WD8ODD Richard @ Stow, Ohio, WD9DBY Bill @ Spencer, Ind.,

WDBKX Dennis @ Northwood, Iowa.

I hope to contact you on a Novice band.

I would be glad to receive a good black-and-white picture of you in your station for possible use in a future CQ Novice column. It is important to include information about yourself and your Novice activities. Include SASE if your picture must be returned.

73, de Bill, W6DDB

Math's Notes *(from page 64)*

after the input pulse drops. Similarly, the circuit of fig. 3b is a pulse "reducer" since the output starts after the input has been applied.

This same basic circuit can also be used to make one-shot or single pulse generators. Fig. 4A shows how this is accomplished with only the addition of a SPDT push button switch. In the non-pressed position, the capacitor is charged to Vcc. When the button is then pressed, the capacitor switches the inverter and begins to discharge through the resistor. At some point the voltage then drops to a point where the inverter again switches. The only restraint on this circuit is that the button must be held for a period of time longer than the length of the output pulse desired.

Where this cannot be done, such as for long duration output pulses, a slight re-arrangement of the switch connections neatly solves the problem. Now, the output pulse only begins when the switch is released but is then completely independent of "push time".

For instances where logic signals must be employed instead of switches, the circuit of fig. 5 will perform the same function. Here a 74CO8 and gate is connected into a one-shot configuration that operates as follows: with the input low, point A is high but since both inputs to the AND gate must be high for the output to be high, the output is low. As soon as the input goes high the gate switches since the capacitor keeps the other input high even though point A has gone low. Only when the capacitor discharges through the resistor does the output again go low.

The high input impedance can also be utilized to easily sense rise or fall times. Fig. 6 shows how this is accomplished. An RC network connected to an inverter input forms a simple differentiate circuit which produces positive pulses when a rise time is applied and negative pulses at the fall time of an input. A diode assures that the negative pulses are short circuited. To sense the fall time, one has only to place another inverter before the RC network.

Although we have limited this discussion to inverters and gates, it should be realized that the entire CMOS family of logic elements can be used in much the same way. The very high input impedances can easily be used to fabricate all kinds of unusual sensing arrangements. In addition, because of the self-limiting nature of CMOS, one need not be afraid to hook-up other test circuits. You really can't blow out these gates even if you short the outputs, or connect inputs to Vcc or ground. Furthermore, switches, relays and standard bipolar transistors can be used to interface with CMOS as long as the same Vcc line is used. Fig. 7, in conclusion, shows both input and output bipolar hookups.

73, Irwin Math, WA2NDM

In Focus *(from page 63)*

will publish your comments for the benefit of others.

By the time this column is published, Dayton's Hamvention will have come and gone. However, I expect to be on hand for the SSTV Seminar and all the meetings, so count on In Focus to bring you news and lots of pictures of the Dayton "do"!

Please keep those letters and pictures coming my way. This is *your* SSTV column and *your* contributions are what keep it going. Same old address, 2112 Turk Hill Road, Fairport, N.Y. 14450.

Regards, Bill DeWitt, W2DD

Antennas *(from page 60)*

"Well, I saw a fine article in *CQ-ham radio,* the Japanese amateur magazine a few months ago. It described a mini-loop antenna that is tunable to either 20 or 15 meters (fig. 4). What do you think of this?"

Pendergast gulped. "Well, my Japanese isn't very good. What's it all about?"

"All the dimensions are in millimeters", I replied. "It is a loop about half-wavelength in circumference for 15 meters. It is 1000 millimeters on a side, or one meter. That corresponds to 40 inches on a side. The antenna is voltage-fed at the bottom with the tuned circuit which can be adjusted from 15 to 20 meters.

"The diagonal dimensions of the loop are 60 inches. The loop is made up of four pieces of aluminum tubing about ⅜-inch in diameter. The ends of the tubing are flattened and bolted together. At the bottom feedpoint, the sections of tubing are attached to an insulating block. The cross-support arm is bamboo and the vertical support arm is wood.

"The tuning network is placed in a small box at the bottom of the loop, which is supported in a vertical position. The tuning capacitor is a split-stator job having an effective capacity of 75 pF. The three coils are made of one section of coil stock about 1¼ inches in diameter. L1 and L2 have 3 turns and L3 has 2 turns. The photo of fig. 5 should give you an idea of the network assembly.

"The capacitor is tuned for resonance either at 15 meters or 20 meters. For the 15 meter band, the operating bandwidth of the loop is about 200 kHz. and on 20 meters the bandwidth is about 100 kHz. So the little antenna should be peaked at the center of the portion of the band that you wish to use".

"What is the radiation pattern of the loop?", asked Pendergast.

"The pattern is at right angles to the plane of the loop. That is, a figure-8 pattern (similar to a dipole) in and out of the page. The builder of the antenna, JG1UEA, reports that it is better than a ground plane on 15 meters by two S-units. He has no comparison antenna for 20 meters, but has worked plenty of DX on that band".

"Looks good", said Pendergast. He paused, and then said, "Any information about treating bamboo to make it waterproof?"

"I'm glad you asked", I said. "I just got a note from VE2TH about that. Mike says that you can get an epoxy compound made by CIBA (and possibly others) called *Epoxy 502, Araldite 825 polyamide*. This resists weathering and protects the bamboo from the ultra-violet rays of the sun which tend to break down carbohydrates. He coats his bamboo with this, and while still wet, wraps the bamboo arm with fiberglass tape. He follows this up with a coat of liquid fiberglass. This makes an exceptionally strong bamboo pole for Quad construction. Finally, he puts on a final coat of fiberglass liquid with a bit of paraffin in it. This gives a glossy surface to the bamboo so that rain and ice don't tend to stick to it.

"He doesn't drill the bamboo pole for Quad wires. No, no. He makes up a sleeve which he passes over the wire at the point it crosses the bamboo. The sleeve is about six inches of polyethylene inner dielectric from a hunk of RG-8/U cable. He slips the sleeve over the Quad wire then attaches the sleeve to the bamboo pole with a wire wrap. He claims this construction has withstood the Canadian winters and winds of over 80 miles per hour!"

"Well, I doubt if you have to go into that detail with the little Japanese loop, but nothing is too sturdy for a full size Quad antenna. I hear that plenty of Quads came down this spring because of the bad weather in the east and mid-west. Perhaps the VE2TH bamboo arm treatment will help this vexing problem".

Pendergast gathered up his car keys and half-empty wine bottle.

"I must be on my way", he said. "Ten meters will open to Japan shortly and I want to be around for all the DX that will be booming in".

"*Sayonara*", I replied. "See you next month."

Announcements *(from page 6)*

mission: $2.00. For more info or reservations for commercial space, call (612) 933-2823.

• **West Huntington, W. Va.** – The Tri-State Amateur Radio Assn., (TARA), is sponsoring their annual Hamfest on Sunday, June 4, 1978. Doors open at 11:30 a.m. at the Camden Park, Rt. 60. Talk-in: W8VA/8 on 04/64, 16/76 and 34/94. For more info and tickets write: TARA, P.O. Box 1295, Huntington, W. Va. 25715.

• **Frederick, MD** – The Frederick Amateur Radio Club is sponsoring the Central Maryland Hamfest to be held on June 18, 1978, at the Frederick Fairgrounds. There will be prizes, exhibits, and demonstrations. For additional info contact: Mike Staley, New Market, MD 21774, (301) 865-5484. Talk-in on 146.52, 13/73.

• **Monroe, MI** – The Monroe County Amateur Radio Club will be holding their annual Swap and Shop on Sunday, June 11, 1978, at the Monroe County Community College, from 8:00 a.m. until 4:00 p.m., on Raisinville Rd. off 50. Talk-in on 146.13/73. $1.00 donation at the gate.

• **Manassas, VA** – The "Ole Virginia Hams", A.R.C. Inc., Annual Hamfest will be held on Sunday, June 4, 1978, at the Prince William County Fairgrounds located 1/2 mile south of Manassas, on Rt. 234. Gates open at 7 a.m. and 8 a.m. for general admission. Fantastic prizes again this year including a Drake TR4CW with R.I.T. and A.C. power supply. Admission is $3.00, under 12 free. Tailgating $2.00 per vehicle. For more info contact: Sam Lebowich, 9512 Sudley Manor Dr., Manassas, VA 22110. Talk-in on 146.37/146.97, 147.84/147.24, and CB channel 1.

• **Willow Springs, IL** – The officers and members of the Six Meter Club of Chicago, Inc., would like to announce their 21st Annual Hamfest to be held on Sunday, June 11, 1978, at the Santa Fe Park, 91st and Wolf Rd. Large swap row and many other goodies. Advance tickets from Val Hellwig, K9ZWV, 3420 South 60th Crt., Cicero, IL 60650. Talk-in on 146.94 FM or WR9ABC 37-97 (PL2A).

• **Granite City, IL** – The Annual Hamfest of the Egyptian Radio Club, W9AIU, will be held at their Club grounds on Sunday, June 11, 1978. For further info contact: The Egyptian Radio Club, Inc., Harry A. Turner, W9YZE, Hamfest Chairman, 1718 Worden Ave., Alton, IL 62002.

HAM SHOP

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Closing Date: The 10th day in the third month preceding date of publication. Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of CQ cannot vouch for the merchandise listed therein. Direct all correspondence and ad copy to: CQ Ham Shop, 14 Vanderventer Ave., Port Washington, New York 11050.

B & K test equipment. Free catalog. Free shipping. Dinosaur discounts. Spacetron-EF, 948 Prospect, Elmhurst, IL 60126.

FREE full color QSL card catalog. Card, Inc., Drawer P, Lexington, NC 27292.

QSL CARDS—Something completely different! Nothing close to it on the market! The "Cadillac" of QSLs! Samples: $1.00 (refundable with order) W5YI Print; Box no. 1171-E; Garland, Texas 75040.

MOBILE IGNITION SHIELDING provides more range with no noise. Available most USA engines, some imports. Free literature. Bonding straps on sale now. Estes Engineering, 930 Marine Drive, Port Angeles, Wash. 98362.

EZ DOES IT BEST. Deals, that is, on Yaesu, ICOM, Drake, Swan, Cushcraft, Larsen, KLM, Dentron, VHF Engineering, and Wilson. For new or used gear, call, see or write W0EZ, Bob Smith Electronics, 12 So. 21st St., Fort Dodge, IA 50501. 515/576-3886.

SOUND SWITCH: Trigger circuits by clapping hands, whishtling, etc., Control lamps, appliances or use as effective burglur alarm. Completely assembled, with microphone: Only $5.00. Michael Wagner, PO Box 3382-Q, Station 'B', Calgary T2M-4M1, Canada. (Guaranteed).

SELL: HW-7 w/a.c. $55, Hustler 4-BTV vertical w/75m and 100 ft. RG-8 $110 or best offer. WB2OPN, 914/928-6288.

COLLINS 30K-4 500 transmitter with 15 teletype, HT-32-B, NC-300, will trade for KWM-2, Grant Morris, 2324 21st Ave., Greeley, CO 80631.

FOR SALE: Hallicrafters FPM-300 MK-II xcvr with blower $350, you ship. Kyle Scott, WA1YRV, 1 Wentworth Ave., Turners Falls, Mass. 01376.

ROHN TOWERS—Special sale—25G sections $33.86 each freight collect—48' fold over tower complete freight prepaid $471.50 each. 30 section 25G freight prepaid $1074.15. National Rohn Distributor—Hill Radio—2503 G.E. Road, Bloomington, IL 61701. Ph. 309/633-2141.

FOR SALE: Motorola VHF-FM xmtr/rcvr combo 50-60W base for 2mtr repeater. Model B53AKB1110B, in 6 ft. rack, all service manuals, excellent, $150 FOB. K0MAH, 1741 South 6th, Brainerd, MN 56401, 218/829-1329.

WANTED: Heathkit oscilloscope OL-1 schematic. Robert Dole, Route 1, Almena, KS 67622.

LOW POWER CLUB: Join QRP A.R.C.—W8JKB Sect'y, 2359 Woodford Street, Toledo, Ohio 43605.

CLUB BADGES: 1 1/4 x 3 1/4, 3 lines, first name, call club or slogan $1.25 each, Blue, Black, Red with White letters or reverse. Arnold Linzner, 2041 Linden St., Ridgewood, NY 11227.

REPLACE rusted antenna bolts with stainless steel bolts. Small quantities, free catalog. Elwick, Dept. 268, 230 Woods Lane, Somerdale, NJ 08083.

O'SCOPE Heath 104541, new factory calibrated, $275. Call (404) 549-2849, WA4FNV.

SENCORE CB 42 analyzer. Complete and delivered $500. Eric Lee Elliott, P.O. Box 1381/RR 5, Box 105, Effingham, IL 62401. (217) 347-7650.

NEEDED: Donations of working ham equipment to start school radio club. WB2TAW, 147 Congress Street, Jersey City, New Jersey 07307.

RADIO Museum now open. Free admission, 15,000 pieces of equipment from 1850 telegraph instruments to amateur and commercial transmitters of the 1920s. Amateur station W2AN. Write for information: Antique Wireless Association, Main St., Holcomb, NY 14469.

JUNE 4, 1978, Starved Rock Hamfest, Bureau County Fairgrounds, Princeton, Illinois. Advance registrations $1.50 if postmarked before May 25, after that $2.00. Large SASE please for registrations, map, information, etc., W9MKS/WR9AFG/SRRC, RFD no. 1, Box 171, Oglesby, Illinois 61348, (815) 667-4614.

BUYING OR SELLING equipment? I keep a listing. 10% charge when the equipment sells. W.T. Reese, WB6TMY, (707) 545-6958.

QUAD BUILDERS—Blizzard/Hurricane proof your antenna. Fiberglass vaulting poles. Increase strength. SASE for info. K5WSE, Box 20-AA, San Antonio, Texas 78201. 512/699-9260.

QUAGI/YAGI BUILDERS—Insulated fiberglass booms to 16 ft. Straight, strong vaulting poles. SASE for info—K5WSE, Box 20-AA, San Antonio, Texas 78201. (512) 699-9260.

QSL CARDS—500/$10. 400 illustrations. Samples: Bowman Printing, Dept. CQ, 743 Harvard, St. Louis, Missouri 63130.

SAVINGS, on scanners and most radio units. Example: Save $60.00 on the Drake SSR-1. Call (707) 544-4388 anytime. Write for a specific price quote. Free shipping. Visa/Master. McDonald Electronics, Box 7492(C), Santa Rosa, CA 95401.

WANTED: Clean blue racer bug. Fred Spencer, K9OTJ, Box 13, Anderson, IN 46015. (317) 644-0047.

QSLs WITH CLASS! Unbeatable quality, reasonable price. Samples 25 cents. QSL Unlimited, Box 27553-C, Atlanta, GA 30327.

B & W Matchmaster mod. 650. D. Load, watts, SWR $25. Antique solar cap analyzer. Hamilton, 6050 North Oakley, Chicago, IL 60659.

YAESU FT-410B exc. condx. Many, many extras. Best offer over $650. Toth, Box 3, Baldwin Place, NY 10505. (914) 245-5779.

TEMPO 2020, 6 months old. With ext. VFO and speaker. $650. J.P. Johnson, 135 W. 9th St., Jacksonville, FL 32206.

WANTED: National 5886 power supply. Will buy or swap for rack model. D. Sheehan, 15 Arcadia Rd., Andover, Mass. 01810.

WANTED: Heath HW-16 transceiver, HG-10B VFO, and HR10B recevier in exc. condx. State price. Caswell Davis, Jr., CET, 601 Delmar, Apt. 2, San Antonio, TX 78210.

ROBOT Mod. 80 camera. Sell $175. Shure Mod 202 Mike (new) $12. Warren E. Cann, W1HSC, Box 264, Hampton Beach, NH 03842.

QSL CARDS: The famous collection of K0 AAB classics again available. Send 24 cents, No. 10 s.a.s.e. for free samples. Marv Mahre, W0MGI, 2095 Prosperity Ave., St. Paul, MN 55109.

DRAKE MS-4 $15, Ten-Tec VFO 200 mount manual $50. Heathkit SW-717 gen. coverage, manual $45. WA2PCL, 101-23 Lefferts, Jamaica, NY 11419.

SPEC-2 synthesized Motorola HT220. Indep. T & R freqs. using RP synthesizer. 12/110 VPS and 10W amp built-in. $285. Computer modules and peripherals for sale. Repaired, custom built, free list. Trades. K2DCY, 11 Squire Hill Rd., N. Caldwell, NJ 07006.

SELL: CQ 1963-1977, 73 Magazine 1967-1971, plus misl. issues. $35. for all. P. Baillie, Box 288, Belmont, NH 03220.

CALL LETTER license plates wanted for collection. Will pay shipping. Art Phillips, WA7 NXL, P.O. Box 201, Flagstaff, AZ 86002.

HELP!! Needed: a manual for the EICO 753 and supply or xerox copy. Nat, WB3ERS, 2139 Clairmont Dr., Pittsburgh, PA 15241.

SALE: 26AV Hy-Gain 6 meter Ground plane antenna $28; Mosley Lancer 1000 mobile antenna 10-75 meters with fold-over mast $50; DR-200 monitoradio 30-50 MH and 152-174 MH receiver $50; HF-62 New-Tronics 6 and 2 meter, mobile antenna, $7.50; Lambda 300 VDC regulated power supply $30. T.K. Brown, RD 1, Box 102, Forksville, PA 18616.

NEED TO BORROW or Buy manuals for H & P model 130B oscilloscope. H & P model 200AB audio freq. gen. Jung Y. Lem, WA6 ROJ, 5222 Coringa Dr., Los Angeles, CA 90042.

BEARCAT 210 for sale just $199.50. used only ten hours. Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Rd., NE, Cedar Rapids, Iowa 52402.

COLLECTORS: Rare Cardwell tapered-plate variable capacitors, $25 for a set of three, postpaid. Carl C. Drumeller, W5JJ, 2824 N.W. 58 St., Oklahoma City, OK 73122.

RCA—T.V. Sweep Chanalyst, WR-514A, Service Man. & 17 Alignment Probes $450. RCA-Crystal calibrated signal generator, WR-99A, $290. RCA-Triggered Oscilloscope type WO-535A $225. Wm. D. Shevtchik, Phone (201) 471-3798, 1 Lois Ave., Clifton, NJ 07014.

GTX-200 wtih 10 xtals, AC supply and T.T. pad, $165. W4LRR, 234 Elden Dr., N.E., Atlanta, GA 30342.

FEW NEW COAXIAL RELAYS: Only $5 each; SPDT 12 VDC, go to 500 MHz. Use own terminals or solder in set. W4API, Box 4095, Arlington, VA 22204.

FOR SALE: HW-7 & HWA-7-1 $80 ppd. SBE-33 and SB-2 VOX $180 ppd. Motorola L41 GGB, 6 meter, table top base on 52.525 and 52.640, $135 ppd. David E. Drake, K8BRX, 4658 Luanne Lane, Traverse City, MI 49684.

WANTED: National converters no. NC300C1, NC300C2, NC300C6, also XCV300 crystal Cal. Maddy Sowa, R 1, Box 30, Auburn NH 03032.

ELECTRON TUBES: 5-4X150 $3 each; 2 air sockets $2 each; 4 steatite sockets $1 each; or $15 for entire lot. Art Johnson, K2POA, 29 Boone St., Bethpage, NY 11714.

WANTED: Hallicrafters HT-37, Trans...State condx, price. Jack Lovell, 105 Kelsey St., Malta, IL 60150, (815) 825-2433.

CANADA: Selling QST 1929 to 1977 $10 calendar year. VE3HU, Box 2747, Thunder Bay, Ontario, Canada P7B 5G2.

HEATH model IG-28 color bar generator. Professionally wired and tested. $100. (Same as model IG-5228 color bar & dot generator). G. Alfred Dodds, 874 Pepperwood Lane, Brunswick, OH 44212.

BOOK WANTED: My Father Marconi, By Degna Marconi. Please inform price wanted. VE2ZK, LIZEE, 29 Lamarche Apt. 5, Delson, Quebec, Canada J0L 1G0.

SAMS Photo Fact CB Series Vols. 2-100. All mint condx. $125, you ship. V.M. Faulkner, RR 2, Box 294A, Yorktown, IN 47396.

URGENTLY NEEDED: CB Rigs AM/SSB in any condx. Clem Duval, 33727 Brownlea, Sterling Hgts., MI 48077, (313) 268-2467.

EICO 720 xmtr 100 wts. Eico 730 modulator, manuals, relay, nice, $80. WA2PCL, 101-23 Lefferts, Richmond Hill, NY 11419.

ASTRO ZOO-with mobile mount, $825 4 months old. Need cash. I ship. Bill, KL7 NQK, Box 977, Soldotna, AK 99669.

SSTV AND PHOTOGRAPHERS—Make offer; 1 each, like new, Fujitar lenses—135 mm, f 4.5—telephoto 35 mm, f 3.5—wide angle. Cary Cowan, c/o CQ Magazine, or call (516) 883-6200.

SELL: CQ Magazine complete. Reasonable offers, cash or trade. Nagle, 12330 Lawyers Rd., Herndon, VA 22070.

FOR SALE: Tektronix 535 oscilloscope with dual trace and fast rise-time plug-ins. Very good condition. $425. Prefer local pick-up. Irwin Schwartz, K2VG, c/o CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

WANTED: Pre-war issues of Short Wave Craft magazine. Bill Orr, W6SAI, c/o Eimac, 301 Industrial Way, San Carlos, CA 94070.

WANTED: Collins 51-R receiver (VHF). Bill Orr, W6SAI, c/o Eimac, 301 Industrial Way, San Carlos, CA 94070.

WANTED: Antique glass—Looking for old milkglass—purple, slag, carmel, and greentown. Tell me what you have. I pay the highest prices. Write: Jack Schneider, c/o Cowan Publishing, 14 Vanderventer Ave., Port Washington, NY 11050.

SELL: Raytrack kw plate tank coil for 80 & 40 plus kw bandswitch, $16. UTC S-50 6kv c.t. 300 ma, new pick-up only, $75. Small (2 kw) $20. R. Ross, 95 Norwood Ave., Northport, NY 11768.

SALE: Heath IM-28 VTVM kit. New, perfect. Ordered by mistake. $40. Schultz, Box "L", FPO, New York 09544.

The book "CQ YL" has been updated again with a new supplement bringing the YLRL Officers section up to date through 1977, plus a report on the 7th International YLRL Convention held in Houston in June 1976. If you have a copy of "CQ YL" and would like to add the new supplement (the pages are "slotted" so they can be inserted directly into the book's spiral backbone), drop a note with your request to author/publisher W5RZJ, Louisa Sando, 9412 Rio Grande Blvd., NW, Albuquerque, NM 87114. Please enclose $1 to cover cost of printing and mailing. The one and only book abaout YLs in ham radio, "CQ YL" contains 23 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.50, postpaid.

MEDICAL: Any licensed amateur radio operator in the medical or paramedical field should join MARCO (Medical Radio Council). Contact: Stan Carp, M.D., K1EEG, 44 Main St., Saugus, MA 01906. (617) 233-1234.

LOOKING FOR old Lionel trains. Interested only in "O" gauge, excellent to like-new condition. Primary interest is locomotives prior to 1952, but will consider complete sets or more recent models. Am willing to buy outright for cash or swap radio gear to meet your needs. Write: Dick Cowan, WA2LRO, c/o CQ Magazine, or call (516) 883-6200.

FOR SALE: Spectra Physics 137P 2mw laser tube, brand new, never used, $80. G.R. 572B 1 kHz Hummer, $15. Irwin Math, 320 Northern Blvd., Great Neck, NY 11021.

HALLICRAFTERS FPM 300-realigned, mint, $350. plus UPS. WB2FZE, Harry A. Lersner, 4 Wedgewood Court, Miller Place, NY 11764.

COLLINS mechanical filter wanted for 75A-4, F455J-05 500 Hz or wider, W2ZP, 24 Baldwin Rd., Scotia, NY 12302.

SALE: GC-1 central Electronics gated compression amplifier. MM-2 Central Electronics monitor oscilloscope, $65. Maverick II 6 meter tuneable filter with output meter $30. Gold Line signal hunter (new) for transmitter hunts $6.50. Heath Electronic switch for dual trace on oscilloscope, $25. T.K. Brown, RD 1, Box 102, Forkville, PA 18616.

HEATH SB 104A plus SBA104-1, SBA104-3, SB604, HP 1144. Factory checked and aligned. Pick-up $750. W9JE, 860 Maple Tree, Wadsworth, IL 60083, (312) 662-2354.

LPF's B & W 424 New $8; Johnson 250-20 $15; Drake TV-1000 $15; Prototype $5; Ten-Tec FR4 CW filter $20; Tempo SWR RBF-1 new $32. Art Ford, 56 Gildare Dr., East Northport, NY 11731.

KENWOOD remote VFO-520. 6 months old. Used 1 hour. Warranty card, cables, manual. $75 or as part of deal for Kenwood AT-200. Shipping paid. Call Jerry, WB1DZQ, (617) 672-5504.

HY-GAIN DB24B 20-40 meter beam $25. No shipping, could deliver LA-SF CA. Dick Shideler, 3731 Evergreen, Visalia, CA 93277, (209) 733-3215.

SWL 15 years wishes to be QSL Manager for So. American ham. Donald, SWL, WPE6DIQ, Box 2558, Riverside, CA 92516.

KONICA Auto-Hexanon F/4, 21 mm wide angle lense for Konica "T" or "TN" cameras, new in case, $175. G. Alfred Dodds, Post Office Box 25, Brunswick, OH 44212.

WANTED: Johnson Ranger II (or model I) transmitter. Sell Johnson original Viking I (or swap). D. Sheehan, Box 48, Ballardvale, MA 01810.

WANTED: Manuals or any info for the following: Shall Cross, Model no. 638-2, Kelivn-Wheatstone Bridge. Ballantine Model no. 305-A, Peak Volt Meter. Philco- "Mobilner" Model no. 5005, Sweep Gen?? Clyde N. Smith, 11 Brown St., Reynoldsville, PA 15851.

FOR SALE Tempo 2020 xcvr w/matching speaker. Purchased March 1977 for $788.95 plus $47 tax. Mint condx. Will sacrifice for $675. Joe Chance, 156 Banbury Court, Benicia, CA 94510, (707) 745-1172.

WANTED: Heath SB-500 transverters, good condx with 28 MHz I.F. will pay $150. You ship. Jerry, WB5YXP, 409 Bolling, Lackland, AFB, Texas 78236. (512) 673-0652.

SIMPSON 270-3 VOM w/leads, $35. AN/USM259 frequency meter, solid-state, AC/DC, 125 kHz to 1000 MHz, all accessories/manuals $50. Both very good condx. WD4NZJ, 938 Grove Park Dr., N., Orange Park, FL 32073.

WANTED: Extra coils for SW-3 receiver. I have odd-ball coils and need your single extras to make up complete set. Buy or trade. Bill Orr, W6SAI, c/o Eimac, 301 Industrial Way, San Carlos, CA 94070.

CQ AND QST 1950-1975 issues for sale. Send s.a.s.e. if ordering 73, Ham Radio, or other CQ and QST issues. One dollar minimum order and all issues cost 25 cents each, including USA shipping. Send chronological list and full payment to W6LS, 2814 Empire, Burbank, CA 91504. Available issues and refund sent within one month.

CERTIFICATE FOR PROVEN Two-Way Radio Contacts with Amateurs in all ten (10) USA call areas. Award suitable to frame and proven achievements added on request. SASE brings TAD data sheet from W6LS, 2814 Empire, Burbank, CA 91504.

CQ Magazines, 1957-59, 61, 62, 63, 64, 66, 67. QST Magazines—1955-56-58-59-61. $6.00 postpaid per yr. $1.00 single copy. Robert E. True, K4JBP, 318 Church St., Box 98, Madison, AL 35758.

YAESU FRDX 400; all options, FLDX 400 clean, cables, manuals, both $475. WA2IBE, Box 215, Ironia, NJ 07845. (201) 584-3384. evenings.

FOR SALE AND TRADE: Heathkit HW-104 SSB transceiver with CW Filter, noise blanker, 10 meter accessory, matching speaker and PTT Mike. Would like to trade for SSTV camera and monitor. Would sell outright for $485 plus shipping. Also Swan Model 45, all band mobile antenna, brand new, with warranty card $70. plus shipping. Mor-Gain 40-20 HD dipole new never used, $30. plus shipping. Kenneth J. Dado, W0RLM, 4821 E. Riverside Dr., no. 141, Austin, TX 78741.

BREAKING UP Lifetime Philatelic stamped and unstamped autograph collection. Send s.a.s.e. and check or MO, one ten dollars or three twenty dollars. My selection. Better ones first, Authentic. L.B. Fuqua, W4WBD, Maple St., Eddyville, KY 42038.

WANTED: All pertinent manuals, schematics and information to the following: Johnson Viking I modified to a Viking II, TVI modifications made. Johnson Viking VFO model 122. Dave Goerky, 310 Maple Ave., Apt. 38, Trenton, OH 45067.

WANTED: Tuning meter for or with NC173 Receiver. Millen 61455-61160 IF's new or used. Need several. Owen Laughlin, 1310 Pinecrest Dr., Frendale, MI 48220.

WANTED: Manual and schematic for Hallicrafters transmitter HT-40 for copy or purchase. J. Peters, 339 S. Cherry St., Itasca, IL 60143.

CRYSTAL LIST: SASE to K8LJQ, 355 Mower Rd., Pinckney, MI 48169.

DXers! Use ham sentences in 54 languages on your outgoing QSL and get results. K3CHP's DX QSL Guide, $3.95. Joe Jikuckis, K3CHP, 6913 Furman Parkway, Riverdale, Maryland 20840.

SELL: SBE 34 xcvr built-in AC and DC sup. Mic, and book, clean. $195. Harold Tarallo, WB6VNR, (213) 346-5871.

GOING HAM! For sale, Tram D-201 CB for $600 or best offer. Bruce Hillier, 6401 N. US 23, Oscoda, MI 48750, (517) 739-8168.

WANTED: HA-10, HT-44, NC-173, NC-183, NC-183D, any HRO. Working or not, HRO coils. WA8MLV, 1008 Englewood, Parma, OH 44134.

WANTED: Radio Antenna Engineering by Edmund LaPort. Alan M. Christman, WD8CBJ, Box 44, Granville, W. Va. 26534.

OFFERING choice items from my lifetime Philatelic Autographed Collection. Send s.a.s.e. and check or MO for 10 dollars singles or 3 for 20 dollars my selection, verified. L.B. Fuqua, W4WBD, Maple St., Eddyville, KY 42038.

COMPLETELY CONVERTED 40 meter BC 459-A transmitter w/power supply. Hallicrafters SX-28 receiver. Teaberry portable scanner 146-148 MHz. Make offer or trade. Michael Donovan, 3423 42nd Ave., Moline, IL 61265.

WANTED: Straight type keys both modern and old. Especially wanted with heavy straight arm. Ralph Sieloff, W2WKR, RD 2, Lagrangeville, NY 12540.

FOR SALE: Heathkit DX-60 and HG-10 VFO. Good working condition with manuals. $100 for both or sell separately. P. Baillie, Box 288, Belmont, NH 03220.

MINT ARGONAUT 509, $280 or swap for 80-10 meter xcvr or 2 meter fm xcvr. MFJ 40T, $20. Mario Filippi, 9 Harold Ct., New Rochelle, NY 10801, (914) 632-4255.

HEATHKIT IG-28 color bar generator, in new condition. Professionally wired and tested. Will mail pospaid for $90. G. Alfred Dodds, 874 Pepperwood Lane, Brunswick, OH 41212.

WANTED: Scott special comm. recevier and early wireless radios from the 20's. Carl L. Elkins, WD4KWQ, 1701 Woodland St., Nashville, TN 37206. (615) 226-0651.

CENTRAL ELECTRONICS 200v. with manual. Almost mint. $495. H. Marhoff, 980 7 St., NW, Largo, FL 33540.

250 Hz 8 pole crystal cw filter new-for either FT-101's or TS-520's. Specify $40. K8AQ, Box 171, Fairfield, OH 45014.

FOR SALE: RCA model WO-56A oscilloscope, Hewlett Packard model 200J audio oscillator, Hickok model 650C video generator, Heath model GD-48 metal locator, University Sound model CP-1 cassette playback. Mike Ludkiewicz, 143 Richmind Rd., Ludlow, MA 01056.

WANTED: 'S' meter for Galaxy 300 transceiver. Pay anything within reason. R. Collins, W6WBY, P.O. Box 143, Port Hueneme, CA 93041.

WILL TRADE early vacum tubes for old Magazines, catalogs, books, handbooks, call books as well as early radio and wireless sets. SASE for list. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood City, CA 94062.

CASH for xtal osc. for Galaxy NOX-1, Galaxy 200 linear. W4NVJ, Sam Horton 1271 Foxhall Dr., Winston Salem, NC 27106.

JOHNSON Navigator wanted. R. Randall, K6ARE, 1263 Lakehurst Rd., Livermore, CA 94550.

TEKTRONIX SCOPES: 543 with CA plug-in, also 585 with 80 plug-in, each $450. Ph. 215/933-8183. D. Shavney, 5 Flintlock Ln., Phoenixville, PA 19460.

WANTED: Original meter from Johnson Viking Ranger I xmtr. A1 condition, state price. WA2SFR, 906 1/2 Emmett St., Schenectady, NY 12307.

SELL: Transmitters and rcvr. from 1930s working and in good condition, also parts. J. Pluth, 7720 W. 162nd Pl., Timley Park, IL 60477.

OSBORNE (hypersil core) type 5962 xfmr 110/220 VAV Pri with center-tapped 5650 & 4000 VAC Sec at .5 amps. Will ship for $55. A. Polityka, 248 Western, Allegan, MI 49010.

FOR SALE: Back issue of CQ from Jan. 1970 to Dec. 1977. Also QST from Jan. 1960 to Dec. 1968 reasonable. K8SGF, 7009 Brecksville Rd., Independence, OH 44131.

40 Solid years QST $250 FOB Rider huge radio manuals Vols, 1 thru 23 complete $250. FOB. Bob Farmer, 3113 No. Columbus, Plainview, TX 79072.

NOVICE ALL—AMERICAN certificate: Work a novice in all 10 call areas. Send list and $1. WB6QBJ, 25 Rudnick Ave., Novato, CA 94947.

WANTED: AM1187/GRC amplifier units, PH-548/AXT-2A conversion unit, APX-6 units. Charles T. Huth, 146 Schonhardt St., Tiffin, OH 44883.

DRAKE "C" Line: T4XC, R4C, AC4, MS4, including N.B., and CW filters, 2.5 and 500. Also C-4 console (mint). Will not sell seperately. $1850 and shipping. K3UKW, Tony Musero, (215) 271-8898.

AC VTVMs: Hewlett Packard HP400D with manual, $50. Both excellent, I pay shipping. W1DL, J.M. Hoffer, 24 Cherry Rd., Framingham, Mass. 01701.

HAVE LIFETIME collection of Philatezic autographs. Want old railroad telegraph sounders. Keys and lanterns. Trade of sell. Col. L.B. Fuqua, W4WBD, Maple St., Box 6, Eddyville, KY 42038.

WANTED: 6 pin vibrator for 1952 150 MHz Motorola transceiver. James Southwick, 3443 Fowler Ave., Ogden Utah 84403.

BUY/SWAP/SALE your gear in the Connecticut Ham Trader. SASE for a free copy. K1IKE, 63 Spice Hill Dr., Meriden, CT 06450.

RELIABLE USA QSL MANAGER has limited openings for additional DX stations. Airmail inquiries to: W3HU, Box 522, Levittown, PA 19057 U.S.A.

LIKE NEW PS-2 charger, $25. PS-18 battery $15 for Genave hand-held. Atlas 200-PS supply, $60. DX-60 transmitter, $45. Brand new Super Sidekicker Mike, $35. WA0NZO, Leon Kirschemann, RR 2, Regent, ND 58650.

HEATHKIT 5-inch 10-18 oscilloscope $60. Triplett Model 600 type 2, transistorized volt-ohmmeter, $70 all excellent condition. FOB K7BD, 103 E. Bartlett, Selah, WA 98942.

SALE: Swan 410 VFO and no. 22 adaptor $50. WA4NJK, 70 Hibiscus Dr., Ormond Beach, FL 32074.

CX7 CW Filter, best offer over $140. Johnson 6N2 and VFO, $50. Bob, WD9YVA/4, P.O. Box 6216, Arlington, VA 22206.

FPM 300 MK11 transceiver, fan, AC and DC mobile cords and mount, documented manual modifications of internal ultimatic keyer, RIT, SWR, MFJ CWF-2 $425. Art Ford, 56 Gildare Dr., E. Northport, NY 11731.

DRAKE C4 console and Drake C line, T4XC, AC4, MS4, R4C includes one cw filter, $1575. (pkg. only). (215) 271-8898, Tony Musero.

WANTED: QRP rig with RIT. Details on adding to Ten-Tec PM-series. K9UKX, 51625 Chestnut Rd., Granger, IN 46530.

DRAKE TR3 AC, DC power supplies, microphone, manual, factory retubed, aligned, $425. Paul Walhus, (707) 869-9936.

HALLICRAFTERS SX-101 Mark III an excellent receiver. Mint condx. $175. Ken, WB9 YCJ, 0N620 West., Wheaton, IL 60187.

SELL OR SWAP: Drake low pass filter (kw) also Eico 50w mod, make offer. Dr. Eric Palmer, W2RD, 1602 Mermaid Ave., Coney Island, NY 11224.

SELL: SB614 station monitor, mint condition, $139. James Hamilton, 414 Augusta St., Elmore, OH 43416.

FREE: 1977 US and Foreign callbooks plus all service edtions free to young Novice ow on cash. Send $1.50 postage to: K6ZTG, 8874 Wheeler Ave., Fontana, CA 92335.

WANTED: Manual and schematic for National receiver NC-44. Please reply to: Daniel Kubly, 229 Summit Ave., Watertown, WI 53094.

SELL: BC-779 as per my article in August 73, $175. You ship, C. Klawitter, W9VZR, 4627 N. Bartlett, Milwaukee, WI 53211.

ARE YOU STILL SEEKING the best possible deal in radio equipment? Our latest flyer can make it happen! Send 50 cents to Communications Centre, Box 600, Chicopee Falls, MA 01020.

HAM RADIO control console plans. Unique, expandable, modular design, easily built. $4.50. S. Swords, 550 Dorset, Goleta, CA 93017.

BE FIRST TO KNOW precisely when and where to work all the choice DX. Bi-weekly LI DXA DX Bulletin has: Hot DX News, Time and Frequency of each goodie, QSL Info, Propagation Forecast, and more, Send business size SASE for free sample copy or $8 for 1-year domestic subscription. Long Island DX Association, DX Bulletin, PO Box 173, Huntington, NY 11743.

WANTED: Commercial outdoor type 50 ohm dummy load; 2 kw or greater. Rod, W7OM, 5632 47th Ave., SW, Seattle, WA 98136.

SELL: 2 mtr FM Sonar transceiver, AC P/S, mobile bracket $175. Heath HW-32A with spare tubes $65. George Pataki, WB2AQC, 34-24 76th St., Jackson Hgts., NY 11372.

SALE: Sony ICF-5900W multi-band receiver designed for SWLs. Like new condition w/ manuals. $100. Schultz, W4FA, Box "L", FPO New York 09544.

FOR SALE: Old issues of Ham Radio, 73, CQ, QST. Some complete runs. Send s.a.s.e. for lists and prices. A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

HW-202 w/built-in Sadlin scanner, crystals; ITC Multi-2000; Bearcat 101 scanner. All good condition. Karl Thurber, W8FX/4, 233 Newcastle Lane, Montgomery, AL 36117.

TECH MANUALS for govt. surplus gear—$6.50 each: SP-600JX, URM-25D, OS-8A/U, TS-173/UR. Thousands more available. Send 50 cents (coin) for 22-page list. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

YOUR CALL in black letters beautifully engraved in finished redwood. 65 cents per letter plus 25 cents handling per plaque. K9MLK, Jim Genisio, 1002 North 9 Street, Clinton, IN 47842.

SELL: HW-8 transcvr and power supply assembled and aligned. $135. WA6SRK, 501 Oak St., Vandenberg, AFB, CA 93437.

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New Reader Service System

To speed information to you on products shown in CQ advertising, a new computerized Reader Service System has been designed. For additional information on a particular ad in this issue, tear out the Reader Service postcard bound between pages 84 and 85, and circle the numbers on the card which correspond with the Reader Service numbers listed on the **INDIVIDUAL ADS. DON'T CIRCLE THE PAGE NUMBERS!** Fill in your name and address, and mail. We'll have your information on the way in short order.

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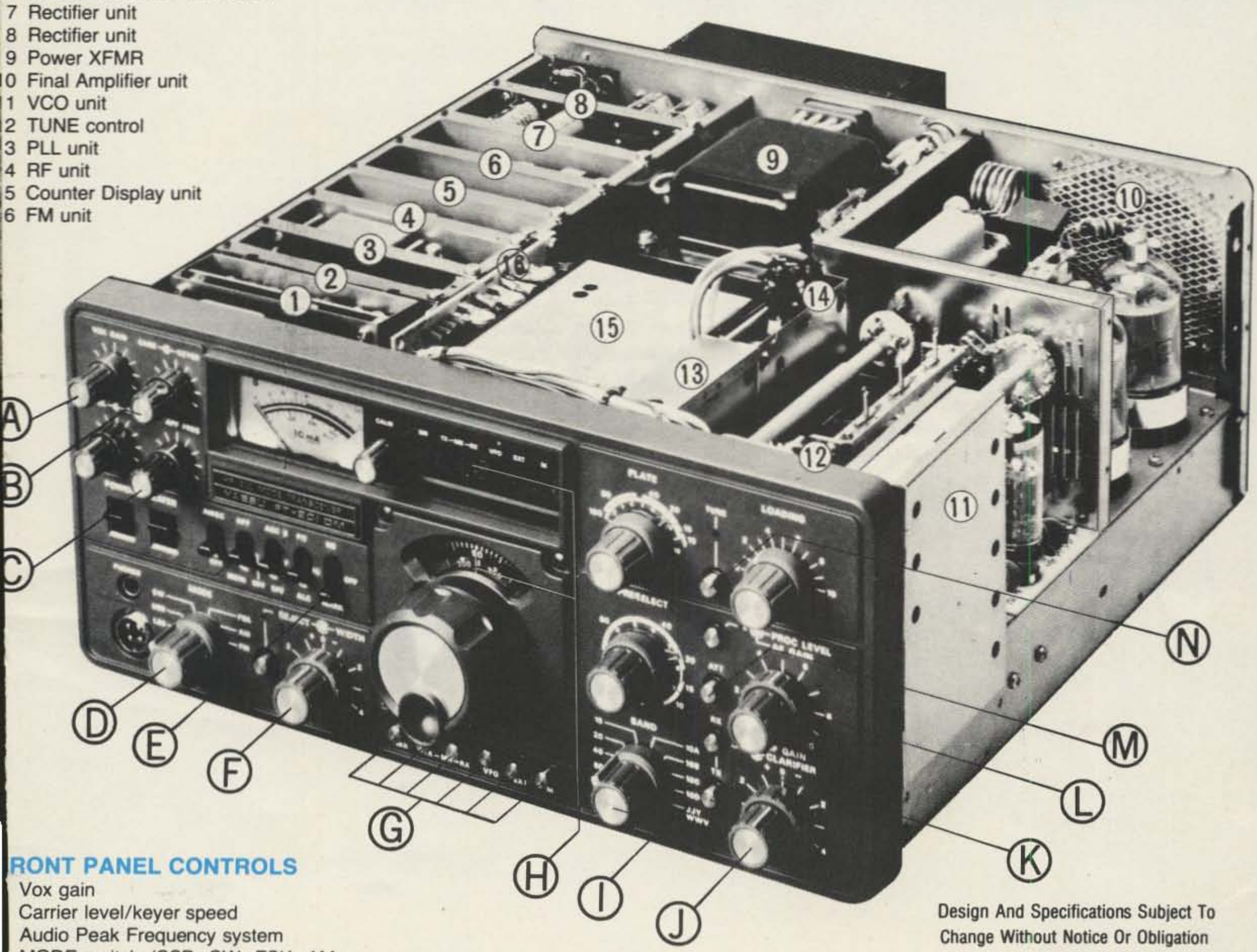

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Rejection tuning/variable IF passband tuning
Frequency memory system
Digital plus analog frequency readout
Band switch (160-10 meters + WWV/JJY receive)
Clarifier control
RX/TX Clarifier selector
RF Processor level
RF attenuator
TUNE control (Places transmitter in "TUNE" condition for ten seconds, then returns to "receive" condition to protect final tubes from excessive key-down time)

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