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CIRCLE 26 ON READER SERVICE CARD

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APRIL, 1979 VOL. 35, NO. 4

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

Novice, QRP, 200 w, deluxe — good, better, best — $299, $369, $399, $699, $869, $899, $1069. TEN-TEC has them all. A choice of seven HF transceiver models — a choice of power levels — a choice of operating features (and accessories) for beginner or old timer. Best of all, there's a wide choice of prices to fit every amateur budget.

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TEN-TEC "ARGONAUT" TRANSCEIVER—QRP CHOICE. The challenge and excitement of working the world on 5 watts. And every feature you need: all solid-state; 5 bands (80-10 m); full amateur band coverage SSB/CW; sensitivity less than 0.5 μV; offset tuning; 4-pole IF crystal filter, 2.5 kHz bandwidth; analog dial; vernier tuning; automatic sideband selection; built-in speaker; 5-watt input to broadband push-pull final amplifier; PTT; full CW break-in; adjustable sidetone volume and pitch; built-in SWR bridge; TVI filter; plug-in boards; small and light weight enough to go anywhere (4½"h x 13"w x7"d and 6 lbs.). World beating price, too: Model 509 only $369; Model 210 AC Power Supply just $34.

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The choice is all yours when you choose TEN-TEC HF transceivers; see your nearest dealer or write for full details.

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WIDEST CHOICE IN HF TRANSCEIVERS: TEN-TEC

Zero Bias

an editorial

Our Cover

Our cover this month comes to us through the courtesy of the Unimax Switch Corporation. They sent the photo in to accompany a press release covering their TH series of convertible lighted push-button switches which are described in our Showcase section. Looking at it brought back the aura of exotic home-brewing again and we thought we'd share it with you.

VTR and Amateur Radio

The local library here in Port Washington has an interesting program which might apply to amateur radio. They have several crews of volunteers who video-tape local events, activities and outings of many of the service organizations and specialized clubs in the area. These tapes are then stored at the library to be used by anyone who has an interest in the event or activity. It's a kind of mini-documentary and an excellent way of preserving local history.

The past few years has seen the proliferation of video tape recorders (VTR) to the point where they are now a mass consumer item, widely advertised and readily available. Their prices though somewhat high have not proven a deterrent to sales. If anything, their acceptance and desirability are increasing each month.

With an eye towards amateur radio then, it would seem logical for clubs to record meetings, Hamfests, Field-Day activities. Think about reliving the day the gang came over to help you put up that new antenna. How about some fancy editing to come up with a tape that showed a complete rig being built in only a few minutes? So much for the fanciful uses. How about posterity?

We are in a relatively new pastime. Amateur radio and electronics in particular is not that old an endeavor. Already many of the giants and pioneers are gone. We rely on ever fading memories, blurred photos and bits of film to recall their words and deeds. We do have the results of their work preserved however, but not the essence of the person. What were they like, what did they sound like and all the subtle nuances that go into making each individual. Well, our chance is here right now. Using VTR techniques, it is easy to imagine a library of interviews with some of the innovators of amateur radio and electronics in general. Think of the possibility of literally sitting in their living rooms or spending time with them in their shacks or work-rooms. It insures the future by preserving the past.

There are many ways this relatively new medium can be used in and for amateur radio. Not only can our personal enjoyment be enriched and shared but we can also add enormously to the fund of knowledge for amateurs and chroniclers yet to come.

Wilfred M. Scherer, W2AEF

It's hard to write an obituary about someone you knew and yet didn't know well enough. It's hard enough to realize that you spent considerable time with a living legend, an innovator, a recognized authority in industry and a voluminous author. It's not that we took him for granted, which we may have on occasion. It's just the fact in looking back at our relationship at how quiet a man he was. He was there all the time, his presence was known not so much by what he said but by the sounds emanating from his laboratory. The squeals of a new rig being tested, and electric drill biting through metal, a hack-saw blade chipping its way through an old aluminium transcription record (his favorite medium) of some forgotten bygone radio broadcast. History was being destroyed in order to make new history.

I remember the mail that poured in everyday hoping for an answer to some impossible electronic dilemma. He could usually come up with a simple solution, or point the writer (teaching as he pointed) towards determining his own solution. I remember a methodical man, who could work for hours, days or weeks to make some circuit work and then sit back and marvel at it. I remember a gentle man whose word was his bond and his hand-shake a contract. I can't remember him without his white shirt and tie each day and I often thought or mused over the possibility of him wearing an old work shirt and dungarees . . . never.

Still here was the man who gave amateur radio the grid-dip meter, the antennascope, the Omni-Verter, the TNS and hundreds of circuits and modifications. Here was the man who created the first true contest machine, The Gold Plated Special for Larry LeKashman, a deluxe transmitter for the deluxe operator. His reviews of equipment were legendary and several manufacturers sought him out to develop a new product or two. Many even made changes to their existing products based on his recommendations.

Yet, while he worked at *CQ* these were everyday occurrences, not the stored memories they are today. The vivid memory of "Al, can you come in here a minute?" to read the colors of a resistor to him (he was color blind) because in his enthusiasm he couldn't take the time away from what he was working on to get the v.o.m. I also remember his hearty laugh at being called "Wilf" by a young writer with a question.

When he retired from *CQ* several years ago we still kept in touch. He would call each month after receiving a new issue and critique it for me and offer his advice. After a while the calls became less frequent to the point that we lost contact with each other over the last year or so. I learned of his death only recently and so offer this belatedly. I will miss him as many of you who knew him will. I am certain however that somewhere on high there is a monograph floating around on "Improvements to the AN/473 Angel Wing to Increase Lift."

It was a privelege to know you Bill.

73, Alan, K2EEK

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- Scan for busy or open channel.
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When used with the **IC-211** or **IC-701** (or **IC-245,** for that matter), the **RM-2** provides memory and frequency control, including automatic band change and memories for four different frequencies, plus auto-increment or single step tuning in 100 Hz, 1 KHz or 15 KHz steps. The **RM-2** also provides automatic offset for repeater operation when used with the **IC-211** or **IC-245.** The tone generator accomodates operation of telephone type devices or a two-tone signal for an external amp that needs to be tuned. (Naturally there is no tuning needed on an **IC-211** or **IC-701.**)

No one could ask for a better Oscar station than the **IC-211** and **IC-701** together for "mode A": and adding a transverter to the **IC-701** mode B or mode J opens newer, better satellite horizons. Within the ICOM LSI based radios there is the capacity for the technically minded Amateur to tune one radio of the pair with the VFO knob of the other. (Oscar transceive, anyone?) In addition, the LSI lends itself to being controlled by a parallel port on one of the increasing number of microprocessors now available for Amateur use.

The complexity of features built into these ICOM LSI twins will be used for a long time into the future. The possibilities are so numerous that even we have not thought of all of them yet.

All ICOM radios significantly exceed FCC specifications limiting spurious emissions.

Shown left to right: IC-211, multi-mode 4MHz trxvr; **RM-2,** remote microprocessor; **IC-701,** multi-mode HF trxvr; **IC-701PS,** power supply / speaker.

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No - 9-10

Announcing

• **Dayton, OH** – On April 27, 28 and 29, 1979, the 28th Annual Dayton Hamvention will take place at the Dayton Hara Arena and Exhibition Center. The Dayton Hamvention is not "just another Hamfest." The 1978 Dayton Hamvention attracted over 160 exhibitors and a registration that topped 19,000. For 1979, they expect to be even bigger. For more info, contact: The Dayton Amateur Radio Association, Inc., P.O. Box 44, Dayton, OH 45401.

• **Rochester, MN** – The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the: Rochester (Minn) Area Hamfest on Saturday, April 7, 1979. Doors will open at 8:30 a.m., at St. John's School Gymnasium. There will be a large indoor flea market, prize raffles, and plenty of free parking. Talk-in on 146.22/82. For further info, contact: RARC, c/o K0TS, 2514 N.W. 4th Ave., Rochester, MN 55901.

• **Columbus, GA** – The Columbus Amateur Radio Club will have its Annual Hamfest at the Columbus Municipal Auditorium, on March 31 and April 1, 1979. Talk-in on 28/88. The donation is still $1 at the door. There will be an indoor and outdoor flea market. For further info, contact: Bob Glasgow, N4BGN, 1503 Layard Dr., Columbus, GA or phone (404) 561-7746.

• **Painsville, OH** – On April 1, 1979, the First Annual Lake County Hamfest will be held, sponsored by LCARA. Doors will open at 8 a.m. to 4 p.m., at the Lake County Armory, Painsville Fairgrounds. All indoors for exhibitors and flea market. Admission will be $2, under 12 free. Talk-in on 52.52 and 147.81/21. For further info, write: LCARA, Box 868, Painsville, OH 44077 or call (216) 257-4486.

• **Madison, WI** – The Madison Area Repeater Association, Inc., (MARA) is pleased to announce its Seventh Annual Madison Swapfest which will be held on Sunday, April 8, 1979, at the Dane County Expostiion Center Forum Building. Doors will open at 7 a.m. for sellers and exhibitors and at 8 a.m. for the public. Admission is $1.50 per person in advance, and $2 at the door, under 12 free. Talk-in on WR9ABT-146.16/.76. For more info, write: MARA, P.O. Box 3403, Madison, WI 53704.

• **Philadelphia, PA** – The Penn Wireless Association will hold Tradefest '79 at the National Guard Armory on April 1, 1979. General admission will be $2. There will be prizes, displays, etc. Talk-in on 146.37/97 and 146.52. For further info, contact: Charles Miller, AD3X, 141 Bedford Rd., Fairless Hills, PA 19030. Tel. (215) 943-3973.

• **Dayton, OH** – The 10th Annual FM B*A*S*H will be held on the Friday night of Dayton Hamvention, April 27, 1979, at the Dayton Convention Center, from 8 p.m. til midnight. Admission is free to all hams and their friends. TV personality Rob Reider, WA8GFF, and his group will present a super floor show and there will drawings for many fabulous prizes. For further info, contact: The Miami Valley F.M. Assn., P.O. Box 263, Dayton, OH 45401.

• **Jackson, MS** – The Jackson Mississippi Amateur Radio Club and cooperating local radio clubs will be holding their Annual Hamfest on April 21-22, 1979, at the Manhattan Academy Gymnasium, 5055 Manhattan Road. For additional info, write: JARC, Box 8371, Jackson, MS 39204, or call on the Mississippi Sideband net daily at 3987.5, 2345 GMT.

• **Trenton, NJ** – The Delaware Valley Radio Association, W2ZQ, assisted by the Lawrenceville Amateur Repeater Group, will hold their Annual Flea Market on Sunday, April 22, 1979, from 8 a.m. to 4 p.m., at the New Jersey National Guard in Lawrence Township. Advance registration is $2, $2.50 at the gate. Talk-in on 146.52, 146.07-67, and 147.84-24. For further info and reservations, write: D.V.R.A., P.O. Box 7024, West Trenton, NJ 08628.

• **Woodward Township, PA** – The 15th Annual Penn Central Hamfest will be held on Sunday, April 29, 1979, at the Woodward Township Fire Hall, from 11:00 a.m. to 5:00 p.m. Talk-in on 13/73 and 52. For further info, write: Richard Sheasley, R.D. no. 1, Box 454, Linden, PA 17744, or call W3FUB, 1-717-322-1280.

• **Worcester, MA** – The Central Mass. Amateur Radio Association, Inc., W1BIM, would like to announce an Auction and Ham Flea Market to be held on April 27, 1979, at the Main South American Legion, Post 341. There will be door prizes and raffles. Dealers are welcome. Talk-in on 146.37-146.97, and .52 direct. For more info, contact: WA1LEA, Rene Brodeur, (617) 753-7480 or K1COW, Dave Penttila-(617) 885-4995.

• **Wellesley, MA** – The Wellesley Amateur Radio Society will be conducting its Annual Auction on Saturday, April 7, 1979, beginning at 11:00 a.m., at the Wellesley High School Cafeteria on Rich Street. Talk-in on 96/36, 63/03, 04/64 and 52. Doors will open at 10:00 a.m. Contact: Kevin P. Kelly, WA1-YHV, 7 Lawnwood Pl., Charlestown, MA 02129.

• **Dixon, IL** – The 13th Annual Rock River Radio Club Hamfest will be held on Sunday, April 22, 1979, at the Lee County 4-H Center, South of Dixon. Tickets are $1.50 in advance, $2 at the gate. Talk-in on 146.52 simplex or WR9ADG Repeater 146.37-146.97. Features will include indoor facilities, rain or shine and prizes. For advance tickets mail to: RRRC Hamfest, Chuck Randall, W9LDU, 1414 Ann Ave., Dixon, IL 61021.

• **Worcester, MA** – The First Annual Spring Flea Market sponsored by the W.P.I. Wireless Association will take place on Saturday, March 31, 1979, on the W.P.I. Campus in Worcester. Hours: from 9 a.m. to 4 p.m. For more info, write: W.P.I. Wireless Association, Worcester Polytechnic Institute, Worcester, MA 01609, Box 2393.

• **Natchez, MS** – The Old Natchez Hamfest will be held on Sunday, April 1, 1979, at the Natchez Convention Center. Free admission and Swap tables. Talk-in on frequencies: 146.31-146.91 and 146.52. For more info, write: ONARC, 1226 Magnolia Ave., Natchez, MS 39120.

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The GLA-1000 was field tested for 1 month by the following amateurs: Robert Allen W8IO, Harold Unger WA2EQN, Robert Schiers NØAN, Jim Turle WA8RCN, Alan Applegate KØBG, Howard Townsend WA5MLT, Mickey LeBoeuf K5ML, Tom Lutman WB8ZWY, Ed Clegg W3LOY and Andy Calandria K5MVP. The group was instructed to "use the prototype under tough operating conditions, not to baby it in any way."

What was the response? Some on the air comments received by W8IO, *"Fantastic signal, 12 db over barefoot exciter"* (75SSB). *"Excellent keying, no change in wave form, 5-9 +30 db in Kentucky"* (40CW). From NØAN, *"Overall quality excellent and up to the standards DenTron has come to stand for."* From K5ML, *"Finally a high quality amplifier that everyone can afford."*

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Our Readers Say

Corrections

There were two typos in the article "All Power To The Load" in the January, 1979 CQ.

First, there should be no parenthesis in the numerator of the fraction to the right of the "equals sign" in equation 13; second, the equation in the legend of Table 1 should read:

$$P_{ABL}/P_o = \frac{(1-|K|^2)e^{-2\alpha L}}{1-|K|^2e^{-4\alpha L}}$$

Editor, CQ:

Reference my article "Vacuum Relay QSK in a Commercially Equipped Station. Part I: The Collins S-Line," CQ, December, 1978.

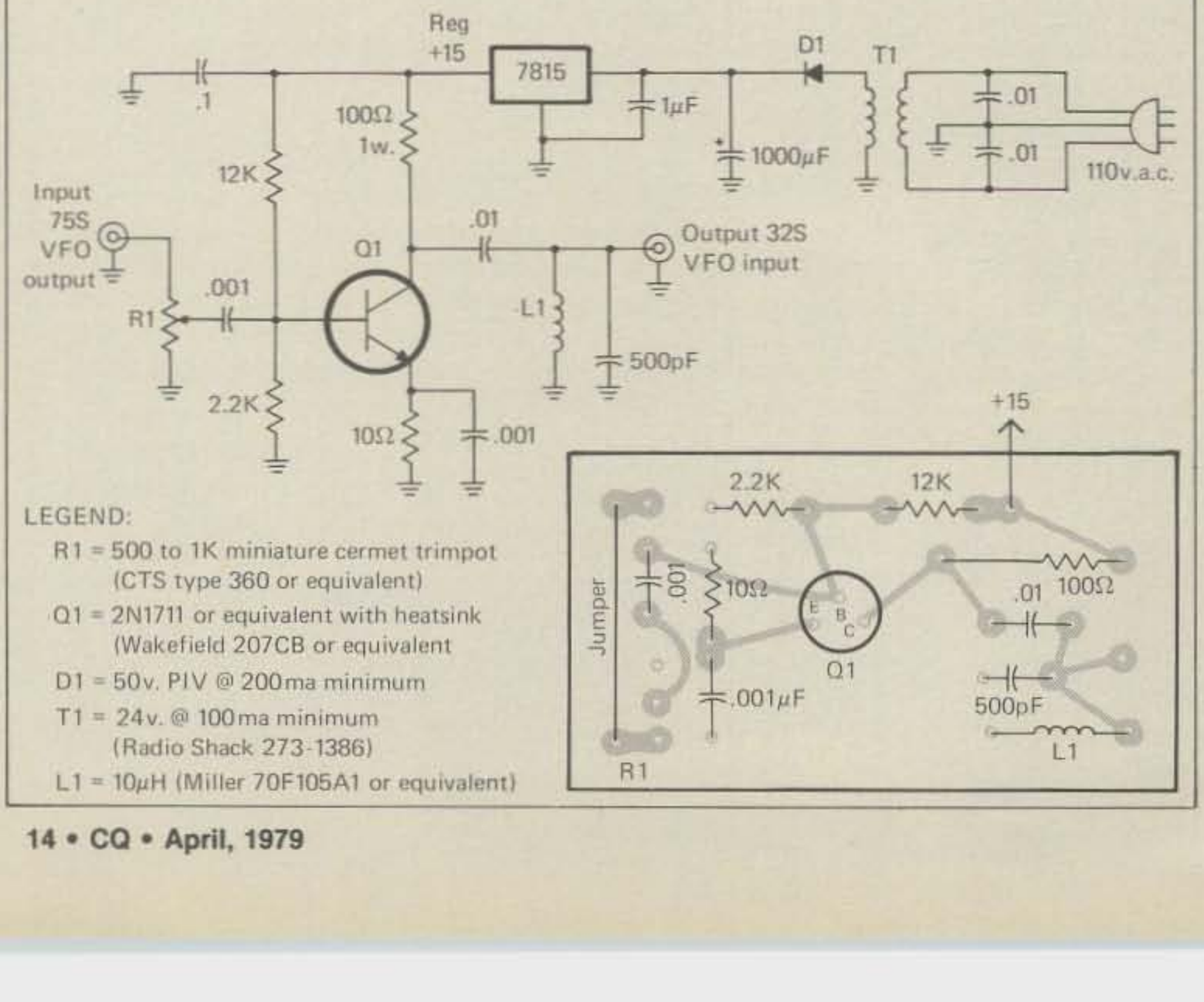
After a few of the gang made the modification described in that article, some criticism was received on the transceive operation of the S-Line. I want to make it clear that the conversion as described in that article works perfectly. However, as stated in the article, there is "some" loss at the v.f.o. frequency in the L-C trap used to eliminate the 455 kHz backwave. The difference in drive level (grid current) when switching from one control v.f.o. to the other is indeed noticable but is of no actual consequence. In fact, even without the trap circuit there is an intrinsic difference in v.f.o. drive noticable when switching from transmitter to receiver v.f.o. Collins provides no means to equalize the v.f.o. drive levels, although, as I have said, they are close enough for practical purposes.

As delivered by Rockwell, the S-Line transceives only on s.s.b. In s.s.b. the grid current meter (should) always read zero, and the a.l.c. and high circuit gains employed act to compensate the drive for the difference in the two v.f.o. injection levels. This difference is therefore unnoticable. However, on c.w. the drive requirements are larger and the grid current meter does reflect the variation in v.f.o. levels.

To satisfy the critics and my own purest inclination, I have replaced the passive trap in the v.f.o. transceive cable with a very simple active isolation amplifier. The circuit is no more difficult to build and is as inexpensive as the original passive trap. It neatly solves both the b.f.o. backwave and drive equalization problems simultaneously.

The following (below) are plans for drive equalization and an isolation amplifier for the Collins S-Line v.f.o.

Richard Klinman, W3RJ
Coopersburg, PA



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Q1 = 2N1711 or equivalent with heatsink (Wakefield 207CB or equivalent
D1 = 50v. PIV @ 200ma minimum
T1 = 24v. @ 100ma minimum (Radio Shack 273-1386)
L1 = 10μH (Miller 70F105A1 or equivalent)

New Toll Free Number For Tri-Ex

Tri-Ex Tower Corporation of Visalia, California announced recently that the toll free telephone numbers listed in their advertisements in **CQ Magazine** are incorrect. The company sincerely hopes that this has not caused any inconvenience to their valued customers. Tri-Ex Towers can be reached at these new toll free numbers:

Anywhere in the nation, dial:
1-800-528-6050 Extension 1025
In Arizona, dial:
1-800-352-0458 Extension 1025

That Old Model "Q"

Editor, CQ:

The article "The Federal ARC Transmitter", by Louis R. Mateo, which appeared in the February 1979 issue of CQ, brought back some very fond memories.

That old "Model Q" was the circuit diagram I had to draw when I got my first radio telegraph ticket. I was to become somewhat more thoroughly acquainted with its operation.

I had some correspondence with Dr. Lee DeForest when he was doing his experiments into voice modulation of the arc. I listened night after night to his signal and reported each day what I had heard. It was not a very satisfactory method as later developments determined.

I have not seen anything on those old arc transmitters in print for many years and I thoroughly enjoyed the story. I was to become employed by the Federal Telegraph Co. and spent 35 years with the parent organization I T & T.

Russ Rennaker, W9CRC
Kokomo, IN 46901

Well Done, Bill

Editor, CQ:

Since becoming a Novice in 1978, I have discovered and enjoyed your magazine. I am writing in particular to express my appreciation of the column for Novices written by Bill Welsh, W6DDB.

Terry Wyngarden, KA8ATA
Grand Haven, MI

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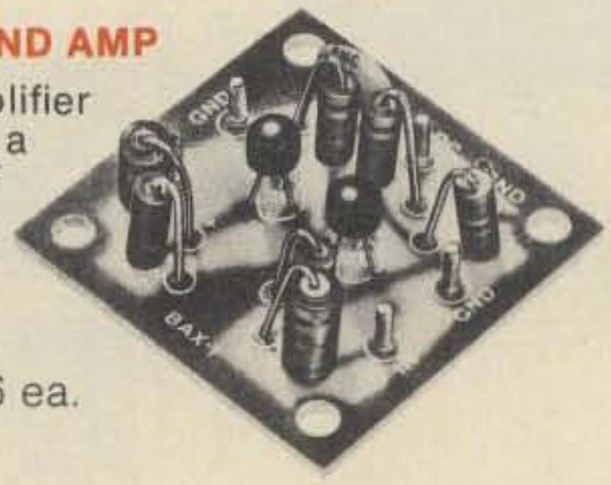

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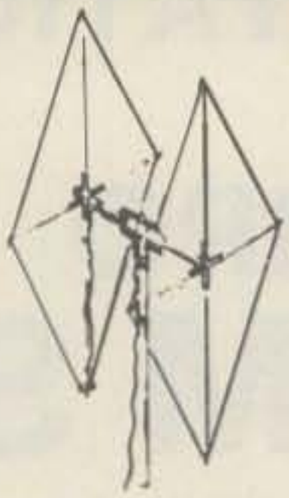

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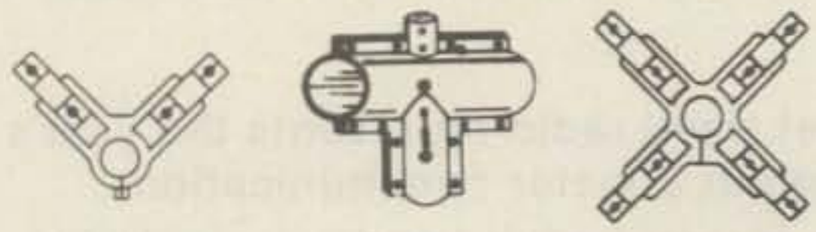

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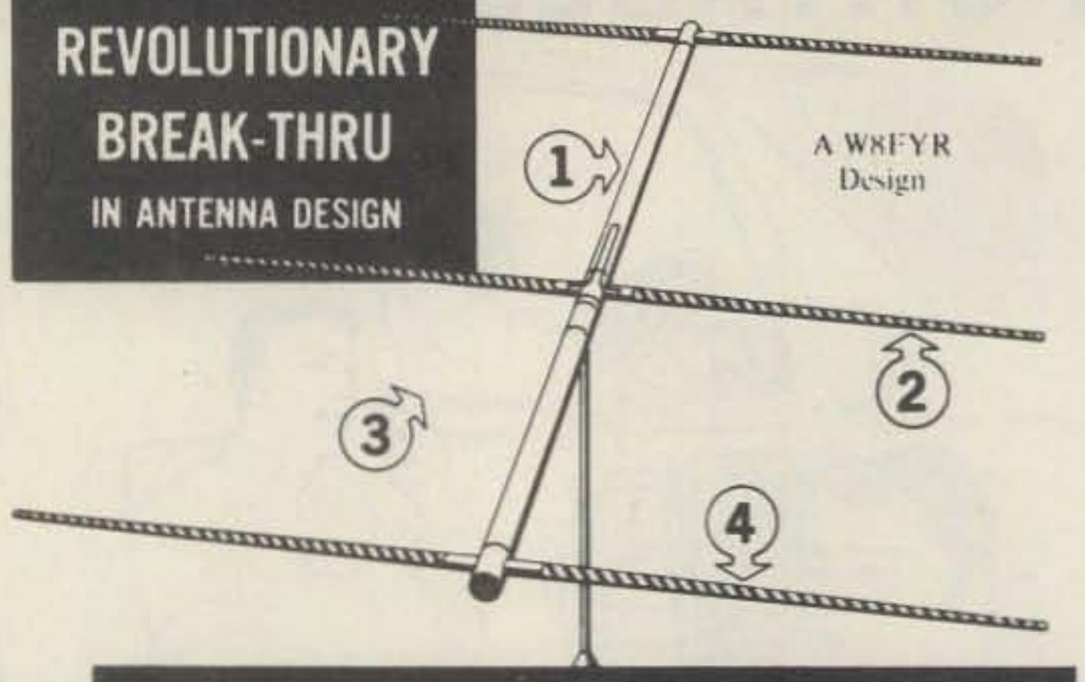

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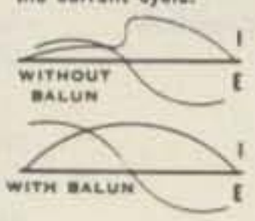

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Summary Specifications.

Frequency Coverage	80, 40 and 15 meters
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With power from car or Alda PS-130	250 watts PEP or dc on 80 and 40 meters, 200 watts PEP or dc on 15 meters
With power from Alda PS-115	250 watts PEP/200 watts dc on 80 and 40 meters, 200 watts PEP/175 watts dc on 15 meters
Dimensions	3¼ inches(82 mm) high, 9 inches (228 mm) wide, 12½ inches (317 mm) deep
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CIRCLE 1 ON READER SERVICE CARD

Professor Heisseluft challenges universally accepted thesis that congestion can only be relieved through the use of Narrow Transmission Bandwidths

Wideband Modulation (WBM) Techniques

Professor Emil Heisseluft*
Lauton Institute
Grossmaul-an Der Donau
Austria

It is not often that we have the honor to publish historical reviews of major, technological breakthroughs in the field of communications. This month, however, we are pleased to present a summary of work performed over 17 years ago which lead to the development of a new, wideband modulation technique. In particular, the material below, assembled by Professor Heisseluft, describes experiments conducted by the Professor in the area of frequency-hopping, spread-spectrum systems.

Introduction

Amateurs have recently heard and read much information about a new modulation technique which, it is said, will revolutionize voice communications[1]. This technique, known as narrowband voice modulation (NBVM), employs a frequency-compressed audio signal for purposes of transmission, while at the receiver, the compressed signal is expanded in frequency to reconstruct the original audio signal. Proponents of the technique argue that a NBVM signal will occupy one-half the spectrum space now occupied by a conventional s.s.b. signal, and as such, the use of NBVM techniques will significantly reduce congestion on the amateur bands.

It is just possible, however, that there are some very definite advantages to be gained by using wideband modulation (WBM) techniques in the amateur service. As noted by Costas[2], the use of wideband techniques "challenges the intuitively obvious and universally accepted thesis that congestion in the radio frequency spectrum can only be relieved by the use of progressively smaller transmission bandwidths obtained by appropriate coding and modulation techniques."

I first read Costas' paper in early 1960 while I was a student at the Lauton Institute. At that time, Professor Jerzy Ostermond-Tor and I were engaged in studies of extrasensory perception (ESP; see Heisseluft[3]). Since our studies already involved such subjects as information theory and channel capacity, it was decided to continue our research in these areas, and to initiate a research program on wideband modulation techniques. More specifically, Professor Ostermond-Tor and I were determined to develop a practical WBM system which could be used by amateur operators in the high-frequency bands. It is this system and the techniques we used which forms the basis for this paper.

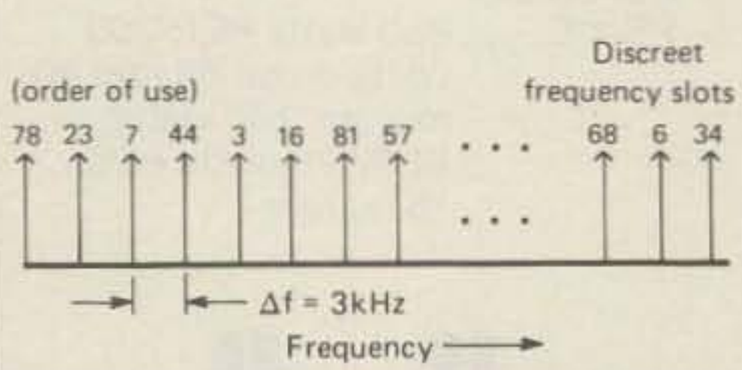


Fig. 1 - In a frequency-hopped system, the instantaneous frequency used for transmission is one of a family of frequencies, or slots, which are spaced by f, and which are selected for use in a pseudo-random basis.

Frequency Hopped Signals

The wideband communication technique Professor Ostermond-Tor and I decided to use employed a transmitted signal which was hopped from frequency to frequency during the transmission. We realized that the method was complicated and that it would be expensive to implement, but that, dear readers, is a fact of life when one does research at the forefront of technology.

In the system we developed, a device was designed to generate a series of random numbers in a prescribed manner; that is, in a

*Professor Heisseluft is currently on sabbatical leave from the Lauton Institute. Correspondence to the Professor may be directed c/o CQ, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050.

pseudo-random manner. The resulting series of numbers, in turn, was used to switch the carrier frequency of a modulated s.s.b. signal over a set of frequencies (or slots) at the rate of about 10 hops per second. The set of frequencies we used covered a band about 250 kHz. wide, with the frequency slots spaced 3 kHz. apart (see fig. 1). The choice of a 250 kHz. band was based on our intention to test the "spread" signal in the 20 meter amateur band under the terms of a special authorization issued by the Austrian authorities.

As to the receiver, a pseudo-random number generator was used to switch the local oscillator in a fashion identical to that of the transmitter's carrier frequency. Sychronization between the transmitter and the receiver, of course, was a critical factor, but in time, we were able to track the frequency-hopped carrier at the receiver. This enabled the receiver to eliminate the frequency hops from the transmitted signal, leaving only the original, modulated s.s.b. signal to be processed by the receiver. Professor Ostermond-Tor and I called this process "de-hopping."

System Performance— Theoretical

The advantage in using a frequency-hopped, spread-spectrum signal derives from the fact that not all of the frequencies which are instantaneously occupied will be in use by other stations at the same time. Put another way, the frequency-hopped transmitter may occasionally jump to a frequency which instantaneously confains an interfering signal, but this should be followed by jumps to a string of frequencies which are instantaneously free of interference. Thus, the de-hopped signal will only occasionally experience interference, and so, the signal-to-noise ratio of the desired signal has been improved through the use of signal processing. The term "processing gain" (PG) describes this phenomenon, and it is defined as follows:

PG = Maximum Number of Frequency Slots
= RF Bandwidth/Modulation Bandwidth

For our crude frequency-hopped, spread-spectrum system, the theoretical processing gain was expected to be about 83, or roughly 19 dB.

System Performance— Experimental

Our experimental frequency-hopped, spread-spectrum system was ready for testing by early 1961. At that time, conditions on the high-frequency bands were still relatively good, though solar activity was on the decline. Regardless, it was decided that Professor Ostermond-Tor, who was once a Radio Amateur (ex YM4XR), would remain in Austria for the summer, and would operate the transmitter. I, on the other hand, was to travel to Cape Cod, and would spend the summer on the North American Coast; here, I would listen for, and record, the signals transmitted by the Professor.

The tests began in July, 1961. The professor, using the experimental callsign OEX4, transmitted taped messages which consisted of material which had been especially developed for use in intelligibility tests. The transmissions were made daily in the band extending from 14,100 to 14,350 kHz., and consisted of one-hour broadcasts which commenced at 1900 GMT. In all, I was able to record 58 broadcasts during the months of July and August.

Before discussing the results of the tests, it is interesting to review the effect our frequency-hopped transmission had on the activities of other stations in the 20 Meter band. Since, on the average, one would expect a particular slot to be occupied by our signal every 8.3 seconds, a receiver tuned to this slot would be expected to hear a short transmission burst roughly every 8.3 seconds. Indeed, a few Amateurs did report hearing "a strange, chirp signal" from time to time on the 20 Meter band. Using directional antennas, they localized the source of the signal as being in Austria, and named the signal the "Austrian Frogmouth."* From the paucity of complaints to the FCC and other regulatory agencies, however, we were able to determine that the frequency-hopped signal caused insignificant interference to on-going activities in the 20 meter band.

The results of the trans-Atlantic tests[4] more than confirmed our hypothesis that wideband modulation techniques could provide a substantial improvement in the signal-to-noise ratio observed under conditions when the spectrum used is crowded with other signals (note that under conditions where no other signals are present, the frequency-hopped, spread-spectrum system would perform as well as would a conventional s.s.b. system). In fact, using a 95% intelligibility level as the criterion for judging system performance, the data indicated that the processing gain for our system was on the order of 16 to 18 dB. This was very close to the oretically-derived gain of 19dB, and confirmed the usefulness of frequency-hopped systems in the Amateur service.

Applications to the Amateur Service

With the advent of large-scale-integration (LSI) technology, it should be possible today to develop a spread-spectrum system for use on the Amateur high-frequency bands which is far more capable than was the crude system developed by Professor Ostermond-Tor and me over 17 years ago. For example, it should be possible to develop pseudo-random code generators with the capability to produce a large number of different codes, all of which have a small probability of setting two transmitters to the same frequency slot at the same time. Through the use of such a suite of codes, a large number of transmitted signals could be independently hopped in a common frequency band without causing interference to one another.

The use of spread-spectrum techniques, however, is not without its problems. Any application in the amateur service would necessarily have to examine such areas as spurious spectral components which are generated by the transmitter, spectrum splatter, and receiver selectivity. As always, sychronization would remain a problem. But given the ingenuity of Amateur operators, it would seem likely that within a very short period of time, they, too, will be experimenting with such wideband modulation techniques as frequency-hopped, spread-spectrum systems. CQ

*The Frogmouth, which is of the *Order Caprimulgiformes,* is a species of bird which is found worldwide (except in the far north). The bird, which is soft-plumaged, is distinguished by its weak feet and very large mouth. ed.

1. Anom., The Radio Amateurs Handbook, American Radio Relay League, Newington, CT, 06111, 1979.

2. Costas, J.P., Poisson, Shannon & The Radio Amateur, *Proc. IRE,* December, 1959.

3. Heisseluft, E., Broadcasters Threaten Takeover of Amateur ULF Band at WARC 79, *CQ,* April, 1977.

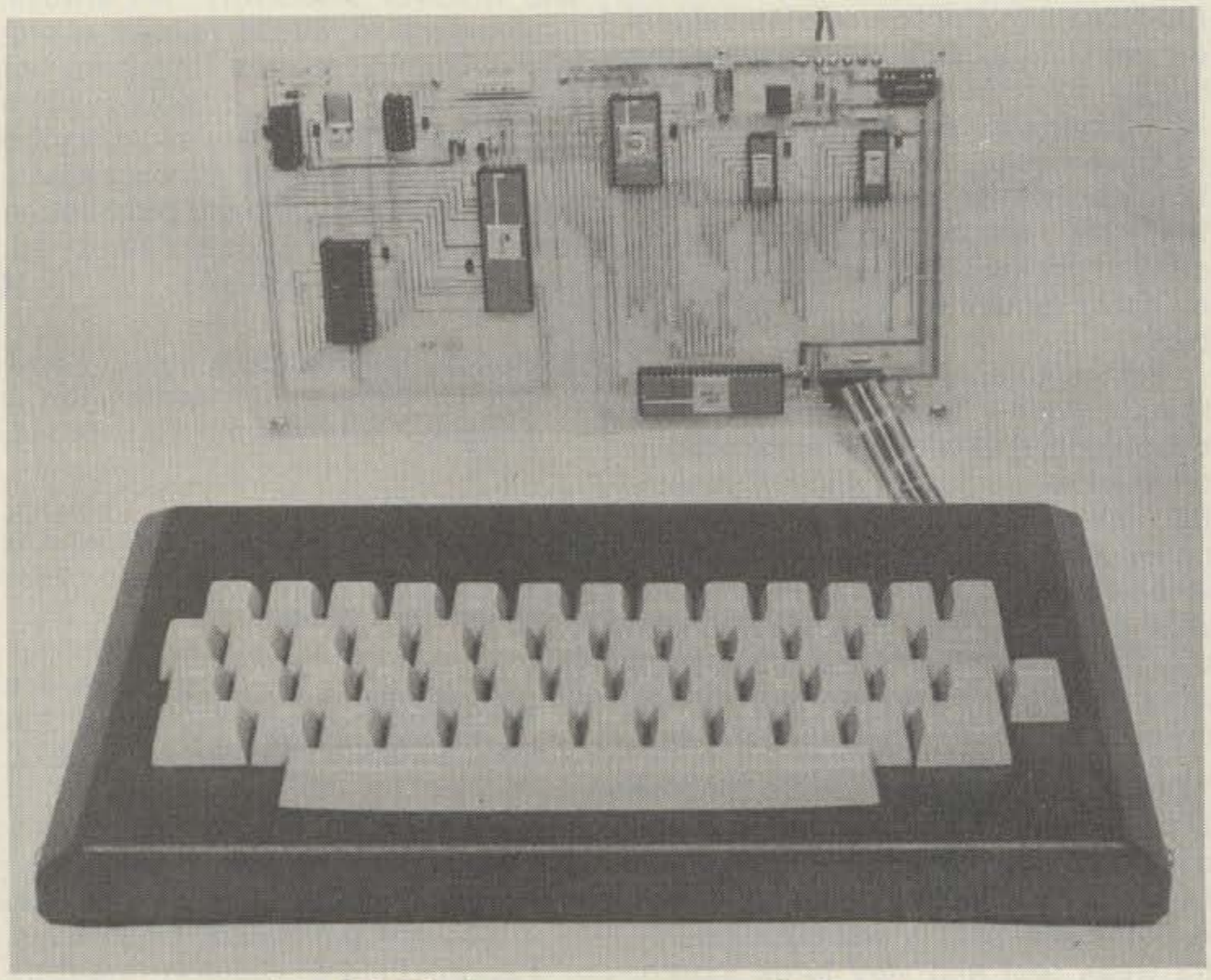
4. Heisseluft, E., and J. Ostermond-Tor, The Use of Frequency-Hopped, Spread-Spectrum Signals in Modern Communication Systems, Report LI-62-5, Lauton Institute Press, December 1962.

Wouldn't it be nice to type on a keyboard and generate perfectly spaced Morse Code? Dale Platteter presents plans for building your own microprocessor controlled c.w. keyer in this three-part series.

Build Your Own MP-80 Morse Code Keyer

Part I - Basic Theory of Operation

BY DALE PLATTETER*



The MP-80 microprocessor controlled keyer.

Up to now, it has been a never ending struggle to learn Morse Code and perfect a good sending "fist." It has been even harder to get a challenging workout to upgrade your ticket or teach code to Novices at a calibrated sending speed.

Those days are gone forever. With just $49 worth of hobbyist IC's, an inexpensive ASCII encoded keyboard, and a power supply one can build a microprocessor controlled c.w. keying system that will directly interface to any transmitter or code practice oscillator. Just think of the fun this will be during the next contest.

Absolutely no knowledge of the 8080A microprocessor or its internal working is needed to construct this project. The MP-80 keyer was designed to be built as a "black box" by amateur radio operators. Every effort has been made to use components which are readily available from mail order hobbyist stores.

The MP-80 operates with four simple English language commands. Just type the letter **C** to transform the keyboard into a c.w. generator. The

*1315 "Q" St., Bedford IN 47421

BREAK key halts c.w. operation to allow for sending speed and message key changes. Typing the letter **S** followed by the desired sending speed alters the sending rate. Typing an exclamation point records a useful message or call letters in a 20 letter memory.

Let The Microprocessor Do The Work

The heartbeat of this system is the popular **8080A microprocessor chip.** It allows a user to generate perfectly spaced Morse code digits by typing on a keyboard. After simply entering a desired sending speed of 5, 13, 20, or 30 w.p.m., the microprocessor automatically adjusts the dots, dashes, letter spaces, and word spaces to be a perfect 1, 3, 3, and 7 time intervals in length. Intermediate, high speed (above 30 w.p.m.), and weighted sending is handled with a one word change in an ultraviolet erasable **EPROM** memory. The user can also store a prerecorded message of 20 characters from the keyboard and recall it by touching a single programmable key. In addition to all the numbers and letters, the MP-80 has keys dedicated to *CQ CQ CQ, SK* (end of work), *BK* (break), *AR* (end of message), *AS* (wait), and *ERROR.* Its **random access memory** allows for typing 100 keys ahead of sending. A small reed relay gives contact "opens" and "closures" identical to a hand key, without all the work.

Basic Theory Of Operation

The block diagram of fig. 1 illustrates the three major parts of the MP-80 keying system. Each time a key is depressed, an **ASCII encoded keyboard** generates a unique **7-bit binary number** along with a **strobe pulse.** A single AY-5-2376 **encoder chip,** usually sharing the same board with the keyswitches, debounces the switch closures and serves as a **look-up table** for the binary number. This number is presented to the microprocessor after passing through an 8255 **peripheral interface.** The strobe signal acts as a **latch** for the 8255 to accept the data.

Most of the work is done by the 8080A microprocessor. Its first duty is to watch for keyboard entry. Even though it is busy transmitting Morse data at 30 w.p.m., it still finds time to sample the keyboard 725 times per second. This is fast enough to keep pace with a 200 w.p.m. typist.

The 8080A looks-up the Morse code pattern for each letter in its 2708 EPROM memory. This EPROM not only holds Morse data but also stores the coded 8080A **operating instructions**. This 8192-bit EPROM can be programmed by the user or purchased with code patterns and instructions permanently loaded inside. When the microprocessor finds (00) in the Morse code table, it sends a dit followed by a unit space. A (01) generates a dah and a space while a (03) indicates that the letter is complete and 3 unit spaces are required. The calibration, speed, and weighting data are permanently stored in the EPROM so that the user never has to concern himself with these headaches.

By counting **clock pulses** from an 8224 crystal controlled clock, the micro keeps track of time. Like a quartz digital watch, the MP-80 can't slip out of calibration unless the 18 MHz crystal fails. As the primary clock of the system, the 8224 divides the crystal frequency by 9, providing a 2 phase 2.048 MHz drive to the 8080A along with synchronizing pulses after a cold start or reset.

Under microprocessor control, a 256 word static random access memory (RAM) is used as a temporary data file. This RAM packs away up to 100 keystrokes of Morse code data if the user gets ahead of the current digit being sent. The memory is configured as a first-in first-out file and is rarely ever found to be 60% full. The 156 remaining words of memory are used to save the 20 letter message, store w.p.m. information and keep temporary data for the MP-80 operating programs. As with all static RAM's, their data bits are lost after a power failure. Fear not, *the micro restores the temporary data and 20 w.p.m. speed information each time the power returns.* The only thing that gets lost is the 20 letter message which can be reentered in a couple of seconds from the keyboard.

The 8228 **system controller** serves as a bi-directional buffer for the internal data bus. Its most important function is to receive status information from the 8080A for generation of memory "read" and "write" signals. These signals are gated by a 74LS02 NOR gate (not shown) to keep the memories from fighting each other for use of the internal data bus.

All input and output to the outside world is handled by the 8255 **periphial interface chip.** This 40-pin general purpose I/O device not only watches the keyboard but sends "open" and "close" voltages to the keying relay on command. The microprocessor thinks of the periphial interface as just another word in its memory array. It reads binary keyboard information from the 8255 and writes keying data back in the same fashion that it communicates with its RAMs.

Molded in a dual-in-line package like the rest of the integrated circuits is the **keying relay.** A transistor handles the drive current for the relay coil which has an internal shunt diode for noise supression. The single pole contacts are rated at 0.5 amp and 100 volts. The internal breakdown of the contacts is greater than 200 volts. ▣

(To be continued)

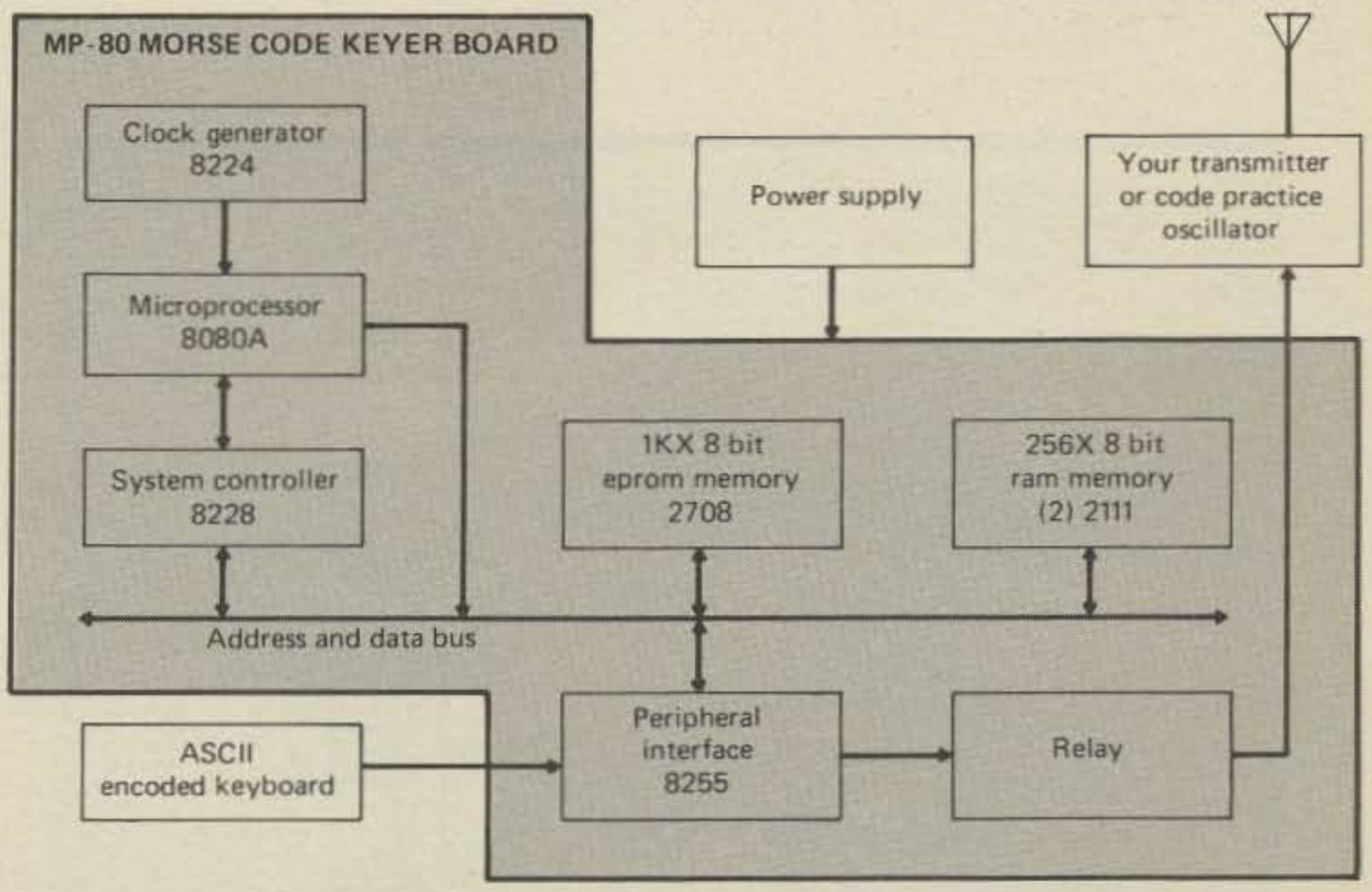


Fig. 1 - Block diagram of the MP-80 keying system. A dedicated c.w. keyer can be constructed with about $49 worth of components, a power supply and a standard hobbyist's keyboard. The hardware can be built as a "black box" with no knowledge of the 8080A microprocessor or its programming.

Some of you old-timers may remember breadboarding your first radio back in the frontier days. Today, radio amateurs are still using the breadboard as a basic tool for easy and enjoyable experimenting. W4FA explains what they are, how you can use them and where to get them. He also has some tips for home-brewing your own.

A Breadboarding And Interconnection Scheme

BY JOHN J. SCHULTZ*, W4FA

In recent years there has been a proliferation of accessory circuits available for the amateur to build to improve the operation of his station. This is due, of course, to the readily available, wide variety of low cost digital and linear IC's. It is often, however, a good idea to "breadboard" a circuit first before building a complete accessory unit. Breadboarding the circuit allows one to work out any "bugs" that may appear in the circuit and also one can experiment with added features, controls, etc., that one may desire to incorporate in the final version of the circuit.

There are, of course, many breadboarding approaches possible and one can purchase fairly elaborate breadboaring units complete with built-in multiple power supplies, meters, etc. These units are probably fine for the amateur who does an extensive amount of circuit experimentation. But, they are a bit of an expensive investment for the amateur who just does an occasional bit of circuit building or the amateur who just likes to build very simple one or two IC type circuits.

The breadboarding unit described in this article is designed for the latter type of amateur. Using the breadboarding unit described and just a simple variable power supply such as the Heath IP-2728, one can have a breadboarding unit that is suitable for a wide variety of discrete transistor or IC circuits at a minimum cost. However, there is no compromise in electrical performance. The unit will perform as well as any expensive commercial type.

The photo of fig. 1 shows the breadboarding unit. It consists basically of a 6x9 inch piece of double-sided copper p.c. board on which the breadboarding sockets and bus strips are mounted. Two BNC connectors are installed on each side of the socket assembly to serve as signal in/out connectors. Three binding posts, two of which are of the insulated type; are mounted above the socket to serve as power supply connection points.

A Continental Specialties type QT-59S socket forms the main part of the breadboarding assembly with a type QT-59B bus strip both above and below the socket. Very similar units are available from Radio Shack under

*Tangier (VOA), Department of State, Washington, D.C. 20520

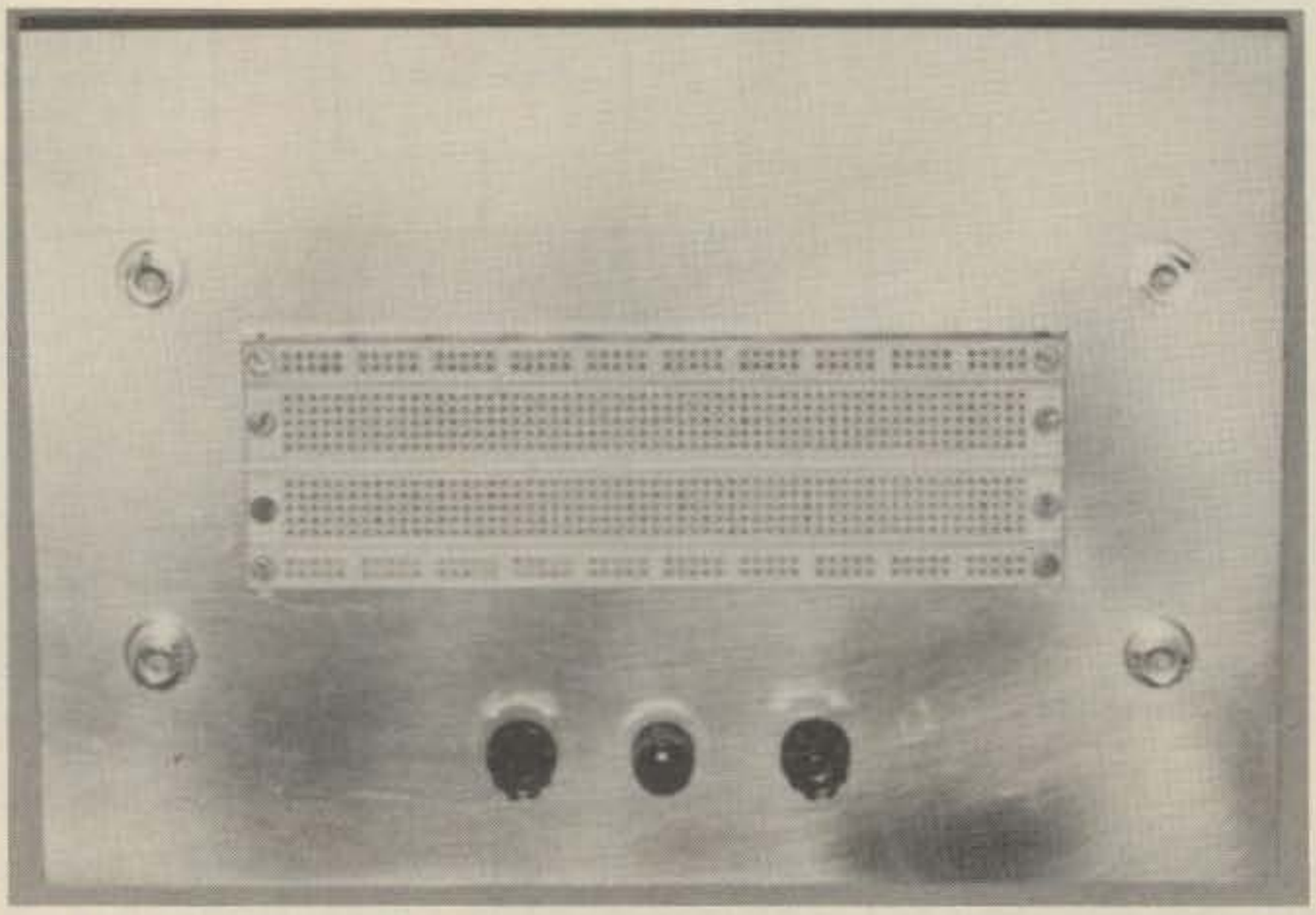


Fig. 1 - The breadboarding unit is assembled on a 6x9 inch of double-sided p.c. board.

their part no. 276-162 for the socket and 276-173 for the bus strips. These units snap/lock together so it is a bit difficult to discern from the photograph that there are three separate units. The actual connectors used in the Continental Specialties units are a type of Molex pin inserted in a high-temperature plastic. The bus strips consist of two rows of ten groups of five clusters of terminals interconnected together. The socket consists of groups of five terminals connected together vertically on each side of the center trough. By removing the backing from the units one can access all of the connectors and break the interconnecting points. Fig. 2 shows how various rows and columns in the breadboarding strips were arranged for connection to the BNC connectors and to the binding posts. The top row of the top bus strip is split in two so one side can function as the positive voltage strip, and the other side as a negative voltage strip. Connections are made to the binding posts on the underside of the board taking care to remove the copper on both sides where the wires pass through the board. The lower row on the same bus strip is a ground strip. Bare wires are soldered to the underside of the strip at at least four points and soldered to the underside of the board where they pass through the board. The top row on the lower bus strip is also a grounding strip. The bottom row on the same bus strip is just split in two but left insulated. The BNC connectors, in a similar manner, are connected to the vertical columns on the main socket indicated in fig. 2.

The photo of fig. 3 further clarifies the construction of a bus strip. One can see how relatively simple it is to remove the strip of connectors from the plastic form and break the interconnection between the clusters of five terminals at any point. The contacts used are of nickel silver alloy and, when in their housing, will accept any diameter lead from .015 to .032 inches. The average contact resistance is between 0.4 and 0.5 milliohms.

All that is needed to complete the unit is some feet to support the board and tilt it at about a 30 degree angle. Suitable feet can probably be found in a hardware store but they are also easily fabricated from small pieces of wood doweling cut at the proper angle and epoxyed to the underside of the board.

The interconnection hassle between a breadboard and test or other equipment can often take the fun out of circuit construction. Also, the jumble of wires that results often leads to

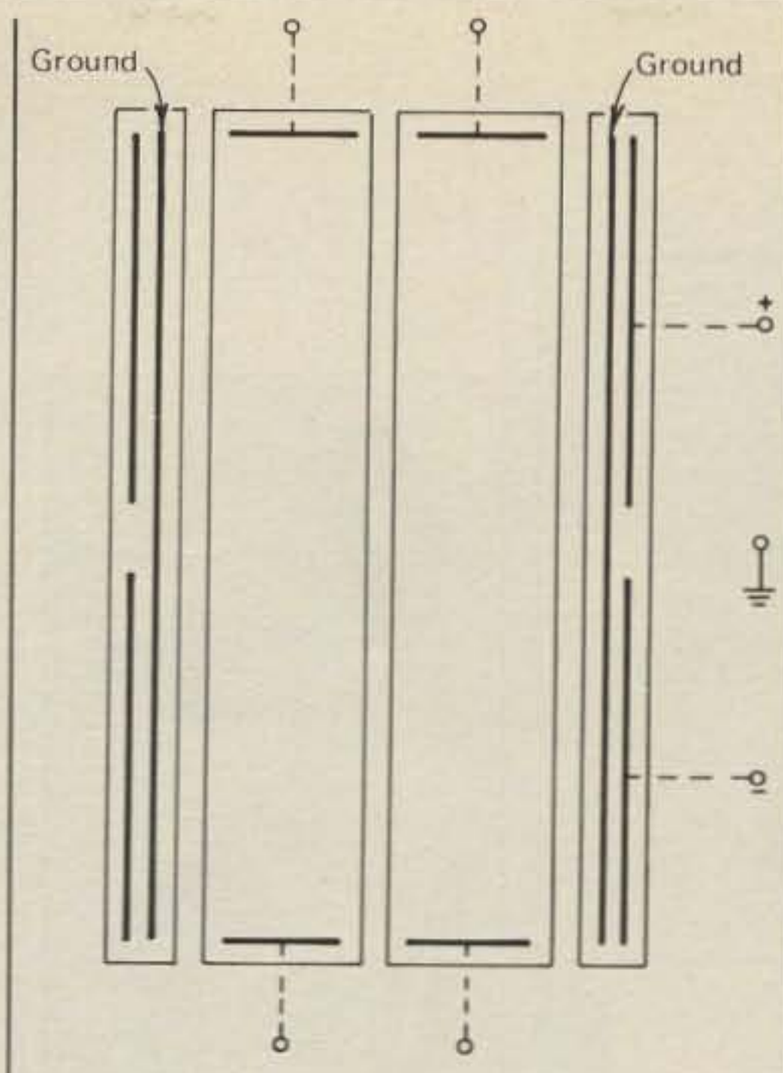


Fig. 2 - This diagram shows how different connector strips in the breadboarding bus strips and socket were separated and wired to the binding posts and BNC connectors.

various undesired electrical effects. A one-time investment, therefore, in a good system of interconnecting cables and accessories should be considered. The BNC series of connectors is a good candidate because of their quick disconnect action, relatively low cost if one does some bargain hunting, and usefullness up into the v.h.f. range. The point about bargain hunting deserves of bit of emphasis. The standard UG-88 BNC male connector usually sells for about $1.13 but has appeared in surplus outlets for around 40 cents.

One should first start by fabricating a series of three foot or so long interconnecting cables using miniature RG/174 coaxial cable with a male BNC connector at each end. Then, one can add accessory connectors as needed. The photos of fig. 4 illustrate some of the wide variety of BNC hardware and adapters which are available. The adapters shown are mostly commercial units but note that most of them can be easily home-brewed at a considerable savings by just buying the individual parts. For instance, the BNC female-to-phono plug adapter is easily constructed from a single hole mounting BNC female connector and any common phono plug assembly. If one constructs any of the binding post or banana-plug-to-BNC adapters remember to keep the center-to-center spacing between posts or plugs at 3/4". This is the standard spacing used on most test equipment binding posts so it makes for easy interface. There are various other adapters that one can make, particularly for BNC/u.h.f. connector interface (only one such type is shown in fig. 4). But, the point is that by having a bunch of standarized interconnecting cables and various adapters one can make good, shielded connections into and out of any circuit being used on the breadboarding unit.

It was mentioned earlier that the Heath IP-2728 variable power supply was used with the breadboarding unit. This is a small 1 to 15 volt, 500 mA power supply which is regulated and has variable current limiting. There are just two uncalibrated controls on the unit—one to vary the output voltage and the other to set the maximum current the supply will deliver. These controls are easy to approximately calibrate with a v.o.m. and such calibration adds greatly to the usefulness of the supply. The voltage control is calibrated using the approximate voltage scale on a v.o.m. with the power supply unloaded. The current control is calibrated by setting a milliampere meter directly across the power supply terminals

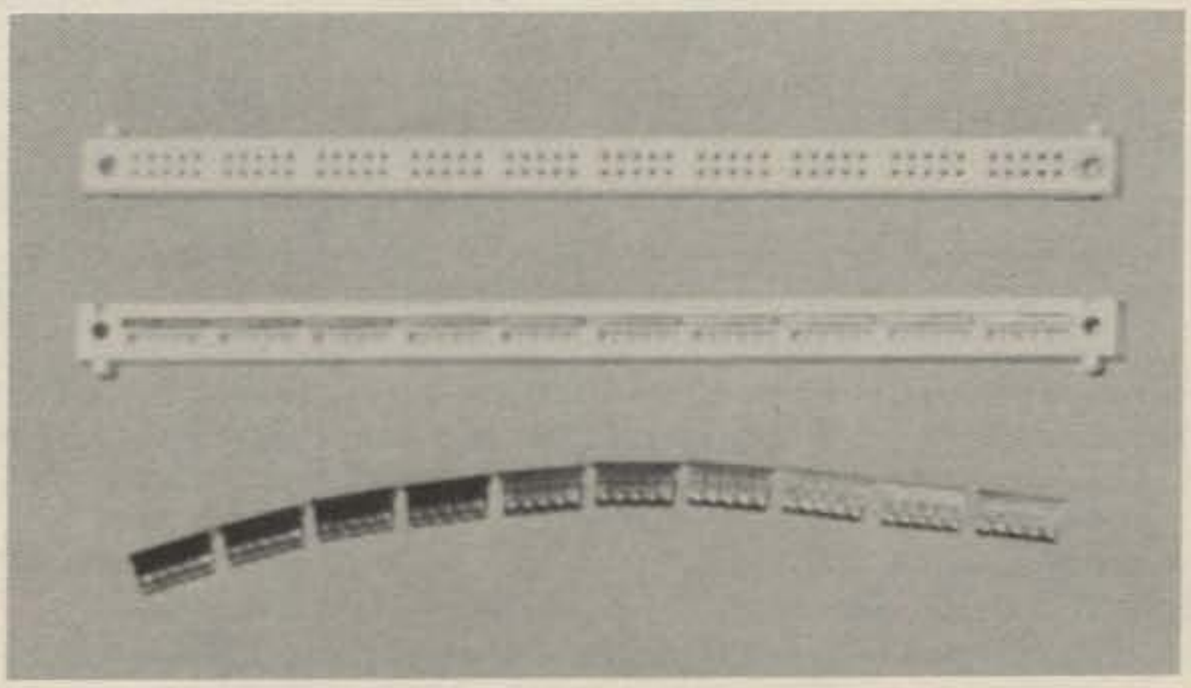


Fig. 3 - This photo illustrates how the connector strips can be removed from a bus strip. The connector strips can then be separated as desired.

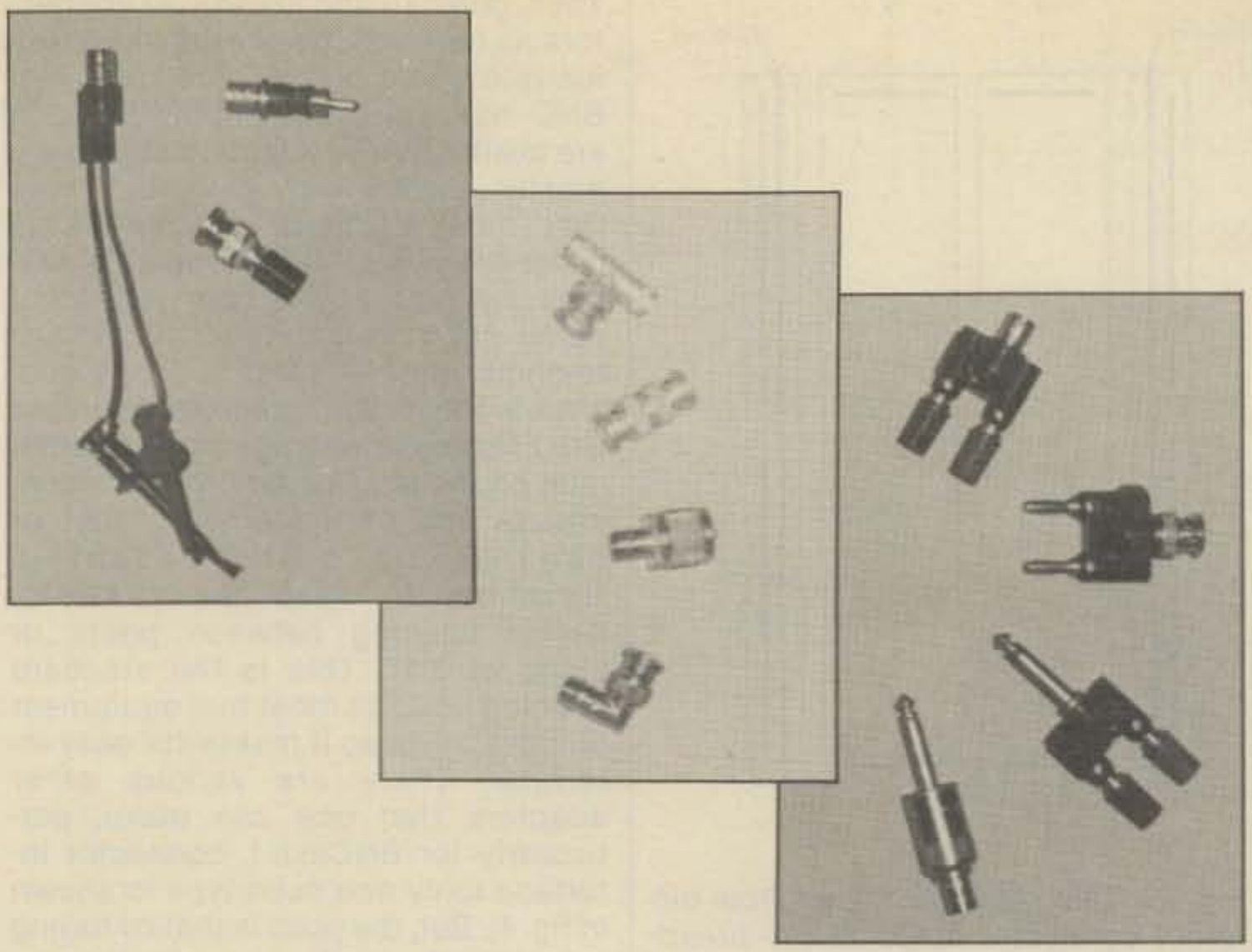


Fig. 4 - These photos illustrate some of the wide variety of adapters that can be used with basic BNC-type connectors. The units shown are mostly commercial ones but almost all of them can be easily home-brewed.

with both the voltage and current controls set to a minimum. Then, the current control is advanced first and the voltage control only as necessary to achieve various current flows. Typically, one can place calibration points at 10, 30, 75, 150 and 500 milliamperes. The stability of these calibration points has remained excellent in a power supply used for several years. The purpose of the calibration is to remove the need for voltage and current meters in most cases when dealing with a breadboarded circuit. The voltage control can be varied, of course, to see over what approximate voltage range a circuit will operate. At any given voltage, one can adjust the current control and note the point at which the circuit stops to function or functions poorly. This will give a good indication of the current drawn by the circuit.

When not used with the breadboarding unit the power supply can be used for other general testing or battery charging purposes. Because of its current limiting feature, it is particularly suited to such applications as charging a series string of nicad batteries.

Introducing Kantronics' Field Day™

Morse Code/teletype reader and code speed display:

Kantronics' Field Day Morse Code/teletype reader and code-speed display reads code signals right off the air. Its powerful microcomputer system picks out signals, computes their speed, and reads even sloppy copy up to 80 words per minute!

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Field Day is simple to use. You plug it into your station receiver just as you would a set of headphones.

Code and teletype conversations are converted from dots and dashes to standard alphanumeric text. The text advances across 10 big half-inch displays, and lab tests show that even the fastest CW is easily readable.

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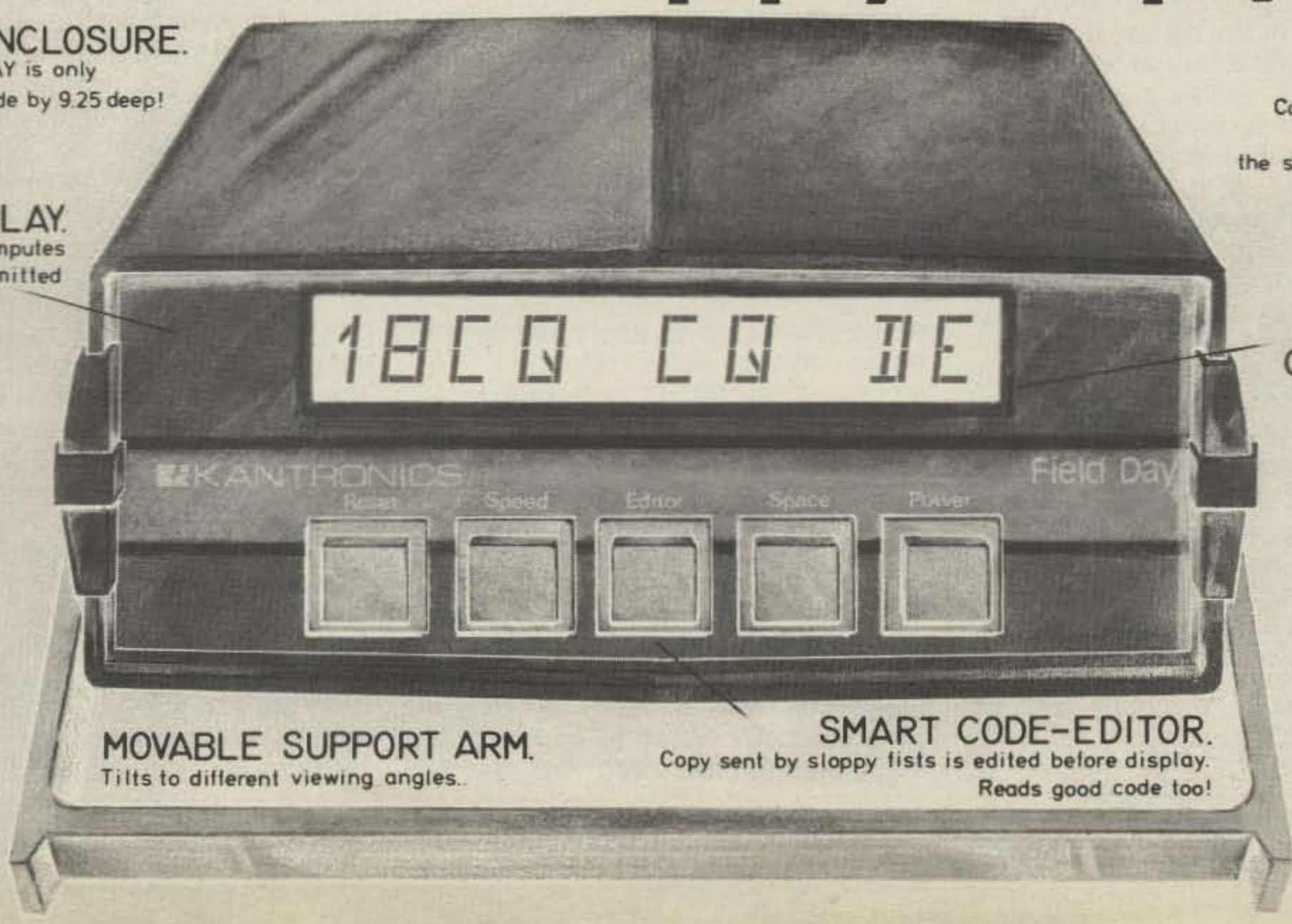

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Last month Ade Weiss, CQ's resident QRP maven, presented plans for his* Viking-5 *transmitter. In this article he shows you how to build a stable, two-band v.f.o. for his little gem.

A Solid-State 3.5/7 MHz V.F.O. For the *Viking*-5 Transmitter

BY ADRIAN WEISS*, K8EEG/WØRSP

In an earlier article, we described an ultra-compact solid state transmitter for 3.5-7 MHz capable of being carried in a shirtpocket and putting a hefty 5 watt output signal on the air either from the home shack or from a portable location. One limitation of the *Viking-5* is that it is a crystal-controlled design. The versatility and effectiveness of the rig can be greatly enhanced by the addition of v.f.o. frequency control. In this paper, we will describe a v.f.o. circuit which provides more than adequate output to drive the *Viking-5* to its full output. When this single band v.f.o. unit is combined with the single band version of the *Viking-5* and mounted in the same size chassis box as the original two-band version, a very compact v.f.o. controlled 5 watt transmitter for either 3.5 or 7 MHz results. The circuit of the *Viking-5* as well as construction details were provided in the earlier article, and the reader is referred to it for those details ("The *Viking-5:* A 5 Watt Solid State Transmitter for 3.5 and 7 MHz," *CQ,* March, 1978).

The circuit for the singleband *Viking-5* is shown in fig. 1 and should permit duplication without reference to the above article for the experienced builder.

Vackar V.F.O. Circuit

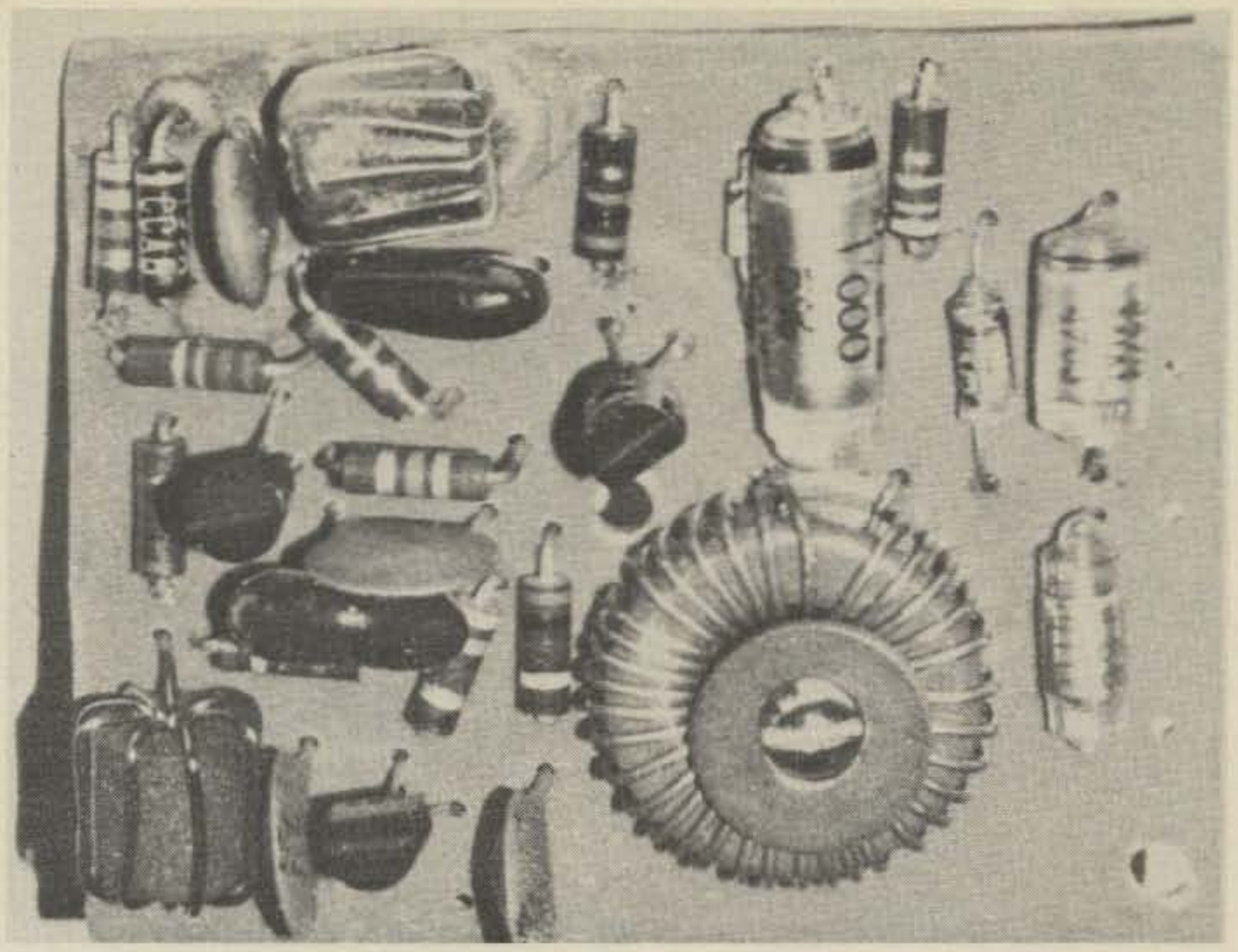
Fig. 2 shows the circuit featured in this project, and it employs the customary three stages, consisting of an FET oscillator followed by two Class A buffer-amplifiers. The Vackar circuit configuration has been available in the literature for over a decade, but surprisingly, has received little use in practical applications. It is interesting to note that the Heath HW-8 oscillator employs the circuit. It is a quite stable configuration, and if reasonable care is exercised in p.c. board layout, parts selection, and mounting, a 100 Hz drift rate is attainable without difficulty. Frequency stability depends primarily upon the stability of the components used in the frequency determining section of the circuit at L1/C1-5. In the design shown, polystyrene capacitors are used due to their excellent thermal characteristics. A pair of mounting holes for the addition of a temperature compensating capacitor at C3 has been provided on the p.c. board if the builder wishes to further compensate for thermal drift.

In the Vackar configuration, the frequency determining circuitry is connected in the drain-gate feedback path, with very light capacitive coupling to the gate. A variable tuning capacitor or varactor tuning diode may be inserted at either the drain or gate end of the tuned circuit to provide the proper frequency bandspread. The optional p.c. board template shown in fig. 3b includes provision for use of the varactor diode tuning system, while the p.c. board at fig. 3a is intended for use with a mechanical tuning system using an air variable capacitor. In experimenting with the circuit, it was found that the optimum C1:C2 ratio is about 3:5. The coupling capacitor at C5 can be as low as a few pF without affecting the operation of the circuit, although it size must be taken into consideration in determining the resonant frequency of the oscillator circuit. The standard practices in achieving stability and interstage isolation have been followed in the design. RFC2-C7-R3 isolated the oscillator at r.f. from the B+ line and Q2-Q3. Voltage regulation, essential to frequency stability in a v.f.o., is provided by the

*83 Suburban Estates, Vermillion SD 57069

dropping resistor R3 and a 1/2 watt, 6.1 volt zener diode. RFC1 is a ferrite bead slipped over the drain lead of Q3 to discourage harmonics in the v.h.f. range. Finally, output from the v.f.o. oscillator is taken across a 100 ohm resistor at the source of Q1. One advantage of the Vackar circuit is that output can be had at this point, which is not in the loop comprised of the frequency determining circuitry and, hence, the oscillator is relatively immune to "pulling" by variations in load presented by later stages. In the unit shown, for example, oscillator "pull" was less than 50 Hz from open circuit to direct short of the output of the v.f.o. The oscillator output is coupled to the Q2 base through a 150 pF silver mica capacitor. The size of this component is non-critical.

The oscillator output is amplified and isolated by the Class A buffer-amplifier stages at Q2 and Q3. The base bias is established by the resistive dividers R4-R5 and R8-R9, whose values are chosen to provide maximum gain for each stage. The base of Q3 is capacitively coupled to the collector of Q2 through C9, whose value is non-critical, and output from the v.f.o. is taken from the emitter of Q3 across a 1000 ohm resistor. Output from the v.f.o. is on the order of 2 v.r.m.s. depending on supply voltages (12-13.6 v.d.c.), a hefty signal which easily drives the *Viking-5* to full output.



Shot of the completed v.f.o. unit using the p.c. board of fig. 3. All resistors are of 1/4 watt size. Q1 oscillator circuitry is at the left-hand side of the board, with L1 and C4a to the left of L1. Bottom left to right: C1, C5, R1, C2, D1 visible at the lower right edge of C2, Q1, with R2 below it; RFC2 with C6, R5, R7-C8, C9 directly above RFC2, C7-D2-R3 to the right of RFC2. Top right to left: RFC3, C10, Q3, C11. Center right edge: R4 above D2, Q2, R6 to right of Q2. R10 directly to the right of L1, R9 to the right of R10, R8 below RFC3 and partly obscured by C9. C12, bypass for B+ input line, is mounted flat against the underside of the p.c. board between the B+ foil and the ground foil. The photo shows RFC2 as Amidon FB-73-801 ferrite core, but this was found to cause instability problems, so the proper RFC2 uses the FB-43-2401 core, which is mounted vertically in the RFC2 position. The paraffin wax used to secure RFC2 to the board is seen as the mottled area around RFC2. A fiber washed and screw used to hold L1 in place is visible at the center of L1.

P.C. Board

Fig. 3 shows optional p.c. board designs for construction of the Vackar v.f.o. Fig. 3a is a miniaturized version intended for use with the single-band Viking-5 transmitter. It utilizes 1/4 watt resistors and represents a fairly high-density layout. This version and the single-band *Viking-5* board will fit into a Calectro #101 chassis box (1.25 × 2.25 × 4.25 inches) with space to spare to provide an ultra-miniature 5 watt single-band transmitter. In this case, an air variable capacitor provides mechanical frequency control and, due to the limited space, it is not possible to use a vernier type drive for the variable capacitor. However, this is not essential in a transmitter, since the fine-tuning required in a receiver is not as important in transmitter frequency-spotting. A Johnson "panel mount" air variable capacitor with maximum capacity of 34pF. (Johnson #193-0010-001) will provide about 120 kHz bandspread on 80 meters, and a 20 pF size (Johnson #193-0006-001) will provide about 110 kHz spread on 40 meters. C4a may be included to adjust the amount of bandspread provided by a given size variable, or it may be omitted if the variable alone provides the desired spread. Of course, if the builder wishes, a larger size enclosure may be used to permit inclusion of a vernier tuning mechanism.

Fig. 3b is a larger version of the board which uses 1/2 watt resistors, and which includes provision for varactor diode tuning, as shown in fig. 2. The advantage of the varactor tuning approach is that all r.f.-bearing, frequency sensitive leads are on the p.c. board itself, and only the non-frequency sensitive control voltage lead leaves the board; hence, the mechanical instabilities associated with off-board frequency sensitive leads are eliminated. If the builder chooses the larger p.c. board, but does not wish to use the varactor diode system, pads 1-2-3 may be eliminated from the board and left as part of the ground foil.

Either board is made from single-clad p.c. stock (cooper foil on one side only). This writer prefers the approach discussed in an earlier article ("Easy P.C. Board Fabrication Using Self-Adhesive Address Labels," *CQ*, March, 1978), although optional methods may be used. In this approach, the following steps apply: 1) cut the p.c. stock to template size, and cover the foil side with self-adhesive address labels found in office supply stores; 2) glue a tracing or copy of the published template to the address label stock; 3) cut away label material and leave exposed the copper to be etched; 4) etch and clean label adhesive off with steel wool. Use a sharp tipped knife or razor, and straight-edge, in cutting away label material to expose the copper foil to be etched. A professional looking p.c. board results.

Assembly and Adjustment

Installation of Q2-Q3 circuitry is straightforward and requires no special care. However, care should be exercised in regard to the oscillator stage. First, when mounting the tun-

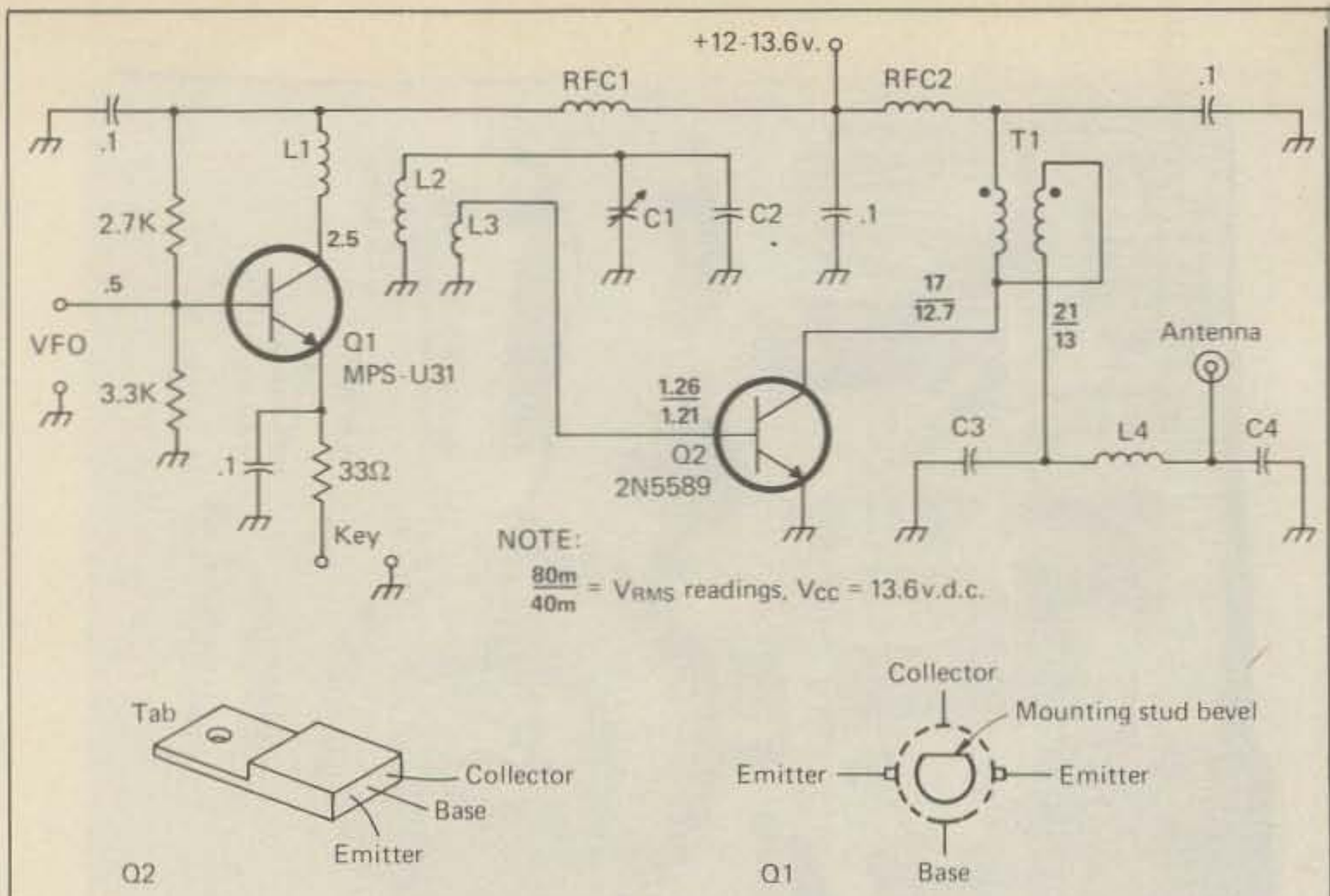


Fig. 1 - Schematic diagram of the Viking-5 QRPp transmitter.

Component Check List

- ☐ RFC1- 8t, #24 wire on FB-73-801 ferrite core
- ☐ RFC2 - 7t, #24 wire on FB-73-801 ferrite core
- ☐ T1 - 16t, #28 wire (2-wire twisted pair on T-50-2 ferrite core
- ☐ L1 - 3.5t hook-up wire, 1/3 core circumference over "hot" end of L2
- ☐ L2 - 35t, #24 wire on T-50-2 ferrite core
- ☐ L3 - 2t hook-up wire over ground end of L2
- ☐ C1 - Elemenco 60 pF trimmer (#404)
- ☐ C2 (40m) - 47 pF
- ☐ C2 (80m) - 220 pF
- ☐ C3 (40m) - 270 pF
- ☐ C3 (80m) - 750 pF
- ☐ C4 (40m) - 330 pF
- ☐ C4 (80m) - 820 pF
- ☐ L4 (40m) - 15t, #21 wire on T-40-2 ferrite core
- ☐ L4 (80m) - 23t, #21 wire on T-40-2 ferrite core

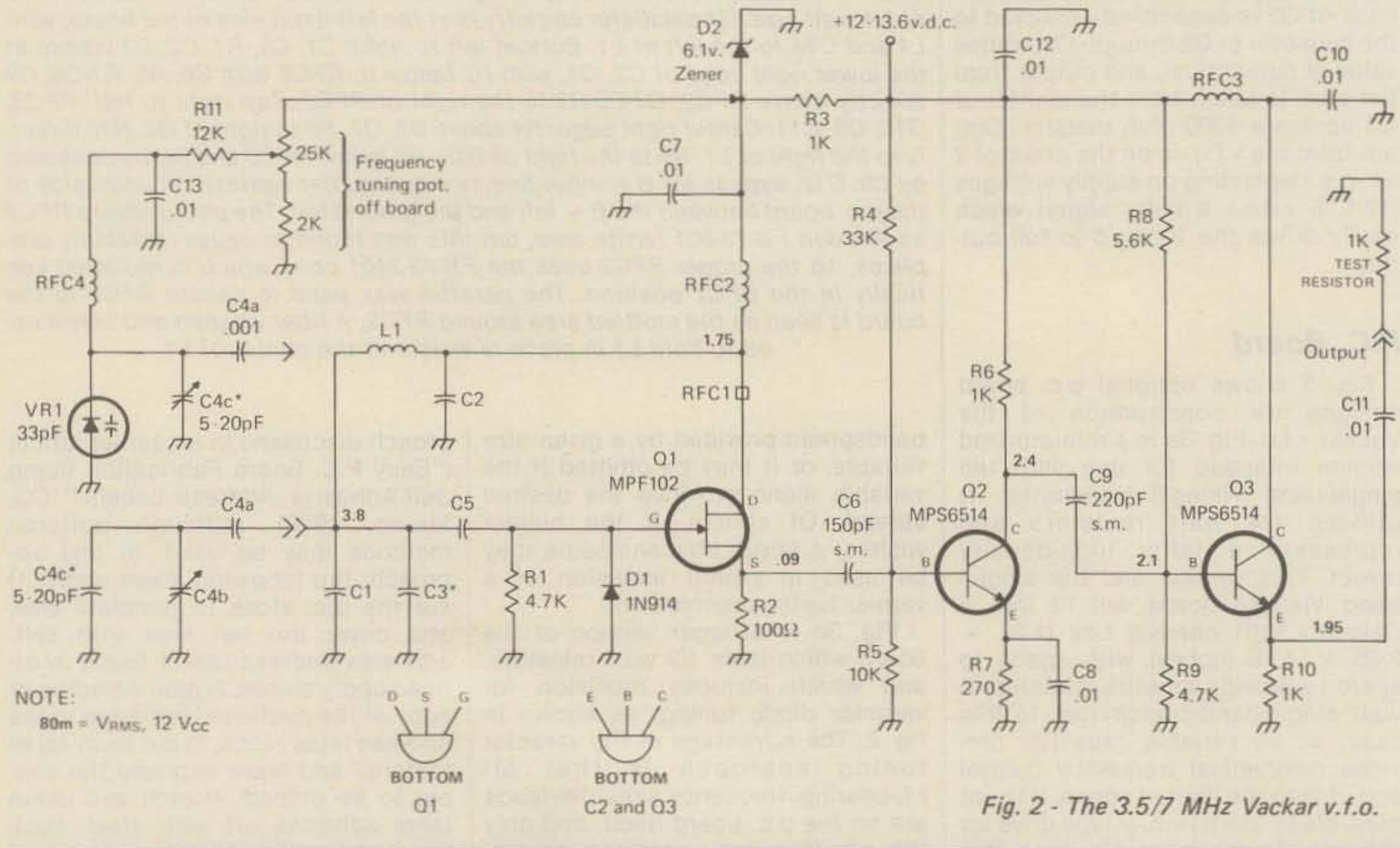
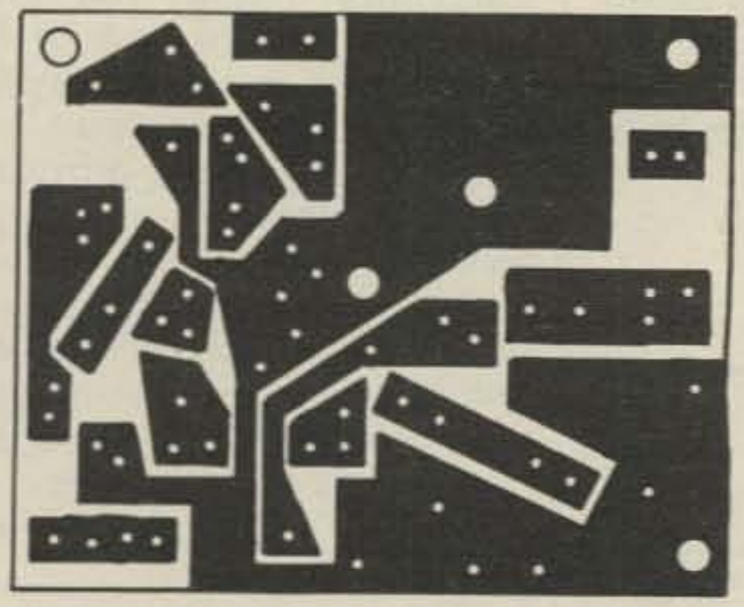


Fig. 2 - The 3.5/7 MHz Vackar v.f.o.

Component Check List

- ☐ RFC1 - Amidon FB-73-101 ferrite bead over drain lead of Q1
- ☐ RFC2 - 21t, #28 wire on Amidon FB-432401 ferrite bead
- ☐ RFC3 - 7t, #21 wire on Amidon FB-73-801 ferrite bead
- ☐ RFC4 - 25t, #28 wire on FB-43-2401 ferrite bead
- ☐ C1, 2, 4a, 5 - polystyrene capacitors
- ☐ C4b - air variable (see text)
- ☐ C4c - 5 - 20 pF N330 ceramic trimmer (Johnson #275-0320-005)- optional
- ☐ CRa - 33 pF (select for proper bandspread - see text)
- ☐ D2 - 6.1 volt zener diode, 1/2 watt, IN753
- ☐ VR1 - 33 pF varactor tuning diode (R-2503/MV2109)
- ☐ L1 (80m) - 5.8 μH, 315, #22 wire on T-68-2 ferrite core
- ☐ L1 (40m) - 2.35 μH, 21t, #22 wire on T-68-2 ferrite core
- ☐ C1 (80m) - 435 pF
- ☐ C1 (40m) - 270 pF
- ☐ C2 (80m) -1000 pF
- ☐ C2 (40 m) - 470 pF

All resistors are 1/4 watt for miniature p.c.b. (see fig. 3b for p.c.b.)



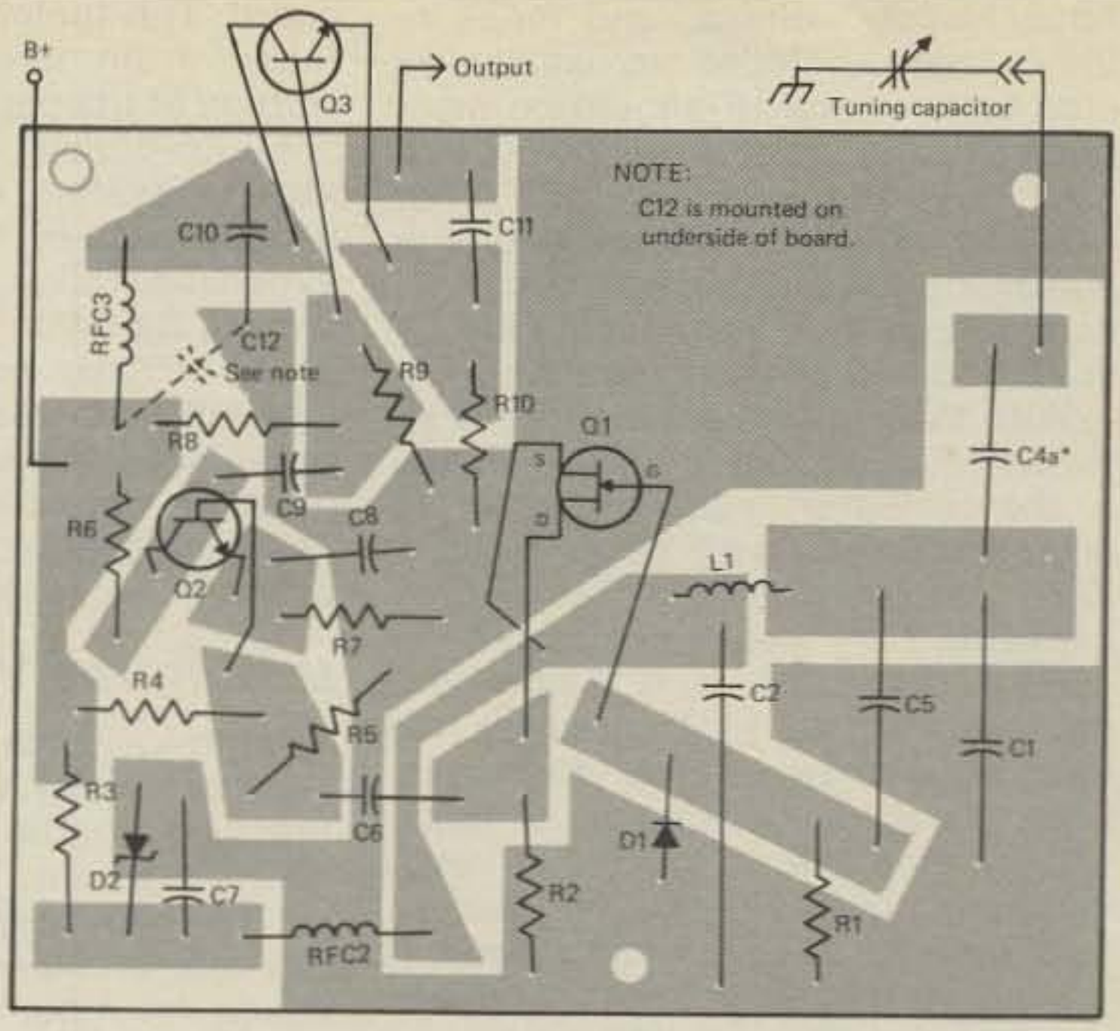


Fig. 3(a) - One printed circuit board scheme for the Viking-5 v.f.o. To the left is the p.c.b. mask (full-size); to the right is the parts placement. See text for explanation.

ed circuit polystyrene capacitors, make sure that the ground foil of the capacitors, shown by the black band at one end, is connected to ground. Pull the capacitor leads tightly through mounting holes to insure that the capacitors are not susceptible to instabilities caused by slight knocks or jarring. Next, RFC2 is part of the frequency determining circuitry, and any mechanical instability at RFC2 will affect frequency stability. After mounting RFC2, a birthday-cake candle, or other type of wax, should be flowed over all the windings of RFC2 and onto the p.c. board so that it is held firmly in place. To assure a rigid mounting for L1, a 1/2 inch 4-40 screw with a 1/2 inch fiber washer at the L1 end is passed through the center of the toroid, through the hole in the p.c. board, and bolted firmly in place. Finally, when mounting the completed unit in the chassis, two or three equal-length metal spacers should be used at the mounting holes designated so as to establish a level plane for the board and avoid warpage that might be caused by unequal spacers and the use of four mounting screws. The lead from the p.c. board to the air variable tuning capacitor should be relatively heavy guage wire—#18 is adequate—to achieve a degree of rigidity.

In assembling the unit, it is wise to proceed stage by stage. Once the oscillator stage is assembled, hook up the supply voltage and check for the presence of r.f. voltage with an r.f. probe—v.t.v.m. unit; if r.f. voltage can be detected at the L1 ends, the circuit is oscillating. Next, preliminary adjustment of L1 can be attempted. With the station receiver tuned to about 100 kHz inside either 80 or 40 meters, compress or spread the turns of L1 until the signal appears at that point. Some experimentation may be necessary in this first adjustment step due to variations in the values of the tuning capacitors and L1. It may be necessary to add or remove one turn at L1 (one turn approximately yields 100-150 kHz on 80 meters, 200-400 kHz on 40 meters) to locate the oscillator at the desired frequency, or it may be necessary to substitute capacitors of slightly differing values at the C1 end of L1. Check the r.m.s. voltage readings of the oscillator unit against the readings shown in fig. 2. A wide range of variation is acceptable, and the check will reveal how well your unit is functioning in comparison to the units tested by the writer. Once the oscillator is ascertained to be operating properly, assemble the Q2 stage, but mount R4 temporarily. Apply power and check the r.m.s voltage reading at the collector of Q2. It should approximate the reading shown in fig. 2. If it is significantly below that reading, the value of R4 that produces the highest reading should be found by substitution of values in the 15k-27k ohm range. Next, assemble the Q3 stage and temporarily insert a 1k ohm test resistor across the output terminal.

Parts Sources

C1 (Viking-5) - 60 pF trimmer, Elmenco 404, $1.22 each
C4b - Johnson air variable #193-0010-001 (34 pF - 80 m) #193-0006-001, (20 pF (40 m) $1.75 each
C4c - Johnson ceramic trimmer, N470, 5 - 20 pF, #275-0320-005, $1.00
Q1 - MPF102, $0.40
Q2, Q3 - MPS6514, $0.46 each
D2 - 6.1 volt zener diode, IN753, 3/$1.00
Resistors - $0.07 each
0.01 ceramic bypass capacitors - $0.10 each
Silver mica capacitors - $0.42 each
Calectro #101 chassis box - $1.48
D1- 1N914, 16/$1.00
All the above can be obtained from Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85257.

Toroid cores can be obtained from Amidon Associates, 12033 Otsego St., N. Hollywood CA 91607. The cores needed are:
T-68-2 ($0.68 ea.), T-50-2 ($0.55 ea.), FB-73-101 (12/$2.00), FB-73-801 (12/$3.00), FB-43-2401 (12/$3.50).

Apply supply voltage, and measure the output developed across the 1k ohm test resistor. It should be more than 1.8 volts r.m.s. If it is below that level, substitute values of R8 other than that shown until peak output is achieved. Once proper output is achieved, the unit is ready for installation and final adjustment.

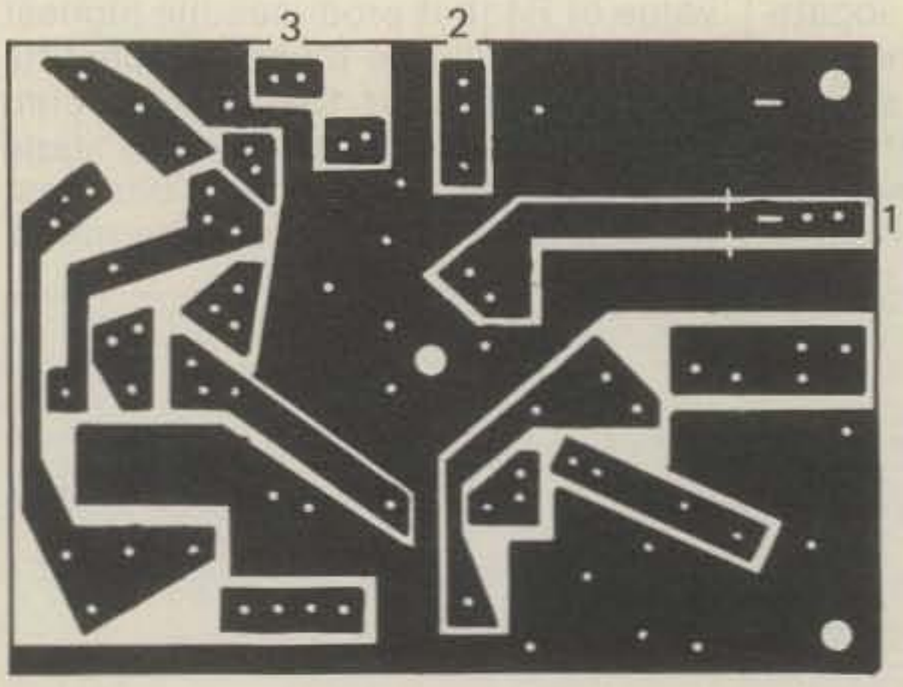
With the unit installed and the air variable tuning capacitor connected to the oscillator, readjustment of L1 and perhaps C1 will be necessary. With the plates of the tuning capacitor fully meshed, compress or spread the turns of L1 until the oscillator signal is located at the band edge of either 80 or 40 meters. Next, measure the amount of bandspread available. If too much bandspread occurs, C4a may be inserted in the circuit to lessen the spread. If the builder desires to further stabilize the v.f.o. unit, substitution of temperature compensating capacitors at C3 and the value of C1 can be experimentally determined for the best drift vs temperature ratio.

Varactor Tuning System

The p.c. board shown in fig. 3b includes provision for use of a varactor tuning diode frequency control system. Reference to fig. 2 shows method of hooking this into the v.f.o. circuit. If the varactor diode approach is used, parts C4a-C4b-C4c are omitted from the circuit and replaced by the C4a-C4c-VR1-RFC4-C13-R11 circuit. The 25k tuning potentiometer and 2k resistor are mounted off-board. The tuning control voltage is taken from the zener regulated voltage at the point shown in order to achieve proper stability. With the varactor system, the size of L1 should be decreased by 1-2 turns, determined experimentally. With the values shown, 3.5 MHz bandspread will be about 120 kHz. For 7 MHz operation, C4a will be decreased to about 270 pF to achieve proper bandspread and must be determined experimentally. The tuning potentiometer should be of the linear taper variety.

Driving the Viking-5

Interfacing the two units is simple, and consists of hooking the output of the v.f.o. to the base of Q1 of the *Viking-5* circuit. The two p.c. boards will fit neatly inside the Calectro #101 box referenced earlier, with adequate space for mounting the air variable tuning capacitor and assorted phono jack connectors. Once the units are installed, apply power and depress the key, and then adjust C1 in the *Viking-5* for indication of output. The bandwidth of the pi network and the Q1 tank is narrower than the 120 kHz bandspread which is the design aim of the above discussion, and hence, the unit will exhibit a drop-off of output at either end of the v.f.o. frequency range. It will not be a significant drop-off, however, in terms of practical output power. However, should the builder wish to maintain maximum output across the entire 120 kHz range, or a wider range, the *Viking-5* C1 trimmer can be replaced by a panel-mounted miniature 365 pF variable capacitor (or smaller size) to permit peaking of the Q1 tank across the entire desired range. However, space is not available in the #101 box for this size of variable, although a miniature panel mount air-variable (reference earlier) will probably fit if positioned properly in front of the transmitter board. The v.f.o. circuit will drive the *Viking-5* to full power output, with excellant keying characteristics and little "pull." The combination, in short, provides an excellent weekend project for those weekend trips where a miniature rig is desirable. The addition of a simple direct conversion receiver will further enhance the attractiveness of the unit, and we will try to show such a design in a future article. 00



NOTE:

Pads 1,2,3 can be eliminated if the varactor diode tuning system is not used. The section of pad 1 to the right of the dashes should remain for connection to external tuning capacitor. The foil of pads 1, 2, 3 can be left as part of the ground foil

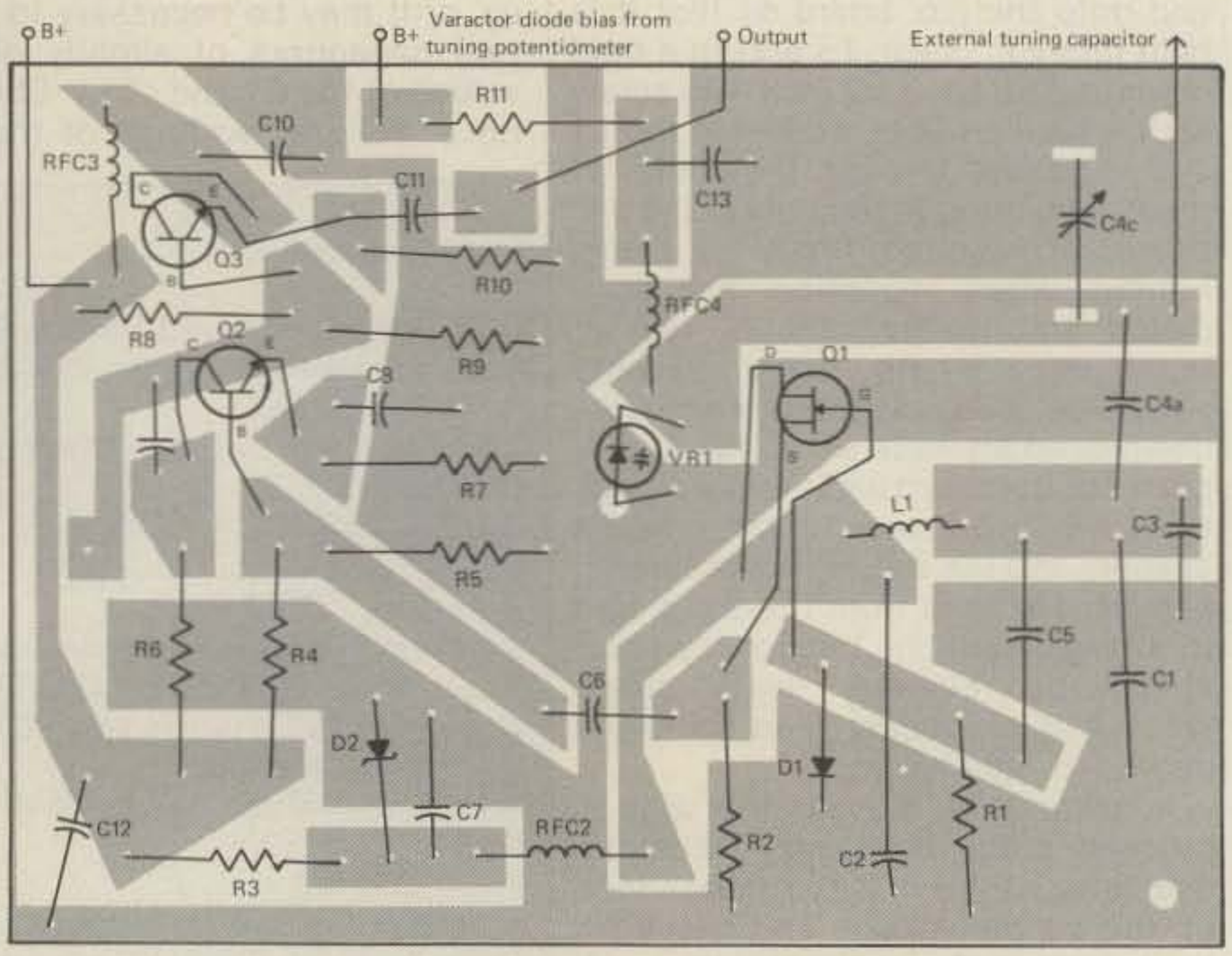


Fig. 3(b) - A second printed circuit board scheme for the Viking-5 v.f.o. To the left is the p.c.b. mask (full-size); to the right is the parts placement. See text for explanation.

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CIRCLE 25 ON READER SERVICE CARD

a monthly feature by

IRWIN MATH, WA2NDM

Math's Notes

A look at the technical side of things

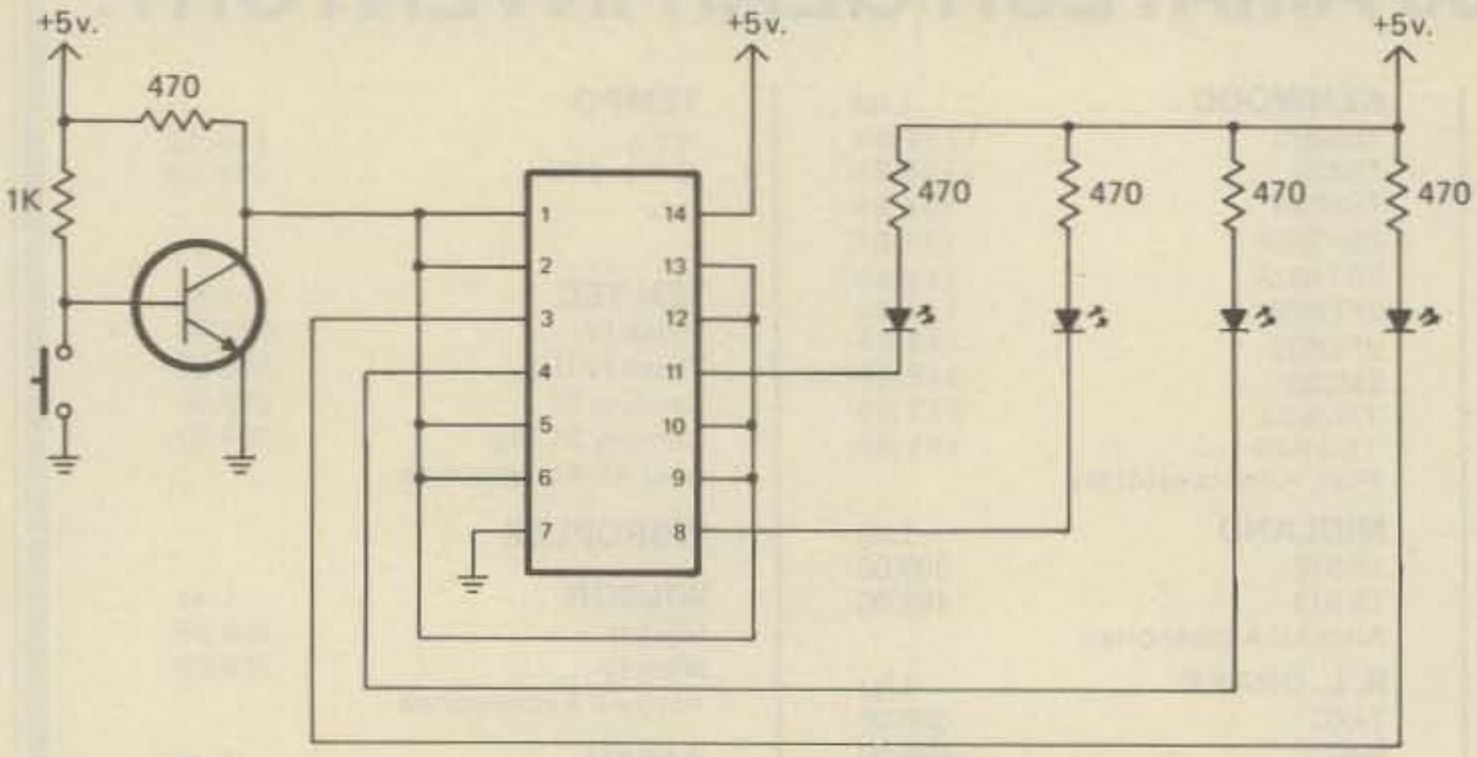


Fig. 1 - 7400 test set described in text.

The electronic experimenter, these days, is familiar with the various surplus dealers' advertisements that offer a "car load" or "truck load" of semiconductors that are untested but extremely inexpensive. They are usually so inexpensive (I saw 100 741 op-amps for one dollar) that it is hard to resist the bargain. The problem however is that they are untested and must be checked. How to do this is the subject of this month's column.

The method we use for testing such large quantities of devices is to build a simple "GO-NOGO" circuit. This usually consists of a minibox with an appropriate IC socket, one or two indicator lights and a button or two. Testing of the chip simply requires plugging it in, pushing the button, and watching that the correct lamp lights. It usually takes 5-10 seconds per chip.

As an example, fig. 1 is the type of test set one could build for testing a common 7400 quad NAND gate. You will notice that all of the inputs are tied together and driven with a simple transistor switch. Each of the outputs goes to its own LED and, when the test button is pushed, bad gate elements are displayed immediately.

Such a circuit can be easily expanded to test other TTL chips by simply rewiring the various pins on the test socket. To be really versatile, one could even bring each pin (with the exception of VCC and ground) to a separate SPDT slide switch and

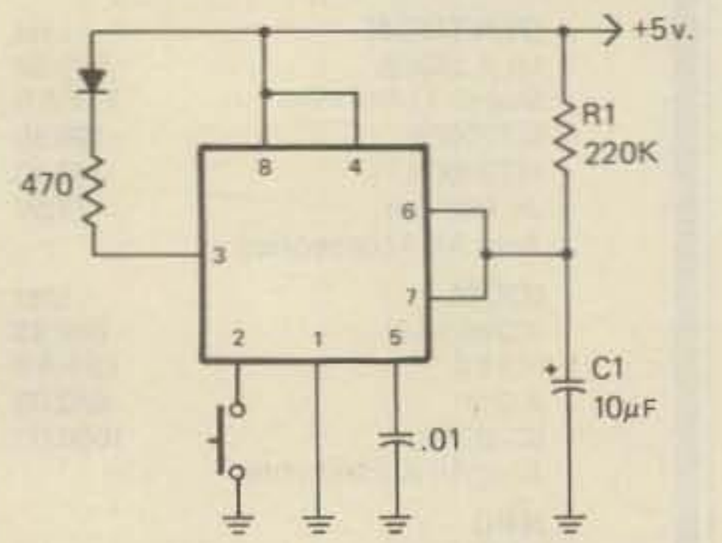


Fig. 3 - Test circuit for popular LM555 timer.

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

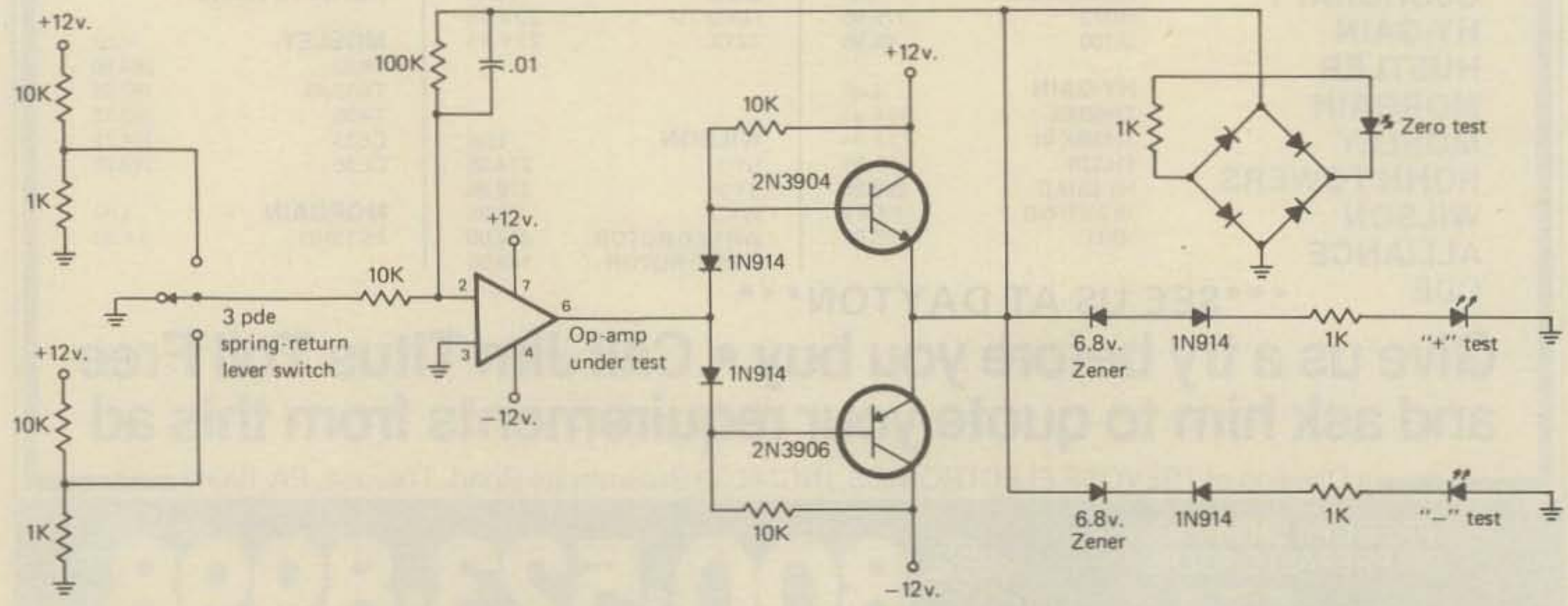


Fig. 2 - Op-Amp Tester. This tester can be used with most 741-type

select input or output as the particular chip requires.

While this approach really does not test TTL levels, noise margins, etc., it does provide a very quick way to determine if the chip is good.

Linear integrated circuits are a bit more complex. With the circuits it is usually not enough to simply test low and high levels, other parameters such as gain, offset, etc. must be checked. This is not a difficult task, however, fig. 2 shows a circuit that we have developed to test operational amplifiers. At the author's company we use hundreds of op-amps of various types and such a "quick tester" has enabled us to quickly screen an incoming batch. While we do not use surplus material, we still often find 1 or 2 units per 100 that simply do not work.

In the tester, the operational amplifier is hooked up in a X10 standard inverting configuration. A two-transistor current boosting stage is added to assure adequate drive for the external indicators.

By pushing the spring-return lever switch to one side, either + or − 10 volts (approximatly) will appear at the output (depending on the polarity of the input of course). This will cause the appropriate LED to light but only if the output voltage is high enough. We used 6.8V zeners to assure enough drive to the LEDS, but 8.2V units could be usable for a more exact test. The third LED, inside the bridge, is used to assure that when there is no input (lever switch at the center) there is no appreciable output. Needless to say, the entire test takes 10 seconds.

Another simple test set is shown in fig. 3. This time the chip is the popular LM555 timer. The tester is simply the standard monostable configuration. When the button is pressed, the chip is triggered, and the LED comes on for precisely the time duration of 1.1 (R_1 C_1), then turns off; about 2 seconds.

While the test circuits shown may seem very elementary, they are very useful when one has a large group of chips whose quality is unknown. They are also useful if an experimenter always uses the same chips in his projects. Then a master test set, with common power supplies, and a number of different test circuits in one enclosure can be built and used whenever the need arises.

In conclusion, bear in mind that any intergrated circuit can be tested in the manner shown. It is only necessary to determine the proper operating circuit and provide the switches and lights necessary for input and output.

73, Irwin, WA2NDM

CQ Reviews: The Yaesu FL-2100F Linear Amplifier

BY HUGH PAUL*, W6POK

The Yaesu FL-2100F linear amplifier is the current version of the basic design that has been on the market for a number of years. Rated at 1kW input on c.w. and 1200 watts p.e.p. input on s.s.b., the FL-2100F covers 80 through 15 meters. Designed to match the styling of the FT-101 transceiver, this linear is small in size, measuring 13-½" by 11-½" by 6". A good portion of its 41 pounds is taken up by the power transformer which has a daul primary winding that may be strapped for operation from either 117 v.a.c. or 220 v.a.c. Plate voltage supplied to a pair of 572B zero bias triodes operating Class B is 2200 v.d.c. at full load with 220 v.a.c. primary power and 1900 v.d.c. with 117 v.a.c. primary power. 100 to 120 watts of driving power is required for maximum rated input. Drive power is coupled to the directly heated cathodes of the 572B's through tunable pi-networks for each band.

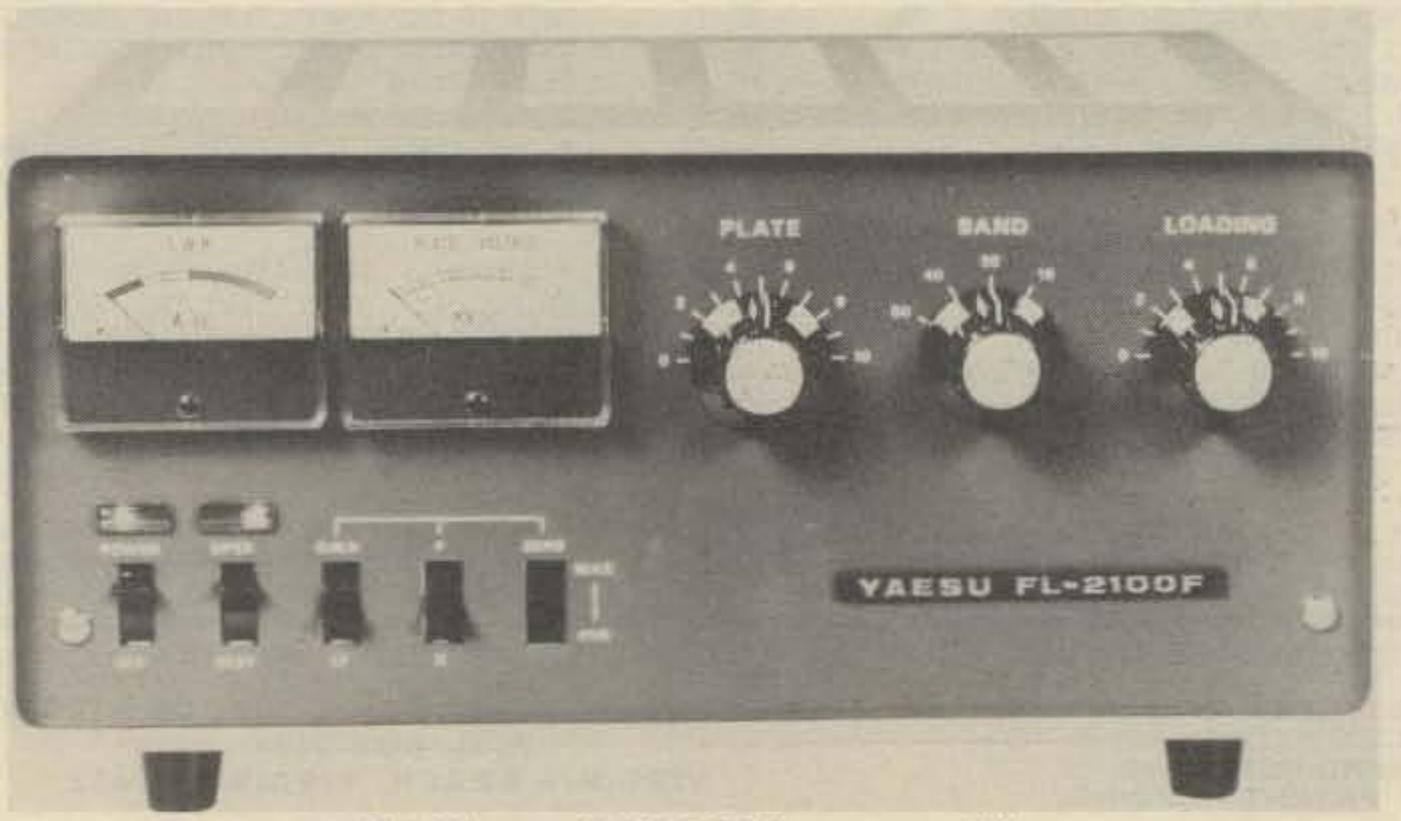
A.l.c. voltage is provided by a pair of diode rectifiers that sample the r.f. on the grids of the 572B's. A.l.c. voltage is not adjustable, but worked well with several makes of transceivers used to drive the amplifier. When the amplifier is in *standby*, the tubes are biased off for protection and to prevent diode noise generation which, if severe enough, could be heard in the receiver.

The amplifier is well metered. The left hand one has a dual function, plate current and s.w.r. readout from the built-in bridge circuit, while the right one displays plate voltage. The internal changeover relay connects the antenna directly to the exciter, when the amplifier is off or in *standby* mode. Since the s.w.r. bridge is connected to the antenna side of the changeover relay, it continues to function as an s.w.r. indicator for the exciter.

Cooling off the 572B tubes is accomplished by two quiet high-speed fans, each mounted beneath one of the tubes. Air is drawn in from beneath the unit and exhausted out the top. The components used in the FL-2100F are more than adequate for their intended use, but the amplifier is not designed for continuous duty. Yaesu recommends limiting key-down time at full input to ten seconds, in order to protect the 572B's. I recommend you learn proper tuning procedure if you wish to avoid arc-overs in the final tank.

It is important that in any high power intermittent duty amplifier to tune the final plate tank circuit to resonance and insert some loading, with minimal drive applied. This is no different from the tuning procedure recommended by most transceiver manufacturers and is the reason transceivers have a "tune" position. The final amplifiers of all transceivers are rated for intermittant duty only. The life cycle of the 572B's in the FL-2100F will be just as good as the finals in a transceiver, if you observe the proper tuning procedure. I owned an earlier model of this Yaesu amplifier and used it extensively for

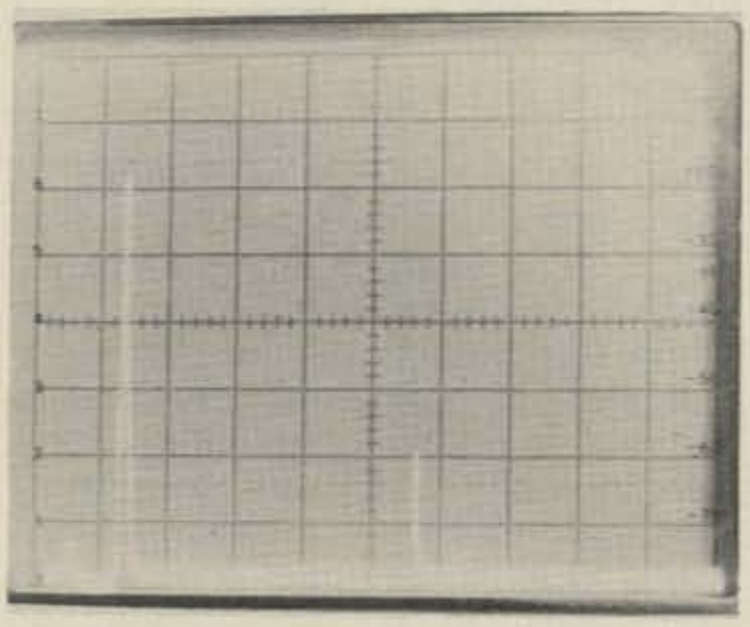
*291 Macalester Drive, Walnut CA 91789



The Yaesu FL-2100F linear amplifier.

contest and DX work. After two years there had been no failure of any component and the power output was almost identical to that measured when the unit was new.

In order to provide a more realistic evaluation of the amplifier's performance, spectrum analysis was made of both the exciter used to drive the FL-2100F and the amplifier output under full load. If you look at the 21 MHz output of the exciter you will see that the second harmonic is 41 dB down from the fundamental. This level just meets F.C.C. specifications. Now look at the photo of the amplifier output and you will see that the second harmonic is 50 dB down from the fundamental.



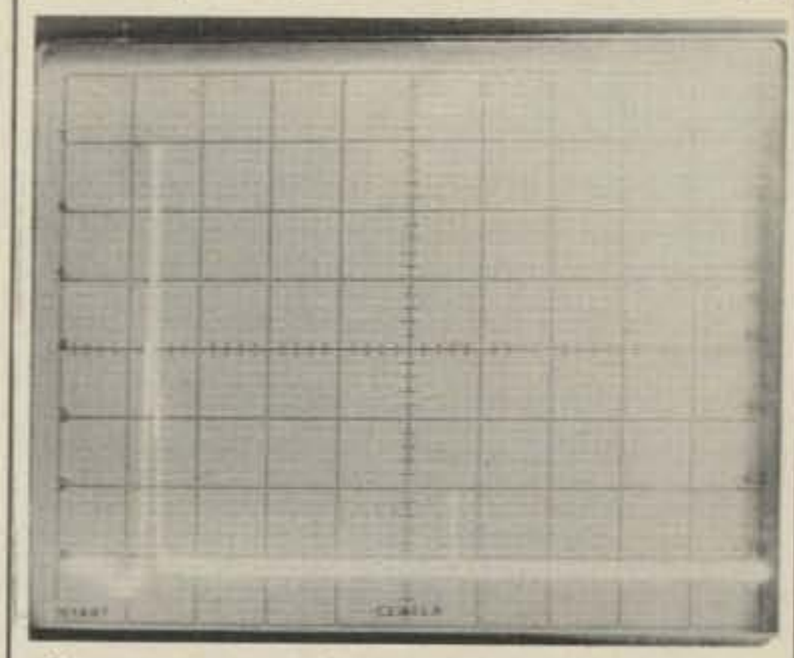
Spectrum analysis of the 21 MHz output of the driver. Scaling is 5 MHZ per division.

Spectrum analysis to determine third order distortion products was made of the driving transceiver. With two audio frequencies of the same amplitude applied, third order products measured 28.5 dB below the single tone level of a two-tone test. This would be 34.5 dB below full output. With two tones applied the output level is 6 dB greater than with a single tone applied. With the amplifier operating, third order products measured the same as was realized with the transceiver along. The same test was repeated with another transceiver exhibiting third order products 32 dB below a single tone of a two-tone test. With the amplifier in operation, third order products measured -32 dB. The FL-2100F is a clean amplifier. Photographs of the analyzer display of third order products are not included here because our analyzer does not have phase-lock, nor display storage, thus making it difficult to obtain clear photos of this particular test. This, of course, does not affect the measurement - only the ability to photograph the measurement. We are working on ways to rectify this and soon hope to be able to show you photos of third order distortion products.

To determine the efficiency of the amplifier we adjusted the exciter output and amplifier loading for maximum power out without exceeding 1 kW input. Efficiency was calculated after subtracting driving power from the total output power. Results were as follows:

Band	Power Out	Drive Power	Efficiency
80 m	630 watts	110 watts	52%
40 m	610 watts	110 watts	51%
20 m	620 watts	110 watts	51%
15 m	600 watts	100 watts	50%

For more information, contact Yaesu Electronics Corp., 15954 Downey Ave., Paramount CA 90723.



Spectrum analysis of the 21 MHz output of the FL-2100F. Scaling is 5 MHz per division.

a monthly feature by

BILL WELSH, W6DDB

Novice

"How to" for the newcomer to Amateur radio

Amateur Radio Callsigns - Part I of II

This month's column is the first of a two-part article providing basic information about callsigns assigned to American amateur radio stations by the Federal Communications Commission. A little background information about broadcast station callsigns is included since we all have some familiarity with local stations and the basic callsigns system is directly related to the one used in assigning callsigns to amateur radio stations. As usual, material is separated into categories for your convenience. It is very understandable that newer amateurs are confused by the variety of callsigns heard on the air. Frankly, even the most experienced operators are confused by the wide variety of callsigns now being issued by the FCC to American amateur radio stations.

Callsign Purposes

It is essentially correct to state that each radio station is issued a callsign to identify (1) the country in which it is located. (2) the type of service in which it engages (such as amateur, broadcast, fire, marine, police, and taxi), and (3) the specific station (location and responsible licensee). Callsigns are the license plates for radio stations using the airways.

Callsign Assignments

The callsign prefix indicates the country where the station is licensed. As examples, the initial (beginning) letters K, N, and W have been assigned since 1927 for the exclusive use of USA radio stations, and A has been assigned to USA radio stations on a shared basis with several other countries. As you may have noticed, the first letter in American civilian radio station callsigns has been W (East of the Mississippi) and K (West of the Mississippi). There are a few exceptions (such as KDKA in Pittsburgh) to the Mississippi River dividing line between W and K callsigns, but it still holds quite firm regarding AM/FM radio broadcasting stations, television broadcasting stations, and merchant ships built on one coast or the other. WNBC-TV is a TV station in New York, as an example; whereas KNBC-TV is a TV station in California. Similarly, I sailed aboard American merchant ships where I used West Coast callsigns such as KKXJ and East Coast callsigns like WJVC.

The FCC abided by the separation of civilian (K and W) and government (N and A) callsign first letter use in the Amateur Radio Service until about one year ago. The callsigns of amateur radio stations started with the letter K or W, although the Mississippi division of K (West) and W (East) never applied to amateur radio station callsigns. Army and Air Force stations used callsigns starting with the letter A. Navy, Coast Guard, and Marine Stations used callsigns starting with the letter N. As examples, I held A1SAD in Army Mars (Military Affliate Radio System) and N0AEJ in Navy MARS. The FCC has been issuing callsigns starting with A and N to amateur radio stations for about a year. I consider this change to be another in a long list of recent FCC changes of questionable benefit to the amateur radio service. Another amateur callsign change recently adopted by the FCC is the use of suffixes starting with the letter X. Callsigns such as WD5XHG now are issued in normal sequence, whereas an X used as the first letter of a USA amateur radio station callsign suffix has indicated an experimental station. Most initial TV stations had amateur callsigns with X suffixes when first bloomed in this country. Perhaps the FCC believes that experimentation and communication advances are no longer possible in the amateur radio service. Another FCC amateur callsign change involves the use of a portable type identification used to indicate that a station is being operated beyond the station licensee's priveleges by an operator with appropriate higher operating privileges. As an example, if I were operating a Novice station assigned the callsign of KA6ABC, I could operate it outside the Novice bands if I identified as KA6ABC/W6DDB. I have never felt comfortable using this procedure since portable indicators are fundamentally used to indicate a changed operating location, not a change in operator or privileges. However, I must admit that K and W have long been assigned to both civilian and government stations in other than the amateur radio service. I must also concede that I have used military type callsigns of ANQU and ANXK while serving as a radio officer aboard USA merchant (civilian) vessels.

Broadcast Station Callsigns

As you may have guessed, civilian radio broadcast stations were originally issued 3-letter callsigns such as WBZ (Boston) and KFI (Los Angeles). These 3-letter combinations were almost all assigned about the start of World War I, so the FCC started issuing 4-letter callsigns such as WNAC (Boston) and KNXT (Los Angeles). Broadcast stations were also allowed to obtain coveted callsign suffixes indicating network affiliations (such as WABC and KABC, WCBS and KCBS, plus WNBC and KNBC for affiliated stations of the American Broadcasting Company, Columbia Broadcasting System, and National Broadcasting Company, respectively), locations (such as WNYC, KLOS, and WACO in New York City, Los Angeles, and Waco, Texas, respectively), or other relationships (such as WCFL -Chicago Federation of Labor, WGN -World's Greatest Newspaper, WLS -World's Largest Store, WMTC - Win Men to Christ, WTOP - Top of the radio dial, WVON - Voice of Negroes, and WXGI - Ex-GI). The FCC stopped accepting special callsign reserva-

*2814 Empire Ave., Burbank, CA 91520.

tions from broadcast station applicants in 1946 and still does not accept them.

When FM stations started becoming popular before World War II and TV stations opened up all across this country after WWII, it became common practice to use the same basic callsign with appropriate suffixes at affiliated stations, Combinations such as KABC-AM and KABC-TV or KPOL-AM and KPOL-FM are now commonplace.

International Callsign Assignments

According to the International Telecommunications Union, the folling callsign series are allocated for the use of the indicated countries:

AAA-ALZ	United States of America
AMA-ADZ	Spain
APA-ASZ	Pakistan
ATA-AWZ	India
AXA-AXZ	Australia
AYA-AZZ	Argentina
BAA-BZZ	China
CAA-CEZ	Chile
CFA-CKZ	Canada
CLA-CMZ	Cuba
CNA-CNZ	Morocco
COA-COZ	Cuba
CPA-CPZ	Bolivia
CQA-CRZ	Portugal
CSA-CUZ	Portugal
CVA-CXZ	Uruguay
CYA-CZZ	Canada
DAA-DTZ	Germany
DUA-DZZ	Philippines
EAA-EHZ	Spain
EIA-EJZ	Ireland
EKA-EKZ	USSR
ELA-ELZ	Liberia
EMA-EOZ	USSR
EPA-EQZ	Iran
ERA-ERZ	USSR
ESA-ESZ	Estonia
ETA-ETZ	Ethiopia
EUA-EWZ	Byelorussian SSR
EXA-EZZ	USSR
FAA-FZZ	France
GAA-GZZ	Great Britain & N. Ireland
HAA-HAZ	Hungary
HBA-HBZ	Switzerland
HCA-HDZ	Ecuador
HEA-HEZ	Switzerland
HFA-HFZ	Poland
HGA-HGZ	Hungary
HHA-HHZ	Haiti
HIA-HIZ	Dominican Republic
HJA-HKZ	Colombia
HLA-HMZ	Korea
HNA-HNZ	Iraq
HOA-HPZ	Panama
HQA-HRZ	Honduras
HSA-HSZ	Thailand
HTA-HTZ	Nicaragua
HUA-HUZ	El Salvador
HVA-HVZ	Vatican City State
HWA-HYZ	France
HZA-HZZ	Saudi Arabia
IAA-IZZ	Italy
JAA-JSZ	Japan
JTA-JVZ	Mongolia
JWA-JXZ	Norway
JYA-JYZ	Jordan
JZA-JZZ	Indonesia
KAA-KZZ	United States of America
LAA-LNZ	Norway
LOA-LWZ	Argentina
LXA-LXZ	Luxemborg
LYA-LYZ	Lithuania
LZA-LZZ	Bulgaria
MAA-MZZ	Great Britain N. Ireland
NAA-NZZ	United States of America
OAA-OCZ	Peru
ODA-ODZ	Lebanon
OEA-OEZ	Austria
OFA-OJZ	Finland
OKA-OMZ	Czechoslavakia
ONA-OTZ	Belgium
OUA-OZZ	Denmark
PAA-PIZ	Netherlands
PJA-PJZ	Netherlands Antilles
PKA-POZ	Indonesia
PPA-PYZ	Brazil
PZA-PZZ	Surinam
QAA-QZZ	Service Abbreviations (Q-Signals)
RAA-RZZ	USSR
SAA-SMZ	Sweden
SNA-SRZ	Poland
SSA-SSM	Egypt
SSN-STZ	Sudan
SUA-SUZ	Egypt
SVA-SZZ	Greece
TAA-TCZ	Turkey
TDA-TDZ	Guatemala
TEA-TEZ	Costa Rica
TFA-TFZ	Iceland
TGA-TGZ	Guatemala
THA-THZ	France
TIA-TIZ	Costa Rica
TJA-TJZ	Cameroon
TKA-TKZ	France
TLA-TLZ	Central African Republic
TMA-TMZ	France
TNA-TNZ	Congo
TOA-TQZ	France
TRA-TRZ	Gabon
TSA-TSZ	Tunisia
TTA-TTZ	Chad
TUA-TUZ	Ivory Coast
TVA-TXZ	France
TYA-TYZ	Benin
TZA-TZZ	Mali
UAA-UQZ	USSR
URA-UTZ	Ukrainian Soviet Socialist Rep.
UUA-UZZ	USSR
VAA-VGZ	Canada
VHZ-VNZ	Australia
VOA-VOZ	Canada

This is Butch LeBrasseur (KA1BLV), a 35 year old truck driver from Ludlow, Mass. Butch credits **CQ** *magazine with helping him get a good start in amateur radio. He is active weekends on all Novice bands using the fine station shown in the photo. His antenna system consists of an 80 meter dipole, 10 meter beam, and a Hy-Gain trap vertical.*

This is the truck Butch LeBrasseur (KA1BLV) drives. It also served as his classroom while he stuidied for his first amateur radio license. Butch picked up a **CQ** *magazine to read while waiting for his truck to be unloaded. The Novice column caught his attention and he soon afterwards obtained his Novice license. The antenna and Novice articles in* **CQ** *are still among his favorite reading. The truck is again serving as a classroom as Butch prepares to upgrade his class of license. It seems that Stanley really does help you do things right!*

VPA-VSZ	Great Britain & N. Ireland
VTA-VWZ	India
VXA-VYZ	Canada
VZA-VZZ	Australia
WAA-WZZ	United States of America
XAA-XIZ	Mexico
XJA-XOZ	Canada
XPA-XPZ	Denmark
XQA-XRZ	Chile
XSA-XSZ	China
XTA-XTZ	Upper Volta
XUA-XUZ	Cambodia
XVA-XVZ	Viet Nam
XWA-XWZ	Laos
XXA-XXZ	Portugese Overseas Provinces
XYA-XZZ	Burma
YAA-YAZ	Afghanistan
YBA-YHZ	Indonesia
YIA-YIZ	Iraq
YJA-YJZ	New Hebrides
YKA-YKZ	Syria
YLA-YLZ	Latvia
YMA-YMZ	Turkey
YNA-YNZ	Nicaragua
YOA-YRZ	Romania
YSA-YSZ	El Salvador
YTA-YVZ	Yugoslavia
YVA-YVZ	Venezuela
YZA-YZZ	Yugoslavia
ZAA-ZAZ	Albania
ZBA-ZJZ	Great Britain & N. Ireland
ZKA-ZMZ	New Zealand
ZNA-ZOZ	Great Britain & N. Ireland
ZPA-ZPZ	Paraguay
ZQA-ZQZ	Great Britain & N. Ireland
ZRA-ZUZ	South Africa & SW Africa
ZVA-ZZZ	Brazil
2AA-2ZZ	Great Britain & N. Ireland
3AA-3AZ	Monaco
3BA-3BZ	Mauritius
3CA-3CZ	Equatorial Guinea
3DA-3DM	Swaziland
3DN-3DZ	Fiji
3EA-3FZ	Panama
3GA-3GZ	Chile
3HA-3UZ	China
3VA-3VZ	Tunisia
3WA-3WZ	Viet Nam
3XA-3XZ	Guinea
3YA-3YZ	Norway
3ZA-3ZZ	Poland
4AA-4CZ	Mexico
4DA-4IZ	Philippines
4JA-4LZ	USSR
4MA-4MZ	Venezuela
4NA-4OZ	Yugoslavia
4PA-4SZ	Ceylon
4TA-4TZ	Peru
4UA-4UZ	United Nations
4VA-4VZ	Haiti
4WA-4WZ	Yemen
4XA-4XZ	Israel
4YA-4YZ	Intl. Civil Aviation Org.
4ZA-4ZZ	Israel
5AA-5AZ	Libya
5BA-5BZ	Cyprus
5CA-5GZ	Morocco
5HA-5IZ	Tanzania
5JA-5KZ	Colombia
5LA-5MZ	Liberia
5NA-5OZ	Nigeria
5PZ-5QZ	Denmark
5RA-5SZ	Madagascar
5TA-5TZ	Mauritania
5UA-5UZ	Niger
5VA-5VZ	Togo
5WA-5WZ	Western Samoa
5XA-5XZ	Uganda
5YA-5ZZ	Kenya
6AA-6BZ	Egypt
6CA-6CZ	Syria
6DA-6JZ	Mexico
6KA-6NZ	Korea
6OA-6OZ	Somali
6PA-6SZ	Pakistan
6TA-6UZ	Sudan
6VA-6WZ	Senegal
6XA-6XZ	Madagascar
6YA-6YZ	Jamaica
6ZA-6ZZ	Liberia
7AA-7IZ	Indonesia
7JA-7NZ	Japan
7OA-7OZ	Yemen
7PA-7PZ	Lesotho
7QA-7QZ	Malawi
7RA-7RZ	Algeria
7SA-7SZ	Sweden
7TA-7YZ	Algeria
7ZA-7ZZ	Saudi Arabia
8AA-8IZ	Indonesia
8JA-8NZ	Japan
8OA-8OZ	Botswana
8PA-8PZ	Barbados
8QA-8QZ	Maldive Island
8RA-8RZ	Guyana
8SA-8SZ	Sweden
8TA-8YZ	India
8ZA-8ZZ	Saudi Arabia
9AA-9AZ	San Marino
9BA-9DZ	Iran
9EA-9FZ	Ethiopia
9GA-9GZ	Ghana
9HA-9HZ	Malta
9IA-9JZ	Zambia
9KA-9KZ	Kuwait
9LA-9LZ	Sierra Leone
9MA-9MZ	Malaysia
9NA-9NZ	Nepal
9OA-9TZ	Zaire
9UA-9UZ	Burundi
9VA-9VZ	Singapore
9WA-9WZ	Malaysia
9XA-9XZ	Rwanda
9YA-9ZZ	Trinidad and Tobago
A2A-A2Z	Botswana
A3A-A3Z	Tongo
A4A-A4Z	Oman
A5A-A5Z	Bhutan
A6A-A6Z	United Arab Emirates
A7A-A7Z	Qatar
A8A-A8Z	Liberia
A9A-A9Z	Bahrain
C2A-C2Z	Nauru
C3A-C3Z	Andorra
C4A-C4Z	Cyprus
C5A-C5Z	Gambia
C6A-C6Z	Bahamas
C7A-C7Z	World Meteorological Org.
C8A-C9Z	Mozambique
D2A-D3Z	Angola
D4A-D4Z	Cape Verde
D5A-D5Z	Liberia
D6A-D6Z	Comoros
D7A-D9Z	Korea
H3A-H3Z	Panama
H4A-H4Z	Solomon Islands
H5A-H5Z	Bophuthatswana
J2A-J2Z	Djibouti
J3A-J3Z	Grenada
J4A-J4Z	Greece
J5A-J5Z	Guiena-Bissau
L2A-L9Z	Argentina
P2A-P2Z	Papua New Guinea
P3A-P3Z	Cyprus
P4A-P4Z	Netherlands Antilles
P5A-P9Z	Korea
S2A-S3Z	Bangladesh
S6A-S6Z	Singapore
S7A-S7Z	Seychelles
S8A-S8Z	Transkei
S9A-S9Z	Sao Tome & Principe

Amateur Radio Station Callsigns

The FCC does not honor requests for special callsigns in the amateur radio service. It is common for amateurs to request their initials, company initials, catchy words (such as ham), or locations as callsigns. They also request callsigns previously held by themselves or deceased relatives. All such requests are rejected by the FCC and cause delays in processing proper applications. However, I remember some remarkable coincidences in which the same callsign suffix has been assigned to the same amateur's stations in more than one area. Fundamentally, amateur radio station callsigns are assigned in alphabetical sequences according to one's class of operating privileges and station location.

Understand that the callsign identifies the station, not the operator. However, it is common practice for amateurs to identify themselves by

No -43-44

the callsign of the station for which they are responsible. This personal identification by callsign even extends to car license plates, stationary, jackets, tee-shirts, doormats, and about everything else one can think of, including some gravestones!

An amateur primary station is the principal amateur radio station located at the specific land location shown on the station license. The primary station callsign usually appears on the license which also lists the operating privileges of the station licensee. Simply stated, the primary station is the one that is most commonly used by the operator.

An Amateur secondary station is one that is located other than at the primary operating point. Secondary stations are usually vacation homes and offices. The basic types of amateur radio stations have been individual primary stations, military recreation stations, and club stations, plus a variety of additional stations such as individual secondary stations, remote control stations, auxiliary link stations, repeater stations, and special event stations. Part 97 of the FCC rules and regulations details station data in sections 97.37 thru 97.49 and callsign data is detailed in sections 97.51 thru 97.53. It is worthwhile to purchase a copy of the FCC Part 97 Amateur Radio Service Rules and Regulations at $1.30 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; the stock number is 004-000-00338-1.

Recent FCC Callsign Assignment Changes

The FCC has imposed several changes in the amateur radio station callsign assignment procedures. These changes have been quite extensive during the past few years and the most significant changes were detailed in Phase I and Phase II of the amateur station callsign assignment system announced in FCC public notices issued March 30, 1978 and October 26, 1978, respectively. Phase I and Phase II changes took effect March 24, 1978 and January 1, 1979, respectively. This article reflects the basic Phase I data as it was amended by the Phase II FCC release. The present system of assigning distinctive prefixes to callsigns according to the licensee's class of operating privileges is an obvious attempt to identify the class of license held by the operator by observing the configuration of the callsign used. As an example, if one is first licensed as a Novice, he/she now receives a callsign like KA4VTL. When such an operator upgrades to a Technician or General class license, he/she can request and obtain a callsign like N4COL. Naturally, one just requests a callsign in a particular group, as detailed later in this article; one cannot specify either the prefix or suffix in a callsign request. Similarly, when the amateur upgrades to Advanced or Extra class operating privileges, he/she can request and obtain callsigns like KB4LS and AF4Y, respectively. It is probably true that most new amateurs will apply for the shorter callsigns as they upgrade to higher operating privileges, if for no other reason than to have the use of a shorter and easier callsign. Callsign changes are also related to amateurs wanting to indicate they have upgraded. Despite these factors, some amateurs will decide to retain their existing callsigns and it is permissible to do so. Under the present callsign structure, it is not possible to positively identify the operator's class of license by the assigned callsign, but a limited indication of license class does exist. As an example, any amateur assigned a new callsign starting with the letter A or N can be assumed to hold at least the minimum grade of license required to obtain the callsign configuration being used. An amateur using N4COL may hold Advanced or Extra class operating privileges but he/she is not a Novice and is most likely a General or Technician licensee.

Using amateur callsigns to denote special things such as class of license and location is not new. For more than 25 years, the letter N was added to the prefix of every callsign assigned to Novices operating in the 48 contiguous (adjoining) states. Callsigns such as WN1COL and KN1SAR indicated Novices whose callsigns became W1COL and K1SAR, respectively, when they upgraded. The letter V was added (in lieu of N) to the prefix of callsigns assigned to Novices for a short time in callsign areas heavily populated with amateurs. The letter V in the callsign prefix also indicated Novice privileges and it was dropped from the prefix when Novice upgraded, causing a callsign such as WV2VTM to become W2VTM. In more recent years, the letter N in the callsign continued to indicate Novice privileges but it was no longer dropped when one upgraded; it was replaced by a new second letter such as A, B, or D. In these cases, a Novice callsign like WN8VGV became WB8VGV, as an example, when the Novice upgraded. Protectorate type callsigns used in places such as Puerto Rico included the letter W as the first letter in the prefix to indicate Novice privileges and the W was replaced with the letter K when one upgraded. In this case, a Puerto Rican Novice would hold a callsign such as WP4BTX and his callsign became KP4BTX when he/she upgraded. Other means were also used to indicate holders of Novice class privileges in other areas. In the Canal Zone, the letter N has been added to the callsign suffix to indicate Novice privileges and it is dropped when one upgrades. As an example, a Canal Zone Novice holding a callsign such as KZ5LSN became KZ5LS when he/she upgraded to a Technician or higher license. Some variations of Novice station identifications still exist, including identification of Novice stations in other countries.

As you most likely know, callsigns assigned to amateurs in American Protectorates included a callsign prefix which fairly well defined each location. The first letter in the prefix of such a callsign was K, the second letter often was chosen to indicate the location, and the third part of the prefix was a number indicating general relationship to the callsign areas in the 48 adjoining states. As an example, the prefix in the callsign KM6BI indicated an American protectorate (K), Midway Island (M), and located off the American sixth callsign area (6). Similarly, a callsign like KV4AA would indicate an American protectorate station (K), Virgin Islands (V), and located off the American fourth callsign area (4). Many of these protectorate type callsigns remain in use even in places like Hawaii (KH6) and Alaska (KL7) which have been states for many years. However, changes have been made and American amateurs not operating in our 48 adjoining states are now assigned callsign prefixes as follows:

AH1-KH1-NH1-WH1	Baker, Canton, Enderbury, and Howland Islands
AH2-KH2-NH2-WH2	Guam
AH3-KH3-NH3-WH3	Johnston Island
AH4-KH4-NH4-WH4	Midway Island
AH5-KH5-NH5-WH5	Jarvis and Palmyra Islands (not including suffixes beginning with K)
AH5K-KH5K-NH5K-WH5K	Kingman Reef
AH6-KH6-NH6-WH6	Hawaii
AH7-KH7-NH7-WH7	Kure Island
AH8-KH8-NH8-WH8	American Samoa
AH9-KH9-NH9-WH9	Peale, Wake, and Wilkes Islands

AH0-KH0-NH0-WH0	Northern Mariana Islands
AL7-KL7-NL7-WL7	Alaska
KP1-NP1-WP1	Navassa Island
KP2-NP2-WP2	Virgin Islands
KP3-NP3-WP3	Quita Sueno Bank, Rancador Key, Serrana Bank, and Serranilla Bank
KP4-NP4-WP4	Puerto Rico

Extra class licensees (Group A) in the preceding locations can obtain what are called two-by-two callsigns, meaning that the callsign has two letters in the prefix and one letter in the suffix. As an example, an Extra class licensee in Hawaii could have AH6T as his/her callsign. Callsigns prefixed AH, AL7, KH, KL7, KP, NH, NL7, NP, WH, and WP are used in this Advanced and Extra class licensees (Groups B and A) in these protectorate type callsign locations can obtain two-by-two callsigns. As an example, an Advanced class licensee in Puerto Rico can obtain KP4LS as his/her callsign. Callsigns prefixed AH, AL7, and KP are used in this application.

General and Technician class licensees (Group C) in these protectorate type callsign locations can obtain two-by-two callsigns using different prefix letters than are used by Advanced class licensees at the same location. General and Technician licensees use most of the prefixes also used by Extra class licensees but the Extra class callsign can have just one suffix letter, whereas the General or Technician class callsign has two suffix letters. As an example, a General class licensee in Alaska could obtain KL7MX as his/her callsign, but not AL7MX or KL7M since those would generally indicate Advanced and Extra class licensees, repectively, in Alaska. Callsigns prefixed KH, KL7, NH, NL7, NP, WH, WL7, and WP are used in this application. Novice class licensees (Group D) in protectorate type callsign locations can obtain (and are now issued) two-by-three callsigns. As is true in the previous paragraph, Novices also use the callsign prefix shared by holders of higher operating privileges. However, the Novice callsign is easily identified since it includes a three letter suffix. As an example, a Novice in Hawaii could obtain KH6ABC as his/her callsign. Callsigns prefixed KH, KL7, KP, WH, WL7, and WP are used in this application.

The number in the middle of each amateur callsign continues to indicate the area of the country in which the station was located when the license application was made. The callsign area number assignments continue to be as follows in the 48 adjoining states:

1 Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
2 New Jersey and New York
3 Delaware, Maryland (including the District of Columbia), and Pennsylvania
4 Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia
5 Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma, and Texas
6 California
7 Arizona, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming
8 Michigan, Ohio, and West Virginia
9 Illinois, Indiana, and Wisconsin
0 Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota

As an example of how the callsign numerals apply, if an amateur has the figure 8 in his/her callsign, it indicates that he/she has a station located in Michigan, Ohio, or West Virginia when the station license was requested.

Incidentally, the zero callsign area is treated as the tenth area with the figure one left out of the number ten as a matter of convenience; this practice applies to amateur callsigns in many countries. You will also notice that just California amateurs are indicated by callsign area numeral six, making it unnecessary for sixth area amateurs to state California when sending their QTH (location) during on-the-air contacts. One of the recent FCC rule changes related to amateur callsigns is that amateurs are no longer required to change callsigns when they move to different callsign area. This means that it is legal for an amateur holding a callsign such as KA5OMI while operating from Texas to continue to use KA5OMI from a new permanent station location in any other callsign area. In this example, if the amateur moved to Vermont, he/she can simply notify the FCC of the address change and operate in the first callsign as KA5OMI. It is my opinion that this is not a beneficial change since it is often helpful to know the general location of a station, such as when using a rotatable directional antenna system. The use of the normal callsign numeral within an area also helps eliminate confusion during contest and DX (working foreign amateurs) operating activities. I advise you to file a form 610

FCC application and request a new (appropriate) callsign if you move to a different callsign area; you are allowed to make this change. However, the FCC no longer issues a callsign with matching suffix in such cases. In this example, it would do no good to request the callsign KA1OMI when relinquishing KA5OMI. It is also no longer possible for any amateur to hold more than one station callsign. As an example, I held W1SAD and W6DDB concurrently for several years since I had legitimate station locations in both Massachusetts and California. If I had still held both of those station callsign in 1978, I would have been obliged to submit one or the other to the FCC for cancellation by October 1, 1978. This is a requirement that is not well known and there are many amateurs who still hold two (or more) station callsigns. A somewhat different but related relatively recent FCC rule change is their deletion of the previous requirement to indicate the callsign area of any operation not conducted from the station location shown on the amateur license. As an example, if I were to operate from Nevada, I was required to identify (during code contacts) as W6DDB/7. Even if I operated from another California location, I was required to identify as W6DDB/6 during code contacts not made from the station location shown on my station license. Despite the requirement being deleted by the FCC, most amateurs continue to use the portable indicators when not operating from their fixed station locations. It is also common practice for portable indicators to be required for contest participation.

A November 21, 1978 FCC general information release lists the following as the latest callsigns issued as of November 1. This list may help you to better understand some of the weird callsigns being emitted by American amateurs:

Radio District	Group A Extra	Group B Advanced	Group C General & Technician	Group D Novice
1	AE1F	KA1DOG	N1AJF	KA1BTR
2	AI2H	KB2GD	N2ARJ	KA2CZP
3	AE3V	KB3DG	N3AMT	KA3BUI
4	AF4O	KB4KX	N4BEZ	KA4EYK
5	AI5S	KB5GT	N5AUP	KA5DAC
6	AK6R	KB6IH	N6AYJ	KA6DQY
7	AE7T	KB7DH	N7APT	KA7CMQ
8	AF8Q	KB8GM	N8ARE	KA8DDY
9	AE9U	KB9EJ	N9AMU	KA9CSF
0	AF0R	KB0EE	N0AOV	KA0CQT
Guam	AH2C	AH2AC	KH2AC	WH2AAP
Johnston Island	None	None	None	WH3AAA
Hawaii	KH6H	AH6AT	KH6EU	WH6AEC
American Samoa	None	None	None	WH8AAF
Alaska	AL7X	AL7AM	KL7CO	WL7ADW
Virgin Islands	None	None	NP2AD	WP2AAK
Puerto Rico	KP4R	KP4AK	NP4AE	WP4AHJ

The same FCC release also reports that many amateurs have also been inquiring as to when callsigns that were previously assigned might be reissued and advises that there are no plans to reissue previously assigned callsigns in the near future.

Summary

This concludes the first part of the two part series on amateur radio station callsigns. Each part contains information which is useful by itself. However, you are urged to read both parts of the article to better understand this complex subject.

Novices are urged to submit good black-and-white pictures of themselves at their operating positions. If your photograph is printed in a future Novice column, you will receive a one year subscription (or renewal) to *CQ*. A brief description of operating activities and some personal background information are needed with your picture.

Some of the stations I've been fortunate enough to work recently on the Novice bands are:

KA1AML Ann @ Dracut, Mass., WA2DZQ Harold @ Lebanon, N.J., KA3BSM Rick @ Newark, Del., WD4RXQ Jim @ Clearwater, Fla., WD5BTU Lee @ Jasper, Texas, KA6DPG J J @ San Diego, Ca., KA7BOP Barb @ Hoodsport, Wash., KA8CFO Bob @ Ottawa, Ohio, KA9BLS Alvin @ Indianapolis, Ind., KA0AMJ Mike @ Hibbing, Minn. KL7-JAW Hal @ Juneau, Alasak

73, Bill, W6DDB

The good news is that you've finished building your kit! The bad news is that it doesn't work. What to do? Read Karl Thurber's final installment. He can help you turn frustration into success.

All About Kits

Part IV — If It Doesn't Work . . .

BY KARL T. THURBER, JR.*, W8FX/4

Fear of not being able to get a kit to work after it has been constructed has kept more than one person from trying out his soldering and wiring abilities. Not every kit will work "up to snuff" the first time it is tried out, even those built by experienced craftsman. Anyone can make a mistake, whether it be the manufacturer through a manual error, the suppliers through a faulty part, or the builder by an assembly error. What is more important to recognize is that the problem can almost always be found and the kit restored to working condition.

Kit, manufacturers do occasionally make errors in their manuals, sometimes technical and sometimes merely typographical. Usually these errors are soon caught and an *errata* sheet is enclosed. Is there an *errara* sheet in your kit, and have you made the changes indicated?

Kit makers do usually make every effort to furnish highly reliable components. Some companies, like Heath, now make 100% checks on all incoming semiconductors and Ic's since the failure rate on these "active" parts is much higher than on "passive" ones, such as resistors and capacitors. Occasionally a few bad ones do get in, however. These can be hard to spot, of course, though resistors and capacitors can be measured, and transistors and tubes checked for performance.

But what about the stickier problems——those caused by errors in interpreting the instructions book, in wiring, and in soldering? The pro's all say that, by far, builder problems far outweigh manufacturers problems. What are some of these?

Some Things to Look For

If your kit doesn't work, and assuming you've checked and rechecked your wiring, before giving up in total frustration, *look for the obvious*. Is the unit plugged in? Is the fuse inserted, and is it good? Are tubes, transistors and Icc's in the right sockets and oriented the right way? Are wires really connected together or does a sliver of insulation remain that breaks a circuit? Be sure that if your instruction book has a step-by-step malfunction chart, you use it in trying to find out what's wrong. Usually, it will lead you at least to the *area* in which the problem lies.

Polarity problems often plague kit-builders. Sometimes this the fault of the manufacturer for not being as explicit as he might be, sometimes it rests with the builder for simply not observing the correct polarity of the components. As a rule, red color codings designate positive markings; black negative. In metal-cased electrolytic capacitors, the case is negative. With diodes, the cathode end is designated with a band or bar. When working with transistors and integrated circuits (IC's), you have to be especially careful to know *which* way you're looking at the component to properly identify where a "key" or "tab" is located to determine proper insertion. Of course, certain components don't have any particular polarity. These include resistors, paper and mica condensers, and bypass capacitors.

Without a doubt, the biggest problems arise from *poor soldering technique*, resulting either in "cold," ineffective solder joints or massive blobs of solder running across contacts and terminals which short them out. Most of these problems can be traced to not applying enough heat to a joint, moving it too soon, or using too much solder and not watching where it flows. If you're having problems with your kit, closely examine *all* solder connections for dull, flaky joints, or "solder bridges" between adjacent components. Usually, re-applying heat to all connections and a close visual inspection will solve most soldering problems.

We mentioned before that many experienced constructors are guilty of failing to follow instructions carefully, believing that the instructions are only for neophytes. They tend to ignore the written instructions and pictorial diagrams, building directly from the schematic. Most end up with some omitted steps or components, or an outright error in wiring. Even if you believe you followed instructions carefully, if you're having trouble, go back through *each* and *every* instruction step. Make sure that each step asks you to do what you *think* it does! It's all too easy to misread or omit an instruction particularly when weary.

The importance of *really checking* your kit can't be overemphasized. It's embarrassing (and not to mention, expensive) to return a kit to find out that the problem was a bad solder joint, broken wire, open fuse, or loose knob. If you run into seemingly insurmountable problems, before sending it back or getting too involved in tearing it apart, let another more experienced amateur look it over. He may immediately spot something that isn't

*631 N. Overbrook Dr., Fort Walton, FL 32548.

obvious to you as the builder. You may have developed a severe case of "tunnel vision" in building your kit! Even the untrained eyes of a non-technical friend or your spouse may help you to spot the problem.

Troubleshooting

If you still can't get your kit working, cart out your v.o.m. or v.t.v.m. and dig in. Make sure, first that you understand the circuit theory, at least in principle. Scan the resistance and voltage charts usually provided. Look first for the more obvious problems, as we mentioned earlier, before digging into the set's innards too closely and possibly introducing *other problems* just from "messing around" inside. Look for the simplest malfunctions first, such as blown fuses and shorts. If a circuit resistance chart is provided, make those checks. Swap out or check tubes. Before making voltage readings, check B-plus lines for grounds.

Once power is on, make the voltage checks called for in the manual. Bear in mind that *low* voltage readings may be the result of resistors that have increased in value or opened up, leaky or shorted capacitors, tube shorts, open coils etc. On the other hand, *high* voltage readings may be the result of shorted coupling capacitors, shorted resistors or tubes, and defective transformers or chokes. If you're working with a receiver, try to *trace* the received signal through each stage until you find the defective stage, or where the signal is lost. If you're working with a transmitter, start with the oscillator circuit and work through subsequent stages to the final amplifier, noting grid and plate current in each stage. In any case, follow the troubleshooting instructions in the assembly manual.

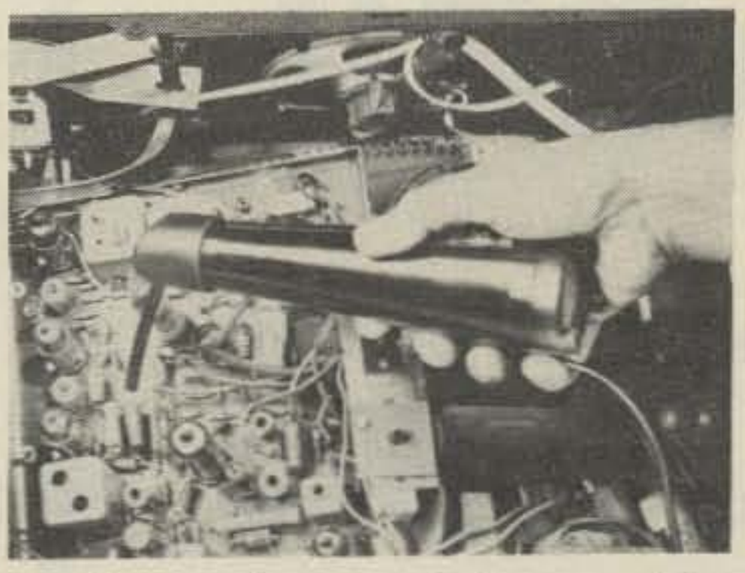
Play It Safe

Remember that when working with the equipment's power on, you may be dealing with potentially lethal voltages. Some good "safety tips" that will help keep you "out of Dutch" when troubleshooting your equipment are:

1. Short all power supply bleeder resistors to ground. They can easily "open up." In fact, short B-plus high-voltage lines to ground at several points before getting near the circuits—filter capacitors have been know to store their charges almost indefintely!
2. Short out the plate caps of all transmitter tubes before touching them.
3. Make sure test equipment and your kit under test are bonded together and grounded.
4. Be very judicious in bypassing any high-voltage safety interlocks on your equipment. Restore the interlocks after you've finished troubleshooting.
5. Make as many checks as possible with the a.c. power *off* and the a.c. plug *removed*. Never check your wiring with the power on!
6. Hint: Keep one hand safely in your pocket when working on high voltage equipment, so you won't accidently come in contact with the chassis or another high voltage point while working.

Write for Help

O.K., you've done everything you can to check out the kit, and you can't find out what's wrong with it. Now's the time to get your story together and write a letter to the manufacturer for some help. The first inclination is to write a nasty letter about the kit that "just won't work." This is not the best way to get results, however. Bear in mind that in most cases—at least with reputable kit makers—the kit left the factory complete, with good instructions, and the most probable cause of error is poor construction practices.



An interesting tool for troubleshooting kits—or any project—is the Wahl "Thermal Spot" tester. The unit directs a steady stream of heated air on a suspected faulty component to quickly bring the "suspect" up to breakdown temperature. This device operates in opposite fashion when compared with the quick-cooling sprays used to "freeze" suspected components into acting up. (Wahl Clipper Corp.)

Many manufacturers have a full-time technical consultation staff who do nothing but help people solve their kit problems. All anyone has to do is to call or write one of these consultants and he will make suggestions on how to diagnose the problem and solve it. Most problems can be solved in this manner without ever having to send the kit in for repair. And, if a part is believed to be the culprit they will usually send one out for you to try. Only as a last resort would you have to send the kit back. But be aware that many smaller "one-shot" kit packagers do *not* have any provision for post-sale services, so you *may* find yourself with no way to get help when you buy an off-brand kit.

The best kind of letter is a simple, factual statement of the circumstances, addressed to the customer service or technical consultation department of the company. The letter should quickly establish that, yes, you do own this particular kit with a certain serial number, purchased on such-and-such date from so-and-so. It should briefly outline the problem, stating what checks you have *already* made and the results obtained. Be sure to make mention of any "strange" measurements or combinations of measurements. In solid state circuits, particularly, symptoms tend to affect one another and only certain *combinations* of symptoms can point to the real problem. Only if you're fairly sure of a defective component should you, at this point, ask for a replacement. Let the expert decide what may be wrong. Give as many *facts* as possible, and few *generalities*. The more specific information you can give, the better.

Most manufacturers are well aware of the fact that a satisfied customer is their best advertisement, and will go to great lengths to satisfy them. So it doesn't pay to get abusive in your correspondence. Your letter of complaint should be written with the objective of getting a helpful response, not criticizing the product or the firm. Keep emotions out of the letter, spell out the facts clearly, and be specific in the assistance you are requesting. Do you merely want technical advice? Do you think a new component is needed? Do you want instructions on how to return the unit for factory repair? A refund? Or what? To get the best results, place yourself in the position of the person recieving the letter, and write it with him in mind. Try to keep your letters businesslike, typing them if possible. Finally, if you are so "up-tight" over the difficulties you're having with the kit, have your spouse or a friend read your letter over. It may keep it from ending up in the circular file!

Check Your Warranty

In stubborn cases, several exchanges of letters *may* be necessary and a couple of sets of parts checked out before the real problem is located, although this isn't too common. After all, by the time you build your kit, chances are that the maker has discovered almost all the possible malfunctions that may arise. If you must return the kit, read your warranty

carefully and ascertain from the manufacturer who's responsible for what. The traditional warranties on equipment, usually 90 days, six months, or a year, become a bit fuzzy when it comes to kits. In many cases, only the parts *themselves* are guaranteed, *performance* being up to you. Sometimes, the cost of factory repair can't be determined until you return the set and it's found whether the problem was caused by your error or a bad component. Usually, if it's the latter, the repair job will be free. But be aware that having to send the kit back for repair will usually cost you *something*, and may eat up the cost savings in buying the kit in the first place. (Most manufacturers' repair fees are reasonable and fair. Just don't send back a modified or incompletely assembled kit, or one wired with acid-core solder. You'll very likely get it back unrepaired!)

For Future Reference

Even if your kit works the first time you try it, it's a good idea to check out and record the various operating voltages that you find are "normal" in *your* kit, even if a voltage chart is furnished with the manual. This is very helpful should you have trouble later on in distinguishing between normal and abnormal operation. Also, be sure to hold onto the instruction manual, schematic, and even the pictorial diagrams and instruction procedures, regardless of how simple the equipment is. They may very well come in handy later. Fill out and promptly return any warranty registration cards to protect yourself, and also record any serial numbers in the instruction book. It's not a bad idea, too, to use a small engraver to mark your equipment inside with your driver's license or social security number before closing up the cabinet and packing away your tools.

Construction Tips For Kit Builders

1. Decide first what you want and *need*.
2. Select the kit that's right for *you*.
3. Find a good place to build your kit.
4. Familiarize yourself with the kit.
5. Use the proper tools and test equipment.
6. Follow instructions!
7. Wire with care.
8. Do the best soldering job you possibly can.
9. Be a plodder!
10. Check and recheck your work.
11. Give the kit a final "Q-C check."
12. Adjust and align the finished product.
13. If it doesn't work, don't despair —seek help!
14. Learn all you can from your experience.
15. To avoid trouble and frustration, check out the kit when it arrives for missing and/or defective parts.

Summing Up

In this series, we've taken a look at the factors involved in building electronics kits. We've examined the rationale for building them, pointed out some of the considerations in selecting the right kit for you, and listed some of the tools and test equipment you'll need to do a good job. We've also described how to wire and solder the kit, and we've made some helpful suggestions as to what to do in the event it doesn't work.

No one can lay down a set of rules that will absolutely *insure* that every kit you build will be a success. But if you follow some of the guidelines we've presented, the chances are good that you'll build kits that work and work right—the first time.

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Safety and Special Radio Service Bureau to Reorganize

By the time you read this, chances are good that the Federal Communications Commission (FCC) will have approved and implemented a significant alteration in the organizational structure of the Safety and Special Radio Service Bureau.

Heretofore, the Bureau was organized along functional and radio service lines, and was made up of six divisions. Under the reorganization plan, the Bureau will contain four divisions, and will be organized only along functional lines. The four new divisions are:

- Policy Development Division
- Rules Division
- Licensing Division
- Compliance Division

The Bureau, which will be renamed the Private Radio Bureau, will be headed by Carlos Roberts; his deputy will be Arlan Van Doorn. Roberts is the present head of the Safety and Special Radio Service Bureau.

The reasons for reorganizing the Bureau are apparently threefold:

- more efficient and economical utilization of facilities and personnel.
- less bias on the part of FCC personnel with respect to one service or another (i.e., organization along functional lines will better serve the public interest).
- more opportunities to perform long-range planning and research, and to develop major policy formulations.

It should be noted that branches within the Bureau's divisions will still address matters pertaining to particular services, thereby assuring a continued visibility for the Amateur service within the Private Radio Bureau.

**8603 Conover Place, Alexandria, VA 22308.*

FCC proposes primary allocation for maritime mobile service in the band 220-225 MHz

On December 4, 1979, the FCC adopted a Report and Order which announced its proposals to the 1979 World Administrative Radio Conference (Docket 20271). While the text of the Report and Order has not been released to the public at the time this is being written, informed sources have stated that the Report and Order will propose that the Amateur allocation in the 220-225 MHz. band be reduced from Primary to Secondary status, and that Maritime Mobile will be designated as a primary service.

Sources in Washington, D.C., who are considered to be close to maritime mobile interests, indicate that these interests are prepared to challenge the amateur service for the 220 MHz. band, and will base their challenge on the following facts:

1. The 220 MHz. band is currently under-utilitzed by the Amateur service;
2. The Amateur service has proposed that this band be used as a "training ground" for voice operations by Communicator Class licensees, something which maritime mobile interests do not feel represents a pressing need for spectrum space.

Many amateurs who were made aware of the move by Maritime Mobile interests to secure use of the 220-225 MHz. band thought that the action taken by the FCC violated procedures set forth in the Administrative Procedures Act. Specifically, with reference to the United States Code, Annotated, Title 5, Government Organization and Employees, Paragraph 553(b) states:

"(b) General notice of proposed rule making shall be published in the Federal Register, unless persons subject there to are name and either personally served or otherwise have actual notice thereof in accordance with law. The notice shall include:

(1) a statement of the time, place, and nature of public rule making proceedings;

(2) reference to the legal authority under which the rule is proposed; and

(3) either the terms or substance of the proposed rule or a description of the subjects and issues involved."

It was thought that since the matter of a Maritime Mobile allocation in the 220-225 MHz. band had not been the subject of a pulic proceeding, the FCC's action was illegal.

As noted by the FCC upon adoption of the Report and Order, however:

"The FCC's underlying policy goal throughout this proceeding has been to minimize the international constraints placed upon the FCC in its domestic regulatory activities. Thus, it should be noted, that merely because the FCC's GWARC position provided for the possibility of implementing a service in some band in the frequency spectrum, the Commission is not required *in any future domestic proceeding* to actually implement it." (emphasis added)

Put another way, before the Maritime Mobile service could be given a Primary allocation in the 220-225 MHz band, and before the Amateur service allocation could be downgraded to Secondary, the Commission would be required to give "interested persons an opportunity to

participate in the rule making procedure through submission of written data, views, or arguments..." (Administrative Procedures, Chapter 5, Paragraph 553(c).

In short, it would appear that the FCC's proposal vis-a-vis the 220-225 MHz band does not constitute a violation of the Administrative Procedures Act since no allocation has actually been made.

If the Maritime Mobile service is given a Primary allocation in the 220-225 MHz band, this service's use of the band would have a significant impact on current Amateur operations in the band. Specifically, use of the 220 MHz band for Amateur repeater operations on the east and west coasts as well as near the Great Lakes could be eliminated if the band had to be shared with the Maritime Mobile service.

Jay A. Holladay, W6EJJ (Director, ARRL Southwestern Division), among others, has noted that over 325 repeater stations are now operated by U.S. Amateurs in the 222-225 MHz band. Of these, at least 100 repeaters are located on the west coast, while over 118 are located on the east coast. Further, 72 of the repeaters are operated in states which border the Great Lakes (Illinois, Indiana, Ohio, Michigan and Wisconsin).

Given the above, every effort must be made by the Amateur service to insure that the Maritime Mobile service is not given access to the 220-225 MHz. band.

ARRL RFI task group warns of new problem facing amateurs

In a letter dated 13 December 1978, the ARRL RFI Task Group warned Mr. Carl L. Smith, W0BWJ (Vice President, ARRL) of a new problem which could shortly face the Amateur service. Specifically, the Task Group noted the increasing concern on the part of the public with regard to microwave radiation. Much of this concern, of course, stems from the heavy publicity which surrounded the microwave "bombardment" of the U.S. Embassy in Moscow. Thus, "there is no question that the radio amateur could be the recipient of some of the fallout from the fears (of microwave radiation) which are generated by the unreasoning ignorance of the general public," cautioned the Task Group.

Speaking as the Task Group Secretary, Mr. Mort Blender, W4LPZ, further stated that it was his opinion "that we may be on the threshhold of a real problem. The term "microwave" can be applied by the average citizen to anything above the broadcast band. Irresponsible journalism...can easily use the term to denote anything in the short-wave region. Citizen ire directed against high-tension towers and microwave relay (towers) can mindlessly be directed toward Amateur radio towers without distinction."

The letter concluded with a call for the Amateur service to prepare for the possibility that questions may be raised regarding the levels of radiation in the vicinity of amateur installations. Presumably, such preparations would include, but would not be limited to, the publications of educational material on the subject in the Amateur and technical literature.

Concern rises over radiation hazards

The Suffolk County, New York, government initiated hearings in December 1978, into the health hazards produced by microwave-emitting, theft-detection systems which are used in retail stores. As reported by *Electronic Engineering Times* (December 25, 1978), "the hearings could lead to the passage of the first local-government-level rules regulating microwave devices."

Robert A. Vuono, a senior staff engineer for the New York Telephone Company, however, was concerned than any limitations imposed on microwave devices might also be imposed on communication systems. Indeed, the Environmental Protection Agency (EPA) is already measuring nonionizing radiation between 3 kHz. and 300 GHz. in a number of large cities. To date, 10,000 measurements have been made at 373 locations in 12 large cities, and according to Paul A. Giardina, chief on the Radiation Branch of the EPA, the median exposure level was found to be 0.005 uW/cm² (time-average power density).

Mr. Giardina also noted that about one percent of the population studied—that is, about 380,000 people—were probably exposed to radiation levels greater than 1 uW/cm². The latter figure, it should be noted, is the approved Russian exposure level.

As noted elsewhere in this column, the subject of radiation hazards and exposure levels is one which could receive considerable attention in the near future. Hopefully, every effort will be made to educate the public in this matter so that decisions will be made in an atmosphere free from emotion and subjective analyses.

Your Editor thanks Messrs. Mort Blender, W4LPZ, and Jack Kelleher, W4ZC, for their contributions to this month's column.

In this part of W6RJO's paper he discusses servicing and troubleshooting of power r.f. transistor amplifiers. Transistor nomenclature is also covered.

R.F. Power Transistors and Amplifiers

Their Care and Feeding
Part II

BY M.S. ASH*, W6RJO

R.f. transistor power amplifiers are comparable to tube power amplifiers in complexity with respect to trouble-shooting and servicing difficulties. However, the mode of operation of transistor power amplifiers is quite different from tube power amplifiers so that the set of servicing difficulties and solutions are also quite different. The servicing troubles divide into two or three main categories. They are d.c., r.f. and combinations of the two. D.c. problems are first discussed, r.f. problems are discussed second, and combinations plus miscellaneous problems are discussed last. Figure 1 shows a typical test setup for servicing which is self explanatory.

Test Setup for Servicing Power Transistor RF Amplifiers

A vexing d.c. problem is that of applying the d.c. input voltage with the wrong polarity. D.c. power input plugs are normally "polarized" in a foolproof manner, but human nature being what it is occasionally results in defeating even such measures. Wrong polarity d.c. input voltage immediately zaps all r.f. transistors as mentioned earlier. In a 3 to 5 transistor amplifier, their replacement costs upwards of $60 or more. Too little d.c. voltage applied results in very low r.f. output. R.f. output is a very sensitive function of the d.c. input. For example, a 13.5 v.d.c. (12.5 v.d.c. nominal d.c. rating) input amplifier rated at 100 watts output can suffer about a one third drop in output r.f. power with only a 5-10 percent drop in d.c. voltage input. This is perceptable in a mobile unit that is operating from the car battery only, with the engine (alternator) shut off.

If the d.c. power supplied is not adequately filtered or regulated the resulting spurious voltage changes will naturally manifest themselves in the output voice quality, background hum, etc. Further, the power supply should also be protected against r.f. leaking into it, since this r.f. can be coupled back into the amplifier to induce all kinds of oscillatory behavior and spurious radiation, not to mention wreaking havoc with the power supply voltage regulator. A quick fix for a certain power supply kit in this respect is to simply strap a 500 μf/50 volt filter capacitor across its d.c. output terminals. In general, any transients fed into the amplifier through a mobile power supply, such as from the auto alternator can sometimes harm the amplifier, since its normal standby condition is d.c. voltage bias applied to the transistors with zero drive. The d.c. input terminals of solid state power amplifiers themselves are usually well filtered, fused, including circuitry to force the power supply fuse to blow if there is a d.c. short in the amplifier.

There should be a carrier operated relay (c.o.r.) system in these amplifiers since they are in series with and between the exciter and the antenna. Hence, on "receive" the received signal can travel from the antenna directly through, by-passing the amplifier, to the receiver portion of the transceiver. On "transmit" that path is switched by the c.o.r. to the amplifier so that it is now being driven by the transmitter portion of the transceiver into the antenna load. There should be additional circuitry to render the amplifier inoperative for operation with the transceiver only if desired

C.o.r. operation proceeds simply by bleeding off a very small portion of the excitation r.f. on "transmit", rectifying it to operate a transistor switch into conduction, which transistor then provides a d.c. return path to ground for the switching relay coil. This switches the overall system from transmit to receive in a manner depending on the relay contact circuits. Occasionally the c.o.r. circuitry becomes defective. The trouble is usually a defective switching transistor (small signal bipolar type) or a defective diode or both. Passive components such as resistors and by-pass capacitors in the c.o.r. circuits, in general, seldom cause trouble.

R.f. problems are a bit more complicated than d.c. problems. One difficulty is blown or partially blown r.f. power transistors resulting from amplifier abuse. This can take the form of too much drive for protracted key-down periods. In u.h.f. amplifiers momentary excessive drive transients can ruin r.f. transistors. Further, wrong d.c. polarity as mentioned earlier, and tampering with the r.f. circuitry and components by the curious or those with a little but incomplete knowledge, in this case is a

*455 21st Place, Santa Monica CA

dangerous thing. Other gross abuses are loose transistor stud nuts, input and output r.f. connections reversed, key down operation for hours in poorly ventilated enclosures, and no ventilation in repeater configurations. In general, these power amplifiers should not be considered as 100 percent duty cycle systems - perhaps 50 percent duty cycle would be a nominal operational value.

If the r.f. transistor can be seen arcing inside through its translucent ceramic case, it is virtually zapped and must be replaced. If the output power from the amplifier seems somewhat low, but very sensitively increases with slight increase in excitation, then the driver or pre-driver stages (transistors) should be suspect. Normal operation exhibits saturation, in that increasing the excitation beyond a certain reasonable level should result in little or no increase in rated output power. This is similiar to low band transceiver drive gain action. However, if the output seems low and the amplifier has been operating properly in the past, but now reacts sluggishly to tuning of the trimmer capacitors on the p.c. board, probably one or more of the output stage transistors is gone or going. On the other hand, if there is no output at all from the amplifier with all inputs correctly connected, and no unskilled technician has handled the amplifier as yet, the lack of d.c. input power because of an open or short circuit in the d.c. lines should be suspected. As in most other types of servicing, if there is absolutely no response when all inputs are properly applied, the difficulty is usually trivial. Other miscellaneous difficulties are blown fuses, shorted diodes as part of the power supply fuse forcing circuit, v_{cc} islands under the p.c. board that are accidently grounded to the heat sink, open v_{cc} ground returns, shorted high C low voltage filter capacitors, or extremely rarely, open p.c. board d.c. tracks etches or defective transistors that were just purchased.

Checking the transistors is quite simple. However, if one does not deftly handle high temperature low wattage soldering irons used in this kind of work, then the transistor can be damaged through overheat when the iron is used to lift the base lead from the circuit board to perform the check. Eight seconds of soldering iron heat contact per lead when installing or unsoldering an r.f. transistor is absolutely maximum - any more you can kiss the transistor goodbye. Assuming that one is knowledgeable about how the transistor seats in the p.c. board, so that its base lead can be adroitly and quickly lifted from the board while momentarily applying the soldering iron, the check is easy. With the lowest resistance scale on most any v.o.m., check the resistance between the lifted base and emitter in each direction, as in testing a diode. One direction should read between 10 and 15 ohms, while the other should read infinity for a good transistor. If more than 10-15 ohms or infinity is read both ways, the base-emitter junction is probably open. If less than 10 ohms one or both ways, this junction is shorted. A similiar check is then made between the collector and base. If the transistor passes both checks, then it is usually good. Occasionally, part of the transistor may check good while the remainder has been partially blown open in the sense of its i.c.-like construction. Also, some transistors can show appreciable leakage currents on most transistor checks and still be good. If the tops of the fingers are placed on each transistor, of a multiple transistor output stage during operation, they should feel equally warm. If there is an easily discernable heat difference, probably one or more of the transistors have been zapped.

It is very important to realize that as far as the average individual user is concerned, he or she should rarely experience a zapped transistor if the amplifier is properly cared for.

Further miscellaneous difficulties include open or shorted v_{cc} by-pass capacitors (rarely), open or shorted resistors (rarely), lack of adequate p.c. board grounding (very rarely) and deteriorating mica dielectric in the trimmers (very rarely). If the latter smoke under operation, the difficulty is dielectric breakdown and it must be replaced. If a low wattage resistor, other than the 1/4 watt balancing resistors across the transistors, begins to smoke, replacing it with a higher wattage counterpart will temporarily clear up the trouble. However, this is probably indicative of improper bias due to the resistor changing its value, which should be investigated. Balancing or ballast resistors that smoke, or begin to appear overheated usually indicate zapped transistors.

Lead dress is quite important. v_{cc} leads should be routed as remotely from r.f. fields as space will allow. Very small r.f. coax connections within the amplifier should have their braid grounded at both ends, and preferably soldered directly to connectors when possible, as opposed to their being soldered to a lug for that purpose. The coax dielectric at the connections should be exposed for

Table 1
European Transistor Nomenclature

First Letter	Second Letter	Total Serial Number
A: Germanium	C: a.f., low power	Three numerals; entertainment type
B: Silicon	D: a.f., high power	Three letters and two digits; industrial type
	E: tunnel diode	
	F: r.f., small signal	
	L: r.f., power	
	P: photosensitive	
	R: control/switching, low power	
	S: switching, low power	
	T: control/switching breakdown	
	U: power switching	
	W: experimental	
	Y: power diode	
	Z: zener diode	

Examples:
1. AF117 is a germanium, r.f., small signal, entertainment type (e.g., f.m. receiver use)
2. BCZ11 is a silicon, a.f., low power, industrial type (interphone amplifier)
3. BLY89 is a silicon, r.f., power, industrial type (175MHz amplifier).

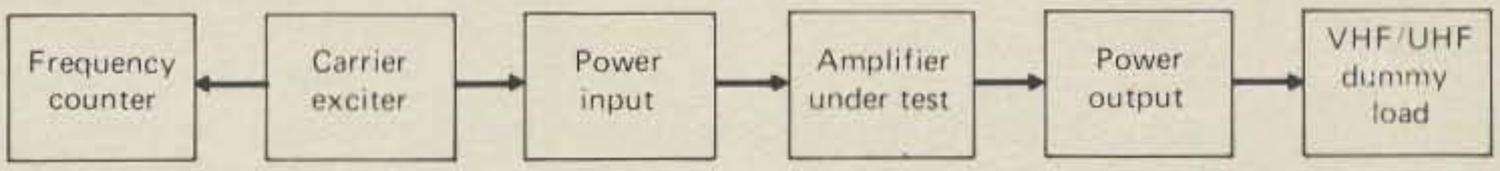

Fig. 1 - Test setup for servicing power transistor v.h.f./u.h.f. amplifiers.

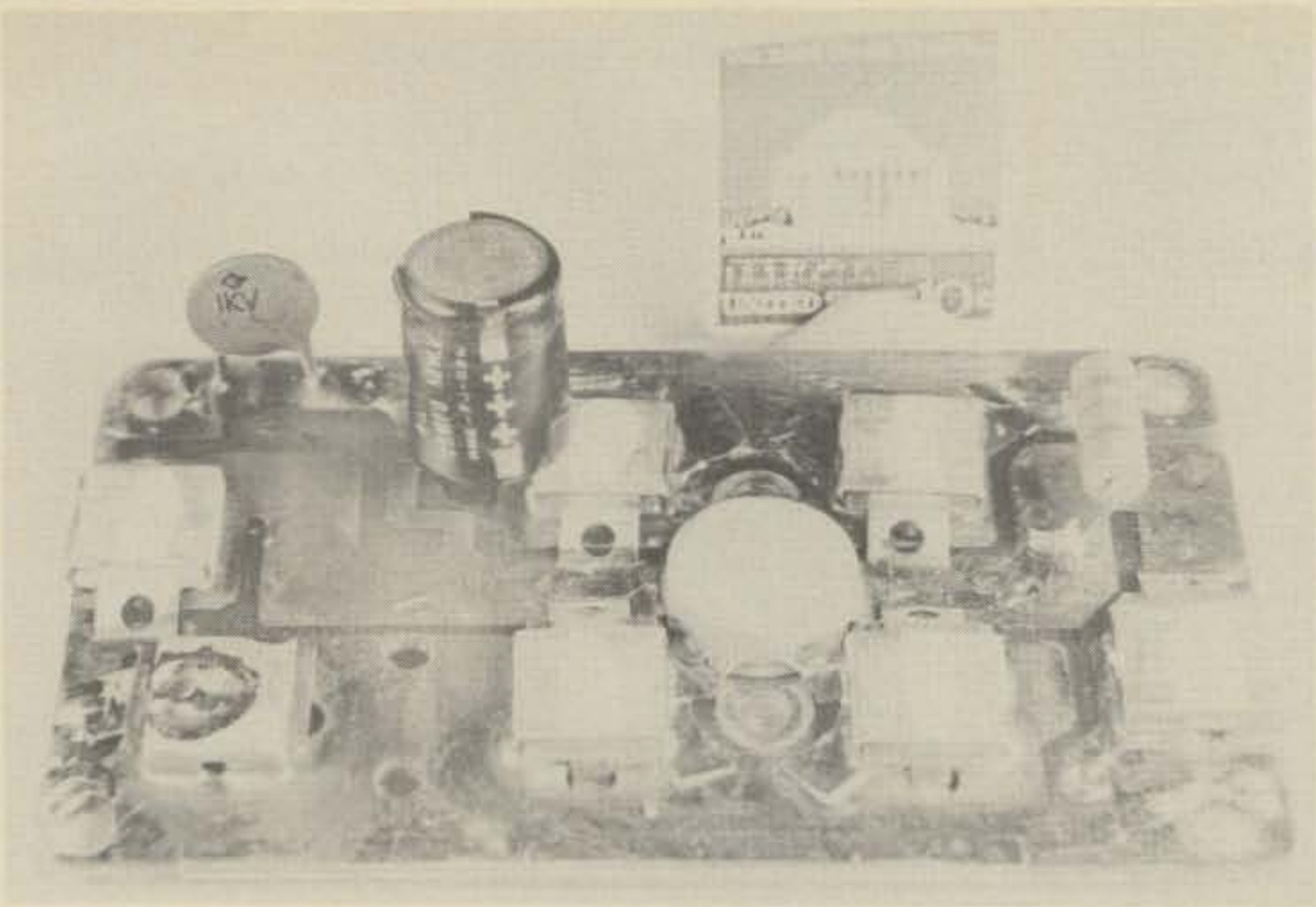

Fig. 2 - Typical u.h.f. stripline amplifier.

no more than 1/32 - 1/16 inch lest impedance matching difficulties become incipient. Little attention to proper lead dress often results in an oscillatory amplifier and/or a chattering c.o.r. relay. Oscillation is checked simply by monitoring the d.c. input current with no drive applied. Any current flow in a class C amplifier after properly jostling it mechanically or electrically if required, indicates that the amplifier is drawing current with no excitation, i.e., it is oscillating.

All external interconnecting r.f. leads between the amplifier and associated equipment should be as short as possible. For example, when the exciter (transceiver) is mounted in the vicinity of the auto instrument panel with a long coax input lead back through the car into the trunk space where the amplifier is mounted, expect to incur at least a 3 dB coax and fitting loss in excitation power to the amplifier. Nevertheless, this is usually the preferred configuration with a rear mounted antenna. This is as opposed to mounting everything under the dash with a long output r.f. power lead to the antenna in the rear. The best solution is to use an over-head cab type antenna, with all under the dash. Then the amplifier-antenna coax lead is quite short, with the exciter-amplifier and d.c. leads even shorter. All d.c. power leads in a mobile installation should be conservatively heavy. D.c. drop in voltage due to insufficiently heavy wire really hurts because, as already mentioned, a 5-10 percent drop in v_{cc} results in a 25-35 percent in r.f. power output.

Matching the exciter input to the amplifier, as well as that of the amplifier to the antenna, cannot be overstressed. The former is usually automatically taken care of in the amplifier, assuming that 50 ohm coax is used from the exciter. Even though the amplifier transistors can take grossly mismatched conditions it is a shame not to put most of this hard gained r.f. into the antenna where it does the most good. Besides, proper matching lessens deleterious side effects consisting of oscillation tendencies, generally hypersensitive and noisy behavior, overheated coax, other overheated components, and hot spots.

With respect to u.h.f. transistor amplifiers, fig. 2, all of the foregoing is true in an exaggerated form-especially the cautionary aspects. For example, u.h.f. transistors are especially vulnerable to large momentary over drive transients. Also, a 1/8 inch displacement of the tab lead of a low inductance fixed capacitor on the u.h.f. p.c. board (fig. 2) can vary the amplifier output by as much as 10-20 percent. As a matter of fact, much production tuning to maximize power output from u.h.f. amplifiers consists of unsoldering certain of these capacitor tab leads, tweaking them into a different position, and resoldering them. Generally the achievement of optimum operation of u.h.f. tran-

Table 2

VHF/UHF 12.5 Volt R.F. Power Transistor Specifications

Band	JEDEC No.	Motorola HEP*	California Transistor Co (CTC)**	Amperex ***	Solid State Scientific (SSS) ****	Nominal Power (watts) Input	Output
VHF to 175 MHz	2N3926-7+	S-3007					
	2N5848	S-3007					
	2N5704-5	S-3006-7	B12-12	BLY88A	SD1014	2.5	12
	2N6081	S-3006			SD143		
	2N5590+	S-3006					
	2N5591+						
	2N5849		B25-12	BLY89A	SD1229	6	25
	2N6082	S-3007					
	2N6368			544BLY++			
	2N6084	S-3009	B40-12	BLW60C	SD1278	10	40
				BS40-12			
			B-70-12	568BLYC++	SD1124	15	70
UHF to 500 MHz	2N5946		CM10-12	BLX68	SD1087	2	10
	2N6136			BLX69			
			CM40-12		SD1089	10	40
			CM45-12		SD1099	10	45
			CM60-12			10	60

* Phoenix, AZ
** San Carlos, CA
*** Hicksville, NY
**** Montgomeryville, PA
\+ Basic transistor chip which can appear in many packages/cases each with a different number
++ Experimental type not yet on market as of this writing

sistor power amplifiers is trickier than their v.h.f. counterparts, and in turn v.h.f. amplifiers are trickier than their h.f. counterparts. This is well known to be the case as the frequency of operation is increased toward the microwave regions.

R.F. Power Transistor Manufacturers' Specifications

Solid state power transistors have been manufactured for more than a decade by most of the U.S. major tube makers, such as GE, RCA, Motorola, and Amperex. Their catalogs are available for the asking from their local manufacturing representatives. These catalogs are usually supplemented by much additional material, including circuit diagrams and construction details for building stripline transistor power amplifiers. Their engineering staffs are generally most agreeable to answering sensible questions by phone or mail pertaining to the use of their transistors.

Extensive experience has shown that comparable transistors manufactured by different companies are comparably priced and perform equally well. This is meant in the same sense that comparable tubes from different makers perform with almost no perceptable difference. Tales about power transistors have sprung up in the same ways that were current when tubes were beginning to become available in quantity four decades ago. If one covers the labels from transistors of like characteristics from different makers, it is difficult if not impossible to distinguish the manufacturers through differences in power transistor performance.

Table 2 [1, 2, 3, 4] is presented as a supplement to the catalogs for nominal 12.5 volt r.f. power transistors that are manufactured by the above tube makers, and whose technical literature is more generally available. The table includes both first and second source manufacturers. Entries left vacant indicate that there is no like transistor made by that particular manufacturer. The reason that the Amperex transistor nomenclature appears recondite with respect to that of the other manufacturers is that the European nomenclature is used. (Amperex is now a division of North America Phillips, Eindoven, Hilland. Also, California Transistor Co. (CTC) is part of Eimac/Varian, Palo Alto CA). This nomenclature provides a succint characteristics descriptor for the particular transistor, and is given in Table 1. ▣

(To be Continued)

a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

Doctor Livingston I. Presume poked his head in the door and asked, "May I come in?"

"Certainly", I replied. "But I have a better idea. It is such a beautiful spring day, let's sit outside and absorb some sunshine".

Fig. 1—The K6VQ Mini-antenna tuner and s.w.r. meter. Using an inexpensive CB-type s.w.r. meter and a homemade tuner, this compact device is used with an Atlas transceiver for all-band operation. The s.w.r. meter, removed from its case, is mounted in a hole cut in the lid of an aluminum utility box. The tuner is at the left. At the top of the panel is the miniature coaxial jack for the antenna line and below it are the controls for the tuner. From top to bottom: Output capacitor switch, output capacitor C2, inductor switch S2, input capacitor C1 and input capacitor switch. The whole unit is almost small enough to go in your pocket!

I opened the door to the shack and sat down beside Doctor Liv on a wooden bench. The warm spring sunshine felt good and it seemed as if the long, cold winter was at last over.

"Where's Pendergast? I haven't seen him for some days", I asked.

Doctor Liv smiled. "Pendergast's nearly forgotten about ham radio. He's been romancing Rosie Radiator".

Rosie Radiator? Isn't that the CB YL I saw him with a few times?"

"That's right", replied Doctor Liv. "Rosie and Pendergast have a thing going".

"Another good DXer falls by the wayside. Where's he going for his honeymoon?"

"You are a little premature", replied Doc. "Not until he gets his two meter gear installed in the car. I'm sure of that".

I looked up at the spring sunshine. "I'd like to be taking a trip, myself", I said. "Sometimes I envy my friend, Bill, K6VQ. He travels a lot and sees the world. And he takes his *Atlas* transceiver along with him".

"What does he do for an antenna when he hits some out-of-the-way place?", inquired the good doctor as he shifted about on the hard bench.

I reached in my jacket pocket and brought out some photographs and a schematic drawing. "Well, Bill has built up a mini-s.w.r. meter and antenna tuner. It had to be very small since he travels light. Look at this (fig. 1). This box, which measures only 6" × 3½" × 2" has all the works in it. The schematic is fig. 2. Note that he makes use of a CB-type s.w.r. meter. He got his at a flea market for a dollar because the diodes in it were burned out. To the left of the s.w.r. meter are the controls for the pi-network matching circuit.

"This network is composed of a tapped coil and variable input and output matching capacitors. Bill was intrigued by the pee-wee imported mica-leaf variable capacitors used in miniature transistor radios, so he bought two of them and checked them out. As you see, they are only a little bigger than a postage stamp".

"Will they stand the gaff with a 100 watt transceiver?", asked Doctor Liv.

"Bill put over 500 volts a-c across the capacitors with no ill effects so he thought he'd try them out in actual service. And they worked just fine! He used two miniature switches to add extra circuit capacitance if he needed it. And a mini-coil and small rotary switch completed the network. He used inexpensive stereo fittings that match coaxial line. An inside view of the unit is shown in fig. 3".

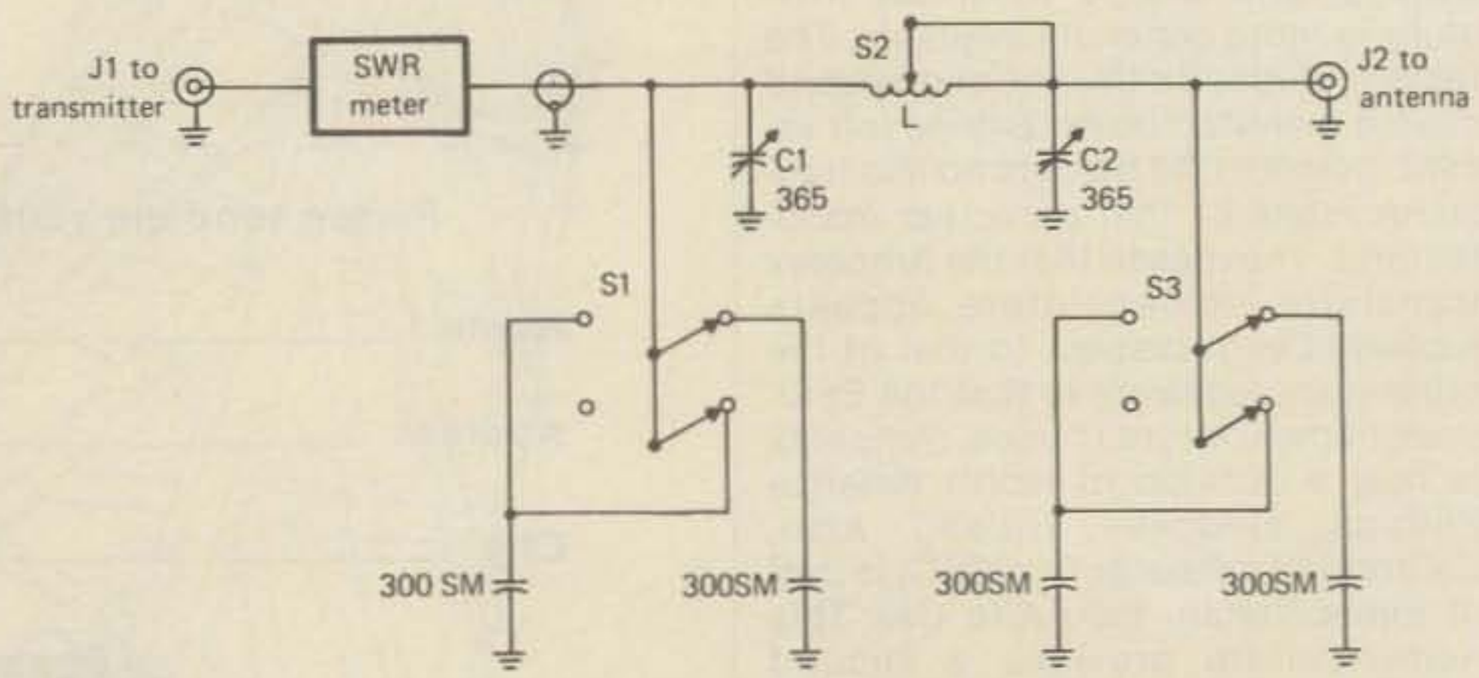

Fig. 2—Schematic of K6VQ Antenna Tuner
C1, C2—365 pF mica compression. Philmore 1951.
S1, S3—DPDT miniature toggle switch. C-H SF2BX191 (On-off-on).
S2—Single pole, 12 position, miniature silicone switch. Oak 399217A.

**83 Suburban Estates, Vermillion, SD 57069.*

"Beautiful", said Doc Liv. He examined the device as if it was a fine jewel. "What kind of an antenna does K6VQ use with this match-box?"

"He uses a trapped, triband dipole for 10, 15 and 20 meters and a random length wire for 40 and 80 meters. As you know, the *Atlas*—as with other solid state transceivers—likes to work into a very low s.w.r. antenna load. The triband dipole, while an excellent performer on three bands, has a rather sharp s.w.r. repsonse. And this reduces the transceiver output because of the built-in protection circuit that reduces transmitter output as the antenna s.w.r. rises. You really need an antenna that is very flat if you want to operate a solid-state transceiver over more than a very narrow frequency range. And this little

Fig. 3—Interior view of the K6VQ mini-tuner and s.w.r. meter. At the left is the s.w.r. meter removed from its case. A home-made aluminum shield runs from top to bottom of the box and shields the s.w.r. meter from the tuner (at right). Placement of the coil and the two miniature tuning capacitors is visible at the center of the assembly, with switches S1 and S3 above and below the tuning capacitors.

matching unit does the job very nicely".

I handed the unit to Doctor Livingston. "Observe that K6VQ placed an aluminum shield plate running between the s.w.r. meter and the components of the tuning unit. Other than that, wiring is very straightforward".

"Tell me about the triband dipole", said Doctor Liv. "It would have to be small and light to go along with this unit".

"Right", I replied. "K6VQ decided to make up a very light and compact trap-style triband antena for 20, 15 and 10 meters. The dimensions are conventional (fig. 4). His assembly technique of the traps is interesting. The antenna is made up of insulated hookup wire, which is very flexible. Each trap is made up of a small air-wound inductor which is slid onto a short length of plexiglass which serves as a support for the coil and as tie-points for the antenna wires and capacitor.

"Bill wanted to use the smallest capacitor available, but little information could be found about the current and voltage impressed upon the capacitor in such a complex trap circuit. While the trap is a very simple device, its function changes with the band in use. And as far as I know, no mathematical treatment has been made of the actual trap operation. So Bill tried the hueristic approach....."

"Hueristic?", queried Doctor Liv.

"Cut-and-try", I replied. "He used a 1500 working volt, dipped mica capacitor for the 15 meter trap. And for the 10 meter trap (not being able to find enough proper values of capacitance) he used three 500 volt capacitors connected in series. After assembly, the traps were trimmed to the proper resonant frequency with a dip-meter. A photograph of the 15 meter trap is given in fig. 5. It is a very simple and light assembly.

"And for the coaxial line, it is possible to use RG-58/U. And for an even lighter assembly, you can use RG-174/U line, which is only 3/32" diameter. It has a little more loss than RG-58/U, but if the line is short it doesn't make much difference".

"Sounds very nice" said Doctor Liv as he returned the photographs to me. "Anything else of general interest that Pendergast is missing?"

"Yes", I replied. "There is a very interesting antenna described in *Radio Communication*, that excellent magazine of the Radio Society of Great Britain (1). It is in the *Technical Topics* column written by my good friend Pat Hawker, G3VA. The antenna was designed and built originally

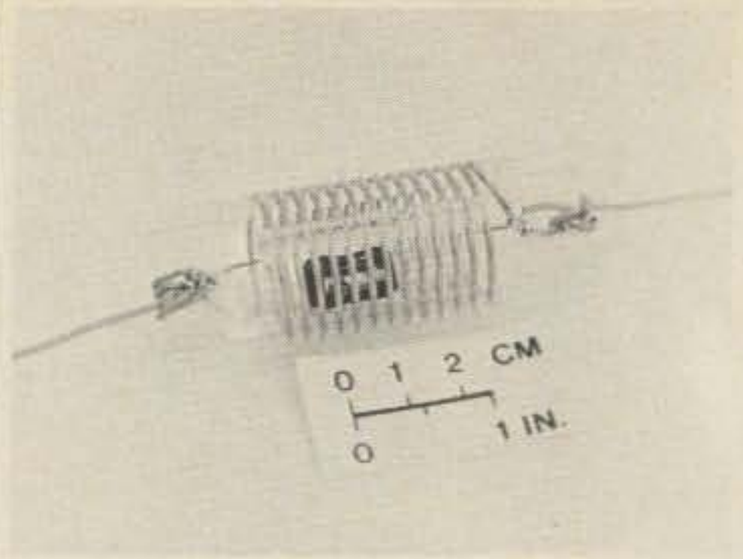

Fig. 5—The K6VQ mini-trap for 15 meters. The capacitor is a 1.5 kV silver mica unit. Overall trap length is about two inches. Trap is dipped to 21.0 MHz. on the bench before placing in antenna.

by UA3IAR, in Kalinin, U.S.S.R. It was written up in the Russian magazine, *Radio* in June, 1978. Basically, the UA3IAR antenna is a two element Quad array supported from a single pole (fig. 6). This is a Quad-type antenna that is fixed, requires no framework of self-supporting elements, yet can be remotely switched so that the main lobe falls in any one of four quadrants. Since the unidirectional pattern is about 90 degrees wide (between the −3dB points), this means that the array provides coverage through 360 degrees with no turning delay.

"The array is, in effect, a two element Quad with a fed-reflector. The array is formed from four half-loops which can be selected so that at any time two half-loops form the radiator and the other two the reflector. Four position switching provides the four basic configurations for unidirectional beams. In each position, two half-loops form the driven element, while the other two form the driven reflector with its phasing section of transmission line.

"Fig. 6 shows the antenna in comparison with a conventional two-element Quad. The upper vertices of the UA3IAR Quad are joined together, while the lower vertices form feed

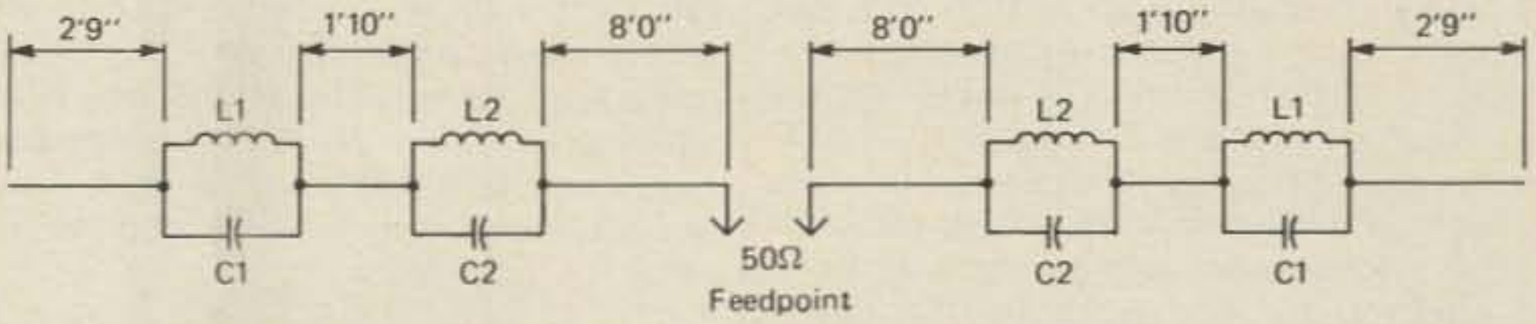

Fig. 4—Schematic of triband dipole for 20-15-10 meters

L1, C1—15 meter trap. 24 pF silver mica capacitor plus 2.3 uH coil. 14 turns, 1" diameter, 8 turns per inch. Adjust number of turns for resonance at 21.0 MHz.

L2, C2—10 meter trap. 24 pF silver mica capacitor plus 1.3 uH coil. 8 turns, 1" diameter, 8 turns per inch. Adjust number of turns for resonance at 28.0 MHz.

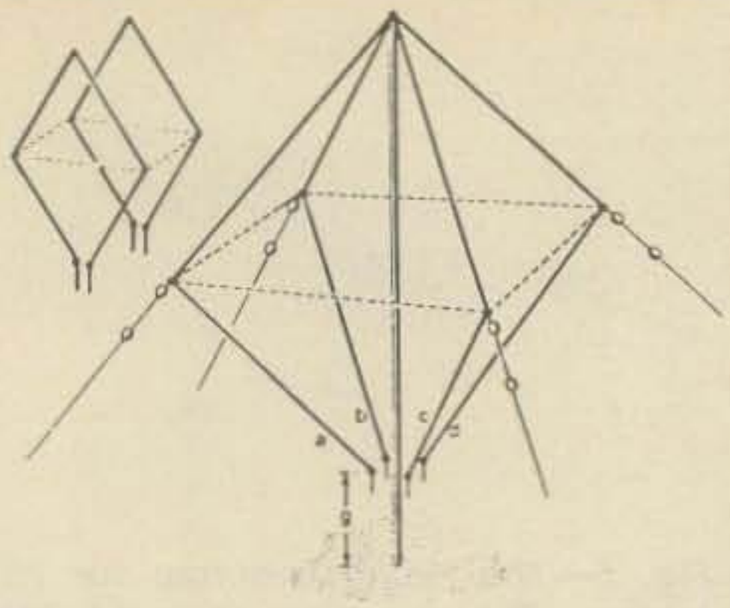

Fig. 6—The UA3IAR switchable Quad antenna for 20 meters. Development from a conventional Quad (left) is shown. The four half-loops abcd are electrically joined at the top, and pairs of half-loops are used to form the full-wave loops which function either as radiator or, with the additional phasing extensions, as driven reflectors (Drawings from "Radio Communication").

points. The middle portions of the loop are pulled out by guy wires. All wires, in fact, are held in place by guying rather than by a framework. And all wires are electrically connected together at the top of the array.

"The switching technique used by UA3IAR is shown in fig. 7. To form a unidirectional radiation pattern it is necessary to provide a suitable phase difference between the currents flowing in the two loops. This phase difference is slightly more than 180 degrees. The exact value of phase shift depends upon the effective spacing between the loops, with an initial phase difference of 180 degrees being obtained by suitable connection to the appropriate windings of the ferrite core transformer, T1.

"Extra phasing elements are connected into the loop forming the reflector elements, with all switching provided by relays RLA and RLB. The switching sequence depends upon the position of the selector switch, S1.

"As an example, in switch position 1 both relays are energized and winding L3 of transformer T1 is connected to half-loops *a* and *b* through the coaxial line phasing elements. In this fashion two complete loops (*ab* and *cd*) are formed with *ab* acting as a reflector. In this example, the beam direction is that indicated by arrow 1. Arrows 2, 3 and 4 correspond to beam directions of the three other switch positions. Four vacuum relays connected in pairs are used by UA3IAR. Contact rating of the relays is not important as no antenna switching takes place with power applied to the antenna".

"What about the ferrite transformer?", asked Doc Liv as he sketched the illustrations into his notebook with a graceful touch.

"According to the G3VA article, transformer T1 is wound upon two, stacked ferrite cores with windings made from three parallel wires. Winding L1 has ten turns; windings L2 and L3 have eight turns each. This particular antenna is fed with a 75 ohm coaxial line and the s.w.r. is stated to be less than 1.4-to-1 across the 20 meter band. I would imagine that it could be used with a 50 ohm line if the number of turns in winding L1 was reduced to seven or eight".

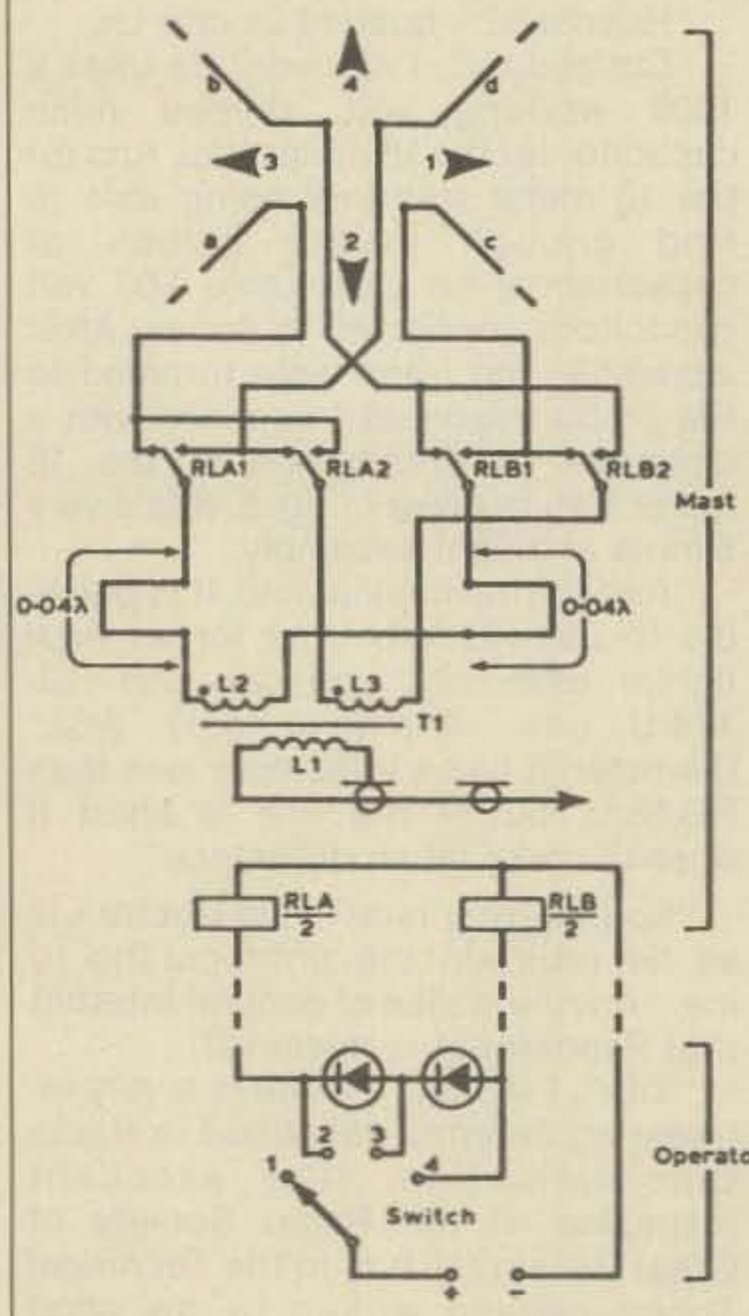

Fig. 7—The control and switching system. The two .04 wavelength extensions are used to provide a .08 wavelength phasing section to convert the appropriate loop into a reflector. T1 is a large ferrite core. Dots indicate winding polarity. In absence of relay energizing voltage the beam is set in direction 1. Note that diode between switch positions 3 and 4 is shown the wrong way. It should be reversed.

"How about the antenna dimensions?", asked my friend.

"Well, for 20 meters, a 30 foot mast is used. The length of each half-loop wire is 10.95 meters, or 35'10". Tests run on 2 meters by UA3IAR indicate that the optimum length of the half-loops is 0.53 wavelength and the optimum length of the coaxial phasing elements is 0.08 wavelength (total). Finally, the polar plot of the 2 meter model is shown in fig. 8. No information is given about forward gain in the original article, but G6XN, who is an authority on antennas in England, estimates the gain to be between 3 and 4 dB.".

"This seems to be a practical switched array for 20 meters and it is not complicated to build. I hope some of the readers of my column try this antenna out and see how it works!"

Doctor Liv got up, stamped his feet and swung his arms about. The air was not as warm as we thought and we both looked toward the shack door at the same time. "I suggest we go inside", I remarked.

Doctor Liv walked into the shack, which now seemed super-heated.

"How are the sales of your new antenna handbook going?"

"Great!", I admitted. "Nearly up to a second printing. I'm pleased to see it doing so well".

"That's good news to start out in 1979", remarked the Doctor. "Now, all we have to do is sit back and see what develops between Pendergast and Rosie Radiator. So you see, your problems are not all behind you".

Information on the UA3IAR Quad antenna is reprinted from "Radio Communication", *the publication of the Radio Society of Great Britain. For information on the magazine and membership data in the RSGB, write to the Society at: 35 Doughty Street, London WC1N 2AE, England.*

The new W6SAI handbook is entitled "The Radio Amateur Antenna Handbook", This 188 page book covers antennas from A to Z and is available from: Radio Publications, Inc., Box 149, Wilton, CT 06897. Price: $6.95 plus 50¢ postage and handling.

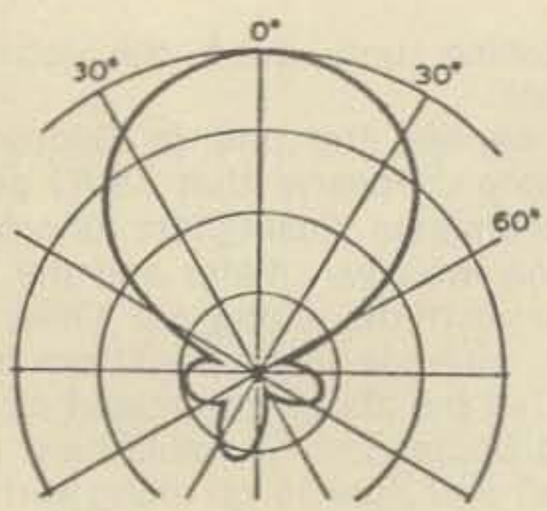

Fig. 8—Polar diagram of UA3IAR model antenna as measured on 144 MHz.

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A Compact 4 X 4 Array For Home Or Field Use

BY T.E. WHITE*, ex-W2JLP, K3WBH/2

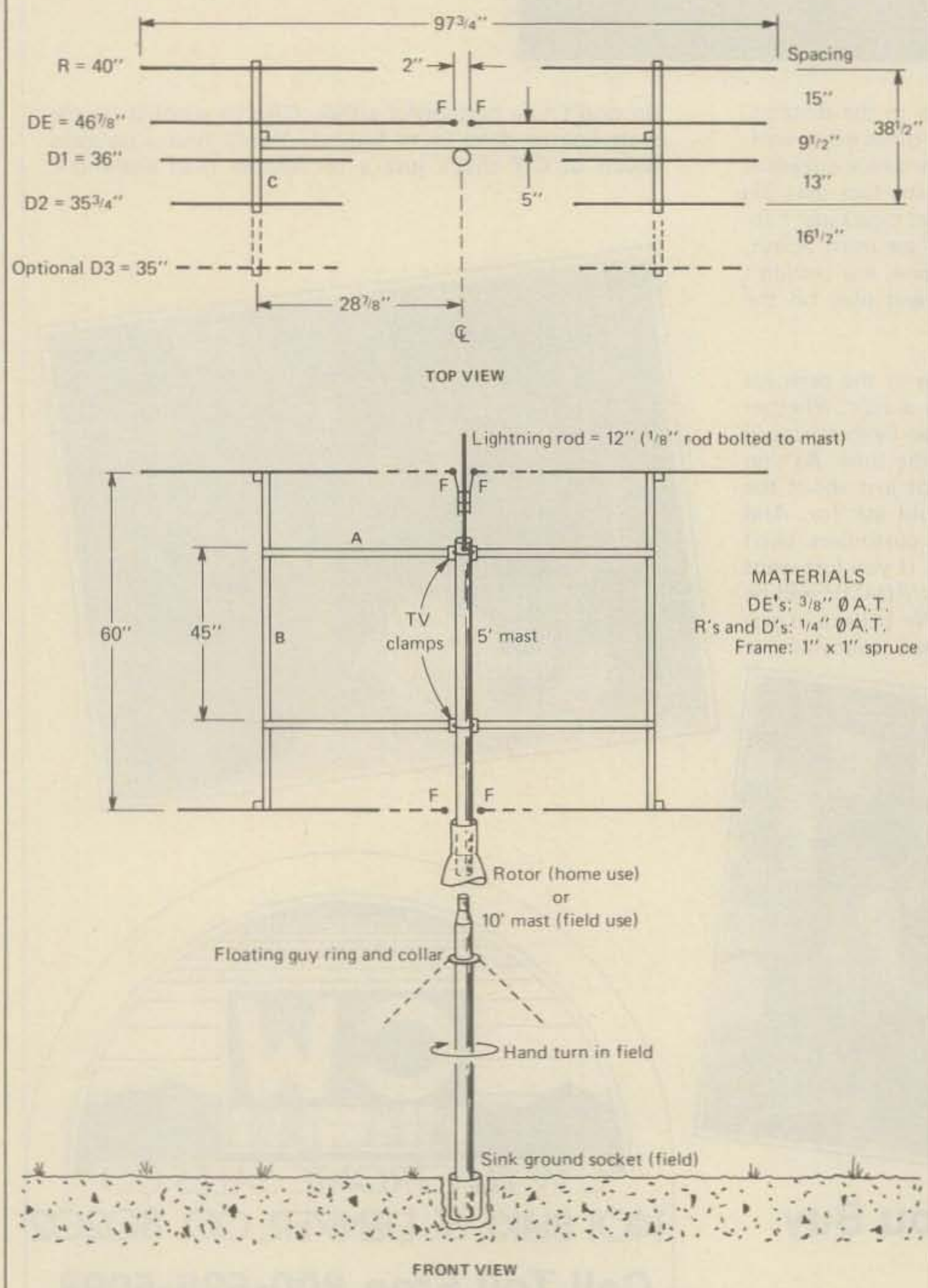


Fig. 1 - Plans for building T.E. White's two-meter antenna.

After 30 years of large array-of-arrays designing, constructing and operating, the author decided one day recently to "think compact." How could one pack at least 13 dB into an aerial of no more than 100" maximum dimension on 2 meters? It must be useable at home, and "take-apartable" for quick field trips.

- It must contain no more than 10 structural pieces including mast, and no piece may be more than 5' long.
- It must be "assembleable" on site (Field Day or mountain-topping) with nothing more than an adjustable wrench and a screwdriver.
- It must have a power gain of at least 20 (10 watts "sounds like" 200).
- It must be direct-feed with no matching devices of any kind on the antenna (no deltas or gammas, no ratio dipoles, no stubs or sliding shorts, etc.)
- It must use "standard" lengths of readily available material for the mounting structure.
- It must perform well at no more than 15' above ground in the field.
- It must have a reasonably low wave angle, and low spurious lobes in the E plane.
- For home QTH use, it must be rotatable with a medium duty TV rotor, and have a small turning radius.
- No dimension to be more critical than 1/8".

*36 Lake Avenue, Fair Haven NJ 07701

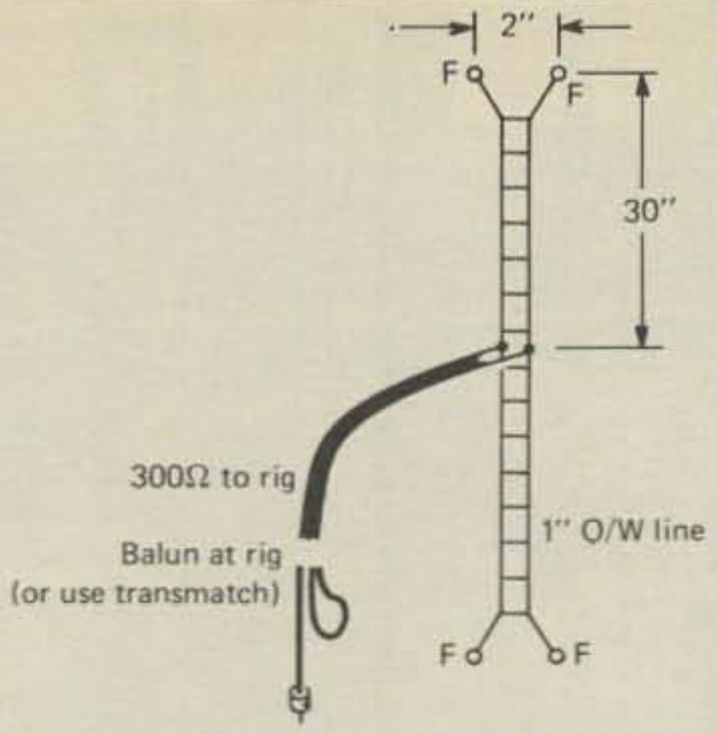


Fig. 2 - The feed system.

- For good reception, capture area should be at least 1.5 square wavelengths.

So, criteria and parameters (and gin & tonic) in hand, your faithful correspondent came up with a straightforward 4 x 4 (optional 5 x 4) yagi. Using "extended" driven elements makes direct feed possible. Using a frame of easily boltable members of wood and standard TV mast sections fulfills the transportability criterion. Open wire line and balanced feeder makes a foolproof, low-loss feed system.

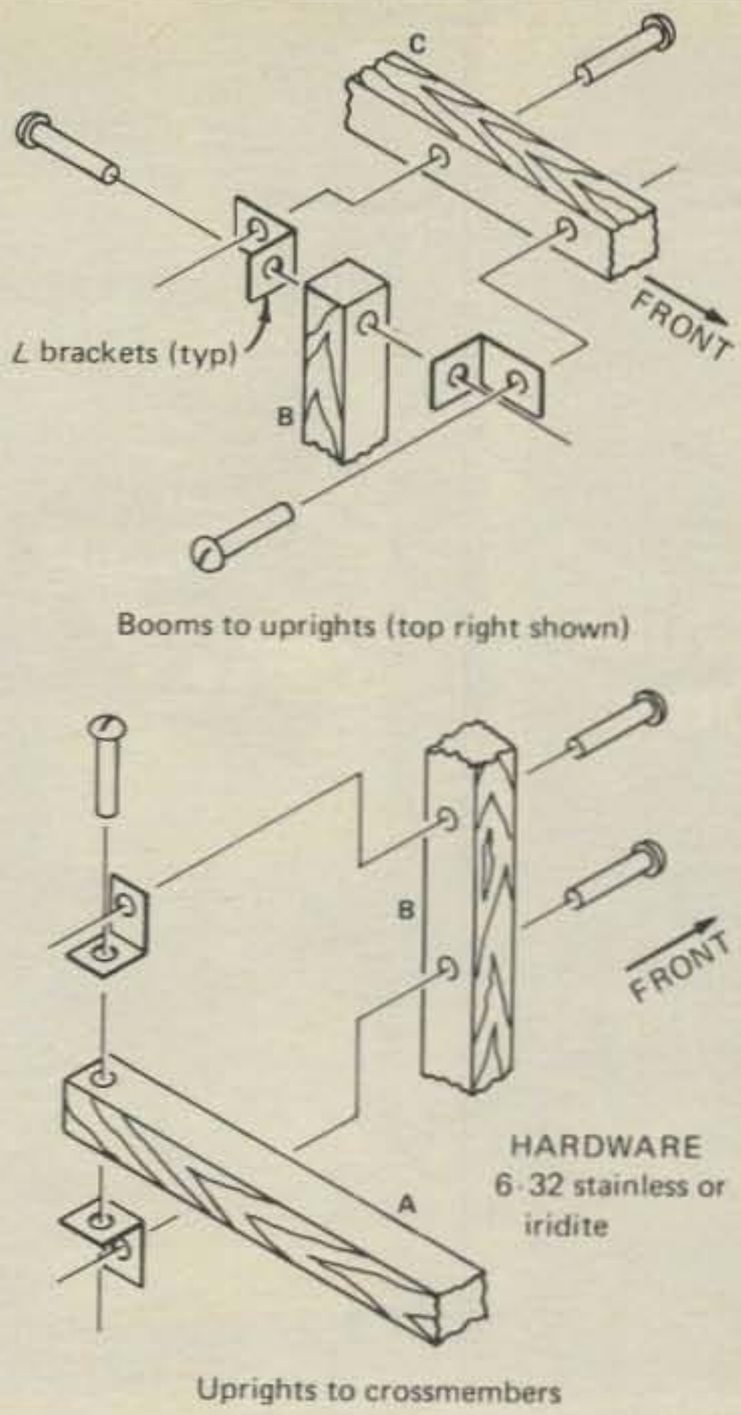


Fig. 3 - The frame attachments.

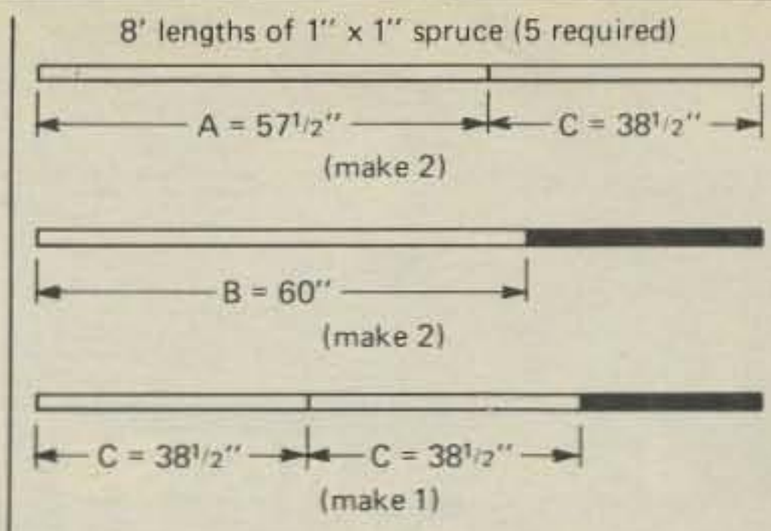
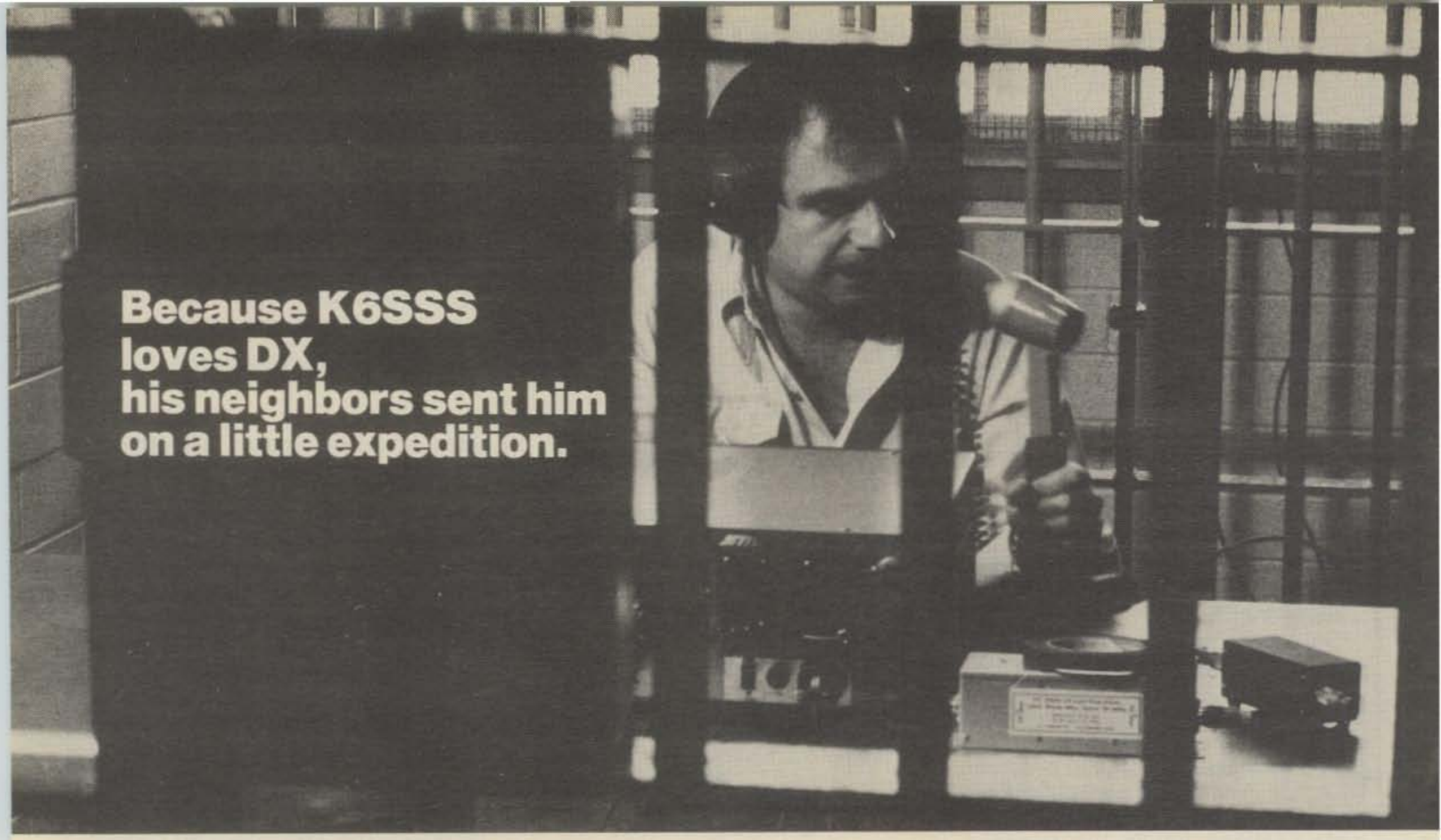


Fig. 4. - Cutting chart.

No, friends, this is not a moon-bounce monster, but antenna range tests plus on-the-air DX reports prove out the starting parameters. A weekend with saw and drill will reward you with a "beam in a box" which will provide many pleasant hours of home and field QSO's.

Reference to the drawings will supply all needed construction info. Just remember this array is all above ground. It has *no lightning protection* whatever. So for home use, install the static arrestor shown at the mast top, run the twinlead through a TV-type arrestor, and ground the mast well. ▣



One neighbor sued him for interfering with Lawrence Welk. Another filed a complaint about that "monstrosity" in his backyard—a tribander at 40 feet.

7,781 tangled with the law

The K6SSS case is an example of what can happen to you these days. No matter where you live. It is hypothetical. But real lawsuits are being fought right now by people like K50VC, W2LTP, WB7NOM, W8NRM and W6UFJ/N6QQ to name a few. Last year nearly 8,000 unsuspecting hams and CB'ers ran afoul of the law. Sure, they're taking their fight to court—but they're losing! Never mind that they've got building permits for their towers. Or that the FCC says their rigs are "clean." Judges are ruling against them. The alarming part is that every suit lost makes it that much easier to nail the next guy. Prosecuting attorneys love to cite recent adverse decisions during a trial.

Legal ammunition available

The tragedy is that suits are being lost that could have been won. But TVI/RFI and tower cases fall into a little-known area of the law. Unless your lawyer is a specialist, he could spend hundreds of hours researching court decisions. And still not be sure he's put together the strongest defense possible. It's expensive (expect to spend an average $4,000 to $8,000 if you're sued). And risky. Which is why we formed the non-profit Personal Communications Foundation.* To provide your lawyer with legal ammunition.

Who we are

We're a handful of ham lawyers, professors and judges (all volunteers) who wanted to help before it's too late. We're putting together the first research library of personal communications and zoning law. And having briefs written by the best legal brains. It's all available to your lawyer. For 10¢ a page. We can't guarantee you'll win. We can't try the case for you. But if you or your lawyer contacts us, we'll sure make sure you get a fighting chance.

Give us a fighting chance

To be even more successful in future battles, we're building an arsenal of weapons to use in court. For example, we're commissioning a study by real estate experts on the effect of a backyard tower on neighborhood property values. The pricetag is a stiff $11,000. But without the study, more cases will be lost. And more dangerous precedents will be set.

We *are* winning. But it takes money to keep fighting. You can help us fight by sending a check. The ARRL did. Think of us as your insurance policy against a lawsuit. All checks are 100% tax-deductible.

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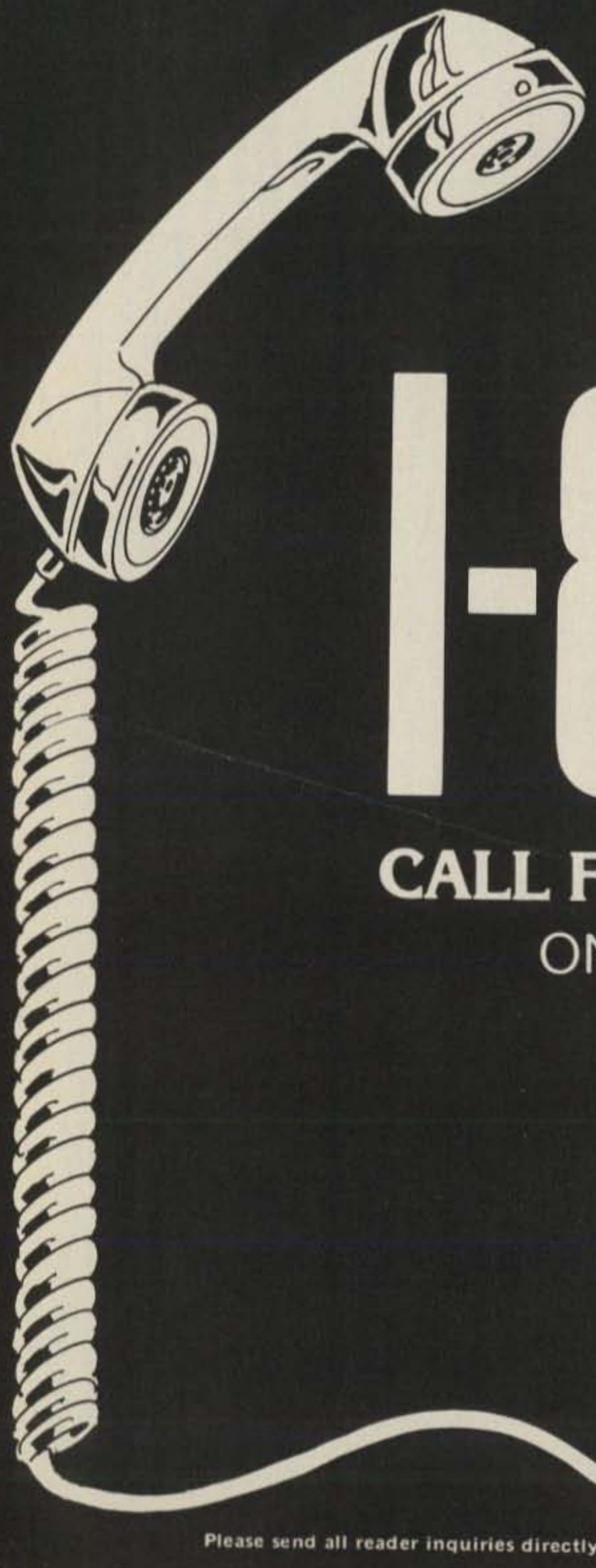

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Here's a construction idea that will give you a usable autopatch rather than an unusable patched auto.

Mobile Autopatch Operation

Safety First!

BY RAYMOND S. ISENSON*, N6UE

Back in the days of wooden ships and iron men when the call, "Man the rigging!," rang out there may have been a mad scramble to obey but one rule. For every body above deck it was, "One hand for the ship; one, for yourself." It made no difference that few of the seamen had any schooling and fewer still could read or write. What each displayed was a full share of common sense. Things have changed considerably since then. Most folks can read and write today. About everybody gets to school. But sometimes one has to wonder about the prevalence of common sense.

For example: Punching up an autopatch call while manuevering a car in city or freeway traffic is at least as foolhardy as furling a sail thirty feet above the main deck. But when some hero is trying to do the former with a Touch Tone™ pad that's mounted on the back of his microphone—look out brother! You've seen it and so have I. The procedure is simple! Delicately balance the microphone in the palm of the left hand, Touch Tone™ pad up. Using the left index finger, close the push-to-talk switch; meanwhile engaging the numbered switches in the desired sequence with the right index finger. Oh yes, hook either the thumb or little finger of the left hand over a spoke or around the rim of the steering wheel to maintain control of the car.—Ho Boy!

No argument about it. The safest way to bring up the patch is to curb the car for the few minutes but, in all honesty, that's often easier said than done. In fact, one's most apt to want the use of the patch in a situation that won't permit curbside operation; like "getting the word" to the XYL during the evening traffic crush on the Freeway or Cross Island Expressway. That being the case the next best thing is to get a patch control that's all ready for simple installation. If not, well, this article describes how one can be home-brewed and, further, it suggests how costs can be held to a minimum even in the absence of that much maligned "junk box."

To achieve the desired end of one hand operation two requirements must be satisfied. First, the switch panel must be rigidly mounted in such a position that it can be readily seen and manipulated without forcing the diversion of the operator's eyes too far from the traffic scene. That means mounting on the steering wheel column or on the dashboard directly in front of the driver's position. Second, the Touch Tone™ control circuit must be such that keying on the tone activates the transmitter. As we'll see, neither requirement is particularly difficult to satisfy.

The circuits shown here were developed initially to be used as a club project. The concept was to design and check out the circuitry and to accomplish bulk procurement of the electronic components and the printed circuit board. Packaging was to be left to the ingenuity of the individual member. Because it could be the most costly single component, the decision was made to place the switch panel in the "optional" category. Commercially available switch panels could be procured or the individual could work up his own. The "project engineer" agreed to come up with a couple of examples of minimum cost switch panels.

The MOSTEK MK5085N/5086N integrated circuit was selected as the tone generator for two—well, actually, three reasons. First, these chips have a unique output signal that is intended for transmitting on keying, simplifying the satisfying of one of the basic requirements. Second, these chips are designed to use the relatively inexpensive, color burst, 3.58 MHz crystal for frequency stability rather than the much costlier 1 MHz crystal. Remember, we did assume that no junk boxes would be available to furnish otherwise expensive components like a 1 MHz crystal. The third reason for selecting the MOSTEK chips had to do with interfacing with the switch panel. This

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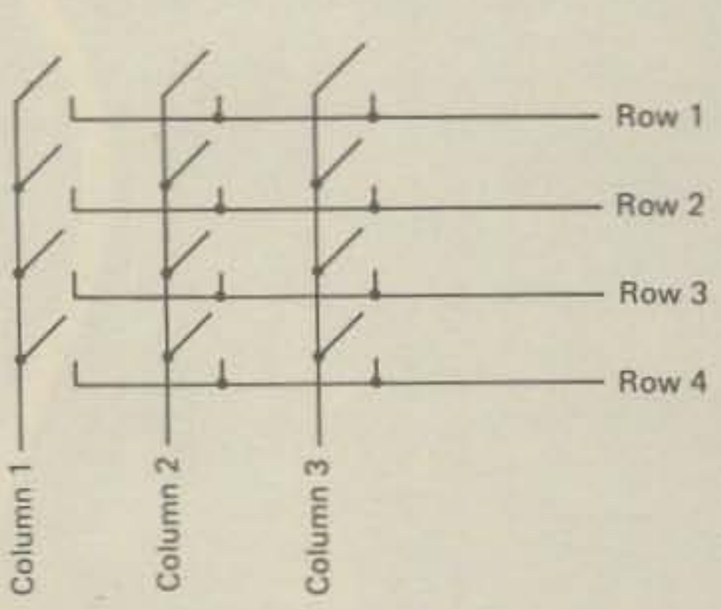


Fig. 1 - Matrixing arrangement of the switches.

Component Check List

- ☐ F1 - 3/8 A slo-blow fuse
- ☐ Y1 - 3.5795 MHz crystal
- ☐ LED - Any available, preferably red for visibility
- ☐ U1 - MK5085N or MK5086N (see text)
- ☐ U2 - LM741 or equivalent
- ☐ CR1 - 1N914
- ☐ ZD1 - 1N758 or other zener diode as available to hold V_{cc} below 10 volts
- ☐ Q1, Q2, Q3 - 2N2222
- ☐ R1 - 180 ohms
- ☐ R2 - 390 to 1 megohms (vary as necessary to limit LED current)
- ☐ R3 - 10 megohms
- ☐ R4 - 10 kilohms
- ☐ R5 - 1k to 3k potentiometer, p.c. board "trim pot"
- ☐ R6 - 47 kilohms (see text)
- ☐ R7 - 10k potentiometer, p.c. board "trim pot"
- ☐ R8 - 68 kilohms (see text)
- ☐ R9 - 1 kilohm
- ☐ R10 - 470 ohms
- ☐ C1 - .01μF; C2 - 10 pF; C3 - .1 μF; C4 - 10 μF

Note: All resistors ¼ watt. "2 of 7" switch panel required for MK5086N IC.

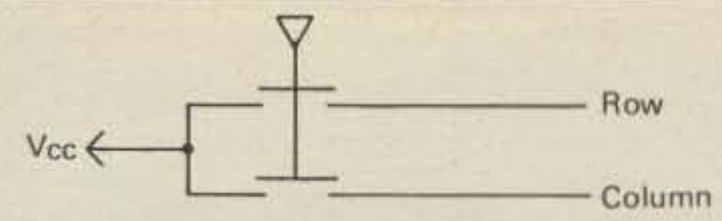
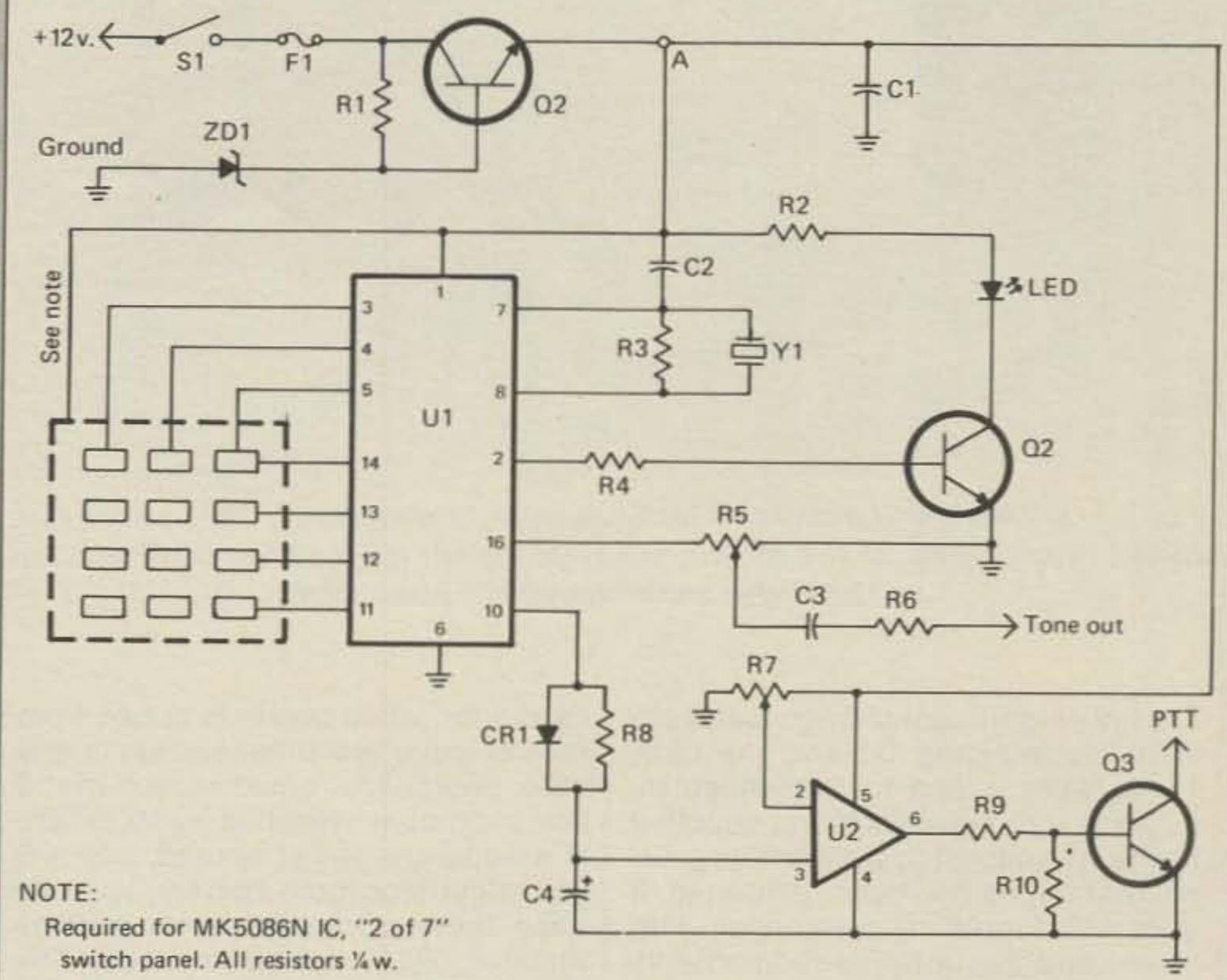


Fig. 2 - Alternative arrangement for the switches.



NOTE:
Required for MK5086N IC, "2 of 7" switch panel. All resistors ¼ w.

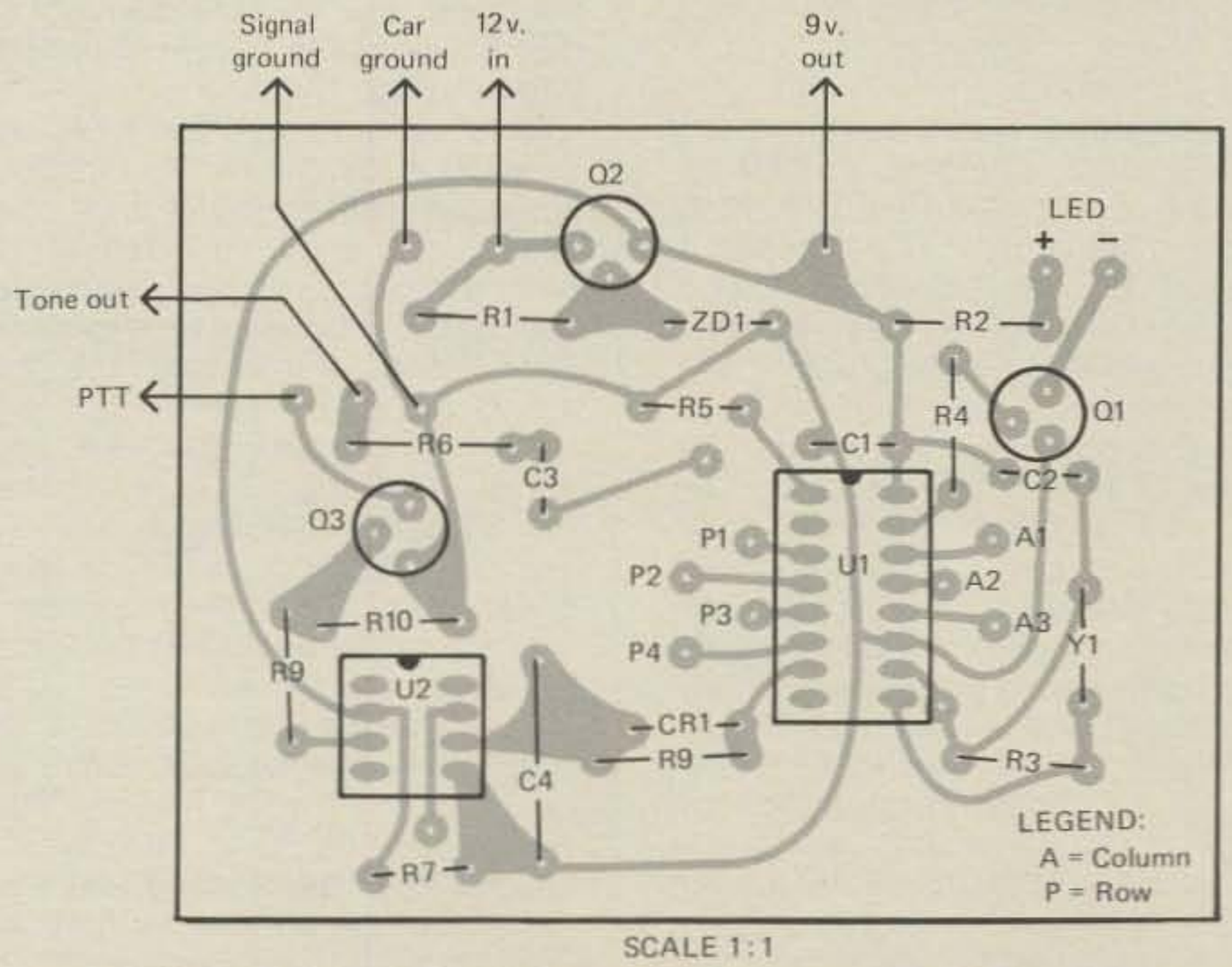
Fig. 3 - The N6UE autopatch schematic.

takes a bit of explaining.

Basically the Touch Tone™ switch panel consists of twelve momentary closure switches arranged into three columns and four rows. The switches can be matrixed such that all switches in each row are connected one to another on one contact and with each other switch in its column with its other contact (fig. 1). Thus when a switch is closed its column is connected to its row. This is called a "calculator type, class A panel," taking its name from the fact that it is commonly used for hand held electronic calculators. The other general class of switch panels consists of twelve single pole single throw switches or double pole signal throw switches so arranged that when a key is depressed a circuit is closed between its column and a positive or negative voltage and between its row and that same voltage. This is shown in fig. 2. Now, and important: The MK5058N is designed to work with the former switching arrangement; the MK5086N, the latter. The chips are otherwise pin compatible. Thus we could select a single circuit board design for all pad builders and allow each individual to order the chip that would match the switch panel of his choice.

There's a fairly significant cost difference between the two chips. In unit or small quantities the MK5085N is slightly over $9.00; the MK5086N, $5.00. Interestingly enough the least expensive, readily available switch panel interfaces with the more expensive chip. "Some days it's tough to make a dime!"

For the most part the circuit is taken directly from application notes for these chips as published by MOSTEK Corp. (1215 W. Crosby Road, Carrollton, Texas. 75006). Our resultant circuit diagram is shown in fig. 3.



SCALE 1:1

Fig. 4 - A full-size printed circuit board mask and the parts placement for the autopatch.

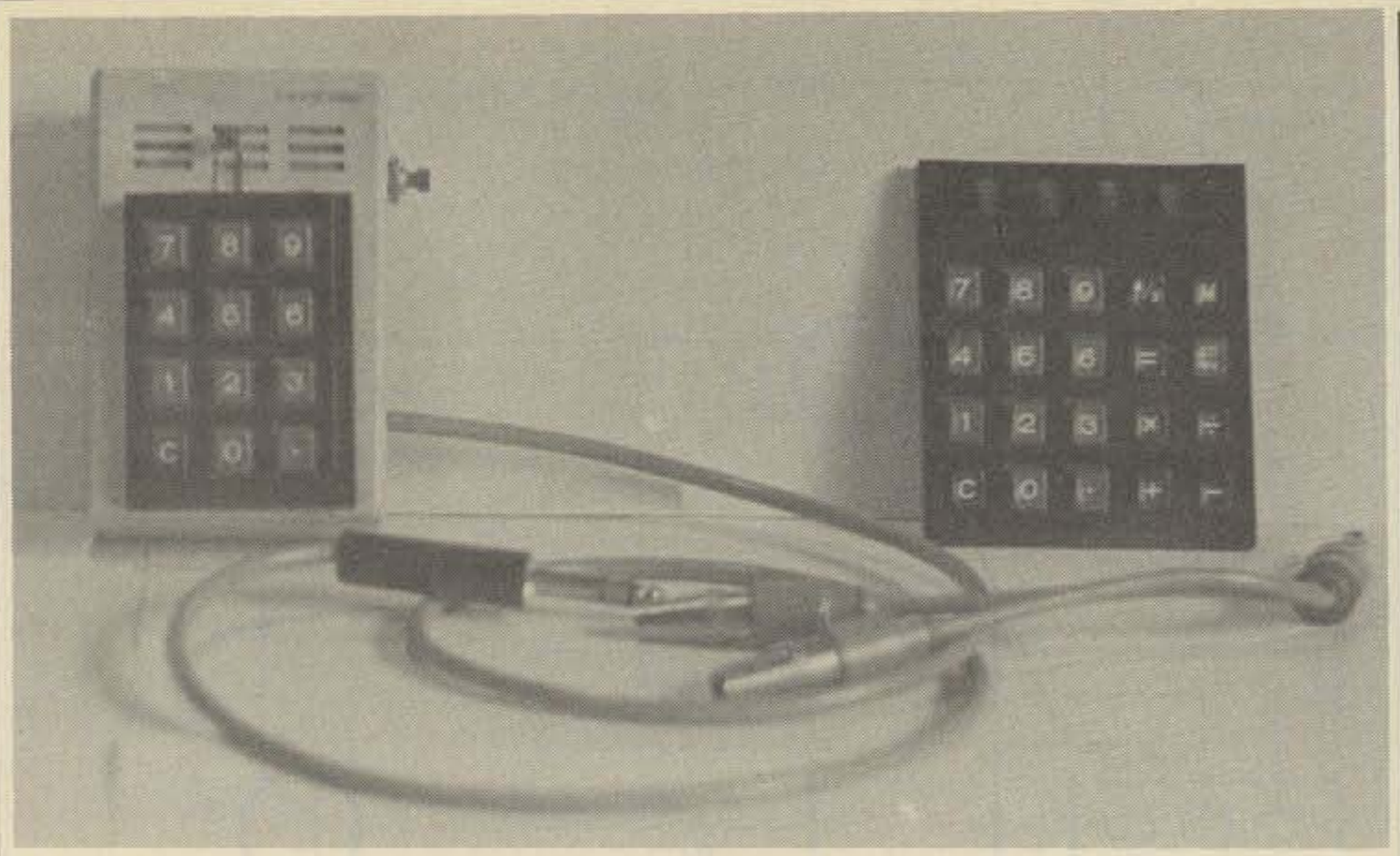


Fig. 5 - On the right is a surplus "calculator-type" switch panel. They can be purchased from Polypak at five for one dollar. On the left is a modified panel trimmed to 12 switches and mounted in a plastic box.

The only significant change is the circuitry surrounding Q1 and the LED. These were added to furnish an indication that power is being supplied to the IC and, when a switch is closed, that a tone has been generated. It does the former by coming on with power and the latter by momentarily extinguishing during switch closure. Q2 and ZD1 are included for voltage regulation when power is drawn from the vehicular electrical system or any other source that could exceed the 10 volt maximum specified by MOSTEK. If a separate power source, say a 9 volt transistor radio battery, is to be used these components as well as resistor, R1, can be omitted. The positive terminal of the battery should be connected through a switch to Point A on the circuit diagram.

The required value for R6 is dependent upon the impedance and gain of the transmitter input stage. Typical values when used to drive microphone inputs are one thousand ohms for carbon type microphones, 50 thousand ohms for the most common, low impedance dynamic microphone and 100 thousand ohms for high impedance dynamic microphones. Obviously these are not critical values. You'll note that we used 47k ohms and I can report that all of the builders reported successful operation.

In order for the telephone company central-office receiver to register the digit properly the tone address signals must be within ±1.5% of the specified value. The MOSTEK chips readily satisfy this requirement. Using .005% (the less expensive) 3.58 MHz color burst crystals we measured output tones as shown in Table I. Relative high tone/low tone signal amplitudes varied less than 10% as measured at the output of the circuit. Where typical preemphasis circuitry is used in your transmitter and the same 75 μs time constant is used for the deemphasis circuit in the repeater's receiver this should be more than adequate for autopatch operation. However if you know that a significant number of the local

How To Make The Printed Circuit Board

The circuit board required for the Touch Tone™ pad that is described in this article is simple enough to qualify it as an excellent project for the homebrewer who has not yet tried his hand at making up his own p.c. board. For that reason a commercially prepared board is not offered. The total list of requirements for preparing the circuit board consists of: a 3″x4″ sheet of copper coated board (single-side preferably), a new etch resist pen, a roll of 1/32″ layout tape (desireable but not essential), a hobby drill - Dremel, Weller, Radio Shack, etc. - with a number 60 drill bit (the hobbyist, bench top drill press is a very adequate substitute), a sharp center punch and a light tack hammer, a glass or pyrex dish about 1″ deep and just large enough to hold the 3″×4″ board, a bottle of etchant, and a sheet of gridded tracing paper (tissue thin graph paper). The latter should have a grid of 10 squares to the inch and be thin enough so that it's possible to read a printed page through it.

The first step is to gather all the items in the above list and the four components for the circuit that conceivably may be sized differently than their counterparts for which the board was designed. These components are the two small potentiometers, the 3.58 MHz crystal, and the 10μF capacitor. The original layout called for 1/8 watt, stand-up type pots. The 10k pot should fit the three holes making up the equilateral triangle in the lower left hand corner of the p.c. layout.

The 1 to 3k pot should fit the triangle that is slightly above the center of the layout. It faces away from the 10k pot. The crystal should fit in the second and third pads from the bottom on the lower right edge of the board layout. The 10μF capacitor, C4, fits along side of R7 and U2. If your components fit, and they probably will, fine. If not, note on the p.c. board layout where the holes should be to fit the components that you have. A considerable amount of space has been left open around these components to give you maximum freedom in repositioning the holes, if necessary. All other components should fit without difficulty.

Place the gridded tracing paper over the printed p.c. board layout and adjust it so that the IC pads line up with and in grid squares. Using a soft pencil or a pen mark the position of each "donut" pad and each of the 24 pads for the two ICs. You should end up with 85 marks on your tracing paper. Now wrap the tracing paper over the 3″×4″ sheet of copper coated board, foil side up. After making sure that the array of 85 spots is reasonably centered on the board, fold the additional paper around to the back of the board and tack it into place with household tape. The tracing paper is your drilling guide.

Using the grid as an alignment

amateurs are experiencing difficulties while working with one or more of your local repeaters, take a look at the article by W3HT in the February 1978 issue of *73*. We talked about providing space on the p.c. board to incorporate a balancing network if one were found to be necessary. This idea was dropped as superfluous when early tests showed tone amplitude balance to be no problem when working through any of the repeaters in our local area that had autopatch capability.

Switch panel control of the transmitter is effected through pin 10 of the MK5085/MK5086. This pin is held at ground level while no key is depressed. Because capacitor C4 is kept discharged through resistor R8, the non-inverting input of the 741 operational amplifier is held at ground level. The inverting input, pin #2, of the op-amp is at a voltage level set by the potentiometer, R7. If the voltage level at pin #3 is less than at pin #2 the op-amp output is low and Q3 is turned off. Pressing a switch on the pad reverses conditions.

Pin 10 of the MK5085/MK5086 goes high and the 1N914 forward biases, charging capacitor C4 to a voltage about one diode drop below the supply voltage. If R7 is set somewhere below its upper limit the non-inverting input will be at a voltage level higher than that at the inverting input and the op-amp output will switch to a value approaching that of the positive power supply. Q3 will turn on effectively grounding the p.t.t. line and enabling the transmitter. When the pad switch is released pin 10 of the tone generator chip again goes low. Capacitor C4 will start to discharge through R8 eventually pulling the voltage at pin #3 of the op-amp below the voltage at pin #2. Pin #6 of the op-amp goes low and Q3 and the transmitter are turned off. The length of time that the transmitter remains on after the switch is released is determined by the time constant of R8/C4 and the setting of R7. Using a 68k ohm resistor for R8 and setting R7 near mid range gives about a ¾ second delay. This allows adequate time to select and press the next button without dropping the repeater and does not look up the transmitter for an inordinate length of time after sending the final digit of the called number.

A 1:1 scale p.c. board etching guide and a parts placement diagram in fig. 4. The circuit could just as easily have been assembled with wire wrap or another conventional technique but we decide to swap our hobby time for money; a simple p.c. board and Molex pins rather than perf board and the more costly wire wrap sockets.

Fig. 5 is a photograph of a surplus calculator switch panel (Polypak, 5 for $1.00) and a picture of an identical panel after trimming it to 12 switches and mounting it on a plastic box. The resulting switch arrangement is that referred to previously as a "calculator

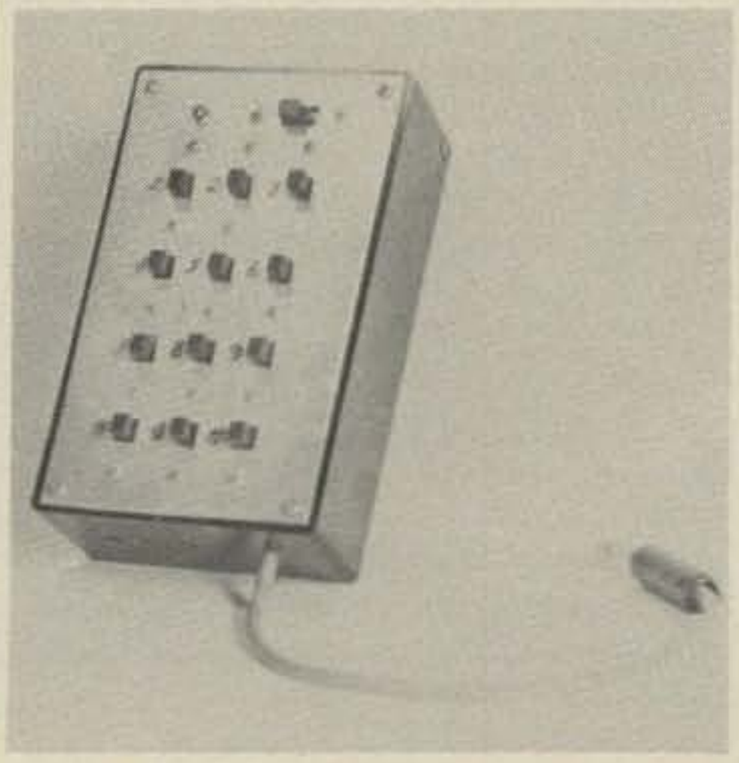


Fig. 6 - A home-brewed switch panel.

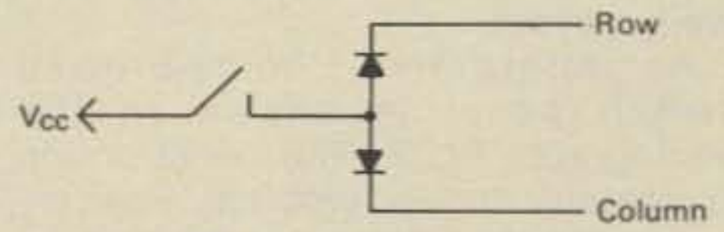


Fig. 7 - A diode circuit which guarantees that two tones are simultaneously generated.

guide, with the center punch and tack hammer make a slight indent into the copper foil at the desired position of each of the 24 pads for the ICs. Carefully drill these holes. Now, working about 1 square inch at a time, mark the remaining hole locations with the center punch and drill the holes. Check to confirm that all 85 holes have been drilled and then remove the tracing paper.

Scrub the copper foil with a good household steel wool scouring pad to remove all grease, fingerprints and other possible contaminents. After cleaning and drying, handle the board by the edges or with a clean cloth. It is important that you avoid touching the copper with your bare hands.

With the etch resist pen draw a small donut around each hole. Allow a few seconds for the ink to dry and apply a second coating. If you are using the 1/32" tape as an etch resist for interhole connections, lay the tape into place at this time.

A sharp pen knife is an ideal tool for laying out the tape. Hold the roll of tape in one hand with an inch or so of the tape unrolled. Position the free end of the tape over one of the previously drawn donuts, pressing it into place with the flat of the knife blade. Slowly play out the tape from the roll and press it into the desired position with the knife. Continue until the entire trace is laid down or you reach a sharp bend. Cut the tape at that point. If the trace is to be continued in another direction, overlap the tape. Do not try to make a butted fit. Repeat this process until all traces are in place.

If you do not use tape, draw in all connecting lines with the resist pen. As with the pads, repeat the inking process until copper cannot be seen through the ink. Two to three coats should be adequate. Now, carefully compare the board with the layout shown in the article. When you're satisfied that the two are electrically identical your board is ready to be etched. Pour the etchant into the glass dish, drop in the board and relax. At room temperature, with fresh etchant the board should be ready in 15 to 30 minutes. Do remove the board from the etchant from time to time to check progress, being cautious to not get the etchant on your hands, clothing, or on any metal surface where it might cause damage.

It isn't likely to be necessary but if it looks as though the etchant is attacking the copper that you don't want removed, rinse the board in cold water, pat it dry with paper toweling and, with your resist pen, replace or reinforce the protective coating. Then continue with the etching process. That's all there is to it.

After etching is completed, rinse the board in cold water and remove the tape and resist ink. The latter comes off most easily with acetone or finger nail polish remover. Polish the board with fine steel wool and begin soldering components into place.

type." One can't guarantee that every package from Polypak will have this exact panel but we found at least two and usually three useable panels in each pack of five.

In the pictured unit the p.c. board and a 9 volt battery were housed inside of the plastic box. The voltage control circuit was eliminated and the battery was connected as described above. The TouchTone™ circuit is coupled to the transmitter through the cable arrangement shown in the photograph. The original design function of the coupling cable was to permit two sets of stereo head phones to be connected to a single receiver. It is available at most radio or electronic parts stores.

Mounting of the box in the vehicle varied between individuals and vehicles. One enterprising type managed to fit the unit into the ash-tray cut-out in the dash panel of his car. It looked elegant but could have forced him to take his eyes too far from the traffic scene. He argued that he worked by feel and not by sight—Well, maybe!

An alternative, home-brewed switch panel is shown in the photograph, fig. 6. The construction is obvious but a problem was encountered that bears touching upon. The inexpensive, 10/$1.00, switches of which this panel was made were momentary contact, double pole single throw. It looked as though they would be ideal for interfacing with the less expensive MK5086N. In practice it was found that the simultaneous closure of both contacts could not be reliably achieved. Some times it would single tone. Autopatch operation was erratic. The problem was eliminated by using only one pole of each switch and a pair of signal diodes - surplus 1N914 types - as shown in fig. 7, for isolation.

Except for the diodes, mounted two to each switch, and the size of the package this unit was essentially the same as that in the previous example. There was the difference, of course, in that it used the less expensive MK5086N. In general it would be OK for use in the cab of a camper or other truck but wouldn't be too easily mounted on the dash board or steering wheel column of a modern, smaller sized car. Coupling to the transceiver is done exactly as in the previous example.

Table I

Tone	Standard (Hz)	Observed* (Hz)	Error (%)
ROW 1	697	699.2	+.316
ROW 2	770	766.2	−.493
ROW 3	852	847.5	−.528
ROW 4	941	948.0	+.744
COL 1	1209	1216	+.579
COL 2	1336	1332	−.299
COL 3	1477	1472	−.338

*Frequency Counter reading rounded to next higher count to assure that actual error is less than figure given.

Fig. 8 - A workable installation in an automobile. See the text for a complete description.

The most elegant approach is shown in the photograph of fig. 8. The switch panel is a Grayhill, "2 of 7." It interfaces with the MK5086N which, along with the other electronics, is in a small box that is hidden under the dashboard and above the transceiver. It uses the vehicular electrical system for power and, thus, requires Q2, ZD1, ad R1 to drop the voltage from about 13.8 volts to the 10 volts or less specified by MOSTEK. The microphone is plugged into the box housing the Touch Tone™ electronics where its output is wired in parallel with that of the tone pad. A single cable, in turn, brings the composite signal to the transceiver and plugs into the latter in the normal microphone jack. The signal LED to indicate circuit status is retained in this configuration. It can be seen mounted directly above the switch panel. The cable connecting the switch panel to the electronics box can be seen coming out of the lower edge of the former. The power switch is mounted on the electronics box. A final comment with regard to this unit that might not, at first, be obvious. Both the switch panel and the electronics box are screw mounted to the metal work on the dash board of the car so the unit is not readily removeable. At the same time the general practice among amateurs is to remove the transceiver from the vehicle when the latter is to be unattended for a while. This being the case it seemed to make sense to minimize the cabling between the two units; electric power is not take from the radio. The total connection between the two is the audio cable.

Note was previously made that this was intended as a club project and is recommended as such to other clubs around the country, particularly where an autopatch capability is just being introduced. It's a practical project for anyone who is interested in a safer autopatch operation and it's simple enough so as to be well within the technical capabilities of the rankest amateur in the club. This doesn't mean that an individual can't or shouldn't take on the building of one. It's an inexpensive project, fun, and could save your life!

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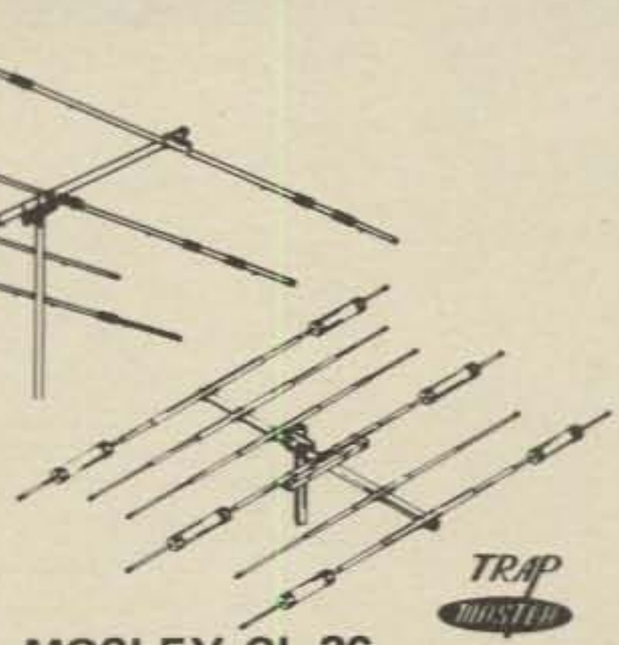

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Take my wife—Belize!

Destination VP1

BY W.R. "DOC" STAPLES*, W4SME/VP1RX

Belize, formerly called British Honduras, is situtated on the east coast of Central America, tucked into Guatamala. Belize was originally the capital of the colony.

Today, the country ships hardwoods (mahogony, rosewood, cedar), is a trade center for chicle, bananas, coconuts, rice sugar and livestock, has a large sawmilling and fishing industry and, of course, hosts DXpeditions.

—K2VG

Three o'clock in the morning is a dark and lonely time for most anyone, unless, of course you happen to be hunting a rare one on the other side of the world. As a general rule though, most of us are collecting zzz's.

However, on October 26th there were two guys up and about trying to rub the sleep out and get themselves underway for the upcoming CQWW weekend.

Atlantic Beach, Florida is a stretch of inhabited sand dunes about 15 miles east of Jacksonville and about 7 hours by car from Miami International Airport.

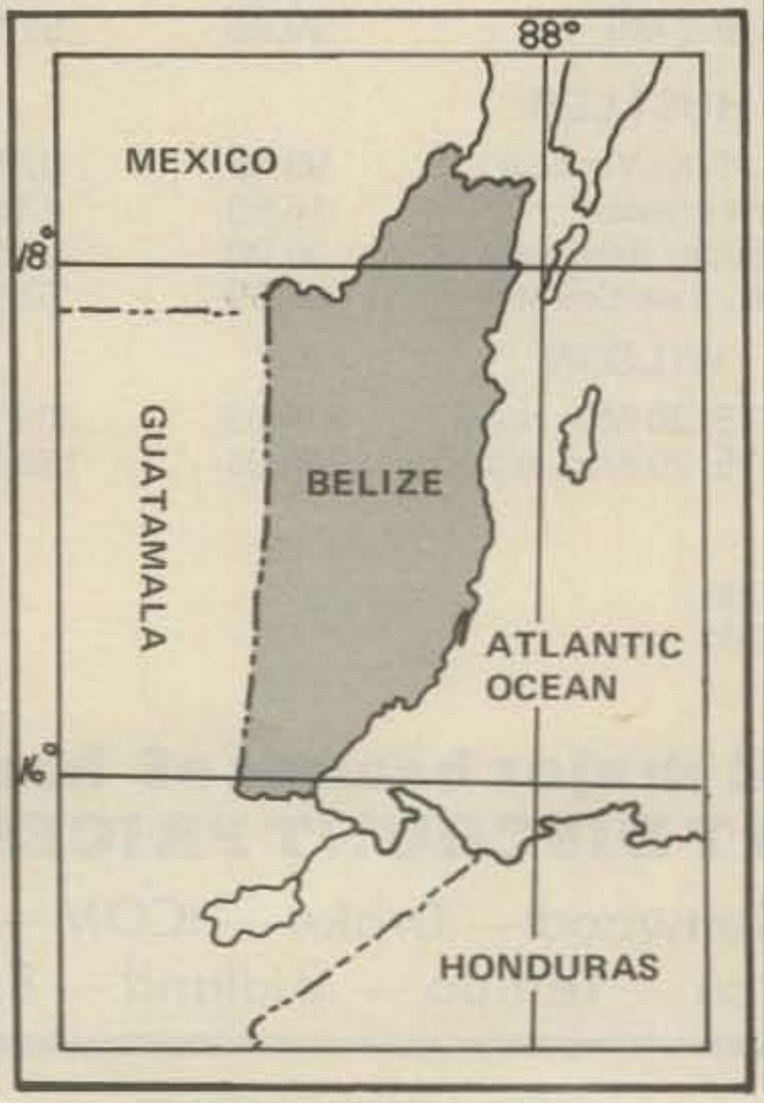
The shadows of the two moving around in the lighted garage attending to the demands of the last minute packing were confirmed, as the garage door opened, as belonging to Doc, W4SME and Joe, W4BSO who were setting out on the first leg of their trip to Belize, Central America. Departure from Atlantic Beach was imminent and stashed away in the back of a pick-up, backing out of the garage, were the carefully assembled elements that would provide an opportunity for VP1 to be heard in CQWW.

Thanks to Doc's XYL, Betsy, a portable snack bar to ward off starvation had been prepared for the trip. Those goodies, plus Joe's donut supply got us started down old super slab I-95.

Seven hours and forty minutes later, we had a steady bearing on Miami International Airport and were ready to unload the truck and made the deadline for checkin at the ticket counter. The baggage hassle over, and the truck in it's parking place, we queued up in line. From the glances of the others in line, who were also checking in, they made us feel as though we were already suspect! It never occurred to us that a couple of TS-520's could evoke so much interest!

Finally aboard, and with our seat belts in place and the runway racing away beneath us, we were soon to be smoothly leveled out at flight level 390. Our Captain informed us that Key West would be visible to our left and that we would skirt the western tip of Cuba. Almost immediately, four very attractive Belizean stewardesses commanded the aisle and began to make sure that Joe and I would enjoy the trip. The menu was superb and the first sight of the Great Barrier Reef was the signal to clear away the trays and crane our necks to spot the coastline of what was known as British Honduras, now Belize. Our descent was terminated with a 'grease job' on the end of the runway and the 720 moved smoothly up to the terminal building of the International Airport at Belize City.

The usual immigration and health checks completed, Joe and I waited for our gear to appear on the Customs inspection stand. Here we experienced our first anxious moments as our carefully prepared inventories were scrutinized. . .and then



*P.O. Box 762, Atlantic Beach FL 32233

the words, "Open them all up and unpack them"....Oh Wow!! After some friendly discussion with the Customs inspector and much verbal assurance that we were there on a radio expedition and not on a full blown invasion, it finally seemed that we had convinced him that we were legit. However, not before we had nearly unpacked every piece of gear including the antenna wire! Later we would learn that if we had arrived carrying scuba tanks, flippers and whatever, the process would have been perfunctory.

Like an angel out of the blue our contact in Belize appeared. Rupert Taylor, VP1RT, otherwise known as Mr. 'FCC' Belize, conferred with customs and after some agreeable nods in both directions, we repacked our gear, loaded it into the back of Rupert's pick-up and departed the airport for our trip to the city.

Hospitality is Rupert's first, middle and last name as he proceeded to give us a travelogue tour en route. Attention to the damage caused by the recent hurricane indicated that Belizeans had indeed been fortunate as most of the damage was from flooding and mud. As we entered the outskirts of the city, Rupert stopped and gave us a guided tour through the Belize Telecommunications Authority where he is charged with the responsibility of the operation and maintenance of the maze of u.h.f. and microwave equipment. Moving into Belize City, we arrived at Rupert's office were we were presented with our official Belizean amateur radio operators licenses. Everywhere we stopped we were welcomed and treated with great cordiality and neither Joe nor I can say enough about the genuine warmth of the people of Belize.

Upon arrival at our destination, the Fort George Hotel, we were welcomed by the staff and management. Our hosts were, Paul Hunt and Steve Maestre, VP1SM. They had already made certain that we would have the most ideal location.....high up on the third floor, facing the beautiful and tranquil Carribean...and most important, close to the access ladder to the roof.

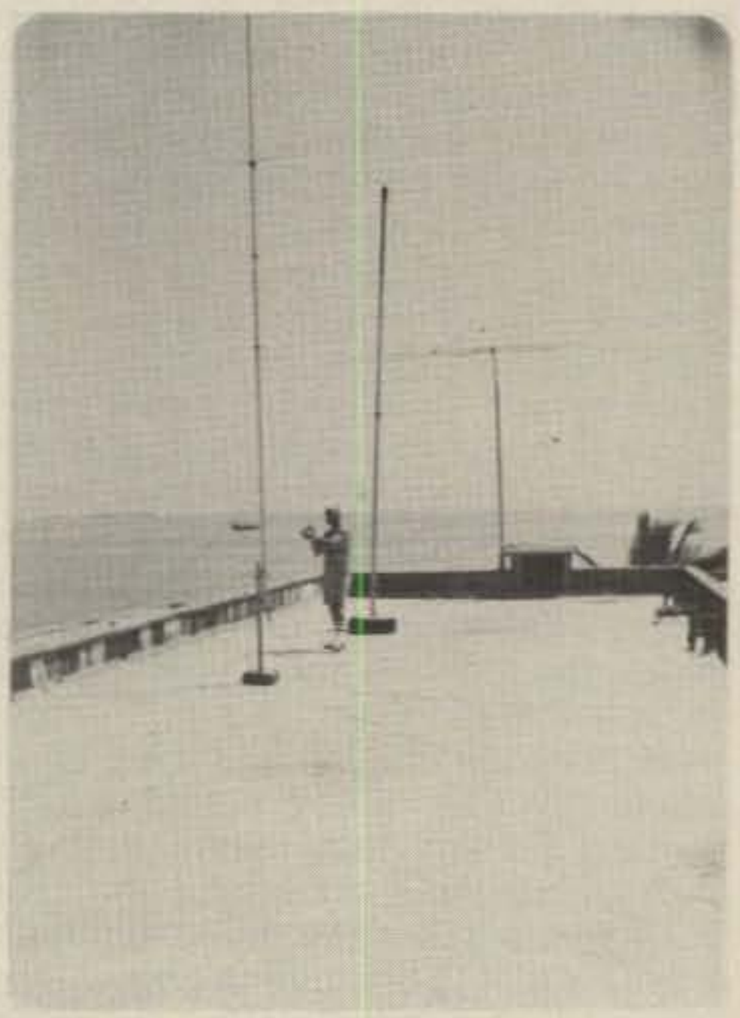
Running totally on pent up adrenalin after more than 15 hours without any shut-eye, Joe and I hurriedly unpacked the gear. Both beds, the floor, a dresser and two chairs were strewn with the contents of our cartons and bags. Fortunately, after our arrival, we met one of the hotel staff whose name was Eddie. Had it not been for Eddie and his rare and unique ability to make certain things seemingly appear from nowhere, we would never have been able to make our projected Thursday night deadline. After several portions of a local brew called Charger, and a ration of Un-cola for Joe, we were off and running. First priority...get up an antenna. During the many hours of preparatory discussions long before we ever departed Atlantic Beach, we had reached a decision in this regard...in fact we had even timed ourselves on a dry run. Up the ladder to the roof and we located the mast...rigged the premade harness... strung up the center connectors...threaded on the coax and up went the 40 and 15 meter inverted 'V"s. With Joe in the room below and me on the roof with our little Ch-14 transceivers, we completed the pruning and now we were ready for our first VP1 contact Thursday night.

At this point however, hunger pains began to tell us that with the time change and after the number of hours since our last repast we had better take advantage of our American Plan and head for the dining room. Following a quick shower and a splash of frou-frou juice, we presented ourselves to the Maitre d' and sat down to a truly sumptous meal; beautifully prepared and served by a staff that we were soon to learn had a fantastic curiosity about everything that happened to us during the next five days.

Back in the room after dinner, Joe slid into the operating position and dropped a CQ from VP1JEC on 15. Before Joe could unbend his tired fingers from the dial, he was confronted with the first of many pile-ups. Hooray...Murphy had been defeated..everything worked and into the wee hours Joe and I gave out VP1. By mutual agreement, Joe and I decided that we still had a pile of work to get done Friday morning. It would only be about three hours before the sun would come streaming through the louvres, so, without hesitation, we immediately took advantage of checking our eyelids for light leaks.

Our work was cut out for us Friday morning. First, the three element Wilson 10 meter yagi. Having also made a prior assembly run with it, and having all the elements as well as

The author in the process of making many DXers very happy.



The antenna farm. "Doc" is shown working of the 75 meter inverted vee.

Left to right: Steve, VP1SM; Rupert, VP1RT; John, VP1JM; Joe, VP1JEC.

the gamma, premarked, thirty minutes saw our array shinning brightly atop the mast some 50 feet above the Carribean. Now the 4BTV...luck was with us..we found a pipe extension that made a perfect mounting and allowed our thirty radials to spread out all over the roof. The twenty meter inverted 'V' went up just where we wanted it and now last but not least was the 75 meter inverted 'V'. This would take some imagination and doing. Among the goodies that we had brought with us was a reel of 00 Nylon fishing line. This looked like the time to press it into service. The 75 was run up the pole but we would experience a problem with physical separation of the center connectors..down it came and another harness was fashioned..up again and we were in the clear and it looked good. Except where would we anchor the ends? Skyhooks we didn't have. The tallest palm trees were below the roof line and it seemed that in any direction we were in trouble. The decision beforehand had been made to give the greatest punch toward EU and that meant that we had to have the ends over the roof edges into the palm trees but still clearing the overhang. No way..What then? Finally we struck on the solution. Nobody ever told the antenna it wouldn't radiate if it was bent a little. You guessed it. More Nylon line and one end over the roof and secured. Now the other end over the roof and headed across the street, bent and stretched like a violin string through the top of a palm tree with the nylon under maximum tension holding it securely to a power pole down the street.

After about three hours on the roof, Joe and I went down to the room to run s.w.r. checks and finish the operating position setup. All of a sudden I looked at Joe and he at me and we had to agree that a boiled Maine lobster couldn't be any redder. Neither of us had stopped to consider the latitude of Belize, nor did we even think about the intensity of Old Sol. You might say at this time, "we were hot"—red hot!

It wasn't long before 0000Z arrived. Now was the time to get with the program. It's germaine at this point to mention that in retrospect we certainly want to compliment the majority of the contest operators. However, as is generally the case there are always a few that make it unpleasant for everybody. It was great to hear the hammer come down hard on these guys by their own peers. We think that some of the comments deserved Oscars.

Friday night rolled on and the log sheets piled up. First, Joe took a run at the pile-up and then as intensity increased we began to shift off and split the load. Alternating at about three hour intervals we soon saw the first glimpse of the sun on the horizon through the louvres in front of us. Now the JA's were on a pipeline and Joe took off for breakfast. By noon Saturday we were holding our own as the three high bands were wide open and conditions remained outstanding. Neither of us really remember what happened to the rest of the daylight Saturday, except for a continuous 10 hour pile-up when we never touched the dial of the 520. With night coming on we hoped for the big push on 40 and 75 when we could pile up the multipliers. Forty proved to be super, but it didn't take long to run out of 4 per minute and the dupes began. Down to 75—what a mess..so much so that due to the lack of any cooperation Joe was helpless to overcome the chaos and time was just being thrown away in trying to get a single exchange. This was the only time in the whole contest that frustration set in. Even though several stateside stations tried in vain to help us, Joe finally had to give it up as a bad deal and find another band. What amazed us most was the number of U.S. stations operating outside the band using our transmitting frequency to carry on unnecessary and stupid conversations. Unbelievable...Absolutely unreal. Black night was again replaced by a new dawn and Sunday morning was upon us. Back from breakfast, Doc relieved Joe and proceeded to keep the crank turning until he finally began to lose his voice. Joe meanwhile had been zapping a few zzz's but soon found himself back stage-center with the pile-up still growing. Doc meanwhile gurgling and gargling ice water to put out the fire tried the cold shower routine to stay awake. Joe charged into the afternoon melee while Doc charged his battery. Long about 10 pages later, Doc looked up from the pillow to see what was causing the deathly silence; only to find Joe with his forehead balanced precariously on top of the mike..places were changed again. Joe went for the cold shower routine and respite, he thought, until Doc indicated that we had run out of log sheets. While Joe was ruling off paper, Doc kept the foot pedal jumping. Operators changed again and Joe took over the late afternoon run. The clock began to tell the story and with just an hour left Doc chased the hands of the clock around to 2359Z and then it was all over.

In spite of being almost totally exhausted, but with the adrenalin still

flowing, we both kept the routine going for another four hours. And then..you guessed it...we both crashed.

Somehow or another, sleep isn't really important when there are a lot of guys out there still hoping for a VP1 contact. After a few zzz's, Monday arrived and we piled up another 8 hours of exchanges. Realizing that we had to start dismantling the station, Joe and I took to the roof after dinner Monday night and working in nothing but brilliant starlight we took down the yagi and the 4BTV. The dipoles stayed.

Down from the roof, we deployed to the Hotel lounge where we met with Steve, Rupert and John. The round-table eyeball QSO lasted for a couple of very enjoyable hours. Tuesday morning wasn't far off, and there were chores that wouldn't wait. Back to the room and everything got packed except for the rigs. For the remainder of the night Joe worked s.s.b. and I ran a string on c.w. Finally we both fell into our beds and slept until the 0630 call. Down came the dipoles and signs of furious packing was everywhere.

Breakfast and check out and we were ready to leave...not really...only because we had to. Again Rupert was on tap to chauffeur us back to the airport. The final moments were spent clearing Customs and saying goodbyes to more Belizean hams who came by to see us off.

Words can never express our feeling about the people that we met during our DXpedition in Belize. We have already mentioned some of the people with whom we had greatest contact during our stay, but it is just as important that we thank all the other members of the Belize Amateur Radio Club who also contributed moral support to our venture and who welcomed us as new members of BARC.

We became so convinced that these fast friendships are so very important to a DXpedition, that we left Belize having already confirmed our reservations for 1979.

Look for us next October.

No-77-78

This month by
JERRY HAGEN, N6AV/WA6GLD

DX

News of communications around the world

The DX Department is delighted to welcome back as guest columnist this month an old friend and former **CQ** *DX Editor, Jerry Hagen, N6AV/WA6GLD. In a recent QSO Jerry expressed interest in exercising his talents at the DX reporting game again after a long period of inactivity. We are happy to provide the opportunity. Take it away, Jerry!!*

After being inconspicuous for several years, your guest columnist was delighted to accept K4IIF's invitation to prepare the DX Column for this issue of *CQ*. As a reader, it has been nice to see *CQ* grow and add outstanding columns such as Bill Orr's Antennas and to read outstanding DXpedition articles such as the spectacular account of the Clipperton Island Operation.

At the same time, DXing in California is healthy, despite poorer conditions during the past sunspot low and other problems such as QRM, etc. The Northern and Southern California DX clubs have high membership and the San Diego DX club has become extremely active. As the sunspot cycle should peak this year, DXers should enjoy many rare and interesting DX contacts.

P.O. Box 1271, Covina, CA 91723

The ladder supported antenna of JH8DEH. Akira works all bands with 20 watts input.

DXtra

Our DXtra this month concerns the assignment of amateur callsigns by the FCC. In 1976, most DXers were delighted as the assignment of additional "1 X 2" calls were authorized by using the "N" series prefix and the "X" suffix.

Changes in military calls were also announced which made several series of calls available for amateur use. At the same time, several operating rule changes were announced, including the elimination of the requirement that amateurs sign portable when operating away from their primary station location. In early 1978, the block system of assigning calls was initiated and calls assumed a new pattern within the U.S. and possessions.

As a result of the multitude of changes, it appears that the FCC has eliminated the use of call areas (Ø thru 9) which have been used since the inception of formalized amateur activity in the United States. Perhaps this is not the case, but I was told by one DXer, that his W6 two letter call was transferred to his new QTH in another call area and that he does not sign portable.

The changes along with new calls have certainly caused some confusion on the bands and other facets of Amateur Radio. For instance, Charlie, W6IR said that his system for dispersing his portion of the SIXLAND QSL Bureau has been disrupted by the new FCC assignments. I decided not to ask him for the details as I'm not sure his answer would be understood. Of course, the new system is supposed to provide more utilization of ITU assignments and provides economy in the issuance of calls. It may work, but it seems more complex than income tax!

As noted in the December 1978 *CQ* DX Column, problems with the overlap of calls from stateside to U.S.

One of the top contest clubs of the world is DLØWU of Wuppertal. Members shown are l. to r. - George,-DK5EZ, Bernd-DK4EM, Klaus-DJ4AX, Werner-DJ8SW, Uli-DK8EQ and Bert-DK4TP.

possessions also exists. KA stations are still active from U.S. personnel in Japan and KA calls are also being issued in stateside areas. Likewise, a KG4 call was recently assigned for a Virginia amateur who was promptly deluged by a pile up of stations looking for a Guantanamo contact. Sooner or later calls for all the former possession areas will probably be issued. When they get to KP6's, the recipients will get lots of calls from excited JA's and Europeans! In case you are hopelessly lost, the West Coast DX Bulletin had the following recap of possession's assignments:

Alaska - AL7, KL7, NL7, WL7
Baker, Canton etc. - AH1, KH1, NH1, WH1
Guam - AH2, KH2, NH2, WH2
Johnston Island - AH3, KH3, NH3, WH3
Midway Island - AH4, KH4, NH4, WH4
Kingman Reef - AH5K, KH5K, NH5K, WH5K
Palmyra Island - AH5, KH5, NH5, WH5
Hawaii - AH6, KH6, NH6, WH6
Kure Island - AH7, KH7, NH7, WH7
American Samoa - AH8, KH8, NH8, WH8
Wake Island - AH9, KH9, NH9, WH9
Mariannas - AH0, KH0, NH0, WH0
Navassa Island - KP1, NP1, WP1
Virgin Islands - KP2, NP2, WP2
Serrana Bank - KP3, NP3, WP3
Puerto Rico - KP4, NP4, WP4
Antartica - Not specified!

The WCXB does not note whether a portable station such as N6AA operating in Hawaii has the option of signing /KH6, or AH6, NH6 or WH6.

On the other hand, the new system does have DX benefits — N6ZZ said that he was visiting a W4 amateur and worked YI1BGD in Iraq on 10 Meters. On the West Coast, this would have been an extremely rare QSO, but N6ZZ may now add YI to his DXCC total. I guess that N6AV should fly to Maine for the next Mt. Athos DX-pedition! An N6 in Maine, why not?

In summary, this columnist wonders if the new system is really easier to administrate and why the assignment of calls could not have been continued with call areas, thus avoiding the measure of confusion that has been created.

10 Meter Band Openings

As the current sunspot cycle has already provided outstanding 10 meter openings, several SCDXC members began looking for some of the Asian and Indian Ocean areas, which are difficult to QSO even on 20 meters. After some thought, I decided to research logs for QSO's in selected zones which were fairly difficult from W6 which would be zones 17,22, and 39. It was noted that even in low sunspot activity years that fairly regular openings to zone 17 occured in the spring and fall about 0300Z. Experience during the past sunspot cycle had indicated that openings to UI8 and UL7 had occured in the spring of 1969. Thus a close watch was kept on 28 MHz. during October of 1978 and good activity from UM8, UL7, UA9, and even JT1 and AP2 was heard, In a similar fashion, ZS and 3B8 areas have been heard in summer months about 0600Z on 20 meters with the beam on LP to the West. Some of the old timers claimed that the same path existed on 28 MHz. which seemed hard to believe. Well, WA6EPQ (now N6AR) took the advice seriously and ended up working several VQ8 DXpeditions in 1967/68 via LP on 28 MHz. at the same time. And in the 1969/70 summer period ZS5JW provided almost a daily beacon on 28 MHz. at 0530Z in Southern California with the beam west over VK6 land. After reviewing this data, I tried to envision other 28 MHz. band openings that are similar to known 14 Mhz. openings. Of course, the normal West Coast short path opening to Europe at 1500 - 1800 GMT occurs on 28 MHz. when the sunspot activity warrants. The West Coast long path opening to the Mid-East and Southern Europe occurs with best signals in December and January about 1500 GMT on both 7 and 14 MHz. Upon inquiring, several SCDX club members reported infrequent 21 MHz. LP openings at this time, but no 28 MHz. openings. Our conclusion was that the MUF would have to be unusually high to cause this condition.

After all the discussion, I'm not sure that any scientific conclusion can be derived, however, those interested in 5BWAZ or 28 MHz. WAZ will certainly think of some system to spot activity from the rare zones. A

Tom, VP2VER takes a break during the 78 CQ WW Phone Test. Back home Tom signs N6RA, and he was assisted by N6CW and N6ZZ for a total of 9,000 QSO's from the British Virgin Islands.

Luis, HI8LC, has confirmed the Dominican Republic for many DXers around the world. He is active in the CQ DX Award programs. (Photo via Bob, K6XP)

The WAZ Program
Single Band WAZ

10 Meter Phone

2...JR1IJV
3...AA6AA

15 Meter Phone

11...AA6AA
12...JF1SEK

20 Meter Phone

178...AL7D
179...KA6RI
180...KA6YL
181...VK3AH
182...K6ASI
183...I8KNT
184...W7RQ
185...PA0KB
186...WB7BBO
187...K4UTE
188...SM5AQD
189...K9ARZ
190...AA6AA
191...N6SV
192...W2BAI
193...W3CDG
194...W7FP

20 Meter C.W.

60...JH1QJC
61...JR1URH
62...K0KES

All Band

1539...WA5YMW
1540...WA2SNI
1541...WA4JTI
1542...W7BG
1543...PA9WRR
1544...K7SFN
1545...W1ESN
1546...K3MWV
1547...VE5PB
1548...I1TBA
1549...WBRLK/VE1
1550...W4WW
1551...XE1YO
1552...CT1SH
1553...K4BYN
1554...W9BEK
1555...I3RAF
1556...I0IUC
1557...W0UYL
1558...SM5BZH
1559...W7ZR
1560...K9ARZ
1561...DK9FX
1562...DK9KX
1563...JY9GR
1564...W7UZ
1565...K6SME
1566...PA0TV
1567...HI8LC
1568...K9BWQ

C.W. and Phone Mixed

4388...W0IYR
4389...KL7CYL
4390...W4KMS
4391...DL8KS
4392...WA1TPR
4393...WA8KME
4394...PA9WRR
4395...K4JYS
4396...WA9USE
4397...YU2CDL
4398...K5PP
4399...KP4CLD
4400...K5BLV
4401...WA2GLU
4402...YU2TO
4403...JA9FOR
4404...CT4BD
4405...SM6BZE
4406...W6CRE
4407...K7ZR
4408...SM4BZH
4409...DL7KL
4410...DF9EU
4411...DJ6HB
4412...W6CLM
4413...W5VSZ
4414...K3KA
4415...W7KVV
4416...N8DE
4417...WA3EPT
4418...AA6AA
4419...DL1YK
4420...DK1OU
4421...N9KV
4422...K4JD
4423...W6IR
4424...SM6CST
4425...K5EVK
4426...JR1IJV
4427...WA1EOT
4428...JA7WMD/JA1

All Phone

547...PA9WRR

The complete rules for WAZ 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 W A Z manager, Leo Haijsman, 1044 S.E. 43rd Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards direct to the W A Z manager should include sufficient postage for the safe return of the QSL cards.

valuable aid will be Ted Cohen's short term propagation predictions, but on-band experience will play a large part in this most difficult DX challenge.

DX 10 Years Ago

In cleaning up the Ham shack, the following recap of 1969 DX activity was found in the Southern California DX Club bulletin. I couldn't help but recall the excitement involved in following a long term DXpedition such as Gus or Don Miller. All it took was a week out of town on business or social plans by the XYL and a new country could be missed, maybe not to be activated for 10 or 15 years. Enough reminiscing, the activity from the past follows:

It's hard to label 1969 with any DX title other than "Fabulous." For DXCC enthusiasts, Heard Island, Malpelo Island and Navassa Island were inhabited by major DXpeditions while contesters enjoyed "best ever" conditions for the ARRL and *CQ* Phone Contests. The new challenge for ambitious DXers was provided by the 5 Band DXCC Award which put great emphasis on 3.5 MC and expedient QSLing. January started off with a bang as ZL1DS and ZL2AFZ scored the first 5 band DXpedition of the year at Chatham Island and were soon followed by ZL1TU and ZL1IL. Not far behind were Don (VE6MY) and George who opened from VR5AE. Bill, W7PHO took a siesta in the Carribbean when not signing 9Y4PHO or VP2DAR. February saw VE6MY and KH6GLU inhabiting Wallis Island as FW8DY while Gus headed for Africa and warmed up by signing 6W/W4BPD. The first DX spectacular of 1969 took place on Malpelo Island by the RCA assisted by W4VPD and W4DQS. The RCA President and HK0TU QSL Manager, HK3RQ were seriously injured in the landing but recovered by making out thousands of QSL's. In S.W. Africa, ZS3AW put on quite a 5 band show while out on Norfold Island W4WS did the same as VK2BRJ/9. Mac, KV4AM began a Caribbean sojourn which took his 5 band activity to VP2DAP, PJ6AA and VP2MQ. March saw Gus moving over to ZD3A while KW6EJ closed out his last month on Wake with 5 band operation. Legal types cleared the airwaves for YB0AAB and WA4PUC/HS. The winter weather got to W1BIH and W2BKK who escaped by signing

The shack of JA1AJA near Tokyo. Masao says the crowded city limits antenna size in Japan. He is a High School Chemistry teacher.

The WPX Program
Mixed

697...WA4QMQ
698...WB3CQN
699...TF3JB
700...N4SX
701...DL9GH
702...N8II
703...DF6QG

S.S.B.

1107...DK6WA
1108...JR1VMX
1109...SM6CST
1110...K7RS
1111...WB7BFK
1112...W8CNL
1113...K4PI
1114...KL7JFJ
1115...N8II

C.W.

1748...K1BU
1749...WA4QMQ
1750...SM6CST
1751...DL9UX
1752...W8CNL
1753...K4PI
1754...N8II

WPNX

131...KA5ACC
132...WB3HVS
133...KA4AUR
134...WB3HFQ
135...WB3JRU

VPX

149...HE9HIJ

Endorsements

Mixed:....400 WA4QMQ, N4SX, DL9GH, DF6QG. 450 WB3CQN. 500 JR1TNE. 550 N5FG, N8II. 650 DJ8WD. 700 YU1NFR, K9UQN, 750 YU1NGO. 1100 N4NO. 1450 W4BQY.
SSB....300 K7RS, WB7BFK, W8CNL, K4PI, KL7JFJ, N8II, DK6WA, JR1VMX. 400 I8KUT, SM6CST. 500 I1RYS, VE1RY. 550 K1KNQ. 650 ZP5RS. 700 N4NO. 750 W4BQY. 1100 VE7WJ.
CW....300 K1BU, WA4QMQ, DL9UX, W8CNL, K4PI. 400 SM6CST, SM6AYM. 450 N8II. 550 K5YK. 600 JH1VRQ. 1000 N4NO.

10 Meters....W8CNL
15 Meters....W8CNL
20 Meters....W8CNL
40 Meters....W8CNL
80 Meters....W8CNL
160 Meters....W8CNL

Asia: I1RYS, N5FG, YU1NGO
Europe: DL9UX
No. America N4WX, KL7AF, N8II
Oceania: WA2AUB

Complete rules and application forms may be obtained by sending a business-size, self addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to "CQ WPX Awards", 5014 Mindora Dr., Torrance, Calif. 90505. U.S.A..

PJ2CC and PJ8AA while VQ8CC tried propagation from Rodirques as VQ8CCR. Herb, KV4FZ established 5 band popularity by one day stops at FG7TI/FS7 and VP2KK. Meanwhile, Bill, (W7ZFY) prepared for 1969's second DX spectacular from Heard Island using the call VK0WR which put this island *off* the most wanted list. In April, Gus teamed with Steve, VQ8CC for a VQ8CPR/VQ8CCR Rodriques operation while the SV0 boys did a bit of DXing from Rhodes as SV0WN. Rumors of Timor DXpeditions prevailed but resident CR8AI eliminated the pressure while TA2E became a fixture 27 Kc above the c.w. band edges. May brought European activity by WA6QGW and WA6PMR who signed from WA6QGW/PX, DL4QQ/PX, 4U1ITU and HV3SJ. Oscar, HB9AFM, assisted by HB9GJ, and HB0AFM and HB0GJ on several bands. Gus obtained another of his

"confusion" calls and signed VQ9/A/D from Desroches Island. June prompted the third DX spectacular of the year as the Florida DX Club invaded Navassa with a 4 transmitter setup signing K4IA/KC4. Gus stirred up the Indian Ocean by signing VQ9/A/BR, VQ9/A/EC and VQ9/A/BC while KX6FN/KC6 became active from the E. Carolines. K5AAD provided July's five band activity by signing FM7WD, VP2GTL and VP2LD. The Nevada DX Club members put Andorra's new prefix on the air as C31CL and C31CK and then radiated from HB0XUV. Not to be out-done, G3KDB and G3LNS made the trip to Isle of Man and signed as GD3KDB and GD3LNS while EA9ER opened up from Spanish Sahara. August started off the fall season with some good 5 band activity as DJ5JK/CT3 made it thru to California on 3.5 MC while K6JGS/HK0 on San Andres spent some time on 7 MC. The JARL displayed its new prefix for the Bonnins signing JD1YAB on all bands during the Asian Contest. DXpedition activity was made by PJ0DX, HB0NL, VK2BKM/LH and VP2VP while PZ1BX and FG7TI/FS7 showed up on 7 and 3.8 MC. November's lone DXpedition to Kure Island signing KH6NR/KH6 resulted in huge but nicely handled pileups. In December we look for Cocos Island by TI8PE/TI9 and XE1PJL/XF4's trip to Revilla Gigedo Islands. Well, 1969 was truly a year of great DXing and now on to a new decade of DXing.

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. Honor Roll must be up-dated annually by addition to, or to confirm present total. If no up-date file will be placed in "inactive" until next update.

Mixed

1745	W4WV	1400	W4BQY	1123	I2PHN	1000	SM6DHU	811	W9WHM
1683	K6JG	1368	W8LY	1120	YU2OB	949	WA6TAX	811	YU3EY
1651	F9RM	1350	DJ7CX	1120	N4NO	938	W0SD	803	N6JM
1606	YU2DX	1350	K2VV	1107	W0AUB	925	I3ANE	782	K8LJG
1512	VE3GCO	1302	PA0SNG	1100	YU1AG	923	K5DB	782	YU4EBL
1477	YU1BCD	1288	K5UR	1095	K6ZDL	918	YU1ODS	755	YU2CBK
1476	ON4QX	1254	W9FD	1094	WA0KDI	902	K7NHG	749	WA5LOB
1475	W2NUT	1250	WB4KZG	1063	W8CNL	902	K6DT	749	CT1LN
1466	W3PVZ	1229	AA4A	1062	DL1MD	900	JH1VRQ	705	UA3FT
1445	W2NC	1225	N6AV	1055	I6SF	855	WA2AUB	610	WB8ZRV
1433	W9DWQ	1208	N6CW	1020	I0JX	848	W6ANB	605	I4BFY
1428	W7LLC	1200	N9AF	1016	SM7TV	831	JA1AG	600	WB9CGL
1428	N4MM	1163	N2AC	1015	W0SFU	830	W0IUB		
1405	N4UU	1139	N6JV	1008	WA1JMP	814	PY4OD		

S.S.B.

1555	W4UG	1231	K2POA	1059	WB4SIJ	900	WB4KZG	719	YU1ODS
1547	F9RM	1182	YU1BCD	1017	F2MO	896	DJ7CX	702	I0MBX
1505	I0AMU	1158	I4ZSQ	975	WA6TAX	889	N4UU	702	N4NO
1415	K6JG	1142	W9DWQ	967	I2PHN	801	YU1AG	680	N2AC
1374	I0ZV	1124	PA0SNG	950	N2SS	783	K8SQE	666	PA2TMS
1300	I8YRK	1107	ZL3NS	948	DL1MD	765	W2NC	653	I4LCK
1295	I8KDB	1100	K2VV	938	OE2EGL	755	W4BQY	654	ZP5RS
1250	N4MM	1070	K5UR	909	PY3BXW	750	JH1VRQ	626	WA2AUB

C.W.

1416	W8KPL	1158	W9FD	1016	N2AC	902	YU1AG	676	SM0GMG
1350	W8LY	1150	N4UU	1012	VO1AW	829	I6SF	668	LZ1XL
1297	ON4QX	1126	W2HO	986	N4NO	800	VO1KE	660	DL1MD
1296	K6JG	1101	N6JV	985	K5UR	716	YU1ODS	649	KH6HC
1279	DL1QT	1087	W4BQY	976	WA0KDI	703	I5IZ	647	W9OYZ
1274	W2NC	1059	G2GM	973	K6ZDL	700	WB4KZG	623	JE1JKL
1251	K6XP	1031	DJ7CX	950	K2VV	698	OK2BLG	600	JH1VRQ
1202	YU1BCD	1030	W3ARK	905	N4MM	694	PY4OD		

Here and There

Congratulations Steve Orland, AA6AA, on being the first U.S. amateur to win a Single Band WAZ Award certificate for 10 Meter s.s.b. Steve's certificate is #3 worldwide.

Desecheo Island - At presstime no further information is available. The DX Department never received a reply from W0DX/VP2VL presenting his views on the controversy. This is disappointing as we feel that Bob could have contributed to our reader's understanding of the situation.

Reciprocal Licensing in Iceland - In last month's DX column, John, K4IIF, described the very pleasant reception he received from the local amateurs when he operated as K4IIF/TF during the *CQ* Worldwide Phone Contest in October, 1978. However, U.S. amateurs living and working in Iceland say it's not the same for them, that only tourists are being given reciprocal privoleges and they cannot get on the air. The TF situation is unusual in that the licensing authorities require that each applicant for a reciprocal license be approved by the amateur radio club in Reykjavik. Unfortunately, there seems to be a strong rivalry between the local club and the non-Icelandic amateurs. There are gentlemen of good will in both groups and *CQ* hopes they will resolve their differences in a mutually satisfactory manner.

Hawk, SM0AQD, is a 23 year old DXer from Nykopping, Sweden. He has over 270 countries confirmed with an antenna up 185 feet. (photo by SM0GMZ)

Lloyd and Iris Colvin - The Colvin duo report 10,000 QSO's and a total of 129 countries worked from W6QL/6Y5. This included their operation during the *CQ* Worldwide C.W. Contest in November, 1978. All 6 continents were worked in 24 minutes on 20 meter c.w. November 28, 1978. The stations worked, with GMT times in parenthesis, were: JA6BVU(0305), LU7XP(0308), AA4BA(0318), UK2RAX(0322), FR7ZL(0324) and ZL1CH(0329).

DA QSL Cards - Holders of DA calls in Germany, past and present, are encouraged to contact Mike Jackson, VE3KQI/DA1UO, who has over 5000 unclaimed QSLs for DA calls. Mike would like to distribute them to the proper recipients. He can be reached at Postfach 1771, 7630 Lahr, West Germany, or to P.O. 2581, CFPO 5000, Via Belleville, Ontario, Canada KOK 3RO.

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QSL Managing Services - Kevin Elliott, WB0YHJ, QSL Manager for 4X4CW, is interested in handling cards for other DX stations. He can be reached at P.O. Box 111, Allerton, Iowa 50008.

New Call Sign Policy in Portugal- CT1ZG advises that CT1 calls from Portugal, as well as CT2 calls from the Azores and CT3 calls from Madeira, will soon be 2 × 2 and 2 × 3, and that CT4 calls will no longer be assigned. Non-Portuguese amateurs operating under the reciprocal agreement will sign their home calls /CT1, CT2 or CT3. For special events such as the *CQ* contests, DXers in Portugal may apply for CT5, CT6 or CT7 calls, or in the Azores for CT8 and in Madeira for CT9 calls.

The CQ DX Awards Program

633 . . . KL7JDR
634 . . . 4Z4DX
635 . . . W0ULU
636 . . . WB4UVV
637 . . . WA4JTI
638 . . . KL7JFJ
639 . . . 6Y5DA
640 . . . DK9CG

C.W.

331 . . . W6YMH

S.S.B. Endorsements

310 . . . W2TP/318
310 . . . W3NKM/316
310 . . . I8AA/315
310 . . . W4EEE/315
310 . . . W6EUF/315
310 . . . K9MM/310
300 . . . I4ZSQ/309
300 . . . W3GG/305
300 . . . N4MM/304
275 . . . VE7WJ/293
275 . . . VE7HP/289
275 . . . JH1VRQ/288
275 . . . WA4WTG/286
250 . . . WA4JTI/261
150 . . . 4Z4DX/187
MOBILE . . . W4WTG/157

CW Endorsements

310 . . . W6PT/319
300 . . . K9MM/300
275 . . . W4OEL/275
200 . . . WB4RUA/202
150 . . . W6YMH/161
150 . . . W7DAZ/152

Complete rules and application 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 SW, Seattle, Washington 98136 U.S.A..

QSL Information

A2CDW - Box 84, Selibe Pikwi
A35MB - Gerhard Jaeger, DF2RG, Ruhseugstrasse 6A, 8460 Schwandorf, West Germany
CO2ER - Box 1, Havana
C21EF - Box 267, Nauru
EL2ET - W3HNK
FG7BA - Box 11, Petitbourg
FM7BB - Box 10, Trois Islets, Martinique
FO8DD - W7VRO
FP0TH - K8BTH
FY7AN - Box 746, Cayenne
HH2CG - Box 428, Port au Prince
N5SB/KH6 - DF2RG
OJ0NA - OH0MA
PY0RO - W1DA
PZ1BM - Box 1919, Paramaribo, Surinam
S79MC - N4NW
TA1ZB - Box 188, Istanbul
TU2FH - Box 40, Oume
VP2VDH - N6CW
VP2VEQ - N6ZZ
VP2VER - N6CW
VP8QG - WA4JQS
YN0H - YN1H
YN0S - YN1S
YS1RVE - WA0JYJ
ZK2AV - DF2RG
ZB2G 1T2FJ
3B9ZZ - W2GHK
3D6AC - Box 167, Siteki, Swaziland
3D6BP - W1OX
3D6CC - VE6AKC
5HF3W - Box 296, Arusha, Tanzania
5T5ZR - Box 202, Nouakchott
5W1BM - DF2RG
5Z4NH - W2PPG
7X2KAR - Box 2, Algiers
7P8BC - K9RD
9G1KB - Box 10320, Accra
9H1FN - WA1YYX

Please send all reader inquiries directly

1978 CQ PHONE World Wide DX Contest
High Claimed Scores

The following are the high claimed scores received by December 27th, 1978.

USA
Single Operator
All Band

W4DR	2,721,792
N7DD	2,685,992
K1XX	2,201,094
W3BGN	1,868,740
W9ZRX	1,797,120
N2LT	1,763,478
N3DA	1,442,805
K6RR	1,442,430
N6KT	1,393,789
N3DG	1,379,010
N3AD	1,338,218
K3ZJ	1,307,573
W3GG	1,298,600
W7NI	1,265,550
WA1TFF	1,161,594
N2SS	1,152,668
N6AR	1,152,064
K4VT	1,112,364
K2BMI	1,097,547
N3UN	1,019,565
K2UA	1,010,740
W2GD	991,561
W2IB	990,856
W9LT	954,662
AA4S	952,845
W4QAW	917,190
W1UR	896,510
W100	868,224
K6HNZ	884,536
K0ZZ	841,875

Single Band
1.8 MHz

K1PBW	2,664
W8LRL	1,608
K6SE	1,280
K5YY	688
W1BB	624

3.8 MHz

W1CF	113,712
N2KK/6	71,520
W8WW	59,202
K8XX	38,052
WA3FET	30,160
K9FN	25,194
K9JF	23,680
K5NU	21,515

7 MHz

K0RF	85,170
K9HMB	55,440
WB9NKH	38,402
K1CV	34,030
K0VUW	26,364
W0UO	14,628
WB2VFT	13,054

14 MHz

K9DX	323,716
W9OBF	241,544
K9RF	230,236
W5NA	226,849
K0KX	205,323
WB2ITR	197,664
W1YG	169,680
WA3VJU	151,840
K3FN	148,920
W8TA	148,717

21 MHz

WA6EKL	635,830
K1VTM	616,572
K1RM	543,691
AE6U	524,162
AI6V	430,815
K9XR	408,750
K1MM	403,004
K9PPY	337,120
W8FF	277,246
K0KE	237,390
N4NW	228,670
K9RN	224,460

28 MHz

K6OQ	532,286
N1MM	431,984
K3UA	402,765
W5MYA	388,922
W4QQN	383,765
K9RA	374,443
K5TJ	349,520
AA4VK	338,100
N4KG	334,334
W9RE	323,595
W0YK	305,665
N4BP	303,373
WA8QIY	294,196
WA1UZH	274,170
K1TN	261,265
WB1DGG	259,461
K5KLA	258,423
N4SF	252,054
WA1HFW	248,642
W6PU	248,487
W4PN	246,874

Multi-Single

K5GA	4,150,407
K1PR	2,897,100
K0UK	2,503,690
K8NA	2,450,739
W6BH	2,217,956
N6MG	1,739,520
WA7NIN	1,607,400
K4VX	1,502,600
K8AZ	1,410,486
K1RU	1,405,620
N3DG	1,379,010
K3RA	1,354,990
W7RO	1,314,048
N2MM	1,250,440
K0CS	1,237,470
W6AQ	1,218,336
W6VLD	1,207,676
N1ZE	1,181,814
N4HB	1,162,838
N8RA	1,110,768
N6AW	1,060,378

Multi-Multi

N2AA	9,000,509
W3WJD	8,631,540
W2PV	7,705,500
W3MM	5,909,712
W1ZM	5,400,200
W4BVV	4,763,987
K8LX	4,545,966
W7KW	4,200,786
W2YV	3,804,270
K3WW	3,798,904
W3AA	3,688,800
W3FA	3,422,837

DX
Single Operator
All Band

9Y4VT	8,300,204
CT3BZ	7,180,020
N1GL/VP9	3,990,071
9Y4VU	3,733,688
OH2MM	3,649,556
UB5WE	3,582,492
DK8FZ	3,181,577
EA4LH	3,103,906
PA2TMS	3,011,940
VC7WJ	2,739,140
WA4UAZ/HC1	2,724,982
KH6IJ	2,582,629
VE7CC	2,462,288
OH1XX	2,307,823
OH6JW	2,254,980
K0AX/DU2	2,238,624
UL7OAO	2,216,920
VE5DX	2,212,227
H44DX	2,119,864
HB9BAM	2,039,400
HS1ABD	2,001,966
CE3XV	1,971,767
VE7CMK	1,849,435
CH3GCO	1,791,108
EA3ADW	1,700,224
CT3BD	1,652,473
JH1JGX	1,623,739
DJ3HJ	1,477,440
CF1RY	1,310,429
EA5TD	1,137,396

Single Band
1.8 MHZ

GM3ZSP	4179
G3XWZ/A	2180
VE3FAC	2072
GU3HFN	1734
GW3UCB	1638
OH2BO	1496
HI8JAG	1024

3.8 MHz

HC1EE	59,972
VE3ECP	53,200
DA1QO	24,702
ON6JG	18,252
JA6BSM	14,014
LA5QK	10,396

7 MHz

I3MAU	240,108
OH8SR	136,952
OH1IJ	107,535
SM5BNZ	97,864
YU1EXY	63,833
DK5WN	61,938
I3BBZ	38,285

14 MHz

KP4RF	1,390,785
VE3BWK/4U	1,061,634
FC9UC	722,598
OH8OS	665,802
LU4MEE	665,734
UA6LBQ	663,468
YU3DBC	616,812
4M3AZC	542,995
G3RRS	472,099
I0ZXB	448,248

21 MHz

YU3ZV	1,212,530
YV3AMM	1,196,118
GU5CAA	1,123,380
CX7AL	1,015,406
VE3BMV	907,774
CW3A	841,000
KP40	801,780
4X4UH	738,315
VE7CML	713,950
EA2IA	707,028
OH2BCP	672,278
KH6GMP	669,240

28 MHz

CW3BR	1,664,803
VR3AH	1,442,244
KG6JIH	1,233,960
KH6WF	823,216
ZX2XB	797,065
YU2RQG	789,932
PY3CB	786,876
EA8JJ	773,216
G4CNY	769,350
GU4EON	721,996
KP4DSD	650,650
I6PLN	650,012
YU3FO	648,096
OH5NW	617,984
HI8MOG	582,894
JH1AJT	540,123

Multi-Single

FY7BC	8,987,836
HH2CQ	8,301,354
RF6F	7,693,140
9L1CA	7,367,846
IZ4VEQ	7,087,404
YU3EY	6,432,251
I1KN	4,858,528
KZ0DX	4,534,740
UK6LAZ	4,318,050
UK9ABA	3,803,674
W4NT/C6A	3,678,381
OH1VR	3,467,646
G6UW	3,286,192
I1UW	3,134,430
HD0E	2,988,216
SP5PWK	2,898,476
WB2RLK/VE1	2,856,384
CG6WQ	2,654,316
F5II	2,542,552

Multi-Multi

PJ9JR	29,668,500
PJ8CO	15,813,035
EX9A	15,415,240
VE3KZ	10,619,740
SK2KW	9,231,930
KL7HR	5,461,066
JH1ZLA	4,846,122
JA3YKC	4,401,980
KL7IRT	3,565,188
JA7YRR	3,338,145
JA3YBF	2,772,225
HK3SB	2,683,984

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

The "Story of The Month" for April as told by Tom, K9GTQ is:

The 5th Annual Midwest Mini-Convention

(Held at the Holiday Inn, Wausau, WI. Oct. 13-15, '78)

"In early October, Jolene and I were about as nervous as a frog on a freeway with a busted hopper! We sure hoped we had an organized weekend prepared for the Mini-Convention. By Friday the 13th, we decided if everything wasn't covered, any new problems would have to take whatever cure necessary - if any problems would show up.

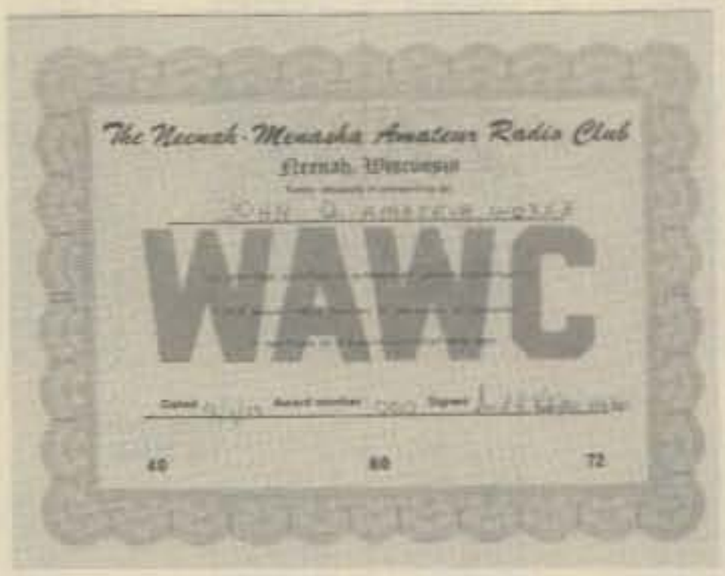
Special Honor Roll
All Counties

#206 Frank L. McJannet, K7LQI 12-15-78
#207 Curt George, W4SSU 12-19-78
#208 Raymond E. Wormley, WB5MBS 1-2-79
#209 S. Leo McGranaghan, WB4AIL 1-2-79
#210 Garnet H. Downing, W7CUJ 1-3-79

By noon I was at the motel setting up what I could. Jack, WD9AXF arrived in his '69 Corvette and helped me set up the antenna, rigs, and locate a source of pop and beer.

By Friday evening, many of the guys and gals were tossing around county line and run stories, exchanging "needed" lists and generally making themselves at home.

By noon, Saturday, most were there, but I got a call from Ralph, W9JR to ask if he could still make it for supper. I had a couple of vacancies yet to fill the maximum planned for the banquet, so I told Ralph to head north.



Worked All Wisconsin Counties.

I never expected such a turnout for a Mini-Convention this far north in Wisconsin! Jolene and I were both flabergasted and thrilled to see so many from so far! K1KPS came from New Hampshire, W5FS from New Mexico, W2UJ from New York, N7SU from Idaho! We had 69 seated for the supper banquet on Saturday night -which represented 43 hams plus their families.

We had enough prizes to get everyone there something to remember the Mini-Convention by -there were 80 prizes for the 69 guests.

Prizes were donated by: K1KPS; WB9NUL; N7SU; WB9ZNA; Frankie -WD8AAE's XYL; K9DAF; WB0ABM -Pal Electronics; W9FBC; W0OWY; K9BX; W6CCM; *CQ* magazine; Radio Shack Store - Tomahawk, WI.; and Jolene - K9GTQ's XYL and me.

Catalogs and battery cards from Radio Shack Stories of Wausau were also available. Catalogs for handouts, and battery cards were included, for each adult, in the registration envelope. I also put in a pen from me. and a pencil from International Crystal Mfg. Inc. - the pens for hams, pencils for XYLs or harmonics.

Jolene, Kristi, and Ruth cut out Jug sillhouettes (sic) of construction paper and I added the details and names for our nametags. We also handmade the meal tickets, which doubled for prize drawings. My family and I had fun preparing for this fun weekend and Sunday afternoon, when all were headed home- we felt a real let down. Friday and Saturday were beautiful weather days but Sunday morning it turned wet, a cold rain added to the dismal feeling I had as the Mini broke up.

USA-CA Honor Roll

3000		2000		1000	
W2AEA	225	WA2AEA	337	WD4OFG	507
K7WUR	226	WB9QNX	338	WA2AEA	508
W4SSU	227	WA5ZDZ	339	I2PJA	509
WB5MBS	228	K2UVG/6	340	K6XZ	510
WB4AIL	229	WB5MBS	341	K0UQV	511
W7CUJ	230	WB4AIL	342	UV3GM	512
2500		W7CUJ	343	WB5MBS	513
WA2AEA	284	1500		WB4AIL	514
WD9AXF	285	WD4OFG	391	500	
WB5MBS	286	WA2AEA	392	UV0EX	1300
WB4AIL	287	WB5MBS	393	WD4OFG	1301
W7CUJ	288	WB4AIL	394	WA2AEA	1302
		W7CUJ	395	WA9WGJ	1303
				WA3ZMY	1304
				K0UQV	1305
				KH6WF	1306
				W9OEJ	1307

We sure had a grand time - as did everyone who attended according to the comments on 20 and 75 meters.

Those attending included (hope I did not miss anyone): W9FBC and XYL; K1KPS; N9ER & XYL & Harmonics; K9DAF & XYL WB9ZNA; WB0TVL & XYL; N9WA & XYL WB9RCY; W2UJ: W5FS; WA0RJJ & XYL; W0RJJ & XYL; W0UM & XYL; WB9EJE & XYL; K9BX & XYL; K9DZG & XYL WD9ITF; WD9AXF & XYL;

Worked Ten Erie Hams - Pennsylvania.

Slow Scan TV Award

**P.O. Box 73, Rochelle Park, N.J. 07762.*

N9TN & XYL N9AIK; AD8W (ex-WA8ASV) & XYL: WD9HID & XYL WD9GRL; WB9QNX; WD9BCG & OM; W9OP & XYL WB9YDT; N7SU & Berta; WB0MNE & XYL; WD8AAE & XYL & Harmonics; W9CFS; W9OEJ; WD9-JHT & XYL; W0KMH & XYL: WA0ODW & XYL & Harmonics; WD9ITQ & XYL WD5HZQ; WB0ABM & XYL; WA0DCQ; WA0BPE; W9JR and WD9CQF - listed in the order of receipt of their registration- and, of course K9GTQ and *family. (See photo of Tom, K9GTQ and Family, page 89 of October 1978 CQ.)*

The Mini-Convention was a financial success, Jolene and I have decided to use any excess funds to gather a few prizes for the next midwest Mini-Convention, when we find out just what our total costs are. (The phone bill came in a couple days ago-Hi). There won't be any great excess but what ever there is will go for prizes in the future.

The large wall maps seemed to go great as prizes, so we'll probably get some of them and probably add a few of my notorious "Junque Boxes" and what ever else we feel appropriate".

Awards Issued

As shown under the Special Honor Roll, more applications for *All Counties* were received during the month than have been received in many a moon.

Frank (Mac) McJannet, K7LQI got his All Counties endorsed Mixed.

Curt George, W4SSU got USA-CA-300 and All Counties endorsed, All s.s.b.

Ray Wormley, WB5MBS/WB5OFF found time to do his paper work and claimed: USA-CA-1000 through 2500 endorsed All s.s.b., All Mobiles, All 14 MHz., All QRP. USA-CA-3000 endorsed All s.s.b., All s.s.b., All Mobiles, All QRP. All Counties endorsed All QRP.

Leo McGranaghan, WB4AIL was fortunate to catch Bea, WA2GPT and Walt, K4ELK to certify his application for his lucky number 209 for All Counties Mixed, also USA-CA-3000 Mixed and USA-CA-1000 through 2500 endorsed All s.s.b., All 14 MHz.

Garnet Downing, W7CUJ grabbed WSA-CA-1500 through All Counties endorsed All s.s.b., All 14 MHz., All Mobiles.

Bob Schmarder, WA2AEA took a little time from his QSL Clearing House for County Hunters to apply for USA-CA-500 through 2500 endorsed All s.s.b., All 14 MHz., All Mobiles and USA-CA-3000 endorsed All s.s.b.

Carol Kimber, K7WUR was some how able to take a little time from her work as Head Nurse in ICU-CCU to send for USA-CA-3000 endorsed All s.s.b.

Jack Johnson, WD9AXF won USA-CA-2500 endorsed Mixed.

Dave Bishop, WB9QNX acquired USA-CA-2000 endorsed Mixed.

Marge Moore, WA5ZDZ sent more data to me to receive USA-CA-2000 endorsed All s.s.b.

Hank Kahrs, K2UVG/6 picked up USA-CA-2000 endorsed Mixed.

LeMar Campbell, WD4OFG (ex-WB0LFN, Om of Peg, ex-WB0LFO, now WD4OFH) finally got around to gain USA-CA-500 through 1500

Antonio Petroncari, I2PJA made USA-CA-1000 endorsed All 2XSSB, #2 1000 certificate to Italy.

Mixed USA-CA-1000 certificates went to:

Robert Craig, K6XZ.
Ted Long, K0UQV.
Walery (Walt) B. Gromov, UV3GM, ex operator at UA3KBO, UA0FGM, 4J0GM. He had received #1 500 Award to USSR in March 1970 and now has #1 100 Award to USSR.
Victor Melnikov, UV0EX (well known in DX circles) qualified for USA-CA-500 endorsed All s.s.b., All 14 MHz. This is #3 Award to USSR, others were UV3GM and UK3AAO.

Dave Christensen, WA9WGJ made USA-CA-500 endorsed All s.s.b.

Bill Faulkerson, KH6WF gained USA-CA-500 endorsed All s.s.b., All 50 States. Mixed USA-CA-500 certificates were issued to:

Bill Irwin, WA3ZMY.
Ted Long, K0UQV.
Duane E. Puro, W9OEJ.

QTH of the 5th Annual Midwest Mini-Convention.

Awards

Worked All Wisconsin Counties Award (WAWC): Sponsored by the Neenah - Menasha Amateur Radio Club has a *New Custodian:* David R. Koberstein, N9DK, 23 Winona Court, Appleton, Wisconsin 54911. Basic Award for working 40 Counties, and seals for 60 and the full 72. Send $1.00, a list of the Counties worked, the stations, the date, band and the mode. Be sure to include your QTH-some applications have failed to mention this.

Worked Ten Erie Hams Award: This award issued by the Radio Association of Erie, Pennsylvania, under the direction of Frank Grace, W3NR. To qualify you must prove two way contact on any band in any mode or combination thereof, with ten Erie Amateurs. Photocopies of QSL cards or log entries will be accpeted. A business-size, self-addressed, stamped envelope will insure prompt issuance of the certificate. Send information or inquiries to the Radio

Please send all reader inquiries directly

Association of Erie, Box 844, Erie, Pennsylvania 16512, or to John Lindvay, WB3IFD, 908 West Ninth Street, Erie, Pennsylvania 16502.

The 9 HI Prefixes Award: The Dominican Radio Club has made a new Award available to all amateurs who confirm contacts with the 9 HI Zones. This was made possible by the DX-pedition that should have been active in late January from Beata Island using the call of HI1RCD. The application should include: date, time, station, reports and band of each contact with a copy of the QSL cards. Contacts from January 1, 1977 on, will be valid. No cost was mentioned in their data but I am under the impression it should be 7 IRCs like their previous Awards. Send to: A.R.S. HI8MFP, P.O. Box 2191, Santo Domingo, Dominican Republic.

Slow Scan TV Awards: *Amateur Television* Magazine is now offering a series of Awards for SSTV activity ranging from a basic award through several levels of difficulty to a Master Scanner Award.

The award levels are:

5 SSTV QSOs on each of any 5 bands, 25 contacts

6 SSTV QSOs on each of any 6 bands, 36 contacts

7 SSTV QSOs on each of any 7 bands, 49 contacts

8 SSTV QSOs on each of any 8 bands, 64 contacts.

9 SSTV QSOs on each of any 9 bands, 81 contacts.

10 SSTV QSOs on each of any 10 bands, 100 contacts.

In addition to the normal frequency bands, the use of Oscar may be used as 2 bands for any two Oscar modes., ie 5 contacts via 450/144 Oscar would count as 1 band for the basic certificate.

Applicants should send proof of QSO and $1.00 for each award to: SSTV Master Scanners Awards, P.O. Box 1347, Bloomington, Indiana 47401. Allow two weeks for processing and award preparation.

Notes

How nice to hear Jack, W0SJE and Dave, W6CCM back on the Net. They both gave us a scare.

Two fine County Hunter QSL Bureaus are:

QSL Clearing House, 4 Pinewood Circle, Corning, N.Y. 14830. This is operated by Robert C. Schmarder, WA2AEA. Write him for full information.

Mobile QSL Bureau, P.O. Box 146, Lakeside, California 92040. This is operated by Dave Manescu, W6CCM, drop him a request for full data.

The Mobile Amateur Radio Awards Club, Inc (MARAC), have a fine program and they issue a monthly newsletter to members. Their address is: Rt. 1, Box 230M, DeSoto, Kansas 66018. For their information packet, send request and 54¢ for postage to, Walt Allen, W0DG, 10310 W. 170th Terrace, Olathe, Kansas 66061.

If you want to keep tabs on just about anything from electronics through plumbing, cars, house repairs, woodworking, lawn mover repairs, things a girl can make, things a boy can make, etc... you name it-write to TAB BOOKS Blue Ridge Summit, Pensylvania 17214. Tell me, How was your month? 73, Ed., W2GT.

Shortly after this was written, Jack W0SJE became a silent key.

FREQUENCY COUNTERS

COMPLETE KITS: CONSISTING OF EVERY ESSENTIAL PART NEEDED TO MAKE YOUR COUNTER COMPLETE. **HAL-600A** 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 600 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ±.001%, UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT..... ~~$149~~ **$129**

HAL-300A 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 300 MHz. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY; AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL 10 SEC GATE AVAILABLE. ACCURACY ±.001%, UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT..... ~~$124~~ **$109**

HAL-50A 8-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 50 MHz OR BETTER. AUTOMATIC DECIMAL POINT, ZERO SUPPRESSION UPON DEMAND. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY INPUT, AND ONE ON PANEL FOR USE WITH ANY INTERNALLY MOUNTED HALTRONIX PRE-SCALER FOR WHICH PROVISIONS HAVE ALREADY BEEN MADE. 1.0 SEC AND .1 SEC TIME GATES. ACCURACY ±.001%. UTILIZES 10-MHz CRYSTAL 5 PPM.
COMPLETE KIT..... ~~$124~~ **$109**

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HAL 300 PRE..... **$19.95**
(Pre-drilled G10 board and all components)

HAL 300 A/PRE..... **$24.95**
(Same as above with preamp)

HAL 600 PRE..... **$34.95**
(Pre-drilled G10 board and all components)

HAL 600 A/PRE..... **$39.95**
(Same as above but with preamp)

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HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3½ x 5½ INCHES. HAS 12 LINES OUT. ONLY **$39.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT utilizing the new ICM 7206 chip. Provides both VISUAL AND AUDIO indications! Comes with its own two-tone anodized aluminum cabinet. Measures only 2 3/4 × 3 3/4". Complete with Touch-Tone pad, board, crystal, chip and all necessary components to finish the kit.
PRICED AT..... **$29.95**

For those who wish to mount the encoder in a hand-held unit, the PC board measures only 9/16" × 1 3/4". This partial kit with PC board, crystal, chip and components.
PRICED AT..... **$14.95**

ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEURS HANDBOOK. **$16.95**

ACCUKEYER—MEMORY OPTION KIT THIS ACCUKEYER MEMORY KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER, IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY. **$16.95**

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*Fits clock case advertised below.

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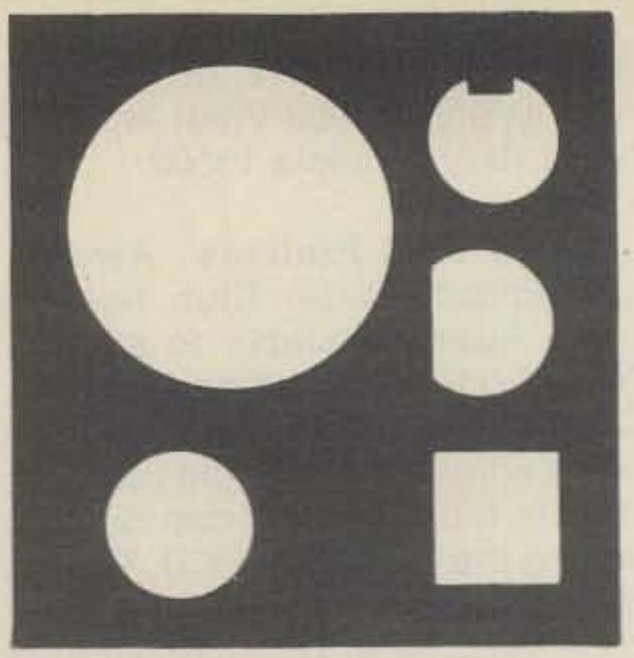

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CIRCLE 38 ON READER SERVICE CARD

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

"Up, up, up she goes and where she will stop no one knows." This ancient ditty ably describes the course of the present sunspot cycle, which took another leap forward at last reading.

The Zurich Solar Observatory reports a monthly mean sunspot number of 119 for December, 1978. Daily values ranged from a low of 50 on the 22nd to a high of 188 on December 12th. This results in a 12 month smoothed running sunspot number of 87, centered on June, 1978. This is a six count increase from May's level.

The Zurich Observatory forecasts a smoothed sunspot number in the upper 130's for April, 1979. This would be the highest level of solar activity to be observed since 1959!

April Conditions

The combination of high solar activity and spring propagation conditions should bring about considerable changes in DX propagation patterns on the amateur high frequency bands, almost all of them for the better.

The *10* meter band, almost completely dead during periods of low solar activity, is expected to remain very much alive during the spring months. Expect considerable DX on this band from an hour or two after sunrise, to just after sunset. While normal seasonal changes should result in fewer east-west openings, conditions may actually improve for openings towards southern and tropical areas. To most areas of the world, peak signals should occur during the afternoon hours.

There's a big surprise in store for *15* meters. During periods of low solar activity, this band generally begins its doldrums about now. But not this year. During April, expect *15* meters to be loaded with DX openings from just after sunrise to *well* beyond sunset. Signals should be strongest to most areas of the world during the afternoon hours, but don't be surprised to find openings as late as *Midnight* to southern and tropical areas.

Twenty meters is expected to take on added importance as a DX band during April. Besides the usual worldwide DX openings during the daylight hours, *20* meters should be the optimum DX band during most of the hours of darkness. Around-the-clock DX openings can be expected during April. Strongest signals, and openings in almost all directions, should take place for an hour or two after sunrise and again during the late afternoon and through the evening hours to about Midnight. Many nighttime openings will be associated with exceptionally strong signal levels.

Even though there are fewer hours of darkness during April, an improvement is expected for 40 meter *DX* conditions. Signals should be stronger and more stable than during the winter months, and openings should occur in more directions. Expect good DX conditions throughout the hours of darkness, with signals peaking from an easterly direction about an hour or two before Midnight, and from most other directions about an hour or so before local sunrise on the USA end of the path.

Fairly good DX openings to many areas of the world should also be possible on *80* meters, during the hours of darkness. Propagation patterns should be similar to *40* meter openings, but *80* meter signals will usually be weaker and noisier.

With increased hours of daylight and seasonally increasing static levels, propagation conditions on *160* meters will not be as good during April as they were this past winter. There is a chance, however, for some fairly good DX openings on this band during the hours of darkness and the sunrise period.

The seasonably favorable equinoctial propagation conditions discussed in last month's column should continue through April for openings between the northern and southern hemispheres. Be sure to check during the sunset and sunrise twilight periods for *both* long and short-path openings between both hemispheres, particularly on *20* meters.

V.h.f. Ionospheric Openings

April should be a good month for v.h.f. ionospheric openings.

Some F-2 layer DX openings should be possible on *6* meters from the USA to southern and tropical areas. These are most likely to occur during the

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for April 1979

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 11, 26, 29	A	A	B	C
High Normal: 1-2, 4, 14, 19-20, 28	A	B	C	C-D
Low Normal: 3, 9-10, 13, 15-16, 18, 21, 23-25 27, 30	B	C	D	D-E
Below Normal: 5-6, 8, 12, 17, 22	C	D	D-E	E
Disturbed: 7	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 and day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good (B) on April 1st, and 2nd; fair (C) on the 3rd; good (B) on the 4th; poor (D) on the 5th and 6th, etc. Subscribe to bi-weekly MAIL-A-PROP, P.O. Box 1714, Silver Spring, MD 20902.

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

afternoon hours when conditions are HIGH NORMAL or better. The best times for such openings are those shown for *10* meters in the DX CHARTS, with a propagation index of (4).

Trans-equatorial propagation (TE) between the USA and South America should reach a seasonal peak during April. These openings are most likely to occur on *6* meters, with some also possible on *2* meters, between 8 and 11 p.m. local time. TE openings favor the southern tier states, but some openings may also be possible to more northerly locations.

Lyrids, a major meteor shower should take place between April 22 and 23, with a peak expected on the 22nd. During the shower's peak, at least 15 large-sized meteors should enter the earth's atmosphere hourly, permitting fairly good meteor-scatter communications on the v.h.f. bands.

A seasonal increase in sporadic-E ionization, with associated short-skip openings on both *6* and *2* meters, usually begins during April and continues through the spring and summer months. While, as its name implies, sporadic-E ionization can occur at just about any time, there is a tendency for it to peak between 8 a.m. and Noon and again between 5 and 9 p.m., local time. Occasional short-skip openings on *6* meters, ranging between 750 and 1300 miles are possible during April.

Unusual iononspheric openings on the v.h.f. bands can also occur during April when widespread auroral activity is present. The best times to check for such openings are during expected periods of radio storminess, since during April many storms will be associated with auroral activity. See the *Last Minute Forecast* at the beginning of this column for those days during April that are expected to be BELOW NORNAL or DISTURBED.

The DX PROPAGATION CHARTS in this month's column contain DX propagation predictions for each amateur band between *10* and *160* meters for the period *April 15- June 15, 1979.* Beginning this month and continuing through the summer and early fall, the times shown in the CHARTS will be local *daylight* time (EDT, CDT, MDT and PDT). For detailed predictions of short-skip openings between distances of 250 and 2300 miles, see the SHORT-SKIP PROPAGATION CHARTS, which appeared in last month's column.

73, George, W3ASK

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 (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates the best time to listen 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 column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. etc. 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 transmitted 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, and a half-wavelength above ground on 40 and 20 meters; and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

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.

April 15- June 15, 1979
Time Zone: EDT (24-Hour Time)
Eastern USA To:

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

Western Africa	10-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	09-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	12-15 (1) 15-17 (2) 17-19 (3) 19-23 (4) 23-00 (3) 00-01 (2) 01-03 (1)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Eastern & Central Africa	17-19 (1)	12-14 (1) 14-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-01 (2) 01-03 (1) 07-09 (1)	20-23 (1)
Southern Africa	10-12 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-15 (2) 15-16 (1) 00-02 (1)	14-16 (1) 16-19 (2) 19-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-05 (1) 05-07 (2) 07-08 (1)	20-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Central & South Asia	18-21 (1)	16-18 (1) 18-21 (2) 21-22 (1) 09-11 (1)	05-07 (1) 07-09 (2) 09-11 (1) 17-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-00 (1)	06-08 (1) 19-21 (1)
Southeast Asia	18-20 (1)	09-11 (1) 11-13 (2) 13-15 (1) 17-19 (1) 19-21 (2) 21-23 (1)	23-03 (1) 03-07 (2) 07-09 (3) 09-11 (2) 11-12 (1)	05-07 (1)
Far East	18-21 (1)	08-11 (1) 15-16 (1) 16-17 (2) 17-21 (3) 21-23 (2) 23-00 (1)	23-02 (1) 02-04 (2) 04-06 (3) 06-08 (4) 08-09 (3) 09-11 (2) 11-13 (1)	03-05 (1) 05-06 (2) 06-07 (1) 05-06 (1)*
South Pacific & New Zealand	11-14 (1) 14-16 (2) 16-20 (3) 20-21 (2) 21-22 (1)	08-09 (1) 09-11 (2) 11-14 (1) 14-17 (2) 17-18 (3) 18-21 (4) 21-23 (3) 23-01 (2) 01-03 (1)	16-19 (1) 19-20 (2) 20-21 (3) 21-03 (4) 03-07 (3) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (1)	00-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-05 (2)* 05-06 (1)*
Australasia	15-17 (1) 17-19 (2) 19-21 (3) 21-22 (1)	08-09 (1) 09-10 (2) 10-11 (1) 16-18 (1) 18-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	05-07 (3) 07-08 (2) 08-10 (3) 10-12 (2) 12-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-01 (3) 01-05 (4)	02-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
Caribbean, Central America & Northern Countries of South America	09-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	07-09 (1) 09-11 (2) 11-14 (3) 14-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	03-06 (2) 06-08 (3) 08-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-23 (4) 23-03 (3)	19-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 21-23 (1)* 23-04 (2)* 04-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-10 (1) 10-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-15 (2) 15-16 (3) 16-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	05-06 (1) 06-09 (2) 10-15 (1) 15-17 (2) 17-19 (3) 19-00 (4) 00-02 (3) 02-05 (2)	21-22 (1) 22-00 (2) 00-02 (1) 02-05 (2) 05-07 (1) 01-05 (1)*
McMurdo Sound, Antarctica	18-20 (1)	15-17 (1) 17-19 (2) 19-21 (3) 21-23 (2) 23-00 (1)	16-18 (1) 18-19 (2) 19-02 (3) 02-04 (2) 04-06 (1)	20-22 (1) 22-00 (2) 00-02 (1) 02-04 (2) 04-06 (1)

April 15- June 15, 1979
Western USA To:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	09-12 (1) 16-17 (1)	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	01-07 (1) 07-10 (2) 10-13 (1) 13-17 (2) 17-19 (3) 19-21 (2) 21-23 (3) 23-01 (2)	20-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Central & Northern Europe & European USSR	14-16 (1)	11-14 (1) 14-16 (2) 16-17 (1) 22-00 (1)	02-07 (1) 07-09 (2) 09-13 (1) 13-16 (2) 16-18 (3) 18-22 (2) 22-00 (3) 00-02 (2)	19-23 (1) 21-22 (1)*

Eastern Mediterranean & Middle East	NIL	09-11 (1) 11-15 (2) 15-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-20 (2) 20-22 (3) 22-23 (2) 23-03 (1)	20-23 (1)
Western Africa	10-14 (1) 14-17 (2) 17-19 (1)	08-12 (1) 12-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-06 (1) 06-08 (2) 08-15 (1) 15-17 (2) 17-18 (3) 18-22 (4) 22-00 (3) 00-02 (2)	20-23 (1)
Eastern & Central Africa	15-18 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-21 (1) 21-23 (2) 23-00 (1)	11-15 (1) 15-17 (2) 17-19 (3) 19-21 (2) 21-23 (3) 23-00 (2) 00-02 (1)	19-22 (1)
Southern Africa	09-11 (1)	07-09 (1) 09-11 (2) 11-12 (1) 12-14 (2) 14-15 (1)	07-09 (1) 13-15 (1) 15-18 (2) 18-22 (1) 22-23 (2) 23-01 (3) 01-02 (2) 02-03 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Central & South Asia	17-19 (1)	08-09 (1) 09-11 (2) 11-16 (1) 16-17 (2) 17-19 (3) 19-21 (2) 21-23 (1)	05-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 16-18 (1) 18-21 (2) 21-23 (1)	05-08 (1)
Southeast Asia	12-14 (1)	08-09 (1) 09-12 (2) 12-19 (1) 19-22 (2) 22-23 (1)	04-07 (2) 07-10 (3) 10-11 (2) 11-13 (1) 22-00 (1) 00-02 (2) 02-04 (3)	04-07 (1) 05-06 (1)*
Far East	12-13 (1) 13-15 (2) 15-19 (1)	08-10 (1) 10-17 (2) 17-21 (3) 21-23 (2) 23-00 (1)	04-07 (2) 07-08 (3) 08-09 (4) 09-10 (3) 10-11 (2) 11-12 (1) 12-14 (2) 14-21 (1) 21-23 (2) 23-00 (3) 00-03 (4) 03-04 (3)	01-03 (1) 03-07 (2) 07-08 (1) 03-06 (1)*
South Pacific & New Zealand	11-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	09-10 (1) 10-12 (3) 12-16 (2) 16-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-03 (1)	06-08 (2) 08-11 (3) 11-12 (2) 12-17 (1) 17-19 (2) 19-21 (3) 21-02 (4) 02-06 (3)	22-00 (1) 00-02 (2) 02-07 (3) 07-08 (2) 08-09 (1) 01-02 (1)* 02-06 (2)* 06-07 (1)*
Australasia	13-14 (1) 14-15 (2) 15-19 (3) 19-20 (2) 20-21 (1)	13-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-00 (3) 00-02 (2) 02-03 (1)	05-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 18-20 (1) 20-21 (2) 21-23 (3) 23-03 (4) 03-05 (3)	01-02 (1) 02-04 (2) 04-06 (3) 06-07 (2) 07-08 (1) 02-03 (1)* 03-05 (2)* 05-06 (1)*
Caribbean, Central America & Northern Countries of South America	10-12 (1) 12-14 (2) 14-15 (3) 15-18 (4) 18-20 (2) 20-21 (1)	07-08 (1) 08-09 (2) 09-13 (3) 13-19 (4) 19-20 (3) 20-22 (2) 22-23 (1)	00-03 (3) 03-05 (2) 05-06 (3) 06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-00 (4)	19-20 (1) 20-21 (2) 21-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1) 21-00 (1)* 00-03 (2)* 03-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-11 (1) 11-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-15 (2) 15-16 (3) 16-19 (4) 19-21 (3) 21-22 (2) 22-23 (1)	00-02 (3) 02-03 (2) 03-05 (1) 05-09 (2) 09-15 (1) 15-17 (2) 17-18 (3) 18-00 (4)	19-22 (1) 22-03 (2) 03-04 (1) 20-03 (1)*
McMurdo Sound, Antarctica	15-19 (1)	15-16 (1) 16-18 (2) 18-20 (3) 20-22 (2) 22-00 (1)	16-18 (1) 18-19 (2) 19-21 (3) 21-01 (4) 01-03 (3) 03-05 (2) 05-07 (1)	21-22 (1) 22-00 (2) 00-05 (1) 05-07 (2) 07-08 (1)

*Predicted times for 80 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.
Six meter openings are likely to occur at times when 10 meter openings are shown with a propagation index of (4) and conditions are HIGH NORMAL or better.

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

The topic I am about to cover is not exactly contest news but will I think develop into something very competitive.

It comes under the heading of "number of QSOs made in a given period."

I got the idea when Dick Spenceley, KV4AA reported that he had made 48,100 contacts for the year ending December 31st, 1978. Now that may not look like a very impressive figure, but stop and think about it for a minute. That averages out to 132 contacts each day, one every 11 minutes.

Contest operation only contributed a very small percentage of the above total. QSL and other information was usually exchanged with each station worked. Anyway Dick will go into more detail in a short story he is writing, which will appear in the next issue of *CQ* and other publications.

In the meantime I have written to Guiness Ltd. to have KV4AA's claimed record entered in their Book of World Records. If they accept this new category you fellows can start making your own claims for world recognition. If Guiness does not go along with the idea we can start one of our own, in this or K4IIF's column.

I'm sure Dick Norton, N6AA will immediately stake his claim for his operation from 9Y4VT in the last CQ WW Phone Contest, 296 QSOs in one hour, 6,432 for the 48 hour weekend.

There are certain requirements the Guiness people request, hopefully I will get them in time for next month's Column.

Next month's WPX C.W. Contest (May 26/27), is creating a lot of interest and will I am sure stir up a lot of activity. Add another Trophy for this one, donated by the Kansas City DX club, for the top score on a single band by a single operator in the U.S.A. That should give you something to shoot for.

73 for now, Frank, W1WY

**14 Sherwood Rd., Stamford, CT 06905.*

Calendar of Events

*	Mr/Ap	31-1	North Dakota QSO Party
*	Mr/Ap	31-1	Tennessee QSO Party
	Mr/Ap	31-2	Wisconsin QSO Party
	Apr.	7-8	Polish "SP" CW Contest
	Apr.	7-8	ARCI QRP QSO Party
	Apr.	11-12	DX-YL to W/VE YL C.W.
	Apr.	18-19	DX-YL to W/VE YL Phone
	Apr.	21-22	Bermuda Contest
	Apr.	21-22	Polish "SP" SSB Contest
	Apr.	21-22	Common Market Contest
	Apr.	21-22	County Hunters SSB Contest
	Apr.	28-29	Dutch "PACC" Contest
	Apr.	28-29	Swiss "H-26" Contest
	Apr.	28-30	ZERO District QSO Party
	May	5-6	Vermont QSO Party
	May	5-6	Florida QSO Party
	May	26-27	CQ WW WPX C.W. Contest

*Covered last month

Wisconsin QSO Party

Starts: 2100 GMT Saturday, March 31
Ends: 0300 GMT Monday, April 2

This year's party is sponsored by a new group and changes have been made in the rules. Therefore it is recommended that you read them carefully.

A station may be worked *only once,* all bands 160 thru 10 meters. Phone and c.w. are part of the same contest. There is a 24 hour maximum operating time limit out of the 30 hour contest period.

Exchange: RS(T) and QTH. County for Wisconsin, state or province for others.

Scoring: Phone contacts count 1 point, c.w. contacts 2 points.

For Wis. - QSO points X (states + provinces + DX countries + Wis. counties) for final score.

Others - QSO points X Wis. counties. (max. of 72)

Novice/N and Techs/T multiply their final score by 2.5. (Foreign countries other than VE or VO count as a multiplier.)

Frequencies: CW - 50 KHz. up from bottom of each band. SSB - 3980, 7280, 14280, 21380, 28580. Novice 20 KHz. up from bottom of /N and /T bands.

Awards: To the highest score in each state, province and highest Club score. (To be presented at the Central Division Convention on June 16th in Milwaukee.)

Include a summary sheet with your log and a duplicate QSO check sheet if you make over 100 contacts.

Mailing deadline for entries is May 1st to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, P.O. Box 1072, Milwaukee, Wis. 53201.

Polish "SP" DX Contest

CW: April 7-8 SSB: April 21-22
Starts: 1500 GMT Saturday
Ends: 2400 GMT Sunday

The SP DX Contest for the past two years has been a two weekend affair, c.w. and phone, each independent of the other.

There are three categories. Single operator, single and all band. Multi-operator, single transmitter, all band only, and s.w.l.

Exchange: RS(T) plus a 3 figure QSO number starting with 001 for foreign stations. Polish stations will end RS(T) and their province. (Wojewodztwo) i.e. 579KA or 57KA.

Scoring: Each QSO with a SP/SQ/3Z station counts 3 points.

Multiplier: Each different province (WOJ) worked. Counted once only. (max. of 49)

Final Score: Total QSO points multiplied by number of provinces worked. The same station may be worked on each band for QSO points but not a multiplier.

Awards: Certificates to the top scoring stations in each category and mode in each continent, each country and each call area of Australia, Canada, Japan, USA and USSR.

S.w.l. entries must report the call of the Polish station as well as the station being worked. Scoring same as above.

Contest contacts may be credited for the PZK awards in lieu of QSL cards, providing they are confirmed in the logs of the SP stations, and an application is made.

A summary sheet is requested showing the scoring, a signed declaration and your name and address in Block Letters.

Entires must be postmarked no later than April 30th for c.w. and May 15th for phone. They go to: PZK Contest Committee, P.O. Box 320, 00-950 Warszawa, Poland.

ARCI QRP QSO Party
Starts: 1600 GMT Saturday, April 7
Ends: 2400 GMT Monday, April 8

Sponsored by the QRP Amateur Radio Club International this activity is open to both members and non-members. Same station may be worked once per band for QSO and multiplier credit.

Exchange: RS(T) and state, province or country. Members will include their QRP number, non-members their power input.

Scoring: Contacts with a member 3 points, non-members 2 points, stations other than W/VE 4 points. The same station may be worked on each band for QSO and multiplier credit.

Multiplier: Each state, province and country worked on each band.

There is also a power multiplier.
Over 100 watts input - 1.
25 to 100 watts input - 1.5
5 to 25 watts input - 2.
1 to 5 watts input - 3.
Less than one watt - 5.

Final Score: QSO points X (states + provinces + countries) X power multiplier.

Frequencies: CW - 1810, 3560, 7060, 14060, 21060, 28060, 50360. SSB-1810, 3985, 7285, 14285, 21385, 28885, 50385. Novice - 3710, 7110, 21110, 28110.

Awards: Certificates to the highest scoring station in each state, province or country. Additional awards depending on activity. And a certificate to the station showing three "skip" contacts using the lowest power.

Include a summary sheet showing the scoring, equipment description and other information.

Logs must be received by April 30th and go to: E. V. "Sandy" Blaize, W5TVW, 417 Ridgewood Drive, Metairie, LA 70001. Include a large s.a.s.e. for copy of results.

DX YL to NA YL Contest
CW: April 11-12 Phone: April 18-19
Starts: 1800 GMT Wednesday
Ends: 1800 GMT Thursday

This is strictly a YL affair in which DX YLs (inc. KH6 and KL7) will be working YLs on the North American continent. (KL7s however are not permitted to work VE5 thru VE8, but may work KH6s.) Contacts with OMs do not count.

All bands may be used but cross-band contacts are not permitted. The same station may be worked on each band for QSO credit. Avoid contacts on Net frequencies. Phone and c.w. are separate contests and require separate logs.

Exchange: QSO no., RS(T) and state, province or country.

Scoring: One point per QSO. Multiply total by number of states or countries worked.

There is a power multiplier of 1.25 for stations using 150 watts or less input. (300 p.e.p. on s.s.b.)

Final Score: QSOs X state or country multiplier X power multiplier if any.

Awards: Trophies for c.w. and for phone to winning DX and No. American stations. Plaques for the highest combined c.w. and phone scores to both DX and N.A. And certificates to 2nd and 3rd place winners.

Submit separate logs for each section and include a signed declaration, postmarked no later than April 28th, to be received by May 12th. To: Margaret Williams, WA4FTJ, 965 Redwood Circle, Virginia Beach, VA 23462

Bermuda Contest
Starts: 0001 GMT Saturday, April 21
Ends: 2400 GMT Sunday, April 22

This being the 20th Anniversary of the Radio Society of Bermuda contest, a new wrinkle has been added to the contest. West Germany has been added to the list of available countries in the contest.

Otherwise rules remain the same as last year. The operating period for scoring is limited to 36 hours out of the 48 hour contest period. Off times must be clearly indicated, and each period to be no less than 3 consecutive hours.

The same station may be worked once per band, either phone or c.w., but not on both modes on the same band. Cross band or cross mode also not permitted. And 40 meters s.s.b. contacts are not permitted between stations in Region 1 and Region 2.

Stations in the U.S. and Canada may work the United Kingdom, West Germany and Bermuda only. While U.K. and DL stations may work W/K, VE and VP9s. However as noted above, W/K and VEs are not permitted to work U.K. or DL stations on 40 meter s.s.b., but it's acceptable for W/K and VEs to work VP9s on 40 s.s.b.

Participation is for single operator stations only, and operation must be from their own residence.

Exchange: RS(T) and QTH. State for W/K, province for VE, county for U.K., DOK for the DLs. The VP9s will use Parishes.

Scoring: Each completed QSO, phone or c.w. is worth 5 points. Multiply total QSO points by the number of different VP9 stations worked on each band, 3.5 thru 28 MHz. for your final score. (Note: it's different stations not parishes.)

Awards: The top station in each US state, VE province, U.K. county and DL DOK will receive a printed award. The overall winners in the U.S., Canada, the U.K. and West Germany however get something more substantial, a Trophy to be presented at the Society's Annual Dinner held in October. Round trip air transportation plus hotel accomodations will be provided for the winners to accept their Trophies in Bermuda. (Trophy winners in the 1977 and 1978 contests however are not eligible.)

Check your log for duplicate contacts and multipliers, and a signed declaration that all rules and regulations have been observed.

All entries must be received before June 30th by the Radio Society of Bermuda, Contest Committee, P.O. Box 275, Hamilton 5, Bermuda.

Common Market DX Contest
C.W. - Saturday, April 21
Phone - Sunday, April 22
0600 to 2400 GMT both days.

The purpose of this contest is to increase activity between radio amateurs in the Common Market of Europe and the rest of the world.

There are 9 countries in the Common Market. Belgium, W. Germany, Italy, Denmark, Great Britian, Luxembourg, Ireland, Netherlands and France.

Classes: Single operation, All Band, Low Band (80 & 40) and High Band (20, 15, 10) And multi-operator, single xmtr. all band only.

Exchange: RS(T) plus QSO no. starting with 001.

Points: *For Common Market stations* - QSO with other CM stations, 1 point. With non CM stations inside Europe, 2 points. With other countries, 5 points.

For non CM stations - QSO with CM stations, 5 points. With other Europeans, 2 points. (With ON4UB, 25 points.)

Multiplier: *For CM* - Each DXCC country worked on each band.

For non CM - Each call area in the 9 Common Countries. (max. of 69 per band) And QSO with ON4UB.

Final Score: Total QSO points times the total multiplier from each band.

Awards: Certificates to the top scorers in each class, in each country, on each mode. Trophies to the top scoring single operator on each mode in the CM and outside the CM.

There is also a s.w.l. class. Score 5 points for each complete QSO reported. Certificates for both c.w. and phone.

Use separate log for each mode and for each band. Include a summary sheet and the usual signed declaration that all rules and regulations for excessive dupes and etc. will be enforced.

Mailing deadline is May 31st to: Michel Le Bon, ON4GO, Chee de Wavre 1349, B-1160 Brussels, Belgium.

County Hunters SSB Contest
Three Periods (GMT)
0001 to 0800 Saturday, April 21
1200 Sat. Apr. 21 to 0800 Sun. Apr. 22
1200 to 2400 Sunday, April 22

This is the 8th annual contest sponsored by the Mobile Amateur Radio Awards Club to increase activity for the County Awards program.

Emphasis is on mobile operation. Fixed stations may work other fixed stations but *once only,* regardless of band. Mobiles may be worked for each county or band change. Mobiles contacted on a county line counts as one contact but two multipliers.

Exchange: Signal report, county and state, country for DX stations.

Points: Contacts with a fixed/portable W/K or VE, 1 point. If it's a DX station, 5 points. (KH6 & KL7 are DX) Contacts with a mobile, 10 points. (The portable designation has been dropped and portables will be considered as fixed stations.)

Multiplier: Total U.S. counties plus VE stations worked. Counties are counted only once, but VE stations each time worked.

Final Score: Total QSO points times (counties plus VE stations) worked.

Frequencies: 3920 - 3940, 7220-7240, 14275 - 14295, 21375 - 21395, 29575 - 28595. Again this year there will be a "Mobile Window" as follows: 3925 - 3935, 7225 - 7235, 14280 - 14290. This space has been set aside for working mobiles only.

Awards: Certificates to the Top 10 fixed and mobile stations in the U.S. and Canada, and the top score in each DX country. Four plaques, overall winning U.S. or Canadian, DX station, and 1st and 2nd mobiles. Only single operator stations are eligible.

It is suggested you write to W0QWS for detailed rules, log and summary sheets. Include a large s.a.s.e.

All entries must be received by June 1st and go to: John Ferguson, W0QWS, 3820 Stonewall Ct. Independence, Missouri 64055

Dutch "PACC" Contest
Starts: 1000 GMT Saturday, April 28
Ends: 1600 GMT Sunday, April 29

It's the world working the Netherlands on all bands, 1.8 thru 28 MHz., on phone or c.w. The same station may be worked on each band for QSO and multiplier credit but on one mode only, either phone or c.w.

Exchange: RS(T) plus a QSO number starting with 001. PA/PI/PE stations will also include two letters indicating their province. (579001/GR)

There are 12 provinces: DR, FR, GD, GR, LB, NB, NH, OV, UT, YP, ZH, ZL. (Possible multiplier of 72.)

Scoring: Each completed QSO counts 1 point. DX stations determine their multiplier by the number of provinces worked on each band.

Final Score: Total number of QSOs multiplied by the sum of provinces worked on each band.

There is also a s.w.l. section. Call of the Dutch station heard and the serial number as well as the station being worked must be logged.

Awards: Certificates to the top scoring station, single operator, multi-operator and s.w.l. in each country and call areas of W/K, VE/VO, CE, JA, PY, VK, ZL and ZS.

Contacts made in the contest may be credited for the PACC 100 Award in lieu of QSL cards providing that the station claimed has submitted a log. Include 7 IRCs with your application to the Contest Manager.

Indicate the multiplier in your log only the first time it is worked on each band. Include a summary sheet showing the scoring, your name and address in Block Letters, and the usual signed declaration.

Mailing deadline for logs is June 15th to: VERNON Contest Manager, PA0DIN, Schoutstraat 15, NYMEGEN 6805, Netherlands.

Swiss "H - 26" Contest
Starts: 1500 GMT Saturday, April 28
Ends: 1700 GMT Sunday, April 29

The dates of this contest are changed each year since it is held two weeks after Easter. Unfortunately this year the dates fall on the same weekend as the fixed date of the PACC contest.

Contacts may be made on all bands, 10 thru 160 meters, phone or c.w. The same station may be worked on each band for QSO and multiplier credit but only on one mode, either phone or c.w.

Exchange: RS(T) plus a contact number starting with 001. Swiss stations will also include two letters indicating their Canton. (579001/ZH)

There are now 26 Cantons: AG, *AI,* AR, BE, *BL,* BS, FR, GE, GL, GR, *JU,* LU, NE, NW, *OW,* SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH. (Underlined indicate new Cantons)

Scoring: Each QSO is worth 3 points. Sum of Cantons worked on each band is your multiplier.

Final Score: Total QSO points multiplied by the sum of Cantons worked on each band. (A possible total of 26 on each band.)

Awards: Certificates to the top scorers in each country and each W/K and VE/VO call areas.

Indicate a Canton in a separate column for each band the first time it is worked. Check your log for duplicate contacts, include a summary sheet showing the scoring and etc., and your name and address in Block Letters. The usual signed declaration is also requested.

Mail your log within 30 days to: USKA Traffic Manager, K. Bindschedler, HB9MX, Strahleggweg 28, 8400 Winterthur, Switzerland.

Applications for the "H - 26" Award (only for contacts after January 1st 1979) go to: Walter Blatter, HB9ALF, Post Box 450, CH 6601, Locarno, Switzerland. (Write to HB9ALF for details)

ZERO District QSO Party
Starts: 2000 GMT Saturday, April 28
Ends: 0200 GMT Monday, April 30

This year's party is again sponsored by the Mississippi Valley Radio Club. It is planned to activate many of the rarer areas especially North Dakota counties. This activity covers a lot of territory so a lot of activity can be expected.

Stations outside the zero district may work zero stations only, but zeros may work both in and out of district stations. The same station may be worked once on each band and mode, and mobiles in each county change.

Exchange: County and ARRL section for zeros, ARRL section only for others.

Scoring: *For zeros:* Total QSOs multiplied by (ARRL sections + zero counties + DX countries) worked.

For others: Total QSOs multiplied by (zero ARRL sections + zero counties) worked.

Frequencies: C.W. - 3560, 7060, 14060, 21060, 28060. Phone - 3900, 7270, 14300, 21370, 28570. Novice-3735, 7125, 21125, 28125.

Awards: Certificates to the top scorers in each ARRL section and DX country. Also to Novice/Technicians and mobiles.

Mailing deadline is May 31st to: Mississippi Valley Radio Club, WØSI, 3518 W. Columbia, Davenport, Iowa 52804 (s.a.s.e. for log forms or copy of results not required)

Stamford VHF Party
Starts: 0000 GMT Sunday, April 1
Ends: 2400 GMT Monday, April 2

This is the annual Sherwood Road ARC 2-meter repeater contest. Although there is limited c.w. activity, it is a world-wide contest. The WAE country list will be used.

The same station may be worked *once only* on each different MHz. regardless of PL or tone burst configuration.

Exchange: QSO no., RS and QTH, Zip Code, Phone no., Social Security no., and blood type. For Sherwood Road residents please add house no.

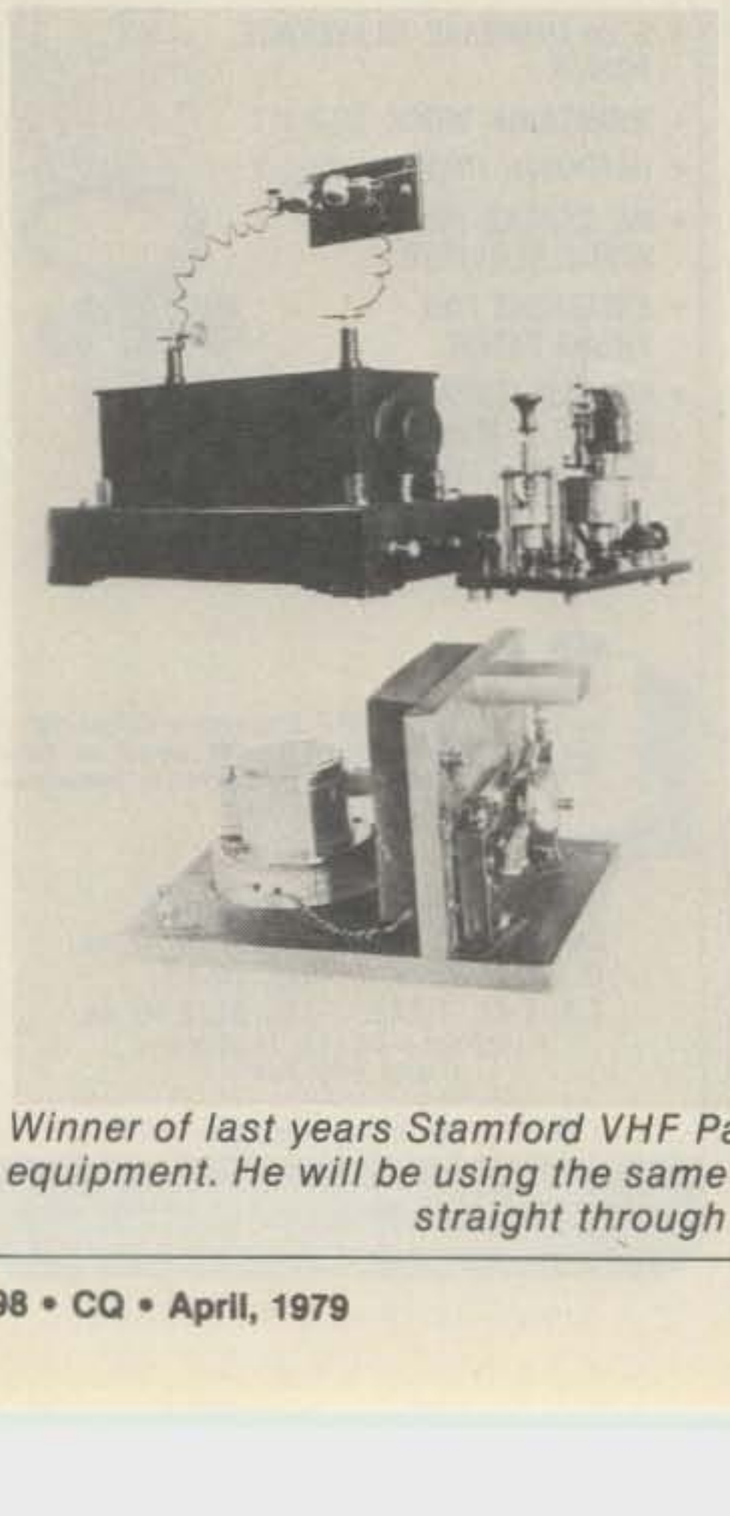
Scoring: One point per half QSO multiplied by zone no. added to the sum of the Sherwood Road ARC club members worked divided by shoe size then multiplied by age.

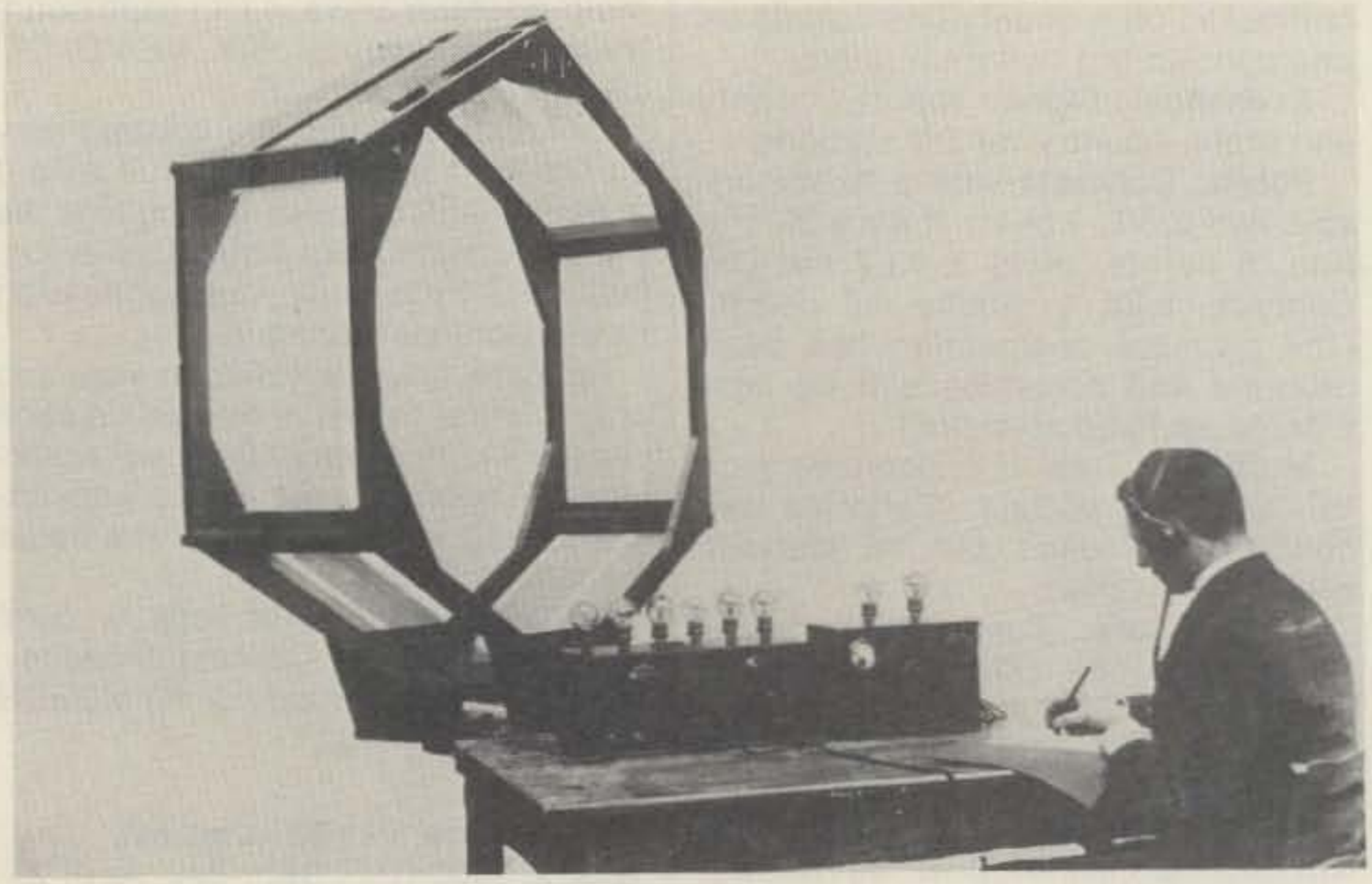
Frequencies: Any 2 meter repeater frequency combination.

Awards: Certificates will be sent at some future date to the individual submitting a different score than everyone else.

North American stations may get copies of the rules, log and summary sheets by sending a large SASE with sufficient postage to F. Anzalone, 14 Sherwood Road, Stamford, CT 06905. The rest will have to fake it.

Mailing deadline for your contest entry is April 3, 1979.





Winner of last years Stamford VHF Party, F. Anzalone, W1WY. Frank turned in a remarkable score using home brew equipment. He will be using the same basic station this year and plans to have his new linear ready to "burn" a hole straight through to Cos Cob. The linear is shown in its breadboard state.

modern electronics

9 Projects For Under $9

BY JEFFREY A. SANDLER*

Traveling chimes

Why settle for a simple one-sound source doorbell when you can build this interesting multi-sound chime set. When the doorbell button is pushed, your guest will be treated to a six-tone chime, with each tone coming from a different location.

Each tone is generated by a separate oscillator built around a pair of gates. The oscillators are gated on by a six stage time delay circuit. Each stage of the time delay is built around one element of a 4050 hex buffer, and has an independent time delay control. These controls let you vary the length of each tone.

Because each stage of the time delay circuit inverts—due to circuit configuration, not the element itself—the tone generators connected to points A, C and E are built around 4011 NAND gates while those connected to points B, D and F are built around 4001 NOR gates.

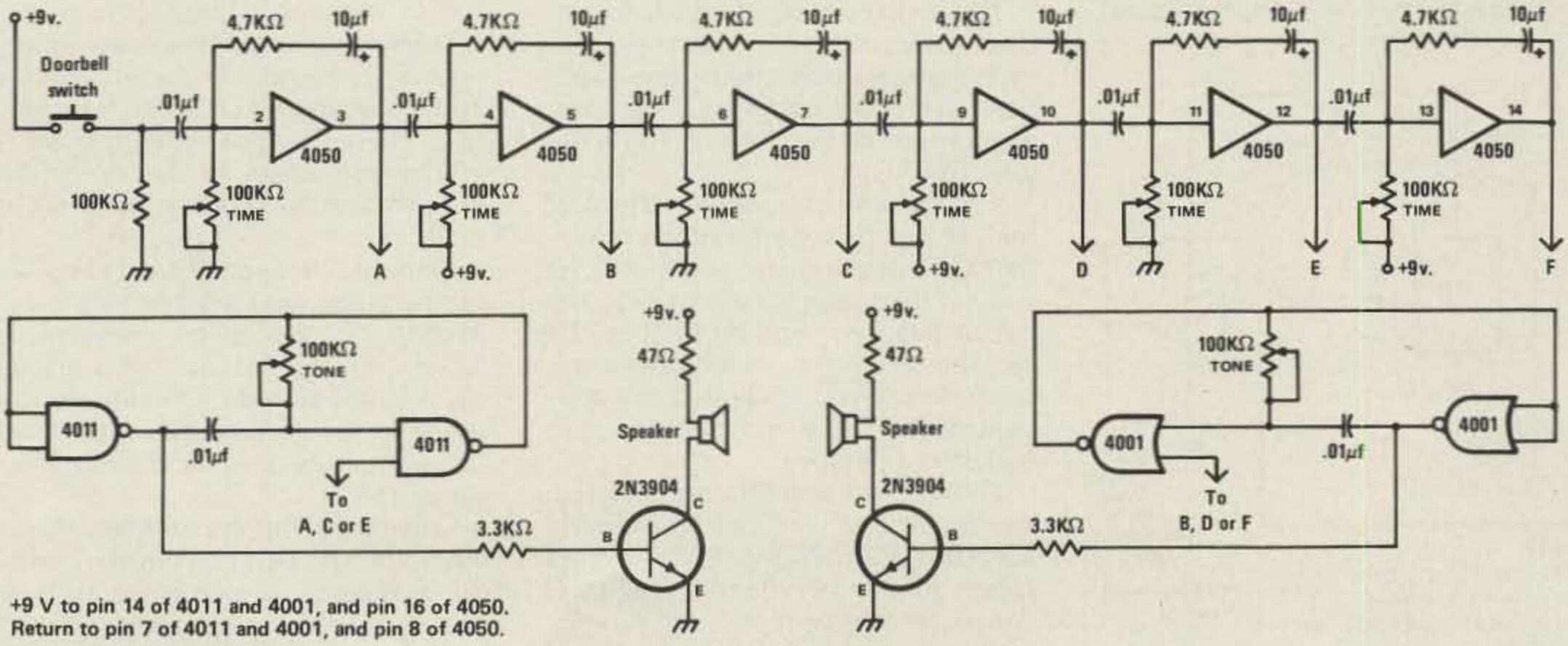
When the doorbell button is pushed, the tone generators are turned on in sequence, each for the period determined by the individual controls. If you prefer, you can use one or two of the 4050 stages to produce silent pauses. You might, for example, use five generators to produce three tones, a pause, then two final tones.

Each generator's tone can be individually set by adjusting a 100K variable resistor. Although a 2N3904 is specified for the audio amplifier, you can use any suitable NPN transistor. Most any speaker can be used.

The circuit shown produces a six-tone chime. However, you can use additional 4050 hex buffer chips to the time delay generator, and 4001/4011 audio oscillators. There's really no limit to the number of tones and pauses in the chimes you build.

Construction is straightforward, and the parts layout isn't critical. However, if one or more elements of any IC is not used in your chime circuit, make sure to tie the input lines to ground or the supply rail. This will prevent self-oscillation in the element, with its added current drain and possible effects on circuit operation.

CMOS logic draws very little current in standby. In normal use, a nine-volt battery will provide power for a period almost equal to its shelf life.



*10 Idell Rd., Valley Stream NY 11580

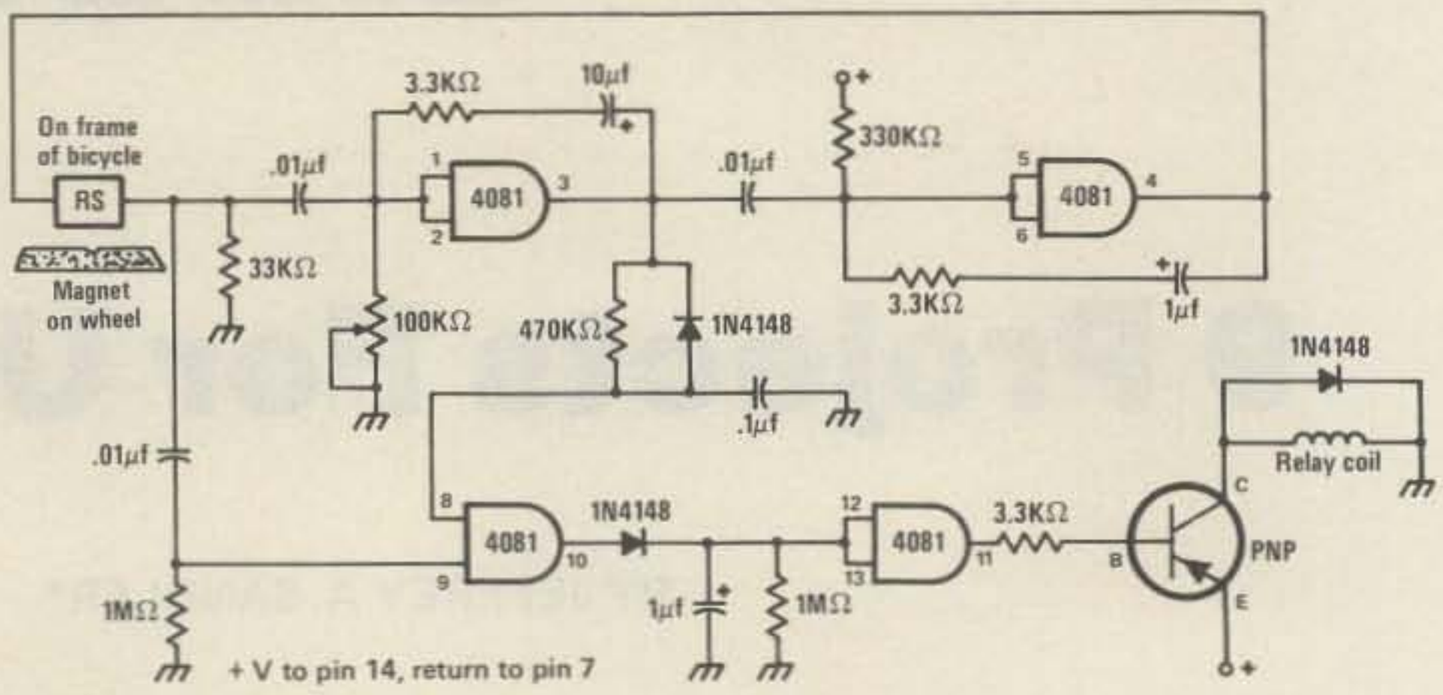
Speed control

Now that summer's half gone, you've probably gotten yourself into pretty decent shape. Now's the time to get into some long distance, sustained-speed bicycling. All you need is this handy minimum-speed alarm to keep you pedaling at a nice, steady pace.

All you have to do is set the control to the minimum speed you want. Then, whenever the speed falls below the preset level, your horn or any other electrical signaling device will let you know. Just pick up the pace a little, and the signaling will stop.

The circuit is built around a 4081 CMOS integrated circuit. Bicycle speed is measured with a permanent magnet attached to the wheel passing across a reed switch attached to the frame. Each revolution of the wheel will cause the reed switch to close once. The faster the wheel turns, the more times per minute the reed switch will close.

The rate at which the reed switch closes determines the level of the dc voltage produced by the circuit. When it falls below the preset level, the output transistor turns on. As shown in the diagram, turning on the transistor energizes a relay, the contacts of which can be used to operate any signaling device. The actual connects are left to you.



Construction is straightforward, and parts layout isn't critical. However, some care should be taken in placing the bar magnet and reed switch. The magnet should be located between four and six inches out from the axle and along the spoke. For best results, it should be mounted on a non-magnetic material which is in turn attached to the wheel.

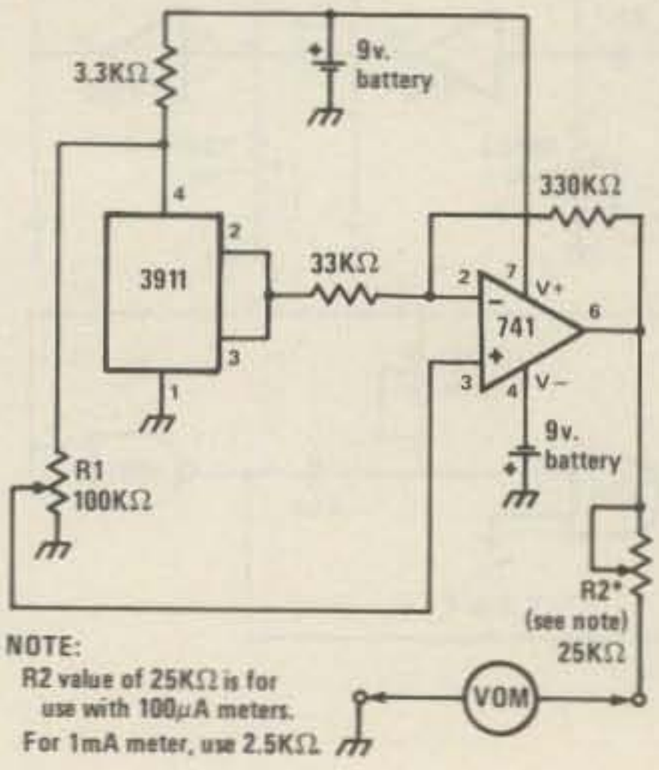
The reed switch should be positioned on the fork so that the magnet passes directly beside it, with a gap of about one-eighth inch between the two. The reed switch itself should be mounted on a non-magnetic material attached to the fork. The idea is to keep both the magnet and reed switch as far removed from the metal in the bike as possible.

You can use almost any small signal PNP transistor with ratings high enough to handle the relay used. The circuit can be powered by a nine-volt transistor battery. If your bike is equipped with an electric horn, you can connect the relay in parallel with the horn button.

Electronic thermometer

If you have a VOM or a sensitive milliammeter handy, you can build this nifty thermometer for about $5, and less if you have a well-stocked junk box.

The heart of the thermometer is the 3911 IC. This amazing device has an output equal to 10 mV/degrees Kelvin.



So, at zero degrees Celcius, the output is 2.73 volts. And since a degree Kelvin is the same as a degree Celcius—the base differs, however, with zero Kelvin equal to -273 Celcius—a one degree Celcius change results in a 10 mV change in the 3911 output.

This swing can be amplified to produce greater output change per degree change. In this circuit, the amplification is provided by a 741 op-amp. The output of the 741 is 0.1 volt/degree Celcius.

It is the low impedance output of the 741 that drives your meter movement. To expand the scale, and let you set the meter needle to zero, the circuit has two controls built-in. R1 sets the zero point, which can be any temperature you wish. But, it's convenient to make your meter zero equal zero degrees.

You can set your thermometer to readout in degrees C or F by properly adjusting R2, which sets the scaling factor. Remember that one degree C equals 5/9 degree F.

Calibrating the thermometer circuit is easy, but does require an accurate mercury thermometer. The easiest way is to use your refrigerator or freezer. Adjust the refrigerator or freezer controls to get zero degrees C or F. Then put the thermometer circuit in and wait till it cools to zero.

Once you've set the zero point, take the circuit out of the refrigerator and allow to warm to room temperature. Then place the circuit in an oven you've preheated to the maximum temperature you want your meter to read.

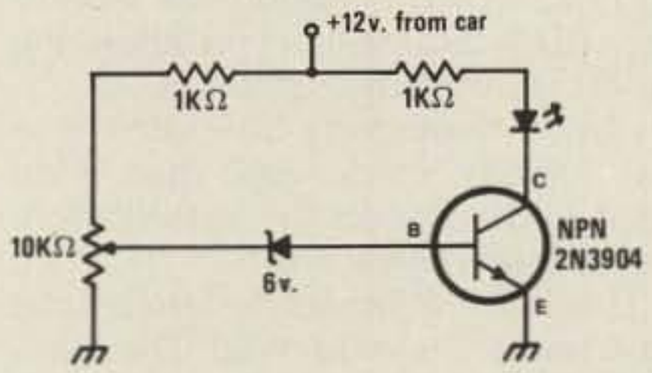
Once the 3911 stabilizes at the oven temperature, set R2 for full-scale deflection of the meter movement. Since the output of the 3911 is linear, all you have to do to calibrate the meter is divide the scale into equal divisions from zero to the top temperature.

Construction of the thermometer is easy, and the parts layout isn't critical. The circuit can be powered by a pair of nine-volt batteries.

Auto limit lights

Although some cars still have an old-fashioned ammeter, most come with idiot lights. While these idiot lights will let you know when your car's electrical system has failed, they can't tell you much about what's happening under the hood.

You can keep tabs on your car's electrical system by adding a set of these easy-to-build voltage limit lights. The number of limit lights you add depends on how exact you want the readout to be.



It is possible to set up a system of limit lights that can readout the battery voltage in steps as small as one-tenth volt. However, a practical approach might be to use the limit lights to monitor battery voltage in one volt steps.

A better way to use the lights is measure the voltages that normally occur under your operating conditions. If they seem okay, set the lights to a point just below the normal voltage for each condition. Then, if, for example, the *cranking* lamp goes on when you start the engine, you know everything is okay. But, if the lamp stays off, you know the voltage has fallen below the normal cranking level, and it's time to check the electrical system.

Using this approach, you may want a separate light for engine cranking, normal idle with no load, normal idle with a heavy load—headlights, air conditioner, etc., normal highway speed with no load, and normal highway speed with a heavy load. You may also want to add a light for the engine-off, accessories-on voltage.

The circuit for each light is self-contained, so you can build as many as you wish. The parts layout isn't critical. The overvoltage condition is indicated by an LED in the collector circuit. You can use any LED you have handy. Although a 2N3904 is specified, just about any small signal NPN will work.

Speed trap

If you're bothered by friends and neighbors driving too fast down your driveway, here's a nifty speed trap that should interest you. It requires a pair of detectors, which can be of any design you'd like. The only requirement is that each detector close a set of contacts when the car passes by or over it. The detectors, which can be photocells or air actuated solenoids, for example, should be positioned a reasonable, and measured distance from each other.

The circuit is built around a pair of AND gates, each wired as a one-shot flip-flop. When a car actuates one of the detectors, its contacts, K1 or K2 in the diagram, close triggering the first one-shot. Its on-time is set by R1* and C1*. For most applications, R1* can be a l meg variable resistor. However, its value will depend on the distance between the detectors. Wider distances will require larger resistances.

If the car passes over the second detector before the first one-shot has reset, the second one-shot will be triggered. This will turn on the NPN transistor switch, which you can use to close a relay or other device to operate your signaling alarm.

The time period during which your signaling alarm runs is determined by R2* and C2*. the values shown in the diagram will provide about three seconds of alarm.

Operation of your speed trap will depend on how accurately you set the first one-shot's on-time. To do this, you'll have to convert distance into time.

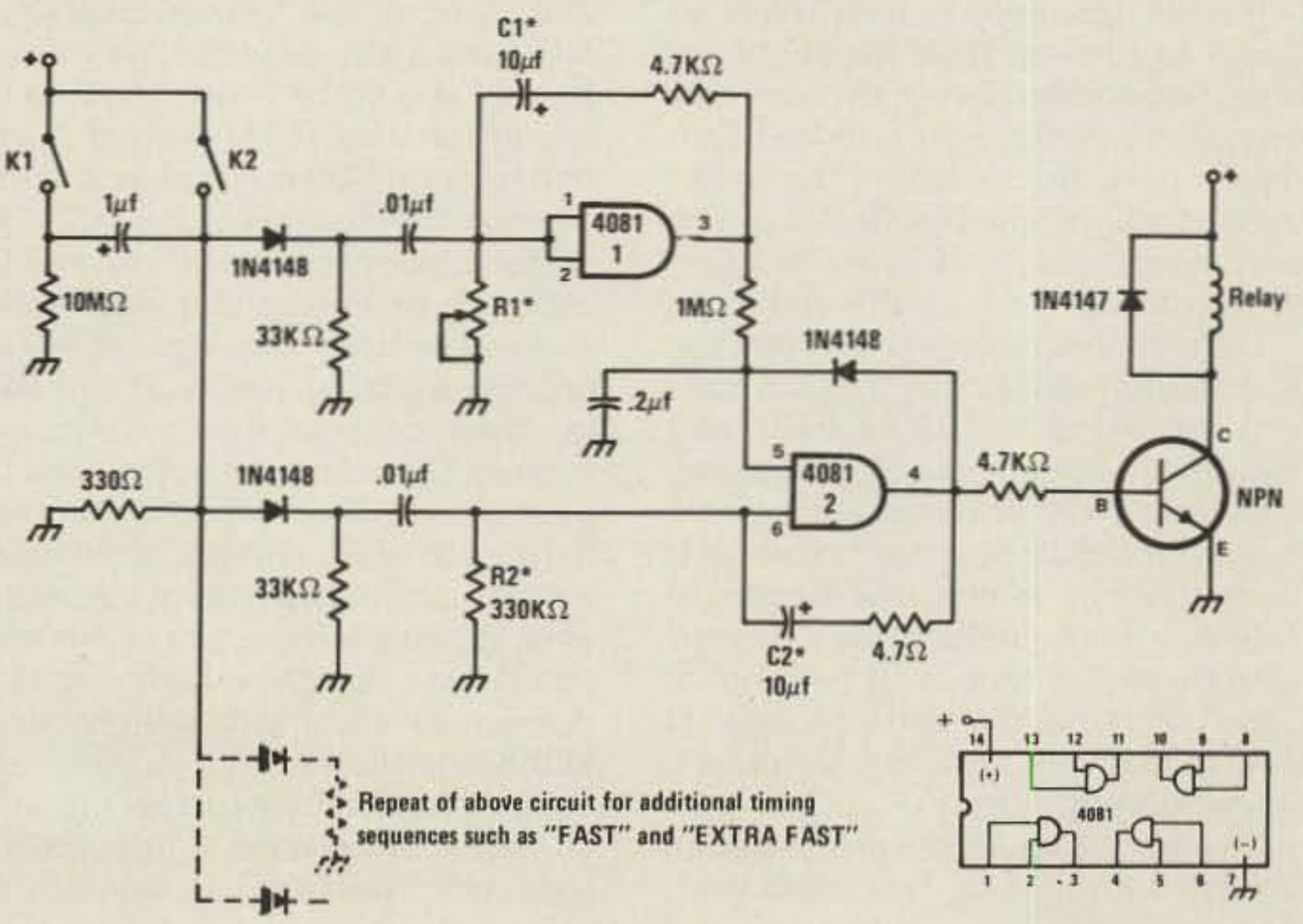
One mile per hour is equal to 5280 feet per hour, or 88 feet per minute, or 1.467 feet per second. To find the distance covered per second at any given speed, just multiply these distances by the speed. For example, at 10 miles per hour, a car will travel 14.67 feet per second.

One approach to locating your detectors is to calculate the distance covered in one second at the speed limit you want to set. So, for a 15 mile per hour top speed, you'd set the detectors 22 feet apart.

If the physical layout of your driveway dictates some given distance between the detectors, you'll have to calculate the time needed to cover the distance at the speed limit. Just multiply the speed limit by 1.467, and divide the distance between the detectors by the result.

If, for example, your detectors were 23 feet apart and you wanted to set an 18 mph limit, divide 23 by the result of multiplying 18 by 1.467. Dividing 23 by 26.4 gives you an elapsed time of 0.87 seconds.

Circuit construction isn't critical, but to insure accurate operation, use high quality parts. You can use any small signal NPN you have handy that has ratings high enough to handle the relay or alarm circuit you use. If you leave any of the 4081 gates unused, make sure to tie the input lines to ground or the supply rail to prevent unwanted self-oscillation. A standard nine-volt transistor battery will provide ample power for your speed trap.



Flashing control

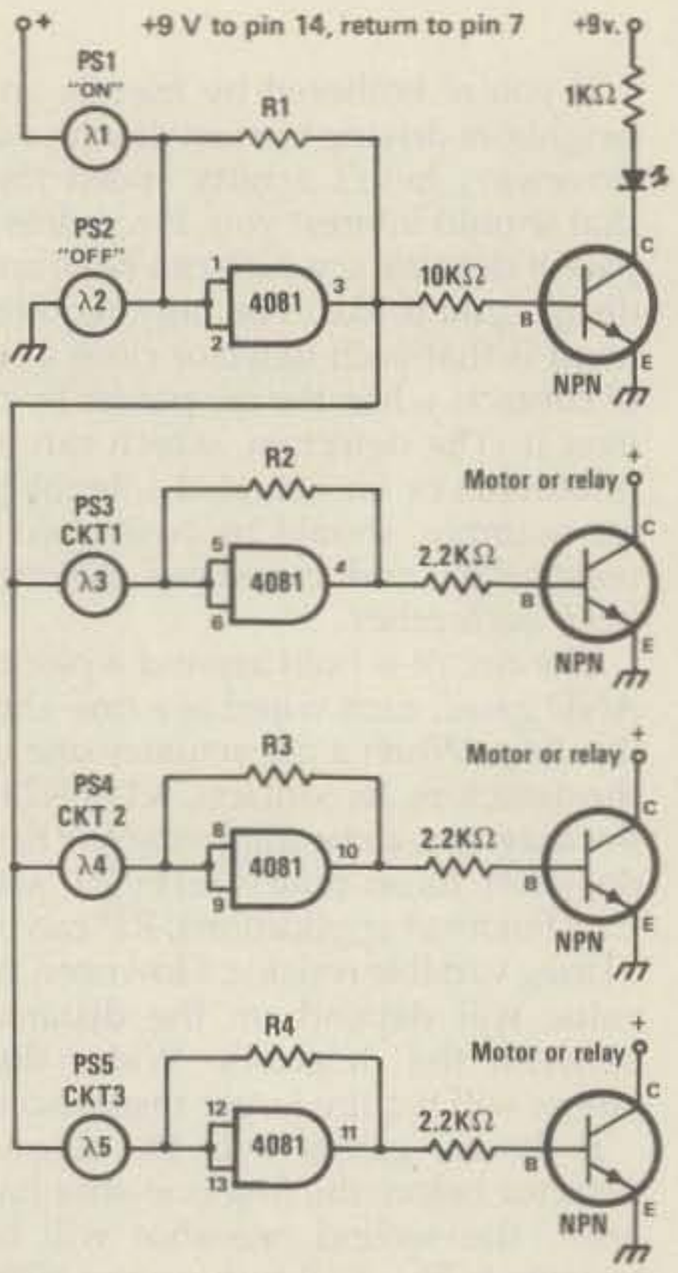
If you're into building powered models of trains or boats, or want to remotely control a powered toy, you'll like this novel idea. It's a wireless remote control system that doesn't use a radio. Rather, it uses a beam of light to control movement.

The circuit uses photocells and battery-powered CMOS logic to turn small motors on and off. The circuit itself is switched on and off by a light-beam actuated flip-flop.

Although the circuit diagram shows 4081 gates, you can use 4011 gates, 4010 inverters, or 4050 buffers as well. For best results, though, use the B-series CMOS integrated circuits. You can use 2N2222A transistors for most small loads, but if they run hot, you'll have to use power transistors.

The entire circuit can be powered by a nine-volt transistor battery. You may find, however, that the motor or relay loads connected to the transistors will require a separate supply.

Construction is straightforward, and parts layout isn't critical. The values of R1, R2, R3 and R4 must be selected so that each gate flips logic state only when the associated photocell is struck by a flashlight beam.



This light-control circuit works best indoors where the ambient light is considerably less bright than in direct sunlight. A reasonably bright flashlight beam is required to trigger the circuit. The beam, however, should be as narrow as possible to prevent triggering more than one leg of the circuit. You may have to place a shield over the flashlight lens to restrict the beam width.

In operation, you simply shine your light beam on photocell PS1, activating the circuit. Then, shine the light on PS3, PS4 or PS5 to activate the specific motor or action you want. When you're finished, shine the light on PS2, which shuts off the circuit. An LED indicator lets you know the on-off status of the circuit.

CMOS draws very little current in the standby mode. So, there's no need to disconnect the battery from the circuit when its off.

This is a fun project designed to let your imagination run wild. The number of controlled devices can be increased by simply adding more photocells, gates and transistors. Instead of controlling a model or toy, you can use the circuit to control appliances, audio equipment, electronic locks—almost anything that runs on electricity.

Lights on

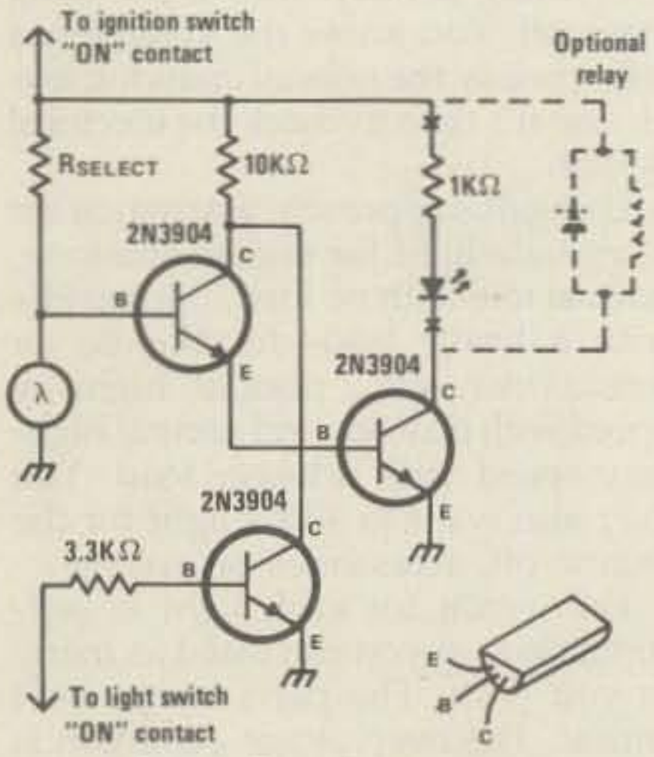
It's not uncommon for drivers to forget to turn on their headlights at dusk, especially during the summer months when daylight lasts well into the evening. But on longer trips driving at dusk without headlights can be very dangerous, and in some localities, can earn you a traffic ticket.

Here's an inexpensive you-left-your-lights-off monitor that can save you the cost of that traffic ticket, and may even keep you out of a nasty accident. The circuit uses just three transistors and a photocell to monitor your ignition switch, the headlight switch, and the ambient light. If your ignition switch is on, and your headlights off, and the ambient light is darker than the level you've preset, the alarm will turn on.

The circuit isn't critical. Although 2N3904 transistors are specified, 2N2222 or most any other small signal NPN will work as well. The value of Rselect should be chosen so that the circuit actuates at the desired degree of darkness. You can replace it with a 1 meg variable resistor if you'd like.

The circuit can be built with an LED indicator, or if you prefer, with a relay that can be used to energize a buzzer or other signaling device. If you want to automate your lights, you could connect the relay in parallel with the light switch. Then, when the ambient light grew dark enough, your lights would automatically turn on. However, if you use the alarm in this way, you'll have to add a delay circuit to prevent on-coming headlights from killing the circuit.

The photocell should be mounted so that it is exposed to the ambient light, but away from any lamps on the car, and unaffected by other lights. An ideal location is under the dash looking at the floor, where it can monitor ambient light without interference.



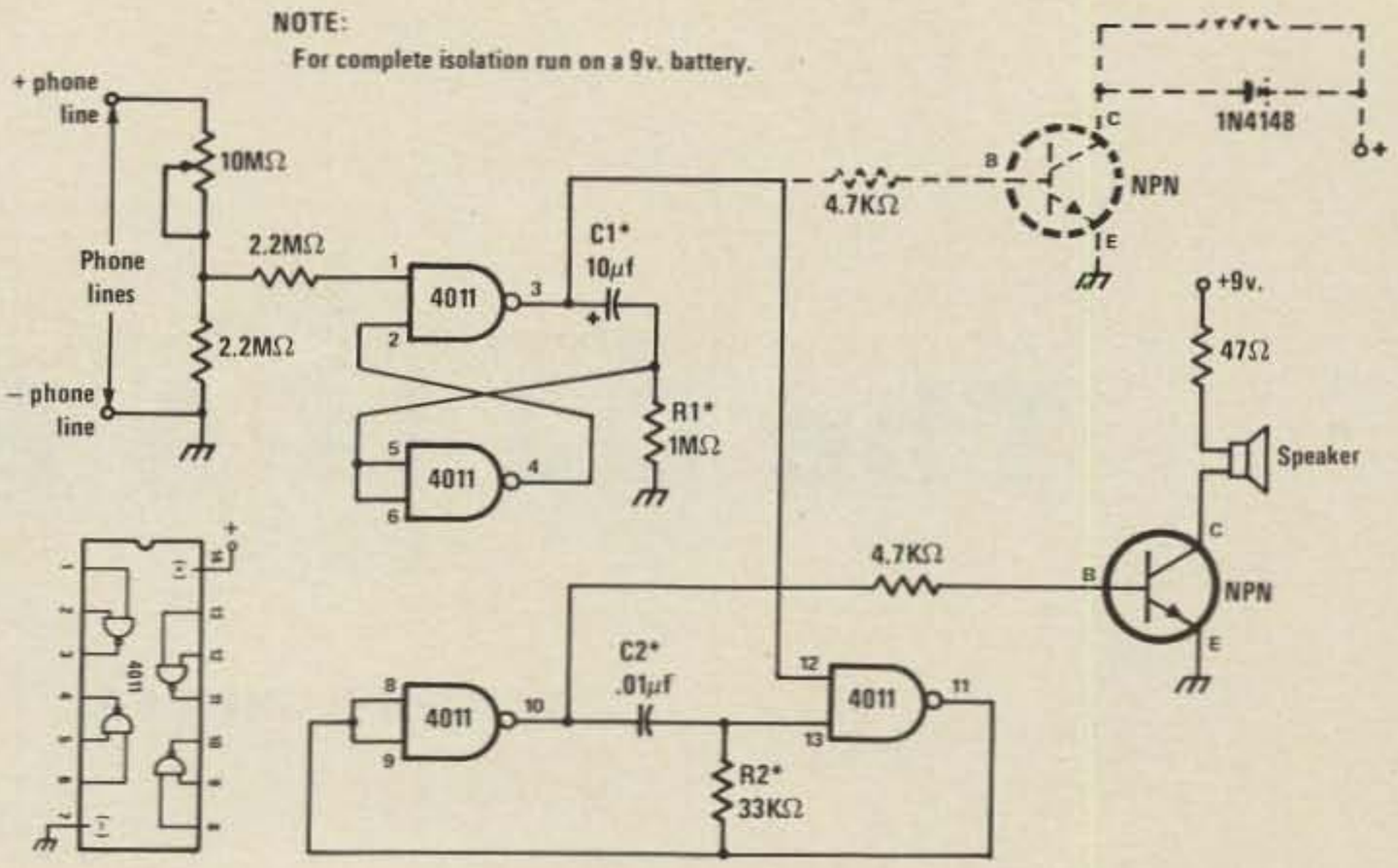
Telephone ESP

Have you ever picked up your telephone only to find someone on the line waiting to talk to you? It's eerie. And imagine how your caller must feel. No ringing at the other end. There's only the sound of switching at the exchange, then the voice of the person being called.

Of course, it happens only once in a great while. The odds of picking up your phone just as a call is coming in are astronomical. But, with this handy circuit you can really improve those odds—if your phone company uses a system that connects the line before ringing the bell. Even if yours rings the instant the connection is made, the circuit can still be used for remote signaling.

Normally, when an incoming call arrives, the voltage across the phone line drops. If the incoming call arrives between rings, you can use the voltage drop to trigger an alarm.

The circuit is built around a 4011 quad NAND gate. The input impedance is in the megohm range, so there's no phone-line loading problems. Powering the circuit with a nine-volt battery will eliminate any problems of hum feeding back into the line. Bear in mind, however, that the telephone company does not look kindly on unapproved devices being connected across their lines.



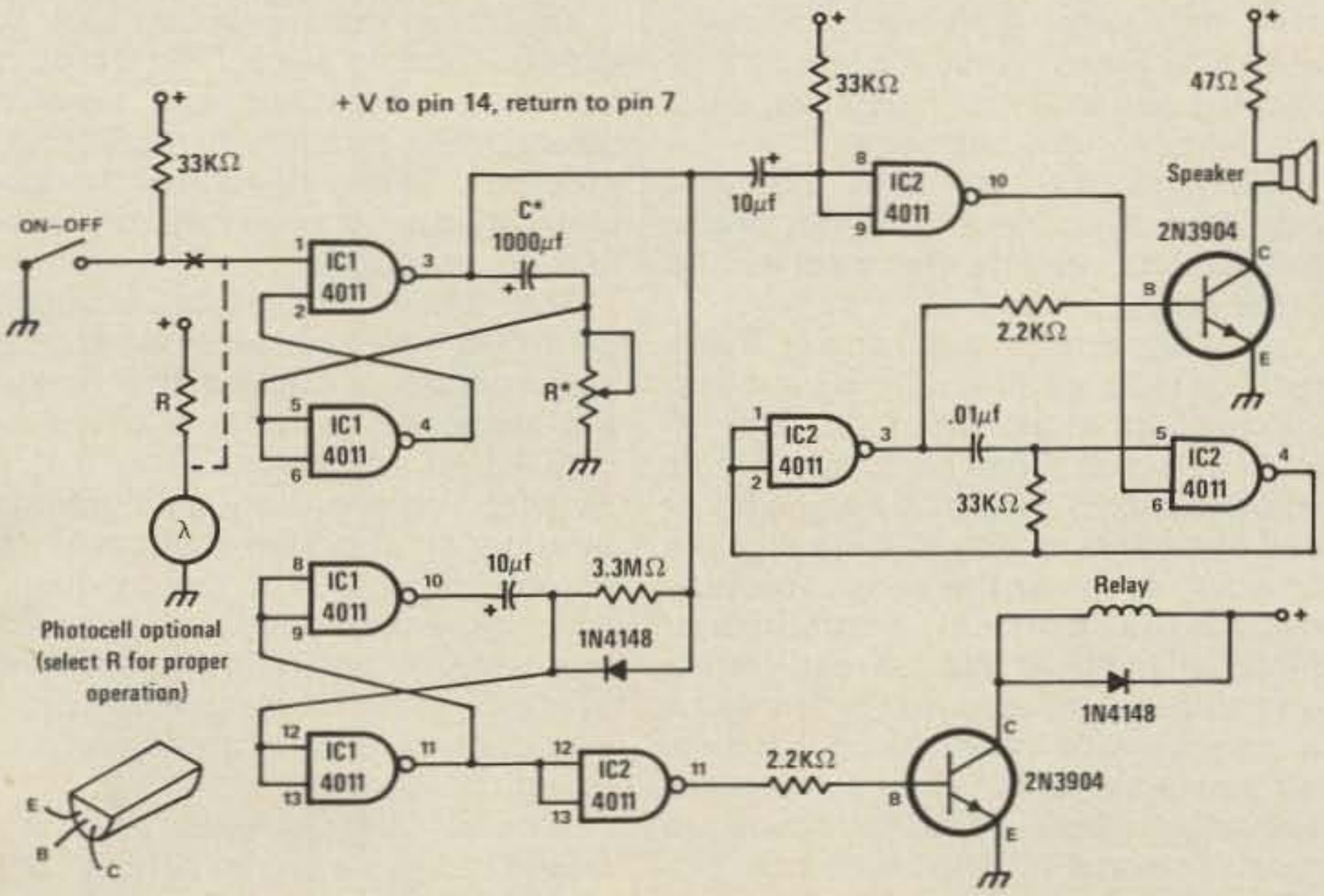
The alarm will sound for a period of time set by the values of R1* and C1*. The values shown will give you about 10 seconds of alarm tone. The frequency of the tone is determined by the values of R2* and C2*. You can use any handy NPN transistor—a 2N2222 or a 2N3904 will work well.

If you'd rather use some remote signaling device, such as a gong or lamp, you can eliminate the audio oscillator and transistor amplifier, replacing them with the relay circuit shown in dashed line.

TV turnoff

Here's a time-delay tv turnoff with a twist—it beeps about a half-minute before turnoff to give you time to recycle the timer, or lock it on. The warning gives you time to take action before the tv goes off—usually at the most dramatic moment in the show you're watching.

The circuit can be mounted inside the tv cabinet with the control switch connected by cable. Or, you can build the circuit into a small box kept at chairside, with only the relay inside the tv cabinet. One other alternative is to substitute a photocell for the on-off switch. Then, all of the electronics can be left in the tv cabinet. All you'd need to control the set would be a small flashlight.



The circuit itself is built around a pair of 4011 CMOS ICs. Parts layout isn't critical. If you can find low-voltage dc inside the tv, it can be used to power the circuit. Otherwise, a nine-volt battery will work well.

The timer is operated by momentarily closing the on-off switch. Your tv will turn on when the switch is closed. The time delay begins when the switch is opened. The delay time, in seconds, is set by adjusting R*, and is roughly equal to the value of R* in ohms multiplied by the value of C* in farads. Using the 1000 mfd capacitor shown, an R* of 3.6 megohms will give you a one-hour delay. For a one-half hour delay, R* should be 1.3 megohms.

Another shattered belief!

The DJ Is A Robot

BY JOHN E. SHEPLER*

The record you are listening to fades and a pleasant voice takes its place. "Good Morning, Rockford. This is Fred, and this morning I'll have the best in album-rock for you on WZOK-97."

You are listening to the all night show on a local f.m. station and Fred could be any of a thousand disc jockeys working the wee-hours shifts across the country. That is, except for one thing . . . Fred is a *robot.*

*1408 Comanche Drive, Rockford IL 61107

"Fred," ready for his next show.

Surprised? You should be! A lot of work has gone into making Fred just as warm and friendly as the human DJ you imagine him to be. I see you still have your doubts, so let's take a look inside the station and see what is going on.

The control studio where nearly all of the station's programming originates is dark, but around the corner is a brightly lit room containing several large racks of equipment. As we move in for a closer look, you can make out four reel-to-reel tape recorders and what appear to be two oversized slide projectors mounted vertically. There is also a control panel of some sort and four machines, each containing a tape cartridge.

Suddenly, the tape deck that was playing a song abruptly stops, and a voice starts reading the weather. Its Fred! But where is he?

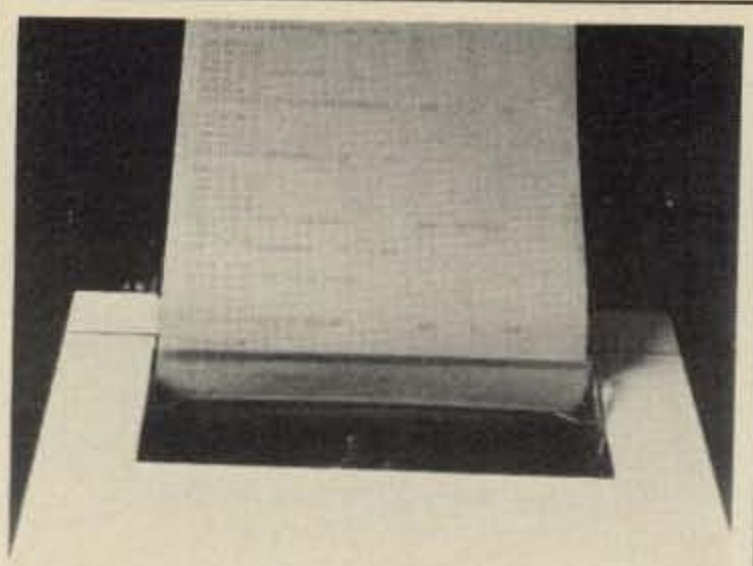
Actually, Fred is everywhere. Those reels of tape are produced by a music syndication studio which provides 30 to 40 selected songs on a tape. Fred's voice is mixed in at the beginning or end of each selection to announce the title and artist of the song. The tape cartridges contain promotional material such as station call letters and slogans, all recorded by the same announcer who provided Fred's voice on the music tapes. There is even one cartridge where Fred introduces a local personality who reads the current weather forecast.

A *digital programmer* or "brain" makes sure everything runs in the correct order. When a song finishes playing, a subaudible 25 Hz tone recorded on the tape tells the brain to stop that deck and go to the next event. This could be a song on another reel or one of the cart decks. The cartridges are similar to the familiar 8-track tapes except that they contain tones recorded on a special cue track of the tape. This allows the machine to play an announcement and then automatically stop or "cue up" to the beginning of that announcement so it will be ready to play again. Some of these cartridges are only twenty seconds long.

Those big machines that look like slide projectors each hold 24 of the same cartridges and can randomly select them much like records in a juke box. These cartridges are used primarily for commercials and public service messages.

The "brain" is a digital sequencer with over two thousand steps. Each step contains a single instruction and the steps run in order starting with "0000" at midnight. The brain's *magnetic core memory* is programmed by entering the step number on the control console and then indicating which tape source is to be activated at that step. In addition, the sequencer contains a digital clock to adjust the sequence of operations if everything is not on schedule.

Like all disc jockeys, Fred is required to keep a record or "log" of his program. This is taken care of by digitally encoding information about each announcement or commercial on



"Fred's" program log in the teleprinter.

the cue tracks of the cartridges. These tone bursts are not heard over the air but are decoded to provide a printed record of what has played and the exact time it ran.

As we stand watching Fred do his act, it seems difficult to believe that someone is not hiding inside with a microphone. A song ends and we see the green start light of a cart machine come on. "This is Fred inviting you to listen to my good friend John Larson tomorrow afternoon on Stereo 97." Then another reel starts and the voice continues: "Here's the latest from Jefferson Starship."

Is Fred a freak...a one-of-a-kind machine? By all means, **no!** There are literally hundreds of "Freds" running radio stations all over the world. Some are sophisticated enough to give exact time announcements and run contests on the air.

By doing the routine mechanical jobs, these machines free their human counterparts to do the really creative work of **producing** radio shows. In turn, many stations have taken to prerecording their own music tapes and announcements, giving the automatic programmers all sorts of wild and crazy personalities.

So, the next time you're driving along and happen to tune in a new station....listen closely. Is it live...or is it Fred?

"Fred's" control console.

Showcase

Yaesu's FT-225RD All-Mode Two-Meter Transceiver

A new state-of-the-art 2-meter all mode transceiver, the FT-225RD, has been added to Yaesu's line of amateur radio equipment.

The new transceiver covers the entire 4 MHz of two meters and provides for u.s.b., l.s.b., c.w., f.m. and a.m. Power output is variable from 1 to 25 watts. Squelch, VOX. p.t.t., semi-breakin c.w. with sidetone and tone burst are standard features of the FT-225RD. A noise blanker permits mobile s.s.b. operation and a discriminator center meter allow precise zeroing on f.m. signals. Repeater splits are the standard 600 kHz, although any split up to 1000 kHz is possible with an optional cyrstal.

The transceiver utilizes high quality plug-in circuit boards throughout and an optional memory unit enables the storage and recall of any frequency within the range of the unit. This allows instant programmable QSY to a favorite repeater or calling frequency with just a flick of the switch.

There is much more. For further information contact Yaesu Corp. at 15954 Downey Ave., P.O. Box 498, Paramount CA 90723, or circle number 72 on the reader service card.

A Microprocessor Book—For Experts

Cambridge University Press has recently released "The Microprocessor and Its Application," edited by D. Aspinall. The book contains fifteen chapters written by a staff of eleven authors.

According to the dust jacket blurb "the topics divide into three areas. First, the properties of popular microprocessor components and techniques for their use for their use are introduced. Second, the all-important management of projects involving the interworking of hardware and software is discussed, illustrated by an application to instrumentation. Finally, the story turns to the attainment of very high performance by advanced microprogrammable components and assemblies of popular microprocessor components."

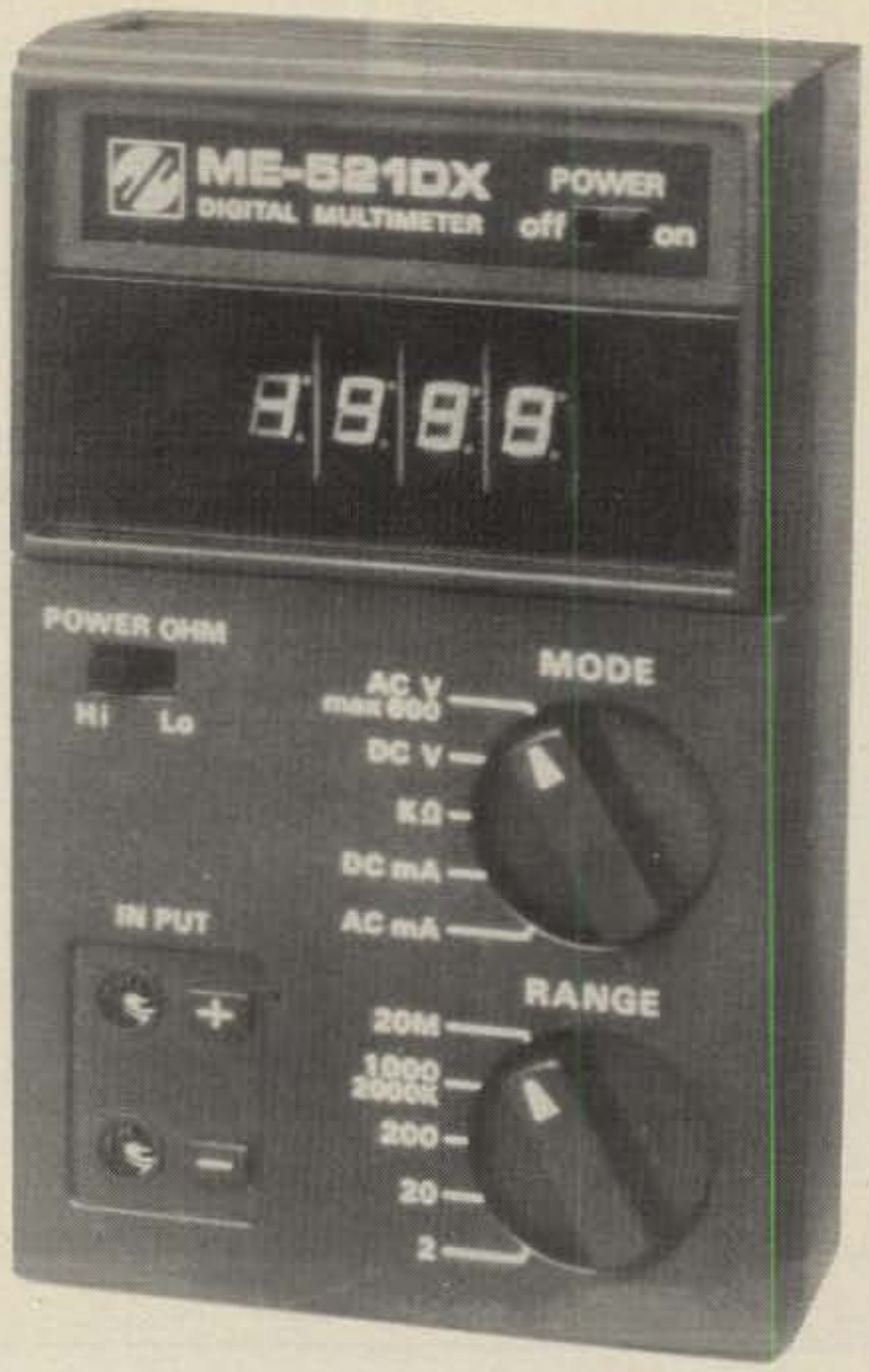
"The Microprocessor and Its Application" is available from Cambridge University Press, 32 E. 57th St., New York NY 10022 for $29.50. For more information, circle number 68 on the reader service card.

Soar Electronics' Model ME-521DX Portable Digital Multimeter

The Model ME-521DX multimeter is a 3-½ digit battery-powered unit. It features a high-low ohm switch for all ranges, five function modes, automatic zero adjustment, automatic polarity and overlaod protection.

Low current drain assures long battery life and thousands of measurements without the need for battery replacement. This accurate and portable device (27 oz.) has voltage measuring capability to 1000 v.d.c. and 600 v.a.c., current measurement range to 1000 mA (a.c. or d.c.) and a resistance measurement range to 20 megohms. Accuracy is 0.5% (typical). This price is $115.

To order yours, contact Soar Corp., 813 2nd St., Ronkonkoma NY 11779, or circle number 74 on the reader service card for more information.



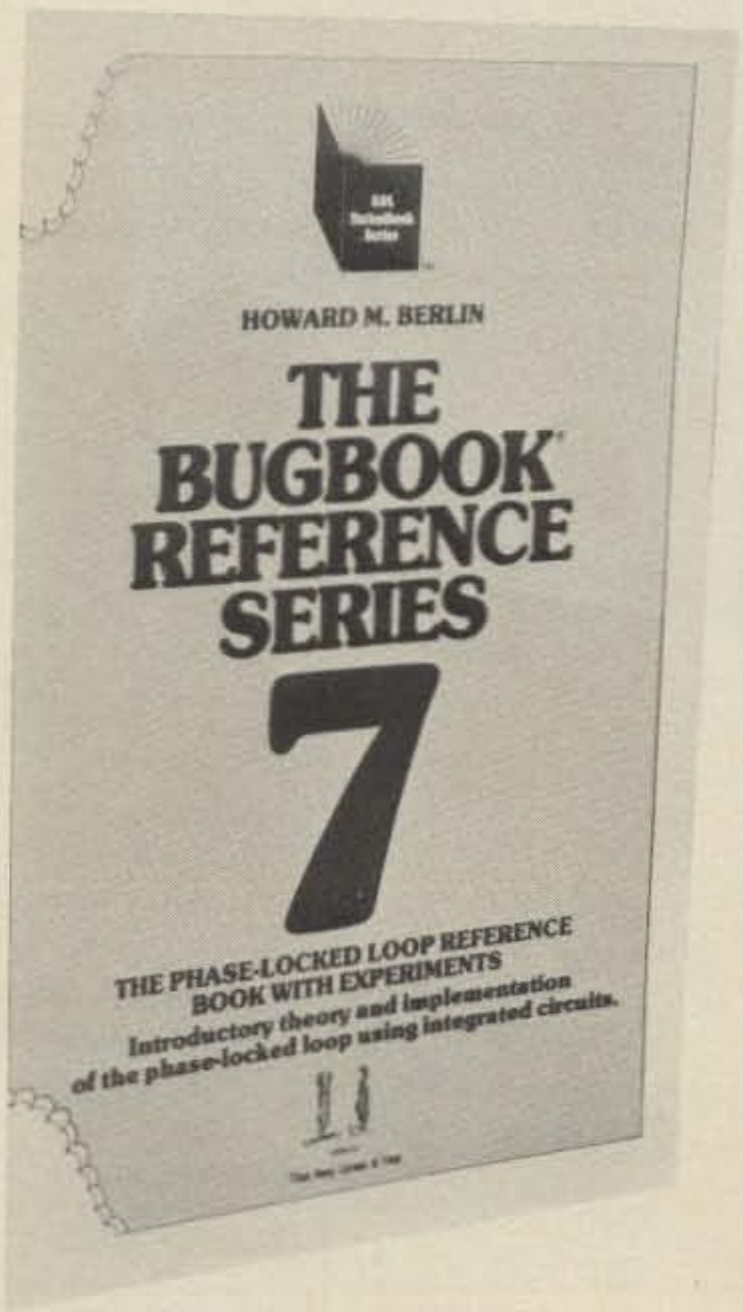
Two New Bugbooks®

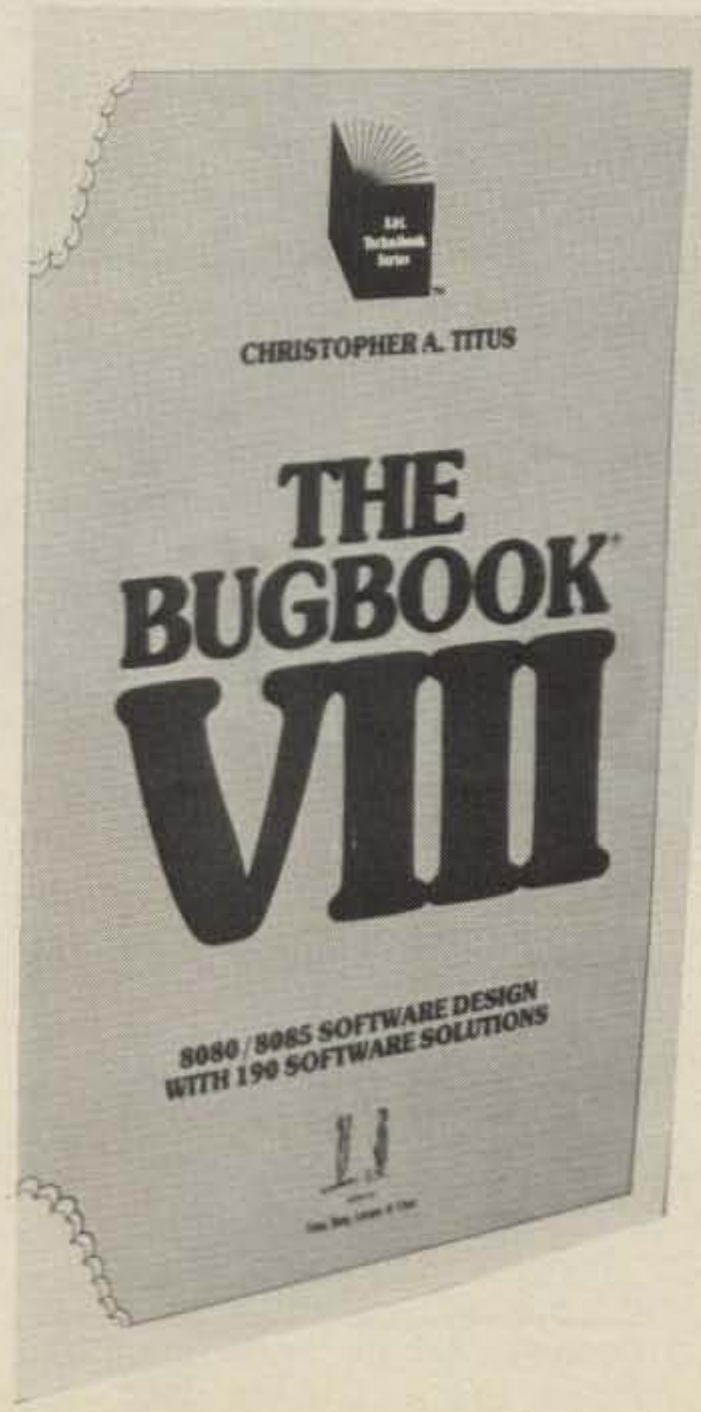
Numbers seven and eight of the popular **Bugbook®** Reference Series is available from E & L Instruments, Inc.

Number 7, written by Howard M. Berlin, W3HB, covers the operation of the phase detector, voltage controlled oscillator, loop filter, frequency filters and monolithic systems, with seven chapters worth of applications. In addition there are over 15 experiments that demonstrate the concepts throughout the book.

Bugbook® 8, written by C. Titus, J. Titus, Larsen and Rony, concerns itself with 8080/8085 software design and its application. The chapters in the book include an introduction to the 8080/8085 microprocessors, basic instructions, subroutines, advanced instructions, mathematical routines, number base conversion and microcomputer input/output.

Bugbook® 7 sells for $8.50 and **Bugbook®** 8 sells for $9.00. Both are available from E & L Instruments Inc., 61 First Street, Derby Ct 06418, or circle number 64 on the reader service card.



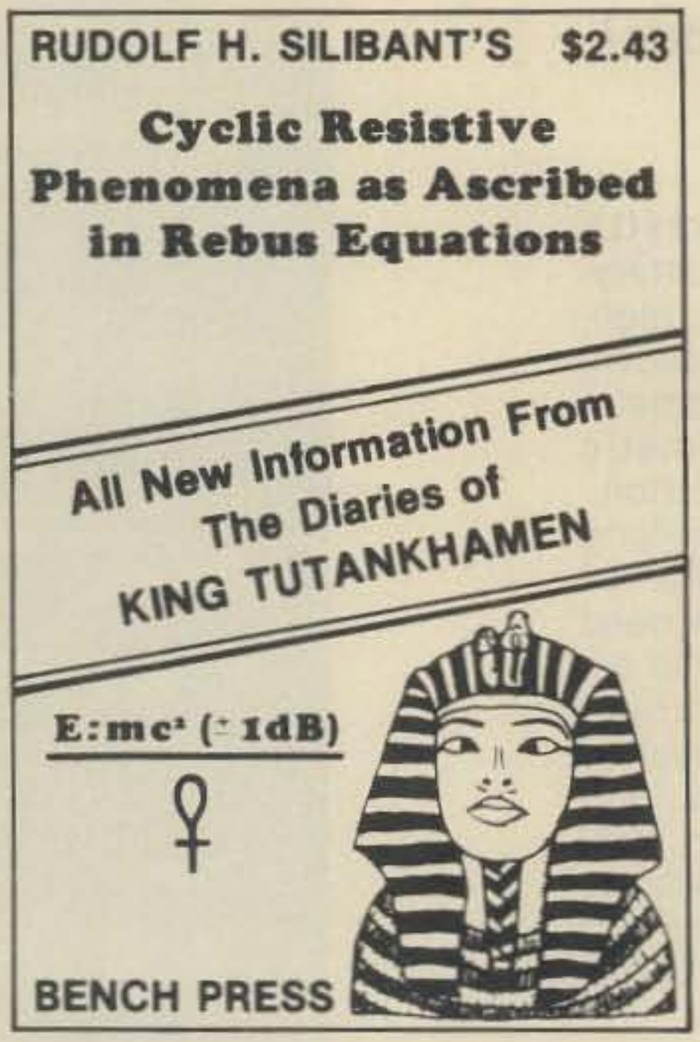


A Catalog From Tucker Electronics Co.

A new 64-page catalog published by Tucker Electronics Co. lists approximately 1200 individual pieces of reconditioned electronic test equipment. Instruments include amplifiers, analyzers, bridges, frequency measuring equipment, signal generators, lab standards, meters, scopes, recorders, r.f.i./e.m.i. equipment and more.

Each unit is described and priced. All units are reconditioned and calibrated to manufacturer's original specs.

For your catalog, write to Tucker Electronics Co., P.O. Box 401060, Garland TX 75040, or circle number 62 on the reader service card.



A New Theory Emerges

Cyclic Resistive Phenomena as Ascribed in Rebus Equations, by Rudolph H. Sibilant, Bench Press (Ogasawara, Idaho), 684 pages illustrated, limp paper edition, $2.43. Taking the concept that the whole is far more interesting than the sum of its parts, Mr. Sibilant draws a picture of Rebus Equations in such a manner as to clarify any grey areas. Inspired by the recent popularity of Tutankhamen, Mr. Sibilant drew upon the flow of Atbara in relation to *Pigmentum* to illustrate his major thesus. Mr. Sibilant is best known as the author of *The Compendium of ½ Watt Vitreous Resistors.* For complete and explicit details plus two tickets to the soon to be released major motion picture circle 69 on the reader service card.

Palomar Engineers' All-Band Preamplifier

Palomar Engineers has introduced a new preamplifier which is continuously tuneable and covers all amateur bands from 160 through 6 meters. It provides 20 dB of gain with a dual-gate FET for low noise figure. The gain and low noise figure greatly improve reception on most receivers, particularly on the higher frequency bands. The added selectivity reduces image and spurious responses.

Gain is continuously variable to prevent overloading the receiver. An r.f. sensing circuit allows the unit to be used with transceivers; the preamplifier automatically bypasses itself during transmit. A built-in 117 v.a.c. power supply and a connecting coaxial cable for the transceiver is included.

For a free descriptive brochure write Palomar Engineers, P.O. Box 455, Escondido CA 92025, or circle number 77 on the reader service card.

Two Microprocessor Reference Books

Osborne & Associates has recently announced the availability of *An Introduction to Microcomputers,* volumes 2 and 3.

Volume 2, called "Some Real Microprocessors," contains 1400 pages of material. Included is information on every major microprocessor on the market 4-bit, 8-bit and 16-bit - in detail. More than twenty CPU's are analyzed and information on the new INTEL 8086 and the Texas Instruments 9940 is offered.

Volume 3, called "Some Real Support Devices," offers extensive descriptions on microcomputer support devices which can be used with more than one microprocessor. Among categories discussed in volume 3 are memory devices, parallel and serial I/O devices, CPU single-function and multi-function support devices, and business systems.

Volume 2 costs $25 (plus $5 for the optional binder) and volume 3 costs $15 (plus $5 for the optional binder). They can be obtained from Osborne & Associates; 630 Bancroft Way, Berkeley CA 94710, or circle number 67 on the reader service card.

Apple's Disk II (An Easy-To-Use Floppy)

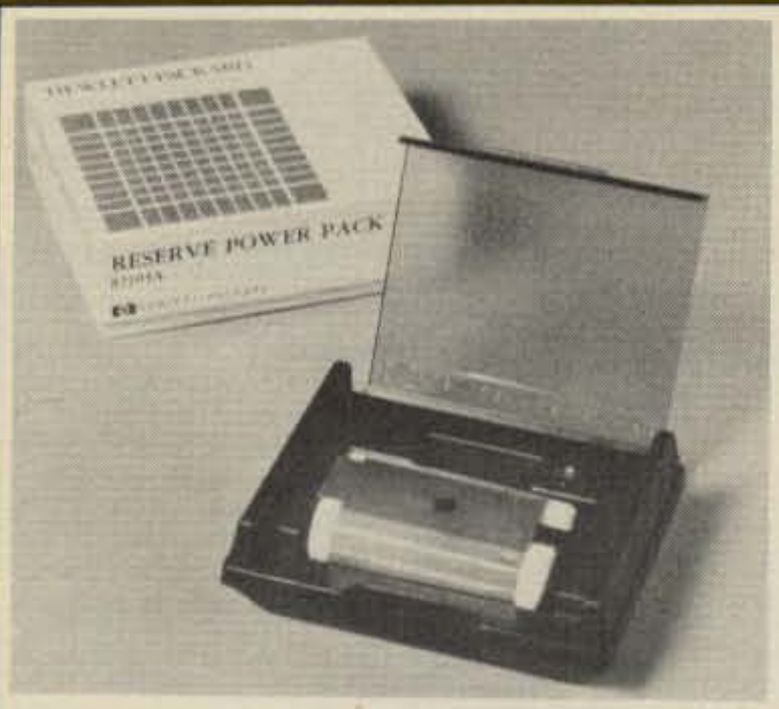
Apple Computer, Inc. announced Disk II, the newest peripheral for its Apple II personal computer.

Disk II's rapid access to programs and data makes home applications like address files, social appointment calendars and recipe files faster and more useful. personal finance also becomes easier with the disk.

Disk II allows the Apple II to handle a wide range of business applications including inventory, general ledger, payroll, etc.

The Disk II subsystem consists of an intelligent interface card and either one or two mini-floppy drives. In concert with Apple II, this means instant acess to more than 1.6 million bytes of data.

Disk II costs $495 and is available from Apple Computer Co., 10260 Bandley Drive, Cupertino CA 95014, or circle number 76 on the reader service card for more information.



Two Accessories For H-P Series E Calculators

Hewlett-Packard has announced the availability of a reserve power pack (Model 83103A) and a d.c. recharger (Model 82144A).

The reserve pack is a small desk-top unit that comes with an extra set of batteries. This pack offers the convenience of always having an extra set of fully charged batteries on hand. It sells for $15.

The d.c. charger features two types of cords - one with a cigarette lighter adaptor and another with the common spade-lug type terminals. Input voltage can range from 9 to 16 v.d.c. This unit is priced at $27.

Both units are available from Hewlett-Packard Co., 1507 Page Mill Road, Palo Alto CA 94304, or, for more information, circle number 73 on the reader service card.

Unimax Switch Corp.'s TH Series Convertible Lighted Pushbutton Switches

Lighted pushbutton switches with alternate/momentary switch function convertability ideal for prototypes and short runs have been introduced by Unimax Switch Corp. as part of the TH series, the newest generation of lighted pushbutton controls.

The new convertability feature, available in a number of TH Series models, is provided by movement of a lever accessible through a small window on the switch body. Conversion of switch function by the unique two-way mechanism is accomplished in seconds.

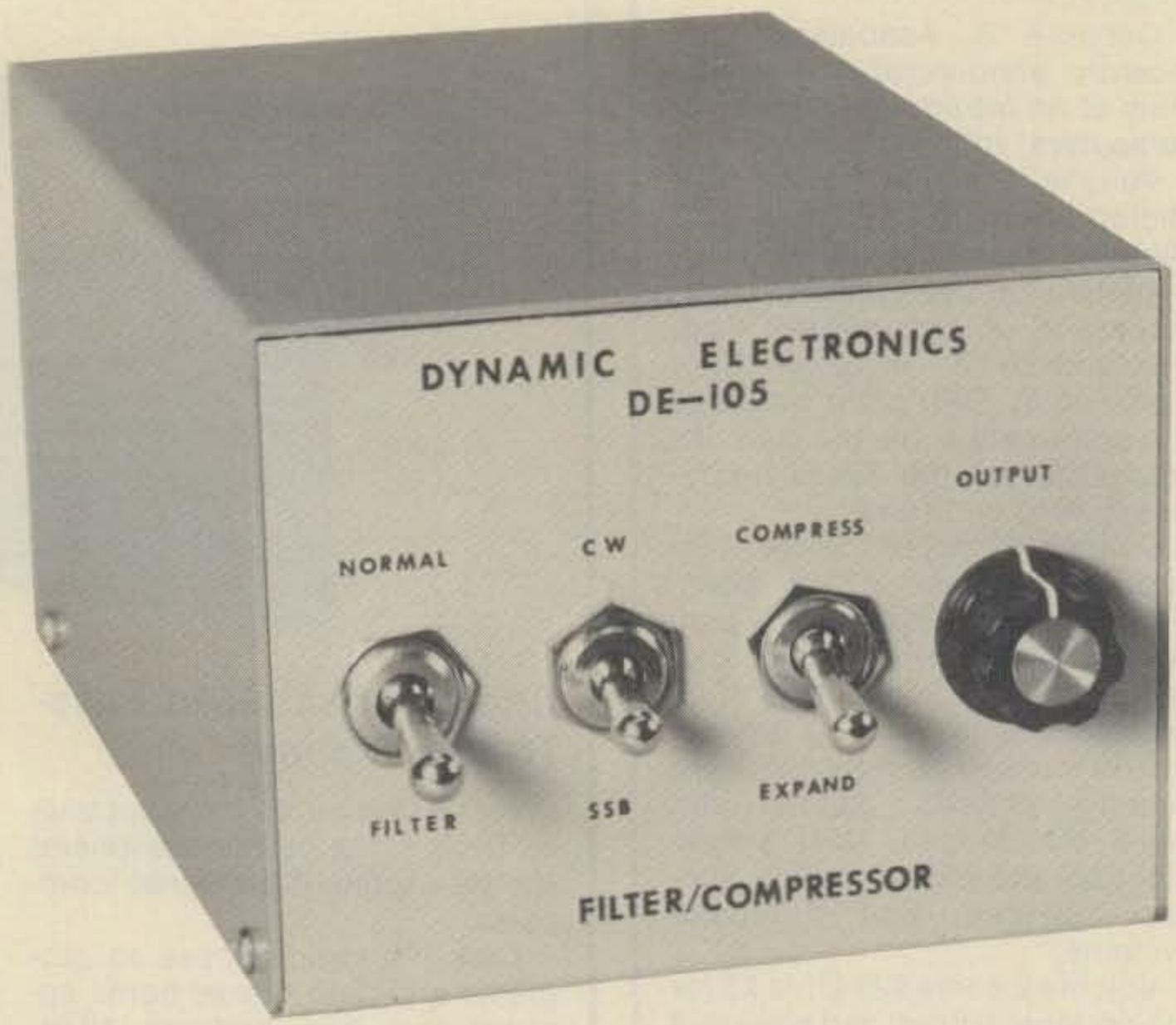
For information, write to Unimax Switch Corp., Ives Rd., Wallingford CT 06492, or circle number 70 on the reader service card.

Dynamic Electronics, Inc.'s DE-105 C.W./S.S.B. Filter

Dynamic Electronics, Inc. has recently designed a c.w. and s.s.b. filter with compress and expand features plus an output control. The fixed c.w. and s.s.b. filters provide sharp attenuation for QRN and QRM. To prevent weak stations from being drowned out by extremely strong stations the "compressed" feature was added. This works on the amplitude of all signals whether they be code, voice, RTTY, ATV or foreign broadcast station.

The DE-105 comes with a patch cord which plugs into a receiver's earphone jack and a speaker or headphones plugs into the output of the DE-105. The unit is available in either an a.c. or d.c. model. The a.c. model, the DE-105A, sells for $79.95 and the d.c. model, DE-105B, sells for $68.95.

For more information write to Dynamic Electronics, Inc., P.O. Box 896, Hartselle, AL 35640, or circle number 63 on the reader service card.



Phor Phone Phreaks

A neat, little book titled "How To Buy, Install and Maintain Your Own Telephone Equipment" has been published by Almar Press. The book was written by Joseph La Carrubba and Louis Zimmer.

The book contains easy-to-follow descriptions of the steps for purchasing, installing and maintaining privately owned telephone equipment. Easy-to-read diagrams and illustrations of the basic telephone parts show where existing equipment can be replaced and new equipment installed as remodelling or new construction is completed.

The contents also give a thorough explanation of dial, push-button and party-line telephones, how they operate, simple planning and installation of equipment and many other helpful tips to the telephone owner.

The price of the book is $3.50 and can be bought from Almar Press, Dept. B, 4105 Marietta Drive, Binghamton NY 13903, or circle number 65 on the reader service card.

For Today's Busy Handyman

Parker Publishing Co. has recently released "Complete Guide to the Use and Maintenance of Hand Power Tools," by G. Howard Poteet. The book costs $10.95.

The book gives the reader down-to-earth, practical how-to information on rules and measuring devices, saws and shaping tools, sanders, drills, hammers, clamps, glues, adhesives, multi-purpose tools, paints, brushes, rollers, sprayers and much more.

Other features include safety tips, buying methods, innovative tool uses and dozens of projects on every level of ability.

For your copy write to Parker Publishing Co., West Nyack NY 10994, or circle number 66 on the reader service card.

Continental Specialties' Model 2001 Sweepable Function Generator

CSC has introduced a new four-waveform function generator, electronically sweepable over a 10:1 to 100:1 range - the Model 2001.

The generator offers sine, triangle, square and TTL square waves from 1 Hz to 100 kHz in five push-button selectable overlapping ranges, tuned with a 10:1 vernier dial featuring 50 increments, and a accuracy of ±5% of the dial setting.

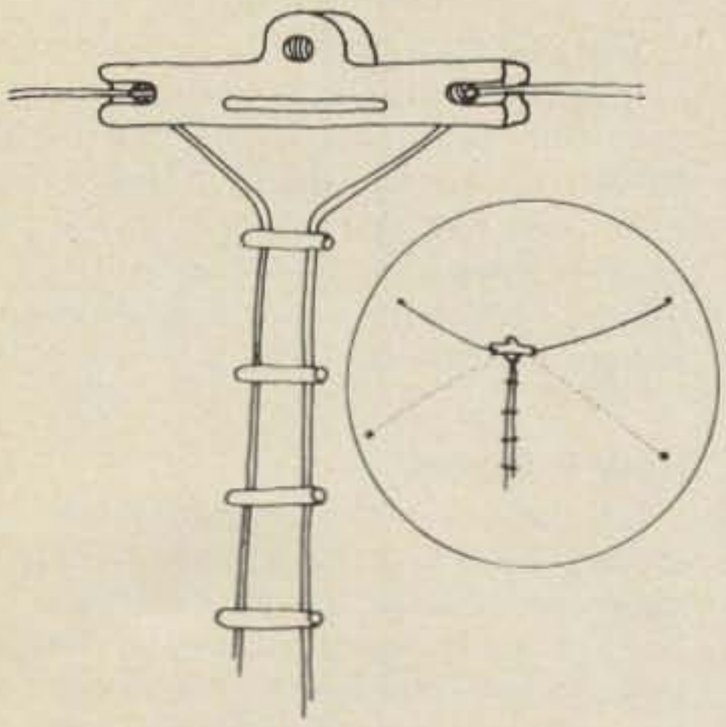
The TTL output will drive 10 TTL loads with rise and fall times of less than 25 ns.

Sine, square and triangle waveform outputs are variable over a greater than 40 dB range. The variable amplitude control, once set, holds the output signal to within less than ±0.5 dB over the entire frequency range.

The 10"W x 3"H x 7"D package weigh 2.2 pounds and the power requirements are 6 watts at 105/125 v.a.c.

The unit sells for $124.95.

To get yours, contact CSC at 70 Fulton Terrace, New Haven CT 06509 or at 351 California St., San Francisco CA 94104. For more information, circle number 75 on the reader service card.



DenTron's All-Band Doublet Antenna

This versatile antenna from DenTron provides coverage from 160 to 10 meters, handles 2 kW p.e.p. and comes completely factory assembled without any traps. It can be erected in any configuration (inverted vee, flat top or sloper) and it can be trimmed to make it fit your particular requirements for space.

The DenTron doublet is center-fed with 100 feet of p.v.c. covered 470-ohm balanced feedline (a DenTron exclusive) and is a solution to your multiband, limited space antenna needs. The antenna was field tested by the 1978 Clipperton DXpedition.

It sells for $24.95 and is available from DenTron Radio Co., Inc., 2100 Enterprise Pkwy., Twinburg OH 44087, or circle number 78 on the reader service card for more information.

Nortronics' Video Cassette Recorder Maintenance Products

The Recorder Care Division of Nortronics Co., Inc. introduced a new series of maintenance products specifically designed for the new video cassette recorders.

The new VCR line includes the model VCR-211 video bulk eraser, designed to bulk erase both Beta II and VHS-format cassettes down to the level of virgin tapes; Model VCR-85 "Foam 'n' Cleaner," a combination kit of effective cellular foam cleaning swabs and spray cleaner; Model VCR-505 foam swabs, 25 professional-quality foam swabs for cleaning the most delicate video casette machine parts and the VCR-95 video cassette maintenance kit, containing all of the important products required for regular VCR maintenance.

For more information contact Recorder Care Division, Nortronics Co., Inc., 8101 Tenth Avenue North, Minneapolis MN 55427, or circle number 60 on the reader service card.

B 111 - 112

Retrieving information from long lists can often be boring and error-prone. Here's a program to help you out.

A Data Retrieval Program

In BASIC

BY CARMINE PRESTIA*

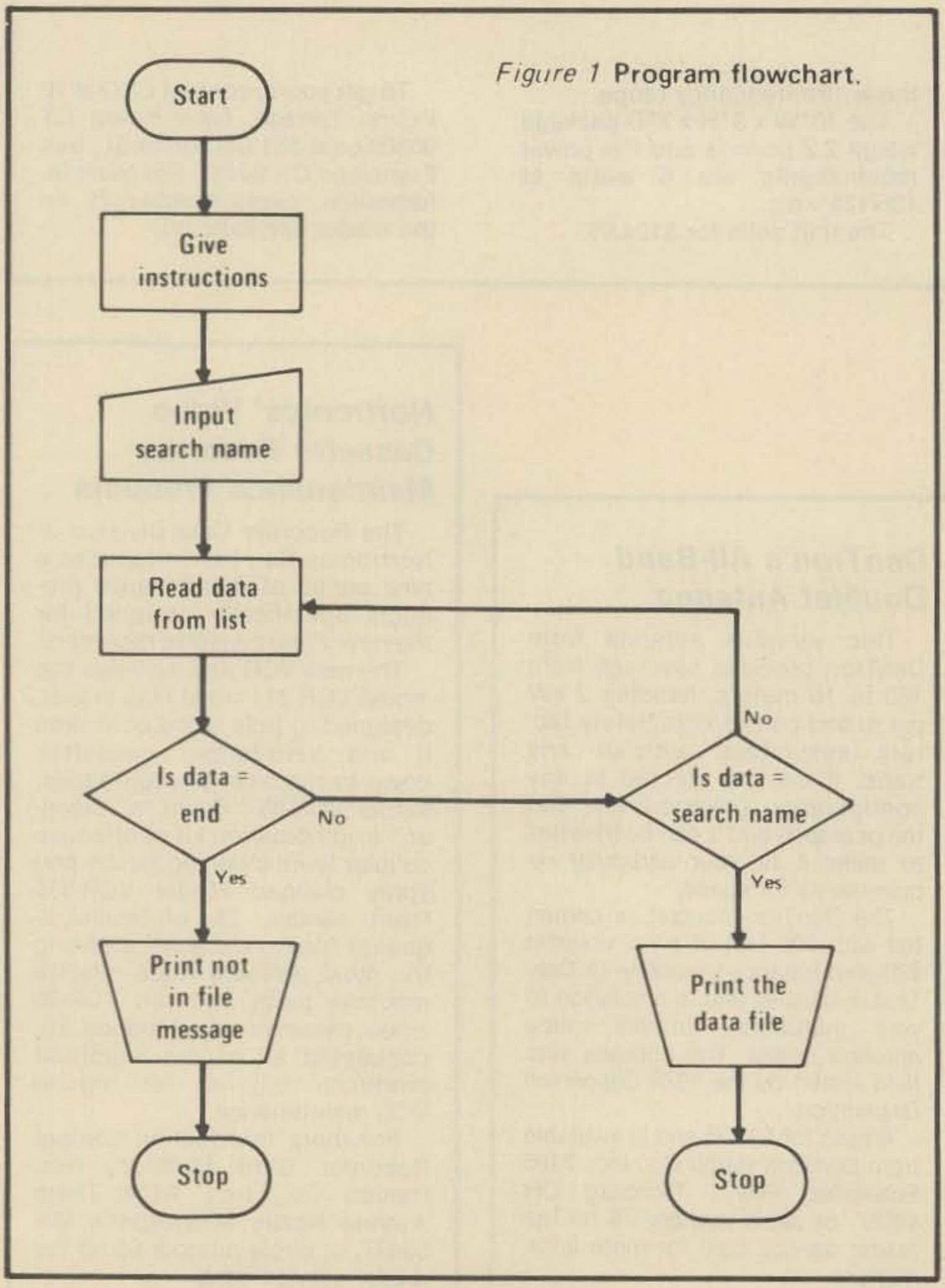


Figure 1 **Program flowchart.**

One of the most useful things that computers can do for us is store large amounts of information and search for specific pieces of that information. This is of particular value when lists of information are long and involved, since our human eyes become weary searching for that piece of data.

This program takes care of just such a job. I wrote it in order to keep the membership list of the local volunteer fire company, to which I belong. It is often necessary to sit down and look up members' names, addresses, and control number. The program does two things at one. First it stores the membership list itself, then it does the searching for me. All of this storage work and programming are done on my Heathkit H-8 Microcomputer. I used Extended Benton Harbor Basic because it allows me to manipulate character strings, which is how we store the data.

The program and data are stored on magnetic cassette tape, and like most of the other programs we've had in this column it takes less than a minute to load it into the H-8. You could use the program to keep a membership list like I do or your Christmas card list, or even a receipt list for your wife.

How it works

OK, how does the program work? I've included the flowchart again, to help us visualize the logic. See figure 1. Since we have already gone into flowcharting (*ME*, June 1978) I won't give an explanation, but you can refer to it to clarify the program.

Now, look at the program itself, see figure 2. Take a quick glance at the entire program and you will see that I have included plenty of the ubiquitous remark (REM) statements to document the

*1206 S. Allen St., State College PA 16801

Program listing

```
005 REM  ALPHA FIRE LIST, VER 1, 04/05/78, CWP
010 REM
020 REM  A PROGRAM CONTAINING THE MEMBERSHIP LISTING
025 REM  OF THE ALPHA FIRE CO. OF STATE COLLEGE, PA.
030 REM  AND PROVIDING A MEANS OF SEARCHING FOR A
035 REM  PARTICULAR INDIVIDUAL'S INFORMATION.
040 REM
045 REM  INPUT THE NAME TO BE SEARCHED FOR
046 PRINT TAB(25) "INSTRUCTIONS"
050 PRINT "PLEASE SPECIFY THE NAME OF THE MEMBER WE"
055 PRINT "ARE LOOKING FOR.  USE THE FORMAT: LAST NAME,"
060 PRINT "COMMA, FIRST INITIAL, SPACE, MIDDLE INITIAL."
065 PRINT "CAUTION, ANY OTHER CHARACTERS WILL CAUSE ERRORS."
070 LINE INPUT "SEARCH NAME, PLEASE?  ";S$
075 REM  NEXT LINE SETS LENGTH INDICATOR FOR THAT NAME
080 LET X = LEN(S$)
085 REM  READ A NAME FROM THE LIST
090 READ L$
095 REM  SEE IF WE HAVE REACHED THE END OF THE LIST
100 IF LEFT$(L$,3) = "END" GOTO 130
105 REM SEE IF THE NAMES MATCH
110 IF LEFT$(L$,X) = S$ GOTO 120
115 GOTO 090
120 PRINT "RECORD IS - ",L$
125 STOP
130 PRINT "THAT NAME NOT IN FILE!  ",S$
135 STOP
140 DATA "ROE,R E   100 WEST ST   123","DOE,J J   300 SOUTH ST 345"
141 DATA "SMITH,J E   200 EAST DR   234"
142 DATA "END"
143 END
```

program coding.

Lines 43 through 65 print instructions for the user, then line 70 asks for the name we are searching for. Line 80 is a device to make the program a little easier for us to use. "X" is a variable that I use to contain the number of characters in the search name that we entered.

"LEN" is a *function* built into Basic to automatically count the number of characters in the string specified in the parenthesis, in this instance, the search name, S$. Now you are probably wondering about that dollar sign! In Basic the dollar sign after the variable name tells Basic that it is dealing with a *string variable*, or string of characters.

In line 90 we also have something new, the READ statement. READ is always used with a DATA statement. The DATA statements contain a list of DATA items that the READ statement reads out of. A pointer is automatically set by the program to indicate the next piece of data to be read.

The next line of coding, 100, looks at the data read into variable L$, to see if it says 'End'. If it does, we have gone through the list without finding the name we wanted. "GOTO 130" sends the program to line 130 where it prints a message that it did not find the data we were looking for. It also prints the search name, for reference.

If this *relational test* between the two variables is untrue, or "falls through" we drop to line 110. Here is where we use the contents of variable "X", that we got in line 80. It is also a good place to explain the next new item, the *function*, LEFT$. This is another of those built-in functions. It uses the number stored in "X" and counts that many chaaracters from the left end of the character string in variable L$.

Fall through the lines

This part of the string is then compared to the search name S$. If they are equal, the program has found the data we want and goes to line 120 to print it. Because of the way I have structured the data the name of the member is always on the left end of the character string so the program is always looking at the name section of the string.

If this test fails and we "fall through" to the next line, 115, it sends the program back to line 90 to read another piece of data. These comparisons and loopings go on until we find the data we want or we run into the end of the list. The statement, STOP, in lines 125 and 135 halts execution of the program when one of these conditions occurs.

Lines 140 through 142 are our DATA statements. Since we are dealing with character strings each piece of data is enclosed in quotation marks to tell Basic it is a string. The different pieces of data are separated by commas. Line 142 contains the string "END" that tells the program we have reached the end of the list. Line 143 is an END *statement;* it signifies the physical end of the program.

If you are going to try this program on your machine, and I hope you do, you will probably have to make some changes depending on the version of Basic that you use . Most likely, the changes would have to be made in the string *functions* LEN and LEFT$.

Whatever you do, good luck! In the future we will try a similar program that can search the data in a couple of different ways.

HAM SHOP

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DXERs BEAM HEADINGS new and different. Personalized great circle bearings from your QTH to over 380 DX locations-all DXCC countries. Two options available ($4 each): AP1 short path bearing, distance and return bearing, AP-2 short and long path bearing with short path distance. Specify AP-1 or 2 and include your Lat/Long. Don Griffith, N0RF, 603 Joyce Ann Dr., Manchester, MO 63011. Developed by a DXer for a DXer!

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WANTED: McMurdo Silver Materpiece IV and VI receivers. State price and condition, first letter. Have Masterpiece V for trade only. Hardy W. Trolander, 1475 President, Yellow Springs, OH 45387.

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The Rochester Hamfest & NY State ARRL Convention will be held on May 25-27, 1979. Add your name to mailing list. Send QSL to Rochester Hamfest, Box 1388, Rochester, NY 14603. Phone (716) 424-1100.

SELL: 2 mtr FM Sonar transceiver, AC P/S, mobile bracket $150. George Pataki, WB2AQC, 34-24 76th St., Jackson Hgts., NY 11372.

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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 about 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.

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CQ AND QST 1950-1975 issues for sale. Send SASE 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 Ave., Burbank, CA 91504. Available issues and refund sent within one month.

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WANTED: Pre-war issues of Short Wave Craft Magazine. Bill Orr, W6SAI, Eimac, 301 Industrial Way, San Carlos, CA 94070.

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FOR SALE: Collins mobile mount with cables and 516E-1 mobile power supply for KWM-2, $125.00. A. Dorhoffer, K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

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Dick Cowan, Mad Train Collector
Publisher, Modern Electronics
14 Vanderventer Avenue
Port Washington, NY 11050
Phone: 516/883-6200

HC270, True Product Det, Ifnl, perfect 6 meters, $120. PR9-FM Polic-alarm, 150-175 MHz, A1, $25; Mint Minox IIIs, meter, flash, $65; New RCA cassette recorder $25. Chester Benson, 732 South 14th St., Richmond, IN 47374.

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KWM-2, S.N. 10025 312-B speaker, PM-2 power supply, $750. N4WF, 217 Bluegrass Dr., Hendersonville, TN 37075.

FOR SALE: 1-Eico grid dip meter model 710 $18 postpaid, and 1-Johnson Viking adventurer transmitter $35 postpaid. KA9AYE, Robert L. Johnson, 129 W. Claremont, Lanark, IL 61046.

FOR SALE: Hallicrafers SR-2000, PS-2000, HA-20 remote VFO. 2KW PEP. $995. National IICX-1000, self-contained kw transceiver, $875. Hammarlund HQ-215 receiver, solid-state, Collins mechanical filter (2.1 kHz) $325. James W. Craig, Jr., P.O. Box 615, Portsmouth, NH 03801, (207) 439-0474, (603) 436-2884.

HAMMARLUND super-pro updating info wanted. Name Mag. and date ok or will buy xerox copy. Bill, 85 Lakeland, Bricktown, NJ 08723.

WANTED: Early amateur equipment. State condx, make, model and price. H.F. Schnurm 115 Intercept Ave., North Charleston, SC 29405.

WANTED: Manuals for Pierson KE-93 receiver or Knight VFO. John Schutt, 1416 Rossi St., Boise, ID 83706.

BACK ISSUES of CQ, QST, and Ham Radio wanted for cash. Ken Miller, K6IR, 16904 George Washington, Rockville, MD 20853.

SELL: HQ-170AC VHF, HQ-100C, HX-20, wanted: Any AM VHF transceivers, Jeff Beals, WB2OUK/7, 6608 E. Mary Dr., Tucson, AZ 85730.

SELL: Autek QF-1, good, $30. Telex CS-7 headphones, mont, $20. Ameco PT-2 preamp mont, $30. Astatic GD-104, fair, $15. Vibroplex std vibro-key, mont, $20. KD4R, David Mitchell, 1620 Young Rd., Lithonia, GA 30058.

DRAKE W4 wattmeter wanted. WB2HIQ, H. Strobel, 84 Chichester Ave., Center Moriches, NY 11934.

100s and 100s of old tubes for sale. Surplus, pullouts, transmitting, eye, pre 20s, 20s, 30s, 40, metal, deforest, loctal, 4CX1500Bs, CRT, UIDI, few WD-12, octal, 5-6-7-9 pin, Alpha numeric, etc. Individual or whole lot. Other "junk". Dave Hunt, RFD 1, Box 24A, Dresden, ME 04342, 1-207-737-2553.

WANTED: Bird 43 watt meter. Send price and details to: K9BSL, 122 Country Club, LaPorte, MD 46350.

QSLs Printed (100) $2.25. Add'l (100's) $2. Include postage. Low priced, quality, (500) gold paper ret. address lables, beautiful, w/we call, $2. postpaid. D. Testa, Box 9064-CQ, Newark, NJ 07104.

SELL: Ameco TX-62 with manual, good unmodified, $50 shipped. Sever, 248 Sheraton Dr., NW., North Canton, OH 44720.

CUSTOM I.D. pins. 2 lines $1.25 3 lines $1.50. Assorted colors. Same day delivery. Saul Slonim, 320 Rose St., Massapequa, NY 11762.

COLLINS mechanical filters, F455H31 and F455Y31, $25 each. Matching Collins 456.350 xtal, $7.50. Jo Hoffer, W1DL, 24 Cherry Rd., Framingham; MA 01701, (617) 872-5084.

SELL: Heath HW-8 factory aligned, like new $115 Fred Weigel, WD4BBZ, Box no. 2641, Sturat, FL 33494, (305) 286-0614.

FOR SALE: $399 cash and local pick-up only. Linear Heath SB-220 or Hallicrafters HT-45 with P-45 AC power supply. K4SYT, (205) 539-4285.

WANTED: Eico 722 VFO. WD8QWM, Jim Teeple, 1230 Ward, Warren, OH 44485, (216) 399-7292 after 6 p.m.

SPEAKER housing to match Collins rcvr 75A1. WB1BVO, 22 Forest St., Branford, CT 06405, 203/488-4267.

SELL QST (20s and 30s), handbooks, ARRL Pubs, Want Ham Radio, 75S3. W0KC, 10 Taylor Estates, Kirkwood, MO 63122.

DX in limited space, Hybrid mini quad-6, 10, 15, 20 meters. Span 11 ft. 15 lbs., $85. WB3HAK, 8409 Snowden Loop Ct., Laurel, MD 20811.

HEATHKIT model AR-3 4 band receiver 0.5 to 30 MHz $50 postpaid. H. Anderson, 816 No. Cedar, Colorado Springs, CO 80903.

WANTED: Will buy crystal sets and any crystal detector stands. Need carborundum unit. WA4NED, Box 2478, Gainesville, GA 30501.

FOR SALE: HT-44, SX-117, power supply. 6M kw amplifier. Wanted: National receivers, working or not. T.N. Colbert, 1800 Rhodes No. 612, Kent, OH 44240.

SELL: RCA Type WT-115A color pix tube tester. New with case and manual. $29. SASE for info. W4JGO, 643 Diamond, Salem, VA 24153.

WANTED: GE 150 mc master line transmitter strip and 12 VDC power supply for ham use. K6KZT, 2255 Alexander Ave., Los Osos, CA 93402.

SB101 and HP23A P.S. $275. Heath Apache 250W $100. Drake R4 $250. W6NPY, (415) 388-4489, 106 Locust Ave., Mill Valley, CA 94941.

19140 VARIABLE CAPACITOR 9.7-148 p.f. $6. HF-140 variable capacitor 6.3-142 p.f. $4. Postpaid. Bob Craig, 4950 Sunshine Ave., Santa Rosa, CA 95405.

ALLIED SX-190 ham/sw, speaker, manual, mint, $135. Knight 75 watt c.w. 80-10, manual, $35. WA2PCL, 101-23 Lefferts, Jamaica, NY 11419.

FOR SALE: Heath HW-8, HWA-7, Headphones, new condx., assembled and tested. Frank Varano, 37 South Market, St., Shamokin, PA 17872.

TEKTRONIX 661 scope DC-4GHz with probe, 451 and 5T1A plug-in. Excellent with manual. Make offer, WA2LYQ, (212) 275-1536 EST 6-8 p.m.

WANTED: HW 22A in working condx. 7304 Dixon Ave., Tampa, FL 33604, N4ACS.

SELL: Viking KW w/desk $500. Pick up only. CE200V $250 CE20A w/458 VFO $85., National NC303 $225, SW54 $60, RCA AR88 $50, RCA ACR 111 $40. Some old battery radios for sale also. SASE for list. J. Doak, W2GHF, 45 Allen Dr., Woodstock, NY 12498 Tel. (914) 679-8723.

HEATH SB-620 Panalyzer $120, Tektronix 513 scope $70. HP205AG Lab generator, $95, Berkley 5500 Counter $20. K6KZT, 2255 Alexander Ave., Los Osos, CA 93402.

QSLS; Design your own or copy your present card at low prices. Write: Rick Dittmer, 1635 Norton Ave., Grissom AFB, IN 46971.

WANTED: ARRL "How to Become A Radio Amateur" book. Glenn, VE3CGU, Box 231, Goderich, Ont. N7A 3Z2.

COMPLETE HAL RTTY Station for sale. DS-3000 KSR with video and the ST-6000X. Send s.a.s.e. to: WB4BYO, 7602 Timberwood Dr., Jax, FL 32224.

SELL: New Drake R-4C receiver, MS-4 speaker, Noise blanker, $800 value will take $500. Dr. Phoenix, RR 3, Columbia, TN 38401.

HEATH: Apache and SB-10, $200; Transcrs: HW-16, HW-17, HW-32, $100 each. National VFO-62 $25. Manual. W1GSM, (617) 657-5696.

COAXIAL SWITCH, Braker and Williamson model 551A new $25. Matched pair 6DQ5A output tubes, $5. Art Johnson, K2POA, 29 Boone St., Bethpage, NY 11714.

WATNED: DEN-35, AFSAV-133C, and AN/FRA-86 demodulators and instruction manuals for above. C.T. Huth, 146 Schonhardt, Tiffin, OH 44883.

SELL: Transceiver 40 and 80M SSB duo bander 84 with p.s. also operates CW 7065 to 7150 kHz. 250W with side tone. W8PY, 618 Geneva, Struthers, OH 44471, (216) 755-2870, $135.00.

WANTED: Old but working s.s.b. rigs for missionaries over seas. Charles Frost, K5LBU, 618 Ector, Denton, TX 76201.

WANTED: A copy of Radio Antenna Engineering by E.A. LaPort. A.M. Fox, Box 895, Greeley, CO 80632.

TEST EQUIPMENT collector's surplus, HP, GR, Tek. Excellent stuff. Free list, PhD, 5220 Carlingford, Riverside, CA 92504.

WANTED: Antique and old keys for private collection. Please send description and price. WD2AHO, 677 N. Main, Highstown, NJ 08520.

FREE "Tax Revolt" postcard for 15 cent stamp. Kirk, 15M beam, local only. Available as QSL Manager. G. Gargiulo, 17 Whitney St., E. Hartford, CT 06118.

SELL: Genave GTX200 10 sets xtals $150. Heath Pawnee 2 meter am/cw $75. Instructiongraph code practice machine with 22 practice tapes. $150. Rich Tashner, N2EO, (212) 352-1214.

QSL's Printed: low as (100) $2.25. Also, quantity prices. Quick service, quality. Orders to: D. Testa, Box 9064-CQ, Newark, NJ 07104.

SELL: SB400, SB301, w all filters, speaker, and 2 meter converter. $400. QFI-$15. Sid, K3SME, (215) 324-7437.

SELL OR TRADE: Clegg 22, Clegg 22-Mark II, TX 6 and 2. Joseph Schwartz, 43-34 Union St., Flushing, NY 11355, (212) 461-5933.

HALLICRAFTER Model SR10-A. Shortwave ha, CB bands, $35. Hamilton, 6050 North Oakley, Chicago, IL 60659.

ANTIQUE McMurdo-Silver absorbtion freq. meter with 6 coils 3.5-300 mc original instruction sheet no box B.O. DX100, $35. Earl Briggs, WA1GOO, 30 Piedmont St., Lynn, MA 01904.

ROTARY SW. 4P11P 5/$5., 6P11P 5/$7.25., DIP SW. 10-SPST 10/$15., Transf. 12.2 VCT-6A plus 8.5 V-5A $6.95, 24V-5A $5.9510' RG58C/U 12/10. Fertik's, 5400 Ella St., Philadelphia, PA 19120.

WANTED: Low-band Unimetrics Dig-Scan receiver in any condx. Give price w/shipping and condx. R. Dewey, Rt. 131, N. Grosvnordal, CT 06255, (203) 923-2188.

2 Hustler MO1 masts at $10, Hustler SSM-2 ball mt. $8, 2 inch ball mt. $7 (mfg?) RDR receiver 225-390 MHz w/man and acc. $20. You ship. Gordon, R4, Box 145A, Monroe, WI 53566.

HW-8 $125, Argonaut 509 $310. Bill, W0MS, 7190 So. Franklin Way, Littleton, CO 80122, (303) 798-6255.

SALE: Kenwood R-300 receiver only $150. One watt Kantronics rock hound transmitter, New, $12. I ship. WB4FTO, Rt. 13, Edens View, Kingsport, TN 37664.

DRAKE T4X, R4A, AC3, MS4, $600; Heath SB500 $125; N9RC, 8377 Chestnut, Newburgh, IN 47630.

FOR SALE: Waters Hybrid Phone Patch model 3002. Like new with manual. Has built in speech preamp, limiter. The cadillac of phone patches, $75. C.L. Skutt, 119 No. Foster St., Lansing, MI 48912.

SPOOLS for your teletype, Kleinschmidt equip. 50 cents each plus postage; QSL's regular and RTTY style, Printed, Low cost sure; Details: send s.a.s.e. to: D. Testa, PO Box 9064-CQ, Newark, NJ 07104.

NEW TUBES 425-6AK6, 350-6BH6, 230-6J6A sell for highest offer, all or part. M. Powell, Jr., Box 500, Carbonear, Nfld. A0A 1T0.

SELL: Heath SB101, HW23A, Speaker, Mic., CW filter, $350. HW-2036, TT pad, AC supply, $250. KB9CI, 1135 Forest, Brookfield, WI 52005, (414) 786-7027.

YAESU 200R synth. 2m FM xcvr $175 or best offer. Misc. equipment. SASE list. R. Hajdak, 1644 Morris St., SE, Mineral Ridge, OH 44440.

SELL: Hallicrafters SX-71, renewed, you pay shipping, $110. C. Klawitter, 4627 N. Bartlett, Milwaukee, WI 53211.

HW 12A, HW32A and HP23B P.S. good condition. $220 you pay shipping. Contact Ed Langston, WD5HWX, 1123 Sayers St., Lulkin, TX 75901.

LOKTAL SOCKETS fit 4CX250B, 4X150A tubes, $1 each postpaid. List gear excess my needs, large SASE. W4API, Box 4095, Arlington, VA 22204.

DXers! Ham sentences in 54 languages on your outgoing DX QSLs get results. K3CHP's DX QSL Guide, $3.95. Joe Mikuckis, 6913 Furman Pkwy., Riverdale, MD 20840.

CW XCEIVER. Heathkit HW-7, power supply and manual; like new. $59 postpaid. KA4DYM, 4719 B Cardinal Ct E., Richmond, VA 23228.

WANTED: 1-1/4 and 3/4 M equipment (rcvrs, xmtrs, etc) and 'N' conn. for 1/2" rigid coax. C.T. Huth, 146 Schonhardt, Tiffin, OH 44883.

"CHIBA" model CPF12 6 channel 2m handheld transceiver w/16-76, 34-94 and 94 simp. built in xtals. Jung Lem, KB6BO, 5222 Coringa Dr., Los Angeles, CA 90042.

HEATHKIT IG-28 color bar and dot generator, with manual, excellent condx, professionally wired. G. Alfred Dodds, 874 Pepperwood Lane, Brunswick, OH 44212.

SIGNAL/ ONE CX-7A $1050; Motorola 2 meter repater station, pick-up only, $250; Heath 2 meter HW-2036 $250; ICOM 22S with synth. switch $260. UPS prepaid. N4WH, 217 Bluegrass Dr., Hendersonville, TN 37075.

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ALL NEW

FT-101ZD

HIGH-PERFORMANCE HF TRANSCEIVER

Today's technology, backed by a proud tradition, is yours to enjoy in the all-new FT-101ZD transceiver from YAESU. A host of new features are teamed with the FT-101 heritage to bring you a top-dollar value. See your dealer today for a "hands on" demonstration of the performance-packed FT-101ZD.

Diecast front panel, plus heavy duty case

Built-in, fully adjustable, VOX circuitry

Built-in RF speech processor for more "talk power" when you need it

Built-in, threshold adjustable, noise blanker

Equipped for SSB and CW operation. Choice of wide or narrow bandwidth for CW (with optional CW filter installed)

Continuously variable IF bandwidth: 300 Hz to 2.4 KHz

Digital plus analog frequency readout. Digital display resolution to 100 Hz

Rugged 6146B final amplifier tubes with RF negative feedback

RF and AF gain controls located on concentric shafts for operator convenience

Full band coverage: 160 through 10 meters, plus WWV/JJY (receive only)

TX, RX, or transceive frequency offset from main dial frequency

For WARAC Flexibility

Select switches for use with FV-901DM synthesized scanning VFO (option). FV-901DM provides scanners plus 40 frequency memory bank.

SPECIFICATIONS

TRANSMITTER

PA Input Power:
180 watts DC
Carrier Suppression:
Better than 40 dB
Unwanted Sideband Suppression:
Better than 40 dB @ 1000 Hz, 14 MHz
Spurious Radiation:
Better than 40 dB below rated output
Third Order Distortion Products:
Better than −31 dB
Transmitter Frequency Response:
300-2700 Hz (−6 dB)
Stability:
Less than 300 Hz in first 30 minutes after 10 min. warmup; less than 100 Hz after 30 minutes over any 30 min. period
Negative Feedback: 6 dB @ 14 MHz
Antenna Output Impedance:
50-75 ohms, unbalanced

GENERAL

Frequency Coverage:
Amateur bands from 1.8-29.9 MHz, plus WWV/JJY (receive only)
Operating Modes:
LSB, USB, CW
Power Requirements:
100/110/117/200/220/234 volts AC, 50/60 Hz; 13.5 volts DC (with optional DC-DC converter)
Power Consumption:
AC 117V: 75 VA receive (65 VA HEATER OFF) 285 VA transmit; DC 13.5V: 5.5 amps receive (1.1 amps HEATER OFF), 21 amps transmit
Size:
345 (W) × 157 (H) × 326 (D) mm
Weight:
Approximately 15 kg.

COMPATIBLE WITH FT-901DM ACCESSORIES

RECEIVER

Sensitivity:
0.25 uV for S/N 10 dB
Selectivity:
2.4 KHz at 6 dB down, 4.0 KHz at 60 dB down (1.66 shape factor); Continuously variable between 300 and 2400 Hz (−6 dB); CW (with optional CW filter installed): 600 Hz at 6 dB down, 1.2 KHz at 60 dB down (2:1 shape factor)
Image Rejection:
Better than 60 dB (160-15 meters); Better than 50 dB (10 meters)
IF Rejection:
Better than 70 dB (160, 80, 20-10 m); Better than 60 dB (40 m)
Audio Output Impedance:
4-16 ohms
Audio Output Power:
3 watts @10% THD (into 4 ohms)

CIRCLE 43 ON READER SERVICE CARD

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YAESU **The radio.**

379X

YAESU ELECTRONICS CORP., 15954 Downey Ave., Paramount, CA 90723 ● (213) 633-4007
YAESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

Two EIMAC 3-500Zs provide the punch in Kenwood's new amplifier.

Kenwood chooses EIMAC for trouble-free service.

The new heavy-duty Kenwood TL-922A linear amplifier provides 2 kW PEP input for SSB service and 1 kW input for CW, RTTY, and SSTV operation.

Kenwood chose two EIMAC 3-500Z high-mu triodes to do the job. With a total of 1000 watts anode dissipation, the two 3-500Zs coast along to provide trouble-free, long-life service.

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Send for the EIMAC Quick Reference catalog covering the complete line of EIMAC products and for the 3-500Z Data Sheet. Learn why the important manufacturers of communication equipment choose EIMAC. Varian, EIMAC Division, 301 Industrial Way, San Carlos, California 94070. Telephone (415) 592-1221. Or contact any of the more than 30 Varian Electron Device Group Sales Offices throughout the world.

What's your pleasure?

DX chasing? Traffic nets? RTTY? Rag chewing? SSTV? The EIMAC 3-500Z provides the power when you need it, with ample safety margin. Value wise amateurs always look for the EIMAC power tube for reliability. And equipment manufacturers, such as Kenwood, choose EIMAC for leadership in power tube technology.

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