Amateur Radio

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73
MAGAZINE

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Amateur Radio

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Amateur Radio

DECEMBER MCMLXXIV Monthly Ham

FCC Chief Optimistic About Amateur Radio

I guess you know I'm not a licensed Amateur, and therefore not eleigible for membership in the QCWA. However, in about another year I shall have been a member of the Federal Communications Commission longer than any other individual, and shall be approaching the quarter century mark of my service on the Commission. Therefore we have a kinship of service longevity, even though not in exactly the same field.

I'm always pleased when Amateurs invite me to participate in their meetings, whether for serious discussions or on the lighter side. I'm especially pleased to be among those who have spent so much of their lives in the business of "communicating," not only on the Amateur bands but in professional capacities as well. People such as George Sterling, Fred Schnell, Bill Halligan, Ray Guy, Howard Chinn, Harold Robinson, your President, Frank Gunther, and many, many others have made significant contributions to mans' ability to communicate via what we call the "ether waves."

Commissioner Robert E. Lee

Tonight I would like to state my opinion of the value of Amateur Radio to our country and also to the world of telecommunication. Much of what I shall say is known to many of you. However, I dug up a few interesting facts bearing on Amateur Radio which you may not have encountered before. It is not my intent to chronicle all the good deeds of Amateurs over the years.

In recent years, however, their performance in emergency situations deserves high marks; such as during the Nicaraguan earthquake about a year ago, and more recently the "Fifi" Hurricane disaster in Honduras. These instances are plus marks in relation to your occupancy of the spectrum.

It is almost impossible to think of Amateur Radio without some reference to the spectrum. Without it there would be no Amateurs. In the allocation table of 1947 after the Atlantic City Conference, the useful upper frequency limit was 40 Gigahertz. After the 1959 World Administrative Radio Conference it was 275 Gigahertz (275,000 Megahertz). With all the expansion of the useful spectrum, it is still crowded and the demands become greater all the time for more and more communication.

The first wireless signals to span the Atlantic ocean back in 1901 were transmitted on 915 meters (328 kHz). By contrast, during the series of Apollo flights to the moon, a frequency of 2,287.5 MHz was used. The power output from the transmitter was only 20 watts, but there was enough antenna gain to produce almost 13 kilowatts of effective radiated power (ERP) from the spacecraft. The engineers tell me that because of space loss in the signal traveling from the moon to earth, the received signal was more than 100 decibels below 1 milliwatt of power flux density.

During the past 75 years, we have been extremely fortunate in respect to the sunspot cycles, which as you know have considerable effect on radio wave propagation. There have been 7 of these cycles since 1900, and 21 since the Zurich Observatory began counting spots on the surface of the sun back in the year 1750. The greater the number of sunspots the better the radio propagation; the higher the "HF" frequency that can be used; and usually the less attenuation of the signal.

FCC Commissioner Robert E. Lee, the senior member of the commission, was appointed by President Eisenhower in 1953 and is currently serving his third term.

Born in Chicago in 1912, Commissioner Lee entered the Federal Bureau of Investigation in 1938 as a Special Agent. He came to the FCC from the House Committee on Appropriations for which he was the Director of Surveys and Investigations Staff.

Commissioner Lee, presently Vice Chairman of the FCC, is a member of the Radio Technical Commission for Aeronautics, and chairman of the U.S. Delegation to the World Administrative Telephone and Telegraph Conference.

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News Pages

SANTA CLAUS HEARD ON FM. Santa Claus was heard on 2m FM, full quieting from his North Pole residence. His mighty, "HO HO HO," put a lot of smiles on the faces of children unfortunate enough to be confined to Children's Hospital of Washington D.C. Through special arrangements with FCC and hospital officials, members of the Green Mountain Repeater Association Inc., established "Santa's" base station in the hospital's public relation's room and dispatched "helpers" throughout the hospital with FM portables. The picture tells the story which took place in rooms, corridors, clinics and emergency facilities. Wherever there was a child "Santa" made his appearance and debut on 2m FM.

Ham Club Project: Interest The Handicapped in Hobby

Otho Jarman WB6KYM made the papers recently with an excellent article about how valuable amateur radio is for him. Otho is a paraplegic and works both 2m FM and the DX bands. The Barstow, California Amateur Radio Club worked to set him up — he works both phone and CW — code being sent by a voice operated keyer. Otho broke his spine when he was 22, jumping into a reservoir to rescue a drowning child.

While there are hundreds of handicapped amateurs on the air today, there are thousands more people with serious handicaps who could benefit tremendously from the hobby. Helping these people is an excellent project for radio clubs. And please, if your club takes on someone to help — gets them licensed and set up to operate — don't forget to get the local paper out for a story. This will benefit all of us — and will help other handicapped people to learn about the wonders of amateur radio.

Congratulations to W6ZGC, W6FRW, W5UNF/6, W6PVR and WA6MUQ for their work in helping Otho.

Hams Aid Victims in Honduras

Amateur radio operators in the United States, Honduras, Canada and several Latin American nations jointly undertook the responsibility for providing emergency communication service in the wake of Hurricane Fifi, which devastated one third of Honduras.

The day after Fifi struck, September 21, Dr. Enrique Avilar, Minister of Health in Paz, established an emergency communications coordinating committee — COPEN, headed by Honduras amateur operator Alhandro Talbott (HR1ALT).

An emergency base station, HRØCPEN, was set up at Tehusecalpa, and contact to organize amateur support efforts was made with Noel Eaton (VE3CJ), Waterdown, Canada, president of the International Amateur Radio Union, and Harry Dannals (W2TUK), Dix Hills, N.Y., president of the American Radio Relay League (ARRL), an organization of amateur radio operators.

With the assistance of the ARRL and a group of Miami amateurs, four long-range, high-frequency stations, 17 short-range, two-meter FM stations, and a repeater station were delivered to COPEN to fill an urgent need for equipment to provide communications both within Honduras and with the outside world.

On September 21 and 22, more than 200 amateurs in the United States and a larger number in Central America handled emergency messages and requests for

Continued on Page 129

73 Staff

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

More and more writing is needed — writing you can do for fun and profit. . .

You don't have to be either a genius or an engineer to make your hobby really pay off — and that's a fact. . .

In addition to articles for 73 Magazine, we have a need for articles which can be used in booklets and other publications — a great need for articles — articles that just about any amateur with any experience can write.

What exactly are we looking for? Well, since most of the articles in 73 are written for the more experienced amateur, with far too little for the rank beginner and Novice we are very much in need of very simple explanations of common things which will help the newcomer to radio and electronics. The Novice needs to understand about antennas — the different kinds that can be made simply and how to use them. He wants to know about how to add a vfo to his rig. How to put in a keyer and how to use it. Why different types of feedline are used and which is best for which application.

How about some articles on basic electronics for photography? How to make darkroom timers — how to hook up slave flash units — sync units for projectors to be used with tape recorders — densitometers — evaluations of kits which are available for building darkroom gadgets — etc.

CBers have an almost inexhaustible need for information to help them along — about CB antennas — matching them — how to use power meters — field strength meters — what vfos are and why they are illegal — what accessories are available and how to use them — all about SSB for CB — info on the 460 MHz CB band and how to use it — evaluations of CB gadgets — CB antenna evaluations — mikes for CB (many CBers have never heard of a noise-cancelling mike) — common CB troubles and how to fix them — how best to mount CB rigs — CB antennas — alarm systems to protect CB gear — etc.

Simple and basic articles are needed in the security field — what equipment is available and from where — simple alarm systems for homes, offices, cars, businesses — closed circuit TV systems — slow scan TV systems — etc. Electronic locks would come under this heading too.

Hi-fi addicts need a lot more info too — how to hook up units — what matches what — how to get rid of hum — how to wire connectors — how to hook up speakers — what mixers are and how to use them — what size amplifiers are needed — what size speakers — what the difference is between all the types of speakers — what kind of wire is needed for speakers, for tape recorders, for turntables, mikes — how to test all these things — how to get rid of hum — what kind of antennas to use for FM at home or in the car — how to use rf amplifiers for the FM receiver — how to get hi-fi in the car — tape decks — cassettes in the car — all about reel to reel tape decks — cassette decks — eight track decks — all about the different types of tape for each application — how about using computer tape?

Speaking of computers — articles on simple computers are needed — what you can get — how to use them — what they can do — how about a home terminal to access a remote computer? Card systems — sorters — new gear on the market in the low price range.

We need to keep up to date on calculators too — particularly the

hand types – what they can do – the newest types and their advantages – accessories for them – new ways to use them – new chips coming out – evaluations of calculators.

SWL info will be good to get too – what to listen for – what receivers are best – surplus equipment which will help – getting QSLs – taping station idents – antennas – SWL clubs and bulletins – books.

In most of these cases we will need articles written by people with a lot of experience and background, not written by newcomers. Oddly enough, new SWLs have little info of any value to others – it takes a good deal of experience and knowledge to understand the field well enough to teach it simply enough for a newcomer to understand it. Thus I expect that amateurs, with their much greater understanding of electricity and electronics, will be able to keep up a good flow of information that will help neophytes to learn – and perhaps eventually get interested enough to become amateurs.

We need hundreds upon hundreds of articles – maybe even thousands. We will pay for them, naturally. So, if you have the ability to explain things simply, then you can make a substantial spare time income by writing for this audience. We expect to be paying out well over $100,000 in the next year or so for articles – is that enough to get you to your typewriter?

Activity is growing on 220 MHz with twenty users on new Connecticut repeater...

The fellows down in Hartford put together a 220 repeater by hooking two of the Tempo CL-220's together. As a temporary measure they set the system up to have its output on 223.5 – since almost all of the 220 MHz transceivers are coming through with simplex set up for this channel – and for 223.42 input – since many of the rigs also have a pair on that channel. The plans are to move the repeater to the more usual 223.34 – 224.94 pair soon.

Activity is high, with the twentieth regular user turning up recently – and with one or two new voices appearing every week. The boys really like the band since the range of the repeater seems to be very much like two meters with the exception of there being fewer dead spots in the downtown area and very little of the picket fence fading when in motion.

More and more ops are calling in on the Waltham 220 Clegg repeater too (WR1ABQ), another of the 34-94 systems. This one has very good coverage, with New Hampshire calling in every now and then.

Ops in any area where 220 is growing are asked to drop reports to 73 Magazine so the word can be passed. Let's have those cards and letters – and even some pictures, if you've got 'em. There will be a lot more pictures of activities, clubs, awards, picnics, things like that, if you send 'em in.

...WAYNE

SSTV SCENE

Dave Ingram K4TWJ
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Birmingham AL 35210

As I mentioned last month, the question has been raised of possible dwindling Slow Scan activity. The reasoning for this was that "on the air" activity is only moderate. We asked some of the fellows their opinion on this and here are some typical comments:

W9NTP – "The Dayton convention's SSTV Forum had standing room only, with newcomer interest very high. Many VHF Fast Scan operators have shown interest in Slow Scan, especially with the availability of Direct Fast to Slow Scan converters." WØLMD – "Possibly after newcomers buy SSTV gear and send pretty girl pictures for a month or so Slow Scan becomes meaningless. However, non-technical operators can still serve many valuable purposes on SSTV if they are seriously interested."

K2KEY – "The number of new SSTV calls on the net each week indicates Slow Scan is growing tremendously." WA7MOV – "Summer vacations and poor band conditions naturally reduce on the activity. Many fellows watch and listen but do not transmit SSTV. I feel the increase in SSTV activity is still phenomenal." W6KZL – "Hundreds of amateurs have built linear amplifiers but shy away from building a Slow Scan monitor. Older hams may not understand solid state circuitry and are timid about getting into it. Newer fellows, unless the engineering type, find circuitry a little over their heads."

W8OZA – "Many non-Slow Scanners comment they are hearing SSTV stations spreading across the band more lately. I've found SSTV interest in homebrewing and experimenting extremely high." W1JKF – "I feel SSTV is just beginning to go, and the best is yet to come."

Personally, I feel SSTV is growing tremendously but presently this growth is primarily technical, and off the air. Many Slow Scanners are busy building rather than operating. Watch for a boom in activity when this hits the air.

How closely the previous opinions parallel those of scanning disc television in 1925! DeForest, inventor of the "Audion" or three element tube, had this to say when asked about disc television. "Once the novelty has worn off there is nothing in the present limited images which will interest, amuse or instruct the average non-technical person." Another noted individual was Dr. E. F. W. Alexanderson. He transmitted the first television pictures from New York to New Zealand during the early 1930s. (These

Melvin Schneider K2KEY

disc pictures were audio tones similar to Slow Scan TV.)

He reasoned some early non-technical wireless operators lost interest like this: "There is nothing in the present crude system to hold one's interest once the novelty of seeing pictures has worn off." We must remember Slow Scan TV is still in its infancy. Radical innovations like SSTV are slow being accepted because people resent change.

Logic State Probe

Paul WA8TMP sent us two unique ideas using the bi-color light emitting diodes first mentioned in the August column. One of these suggestions is a logic state probe which should prove indispensable for designing and troubleshooting. The circuit is shown in Fig. 1 and will give the following indications: High-green, low-red (depending on which way LED is installed), open-no indication and pulsed-LEDs light alternately proportional to duty cycle.

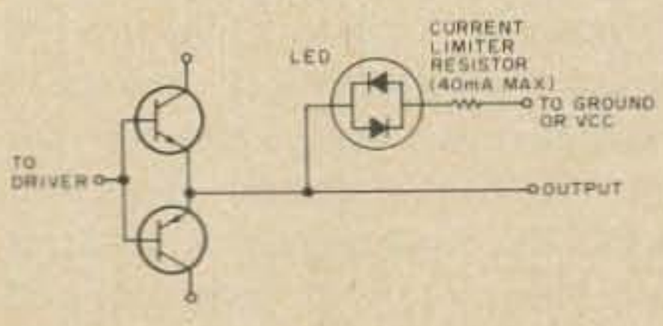

Fig. 2.

The second suggestion is for using the LEDs to monitor the state of a complementary output circuit. An example is shown in Fig. 2. Thanks Paul, for the information.

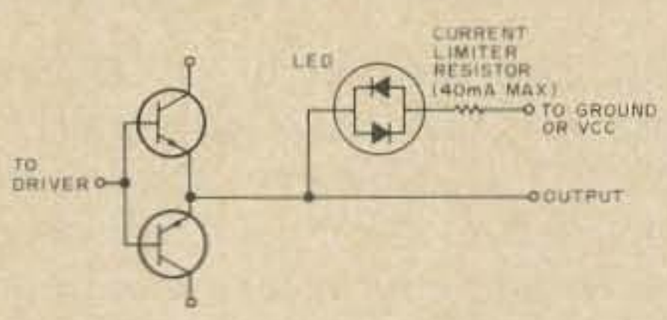

Fig. 2.

SSTV Happenings

Here's the latest ramblings on what's happening in Slow Scan TV. WA7MOV is receiving good quality weather satellite pictures from ATS-1 and ATS-3 using a VHF receiver (136 MHz) and modified Robot monitor. Often he transmits some of these pictures on the SSTV net, which meets Saturdays at 1800 GMT on 14.230 kHz. Talk is he's working up an article on this for the magazine. WØLMD is busy developing his Mark 2 version of the Digital Slow to Fast Scan converter. This converter interfaces a regular television to your HF receiver and results in fantastic pictures. The heart of this unit is a large MOS shift register. Present surplus chip cost places this system in the $400 range, but future price reductions are expected. Write Bob for more info.

I1LCF reportedly has designed a European version of the SSTV keyboard and has information available to interested parties. He also has a weather satellite monitor working very well. WA2ZDF/CP1 reports the Bolivian Government has placed a temporary ban on transmitting SSTV. Officials are studying this "new" mode, while locals display systems, so the ban shouldn't last long.

W3GKC is producing PC boards on the W7ABW plumbicon camera. (Details in SSTV Handbook.) This seems like the perfect way to build a good quality camera. W9LUO is producing PC boards on his solid state SSTV monitor which appeared in QST during 1972. This seems like the perfect way for newcomers to get started in SSTV. All you need do is to put components on the board and follow some simple external wiring and a fine quality inexpensive monitor results. PC boards can't be miswired like regular circuits.

W8OZA is making PC boards on the WØLMD SSTV keyboard and scan converters. If you would like to attempt some modern digital circuitry this looks like the perfect answer. PC boards are really nice when building involved gear. W6MXV is producing his top-notch monitor in a variety of kits, according to desired parts and cost. Write Mike for the full story.

A few month's back I had a brief description in this column of 1925 style TV, which was one of the very first systems aired. Since that time I have submitted a request to the FCC for special permission to transmit 1925 style TV signals on a three minute one-time basis. I will, hopefully, transmit these nostalgic signals on 80 and 20 meters during the early part of 1975 commemorating the 50th anniversary of television. Additionally, I am writing an article complete with pattern cut-out of scanning disc, descriptive information on an inexpensive (less than $10) receiving unit and schedule of transmission. (All you really need is an ac motor, light

dimmer for speed control and 2 to 4 LEDs to get a unit going.)

My first reply from the FCC came from A. Prose Walker and was, naturally, discouraging. However, the reply indicated my request obviously was not read, so I am still pushing for authorization. It's difficult for me to understand why we are being pinned down so heavily by regulations. Are we expected to be a simple bunch of operators with no incentive? I don't think so.

Should all airing attempts fail, I will still have info and tapes available via mail for the cost of an SASE. These disc signals sound like a poor quality 1000 Hz note. If the idea of actually receiving these unique TV pictures appeals to you why not drop me a card with your opinion. It's rather difficult pushing a project like this with only a handfull of hams interested.

K4TWJ

W1JKF and XYL

I would especially like to thank W1VRK for the fine photos in this month's column. Gene, in addition to being quite active himself, is responsible for getting many fellows interested in Slow Scan. Possibly you remember his introduction to SSTV article a couple of years ago.

K4TWJ

Bill Pasternak WA2HVK/6
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Some must have thought it real fun to hang up someone else in the middle of a call. Others thought the real fun was to dial up the local time and then leave the system "off-hook." Another group thought that the few simple rules concerning identification and call content didn't apply to them. Perhaps though, the most decisive factor was the apparent feeling by many users that this machine, like all others, was their god-given gift to use as they saw fit showing little regard to the wishes of the owner or licensee – least of all the FCC regulations.

Then too, there were the jammers those sick, warped minds that get their kicks by making life miserable for everyone else. Last and of greatest importance was the apathy on the part of most of the users not to do a damn thing about what was going on. The typical attitude was to leave it to the licensee to clean up the mess or let "Joe Ham" do it! So the licensee did "do something;" he was forced to close the WR6ACK "open" autopatch and return the system to a local area open repeater.

When Doug Andrews K6VGH, owner of WR6ACK and Fred Deeg K6AEH, its licensee, put the autopatch function into operation, it was made clear to all potential users that it would take their complete cooperation and total adherence to the rules for the first "Big City" open autopatch system to be a success. An open autopatch in a city like Los Angeles had never been tried before. Unfortunately, in short order 'ACK became a fad. Everyone rushed to hook up a touch-tone pad to their radio and join in on the new thing, whether they really had a valid need for it or not. No matter what repeater you were operating there was always someone who would break into your QSO for a check on how their tones sounded.

On the system itself, some of the most useless calls were made, like someone sitting in his driveway and calling his XYL in the house to tell her he was home. Few really cared about the fact it was someone else's station license and that the licensee was responsible for the legal operation of the system. This is an important point that so few VHF repeater operators realize.

Neither Fred nor Doug wanted to turn the autopatch off and appealed to the users to "clean house" and quit the kid-stuff. They even tried turning off the autopatch function for a few days in the hope this message would motivate the people that really cared into doing something. Alas, when the autopatch came on again, so did the garbage. Seeing no other alternative, and wishing to adhere to the regulations as set forth by the FCC, the autopatch function was permanently taken off in mid-September. The WR6ACK Open Autopatch killed by apathy!

Los Angeles has witnessed some fantastic growth on 220 MHz this past year. At present, it is safe to assume that the L.A. area probably accounts for 50 percent of the FM repeater activity when compared on a national scale. When the call "220 – Use It or Loose It!" rang forth, Southern California was quick to respond and did so in a big way. To date, the SCRA has coordinated some nineteen channel allocations of which eight are already in full-time operation.

The first to get on was WR6AFG, 222.38-223.98 from atop Johnstone Peak. Sitting at the east end of town, this system provides coverage of Pomona,

Riverside and most of Orange County. Much of the credit for getting AFG, which is an AREC Repeater on the air must be given to an old friend of mine named Mike Santana WB6TEB. I've known Mike for a number of years back when he was known as WA2AZX and he has always been in the forefront of trying someting new. Out here it was 220.

Close on the heels of AFG came WR6AER, the first successful .34-.94 repeater in Los Angeles; even if that had to be 222.34-223.94, rather than its two meter counterpart. AER, built by Bill DuHaime WA6NTW and Warren Andersen WA6JMM, has fast become the "people's gathering spot" on 220 and accounts for a good part of L.A.'s total activity. Though it was originally designed to cover the L.A. basin, quite soon it became evident that the site offered more than expected. From Long Beach, Orange County and San Diego the system attracted users. One day recently, while on a trip to Palmdale, Warren was surprised to find that he could work the system, good copy right over a range of mountains, doing so with a 10 watt Midland radio and a ¼ wave whip!

The AER system is composed of an all solid state RCA Super CAR-FONE receiver strip driving the transmit portion of a Midland 220 radio. However, at this writing, Bill is hard at work converting a Micor transmitter to replace the Midland and free it for other service. To date, after almost a year of day-to-day service, the system has never been off the air due to equipment malfunction, either rf or control, much to the credit of Bill and Warren.

Not to be left out by any means, the gang from Sulphur Mountain have 222.42-224.02 active with WR6AEP, as part of and in conjunction with their WA6SIN Remote – WR6AEP Repeater system on both two and 220. In Hollywood, WR6ABJ keeps 223.14-224.74 humming and to the Northeast at Crestline, WR6ACJ is to be found on 223.26-224.86. Finally, a recent addition is WR6AGH in Hall Canyon on 222.46-224.06. There are also a number of private closed systems operating and plenty of simplex on 223.500.

Along this line, I had a late evening talk and snack with Warren WA6JMM the other night. Our discussion centered around establishing a National Repeater Calling Channel for 220. If now, while activity on 220 is still in its formative years, we can agree nationally on a primary channel for "first repeater in the area" allocation, then in a few short years it may be possible to drive coast to coast with but one set of crystals in your radio (a single crystal in the case of the Clegg FM-21) and never be out of radio contact. Warren suggested the 222.34-223.94 pair since it can easily be remembered when associated with its two meter counterpart.

Whatever channels are chosen it must be started now to insure success in the future. Both Warren and I would be interested in your feelings about this and please do not hesitate to write.

Back to two meters. At the present time all available 30 kHz split channel allocations statewide have been assigned and are in use. But constantly, both SCRA and CARC are being bombarded with requests for new assignments by those who want a two meter system of their own. Like it or not, there is only one way to increase the number of available repeater channels and that is to split the separation in half and allocate these split-split channels. For a while, it was believed this would be an overwhelmingly approved statewide move. At this writing, however, Northern California has elected to stay with the present system and allocate the split-splits only when no other alternative can be found.

As to this area, the decision will be made at the November SCRA meeting. IRumors are that at least Southern California will go split-split. We already have a successful system on .295-895. Next month we will bring you an update. In case you are not familiar with split-split allocations and the trials and tribulations they entail, may I refer you to "Can Split-Split Channels Really Work" to be published soon.

In closing this month, Sharon and I wish each of you the best of Season's Greetings and happiness in the New Year. May it be one of building together for Amateur Radio's future growth and prosperity.

novice

Schley Cox WN9LHO
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QSL?

Some Novice operators are confused about when and how to send QSL cards and many are frustrated about not being able to get return QSLs from some states and DX stations.

Back in the good old days when I was KN4EMX there were quite a few operators (including myself for awhile) who sent QSLs to every new contact. Postage was three cents and the cards were cheap.

Today postage has increased 166 percent and QSL cards are expensive enough so that some operators never bother to get any. The idea today is to QSL only when one or both operators need the other's card. Most of us couldn't afford to send a card to every new contact anymore anyway.

Here are a few ideas on getting your share of the cards:

You can't complain about not receiving any if you yourself don't have QSLs to send. There are still some good deals on printed cards (73 Magazine's QSL selection, for example) and there is no law against homemade cards.

The kind of information to make sure of on your card is generally the same kind you include in your log – date, time, calls, frequencies AND something that confirms that a two-way contact actually took place. Without

that confirmation the card is not really a QSL card.

Some award committees throw out cards with calls or dates crossed out and correct information written in. If you miswrite information on a card throw it out and write a new QSL card.

It's perfectly all right to write in additional information on a card such as portable QTH and the slant bar portable sign after your call letters, and to change the Novice N to a General B when you upgrade your ticket.

When you need a card from a state, and the QSL exchange is your idea, send along an 8¢ stamp with your card in an envelope. The whole package will cost you nearly a quarter but it's more likely you'll receive a reply, especially from some of the rare states like Delaware and Alaska. Of course, if it's the first time the KL7 on the other end has worked your state and it's the first time you've worked Alaska, there's no need for anybody to include extra stamps with the QSLs.

DX QSLs aren't much different than those from the rare states. Most of the DX stations you will work won't need your card. Sending you one of theirs is not just a courtesy on their part but may be a financial burden also.

With so many WN stations chasing so few DX, in most cases it is a good idea for the WNs to pay the DX postage bill. The only way to do this is to send the DX station an International Reply Coupon. The coupons, available at most large post offices, are redeemable overseas for postage in that country good for a surface letter or QSL card back to the US. The IRCs cost 26¢ each. Send two for airmail returns. Sending them with your card may cost a lot more but it also takes the postage burden off the besieged DX station who is nice enough to get up into the US Novice portions of the bands.

The DX station probably will send his card to you via your local QSL Bureau. Make sure you have a stamped, self-addressed envelope large enough for QSLs on file with the bureau manager. Good hunting!

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

The following comes from Ken WB4MXC, 191 Biesecker Road, Lexington NC 27292. "The North Carolina Six Meter Association is now one month old and has about 30 active members. We figure this is at least 75 percent of the active six meter operators in the state. We are offering a nice certificate for working five member stations. Rules are simply log data for contacts after September 1, 1974 with $1 to WB4MXC, at the above address. We have a fine net on Sunday mornings at 0900 (1300CUT) on 50.12 MHz SSB. All station are welcome to check in. Our aims are simply to increase six meter interest and activity in our state. Other activities planned are member contests, annual picnics, a newsletter every couple of months and most important a lot of good old fashioned fellowship.

I would be interested in hearing from other state and regional groups of this type. Perhaps a mutual exchange of newsletters could be arranged to allow each group the benefit of the experience of the others. If each group will send me a copy of their publication I will see that duplicates are made and distributed to the interested parties.

From Dallas WA5IKU says September was slow with only a few 4s worked plus the locals. Perry says the city of Dallas will not issue a permit to erect a tower of over 24 feet. If you pay a $40 fee for a permit they will allow a maximum 36 foot tower. Local clubs are attempting to get the ordinance reversed.

Monte WB2EYF says after living in apartments he is very happy to be a homeowner and can't wait until his Swan 250 arrives. He has been stuck on 2 FM for a long time and looks forward to a good six meter band opening. Monte passes along news that the local VHF club, the RAM Association, is sponsoring a new six meter repeater, WR2ADK, with input on 52.68 and output on 52.525 with 360 Watts ERP. The split site machine consists of RCA LD units located in Pleasantville, New Jersey.

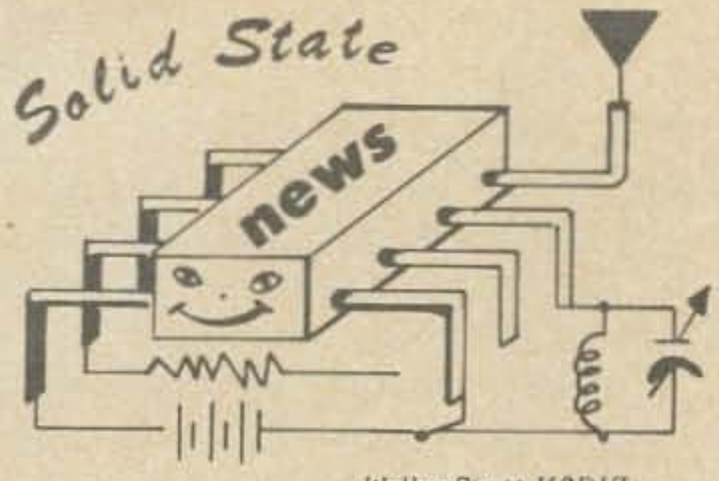
From Florida, WB4OSN says, "Even the September VHF contest was a bust as conditions were El-Stinko." A few 1s and 2s were worked there on Sunday. Joe says he has been busy on 10 and 15 trying to inspire six meter interest in Central and South America. The suggestion has been made that stations with the capability monitor 28.53 weekends as a way to exchange ideas, what's been heard, etc.

Ray K5ZMS says six has been slow but he doesn't seem to mind too much. "It gave me time to spend with my family...I have been so busy getting SMIRK on the go. We now have 547 members in 44 states and 12 countries. I am starting to get back reports that the TVI education program is starting to have some effect and that members are using it to combat and end neighbors' TVI difficulties. I would like to hear from more who have used the info to help a neighbor rid themselves of their TVI problems."

The October 6 – 6 Club newsletter contains several items of interest. First and foremost, the membership has reached the 171 mark and is nationwide. The twenty latest members represent eight call areas. The latest state representatives are: Mighigan WB8MXP, 1692 Mandigo Road, Kalamazoo 49002; and Texas WB9KPC/5, RR6, Box 515, Paris 75460. The group around Ashland, Kentucky conducts a "Band-Aid" net every evening on 50.14, members monitor 50.11 too. The Kokomo, Indiana Amateur Radio Net is held each Sunday on 50.7 at 2100 CUT. And finally, each morning from 1230 to 1330 CUT a group meets on 50.110 for a ragchew session. These fellows hail from Indiana, Kentucky and Ohio.

The VHF Handbook for Radio Amateurs by Bill Orr of Eimac and Radio Handbook fame and

Continued on Page 129



Waller Scott K8DIZ
7318 Hollywood Drive
West Chester OH 45069

Recent advances in solid state electronics have resulted in the marketing of a wide variety of test equipment that should be of interest to the ham experimenter.

Digital voltmeters have become available at ever decreasing prices. Some are battery powered and the cost is much less than designs of several years ago. Accuracy is much improved, considering the price range of these instruments, (i.e. Hewlett Packard's Model 970A hand held probe type DMM, 3½ digits, N 1% dc volts accuracy for $310.00). DMM's aren't likely to replace the conventional multimeter in all applications though.

While accuracy of reading increases with DMM's, changes in the measured voltage, or current, that occur too fast for the digits to be read, result in a meaningless reading of blurred numbers. The faithful analog meter still shines in the realm of peaking type measurements, as in receiver alignment, or in measuring fast drifting voltages. DB measurement is still more readily attained with the analog meter.

Waveform generation equipment has begun to appear on the scene at quite surprising prices (i.e. Wavetek's Model 30, 2 Hz to 200 kHz Function Generator – SINE, SQUARE, and TRIANGLE waveforms – $149.95, all solid state and battery operated). Most of these new generators cover the frequency range of from 0.01 Hz (that's 100 seconds per cycle!) to 1 MHz. Some of the more expensive go to 11, 20 and even 30 MHz on the top end. This isn't much compared to a regular CW signal generator, but these instruments generate many complex waveforms, far beyond the capability of a standard RF signal generator.

The circuitry behind the scenes in these new instruments is often one or more custom designed ICs with associated control and switching elements. These elements switch the IC into the correct frequency or voltage range and provide the proper type of output, be it digits of display or voltage output of the proper waveform.

Experimenters who feel that even the new lower equipment prices are still a bit steep for the average budget, will be pleased to learn that most of the complex functions performed by these instruments are available in special function ICs available through manufacturer's distributors or 73 advertisers.

This month we'll consider the generator type ICs and some multimeter types next month. The generator IC is usually referred to as a Function Generator because of the multiple output waveforms it generates. Some of the more common waveforms available from function generators are: SINE WAVES, SQUARE WAVES, TRIANGULAR WAVES, RAMPS or SAW-TOOTHS, and PULSES. In addition to the variety of waveforms available, a number of control modes and modulation types are available.

The frequency of the generated waveform can be varied with an ac or dc control voltage (voltage controlled generator–VCG), sometimes even referred to as FM! The waveform can be "gated" off and on for any desired duration by an external input. Outputs can be "triggered" into momentary single cycle operation. Amplitude modulation (VCA) can be obtained or the AM control can be used as an output level adjust. The frequency of the generator can be swept from F1 to F2 and then reset to F1 to begin another sweep. In this case, an external ramp signal is required. The symmetry or duty cycle of a waveform can be adjusted with a pot. Square waves can become pulses and triangles ramps.

By now you can probably imagine many different uses for these circuits. A logical choice would be a function generator test instrument which could be as simple or elaborate as you choose to make it. Perhaps your requirements would be met by a low frequency sine and square wave generator with no need for the other controls and output waveforms. On the other hand, a complete audio to rf frequency sine, square and pulse generator with gate, trigger, sweep and symmetry controls may be just the thing for a more serious experimenter.

These circuits aren't limited just to test equipment applications. Frequency shift keying (FSK) voltage and current to frequency conversion, DSB with suppressed carrier, simultaneous AM and FM, phase shift keying (PSK) tone burst, crystal control, and phase-locked-loop operation are all possible with function generation type ICs.

Some of the units have more capabilities than others. The basic

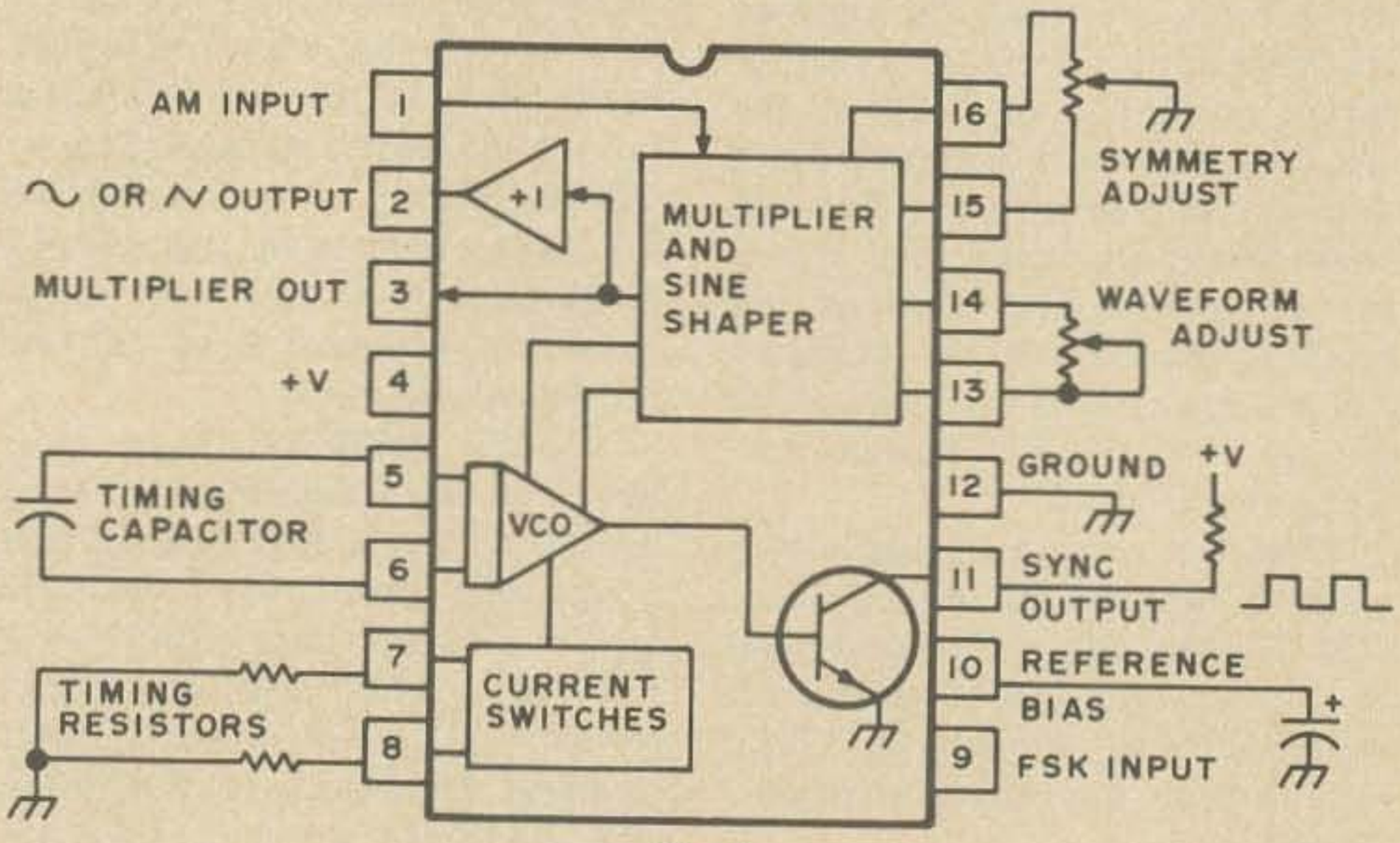


Fig. 1.

Characteristic	XR-205	XRS-200	XR-2206CP	XR-2207CP	8038BC	LM566CN NE566
Sine Wave	X	X	X		X	
Square Wave	X	X	X	X	X	X
Triangle Wave	X	X	X	X	X	X
Ramp	X	X	X	X	X	
Pulse	X	X	X	X	X	
FM	X	X	X	X	X	X
AM	X	X	X			
DSB	X	X	X			
FSK	X	X	X	X	X	X
Sweep Range (F2:F1)	10:1	10:1	2000:1	1000:1	1000:1	10:1
Symmetry Adjust	X	X	X	X	X	
Max. Frequency	4 MHz	30 MHz	1 MHz	1 MHz	1 MHz	1 MHz
Supply Voltage	8-26 V	6-30 V	10-26 V	8-26 V	10-30 V	10-24 V
Package (dip) Pins	16	24	16	14	14	8
Manufacturer	Exar	Exar	Exar	Exar	Intersil	National Signetics
Aprx. Price Each	$12.05	$28.90	$5.50	$4.15	$5.75	$2.50

Operating features of function generator IC s.

component of the system is a stable voltage controlled oscillator (VCO). The VCO generates the basic periodic waveform. An external timing capacitor is usually charged and discharged with a constant current providing a linear triangle or ramp waveform. The VCO is usually followed by a wave shaping circuit which performs triangle to sine conversion or symmetry adjustment. Then an AM modulator would follow, if included. Lastly, an output buffer stage is included to provide adequate drive levels to the load. Fig. 1 shows the block diagram of a new and versatile IC, the XR-2206CP.

The chart above lists some of the important operating features of a selection of function generator ICs.

Exar offers an excellent AM/FM generator kit (XR-205K) for $28. This kit contains two XR-205 ICs. One IC is used as a carrier generator and the other as a modulator. CW, AM, FM, FSK and PSK waveforms over the frequency range of 1 Hz to at least 5 MHz can be obtained. In addition to the two ICs the kit includes an etched and drilled circuit board, a component list of other required components and their approximate prices, and detailed assembly and hook-up instructions.

Data sheets and application info on these ICs are available from the manufacturers at addresses listed in the July column, except for Intersil Inc., 10900 N. Tantau Ave., Cupertino, California 95014, and Signetics, 811 East Arques Ave., Sunnyvale, California 94086.

Merry Christmas and Happy Experimenting!

... K8DIZ

F6CBX

Jean Claude Miceli F6CBX wins the one year subscription this month with this interesting etching depicting life in Blois, France around 1650. Blois, his home town, is located in the Chateaux region, 180 km from Paris. Keep sending your entries to 73 Magazine, Peterborough NH 03458.

ANOTHER FCC BOLLIX

A repeater group in Ruston, Louisiana managed to get its license approved and issued — only to find that Gettysburg had screwed up and issued them a WR4 call instead of a WR5. They quickly returned the license (in early March) and waited for the correct call to be issued. They are still waiting as of the end of October. FCC officials in Washington have advised that they go ahead and use the WR4 call until the correct call arrived. Visitors to the area are warned not to worry about working through WR4AFN while in the 5th district.

News Pages Continued on Page 114

LETTERS

ou goons don't ever proofr
l asy m s p f m b
bunch of rocks re g n
you ignored my comments In
I insist that you print ev

CLEVER IDEA

Thought you might be interested in a new trend that is developing within repeater clubs.

Pictured are the decals purchased by the Metropolitan Repeater Assocation WR2ACD and the Mt. Beacon Amateur Radio Club WR2ABB.

Both groups are offering one free decal to each paid member. Additional decals for members as well as interested hams may be purchased at $1 each. It is generally preferred that a station work the particular repeater, thus having the decal become a form of "QSL," though this is not really necessary.

Persons interested in purchasing decals should contact the following, enclosing a large self-addressed, stamped envelope and a dollar for each decal.

For WR2ACD: Tom Provost, WA2YJF, 146 Merrick Rd., Lynbrook, N.Y. 11563.

For WR2ABB: Ron Perry, WA2CGA, RD 1, Glen Ave., Fishkill, N.Y. 12524.

More information on design and purchase of these decals can be secured from Mike Shaner, WA2GGE, 938 N. Ontario Ave., Lindenhurst, N.Y. 11757.

The decals can be good money makers for a club or a nice little extra for dues-paying members. In either case, they are different and distinctive.

Ron Perry WA2CGA

WOMEN SAILORS

Being a seagoing "sparks," I read with some interest your article in the September issue on Gloria Vader, the "first YL Maritime op". She is probably the only one at the moment but is certainly not the first.

Shortly after the Second World War the American Communications Association, CIO, now known as the American Radio Association, AFL/CIO, and the larger of the two unions of seagoing radio officers, called for an NLRB election in a small company running out of New York to Europe and won the election. Under the terms of the law, since the union won, all radio officers who voted in the election were entitled to full books in the union.

Much to the consternation of the union officials, and later the steamship officials of various companies the union had contracts with, one of the radio officers voting in that election, although named Billy Adells, turned out to be a woman. At that time, and practically the same today, the only women on American ships were on passenger ships in the steward's Dept., nurses, telephone operators, etc. However, there was no choice, under the labor laws, and she applied for and received her full book in the union.

Around 1947, Miss Adells quit her ship and registered at the union's hiring hall in New Orleans on the rotary hiring list. Eventually her turn came around and she took a job on the S/S Gulf Banker, a 10,000 ton freighter, also carrying 12 passengers, of the C-2 class. It belonged to Gulf & South America Line, owned jointly by Grace Lines & Lykes Bros. SS Co., a steady run from various gulf ports to the West coast of South America. Amongst seamen it was considered a good ship, a good company and an excellent run.

Up until 1949 the radio operator on a ship was not legally an officer although all the rights and priveleges of such were extended to him, or her in this case. In 1949 Congress, at the instigation of the union, passed a bill legalizing the officer status of the R/O aboard ship. The USCG Bureau of Merchant Marine Inspection then issued a "Radio Officer's License", the qualifications for which were that one had to have a "valid 2nd or 1st class radiotelegraph license issued by the FCC", take a first aid test and pass a cursory physical. Miss Adells applied for the license in New Orleans and was turned down because she was a woman. She immediately started raising cain, asked them to show where the law mentioned sex, threatened to sue, etc. They caved in and issued her the license. This was 20 odd years before women's lib.

In the early 1950's Miss Adells quit the S/S Gulf Banker, and the sea, and went to school. She then set up practice in Houston, specializing in felines, and, as far as I know, is still there practicing.

However, around 1967 when there was a shortage of radio officers due to ships being brought out of the boneyard for the Vietnam sealift, Miss Adells made several trips on a big bulk carrier, belonging to Bethlehem Steel, hauling grain to India. After that she went back to her veterinarian practice and that is the

last I have heard of her.

Some years ago I heard of a captain on a tanker of a small independent company who had his wife signed on as 2nd radio officer. How much of her duties were radio operating and how much were "wifely" I don't know. These are the only two women R/O's on U.S. ships that I have heard of although there might have been more before my time, which would have been before the Second World War.

The Scandanavians, particularly the Danes and Norwegians, carry quite a few women R/O's on their ships, sending them to government schools for training.

I have been asked many times how one qualifies to become a seagoing R/O. The primary thing, of course, is to have at least a 2nd class telegraph license, and the USCG radio officer's license, plus seamen's papers, commonly known as a "Z" card, with the proper endorsement.

However, 99.9% of the ships only carry one R/O and in order to qualify for those jobs one must have a "6 months sea experience" endorsement on the FCC license. This is rather hard to get. Seatime on a foreign ship is not recognized — it must be a U.S. vessel. See subpart "F" of FCC rules & regulations, Part 83.

Years ago it was common to get this time as a junior R/O on a passenger ship but passenger ships, under U.S. flag, are now few and far between. The only other way is to sail on a non-compulsory equipped ship, which are smaller vessels such as seagoing tugs, research vessels, etc. I'm not sure of what the cutoff tonnage between non-compulsory & compulsory ships is. It must have, of course, in order to qualify, a radiotelegraph station, a watch stood on 500 kHz which is the CW international calling, answering and distress frequency and be open to public correspondence. For this reason the FCC has never recognized Navy seatime as they do not stand a watch on 500 kHz. At one time, and possibly still, the FCC did recognize USCG time on the weather ships as they stood a watch on 500 kHz, handled traffic with merchant ships, etc.

Some years ago there was an electrician on a ship with me, who is W5JDK, who had the proper commercial licenses, but no six months. For about a year with the captain's permission, he came to the radio room, stood a regular watch, signed the log, and got his time in that way.

If Ms. Vader's survey ship has a W/T station she can, after six months, have the captain endorse the back of her license, go to the FCC, get her endorsement and be fully qualified to sail any ship, except chief on a passenger ship which requires a first class license.

With the rare exception of women in the stewards department there are no women, presently sailing on oceangoing vessels of the U.S. Recently though the U.S. Merchant Marine Academy in Kings Point, N.Y. accepted 15 women midshipman (midshipperson?) who, during their 4-year course will spend a year at sea as coadets on merchant ships. When, and if, they graduate in 1979 they will receive licenses, as either 3rd engineering officers or 3rd mates (deck officers), be commissioned in the Navy Reserve as ensigns, and in the case of the deck officers as line officers, receive a B.S. degree. I believe the California State Maritime Academy at Vallejo has also taken in some women to train as ship's officers. Why not women radio officers?

Richard F. White W6UKK
Radio Electronics Officer
S/S Genevieve Lykes/WZJA

CRYSTALS WANTED

I am a proud owner of HEATH HW 32-A. In spite of all I am gloomy due to its restricted coverage. I would be grateful if someone could send me crystals of 18.075 and 18.175 MHz so I can cover whole 20 meter.

R.D. Gupta VU200
3, Naya pura
Guna 473001
India

TRY HARDER?

With reference to Ernie Opel's W7YTE comments in the Sept. issue, once again the fellows in Washington must be spending too much time floating face down in the Potomac. As in Seattle, they must not have tried too hard to push 25W erp through some of the granite hills in the New England area. I admit we shouldn't expect commercial quality coverage from the run of the mill 15W mobile and the restrictions on power from the machine does tend to make one hang up the mike and talk to oneself. (At least it's full quieting). I don't want superpower but why can commercial two-way repeaters be licensed at 60-100W out, then that going up to 6-10 DB gain antennas? It's only a hobby but sometimes it counts for more than that.

Daniel J. Szymanski
Ellsworth, Maine

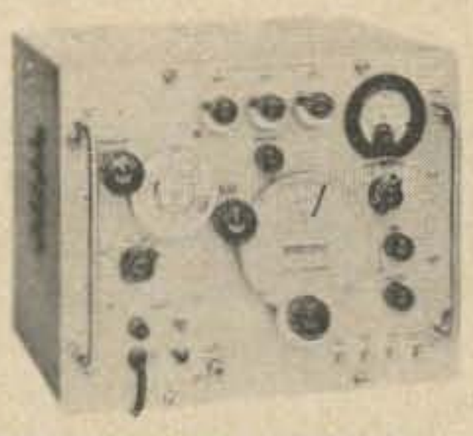
TR-285 CONVERSION WANTED

Thank you for the letter informing me of your magazine shortly after I received my Novice ticket. I have been reading 73 for a few years and am already a subscriber. In my opinion, no other magazine can compare with the quality of 73. I am now a General class license holder. Recently I acquired a few RT-285/URC-11 walkie-talkies for 243MHz air, emergency. I would like to convert these for use on the 220MHz amateur band. I would greatly appreciate it if you could possibly get me in touch with anyone who has performed this conversion or anyone who could get me a schematic of this unit. Thanks again for the best magazine for radio amateurs, and three cheers for Wayne Green!

Thank you for your assistance.

George Galloway
P.O. Box 2488
College Station TX 77840

Letters Continued on Page 121



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BALLANTINE 300H VTVM: The 300H is a compact, conservatively designed instrument for applications where high accuracy, low maintenance cost, long life, freedom from power line disturbances and simplicity of operation are of prime importance. Its basic accuracy of 2% of reading combined with calibration stability of 5000 hours and high sensitivity of 30μV in the null detector mode makes the 300H a versatile laboratory tool. It is also usable as a 40dB gain wide band amplifier. Voltage range is 300μV to 300V with frequency range from 10 Hz to 1 MHz, input impedance of 2MΩ shunted by 15 or 25pF and −10 to +10 linear dB scale **$130.00**

MILITARY AN/UPM-15 200 VOLT PULSE GENERATOR: A portable, general purpose pulse generator set used for testing pulse amplifiers and networks, and for modulating oscillators in field and depot maintenance. It generates single or double pulses of variable repetition rate, width, amplitude, separation, delay and rise decay time. The pulses may also be synchronized with oscillators or other instruments. Output rep rate is externally or internally variable from 50 Hz to 10 KHz, pulsewidth variable from 0.5 to 100μ seconds, amplitude 0.002 to 200 volts and calibrated delay from 2 to 225μsec. An extraordinary value ... **$75.00**

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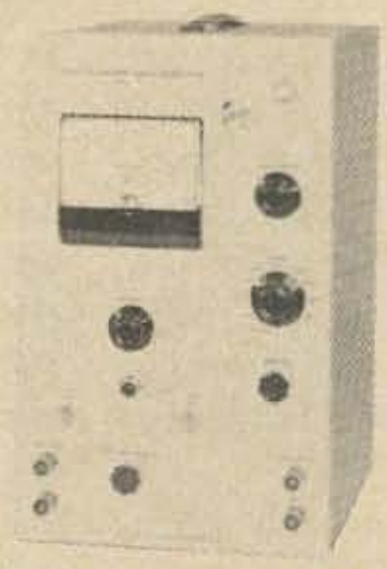
Fluke 1941A Counter **$249.95**



TEXTRONIX 105 SQUARE-WAVE GENERATOR: From 25 Hz to 1 MHz and with a risetime of less than 20nsec into a terminated 93 ohm cable - the 105 will generate up to 15V and more than 15mA peak-to-peak. Precision square waves over the complete range make the 105 a perfect instrument for testing amplifiers and other test instruments. The TECO price makes it even better **$75.00**

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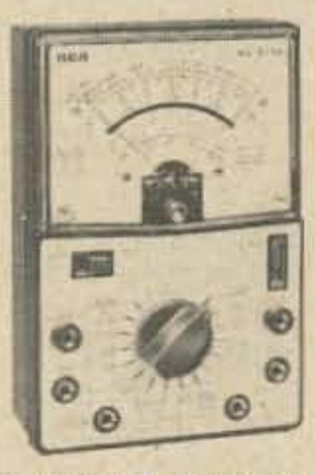

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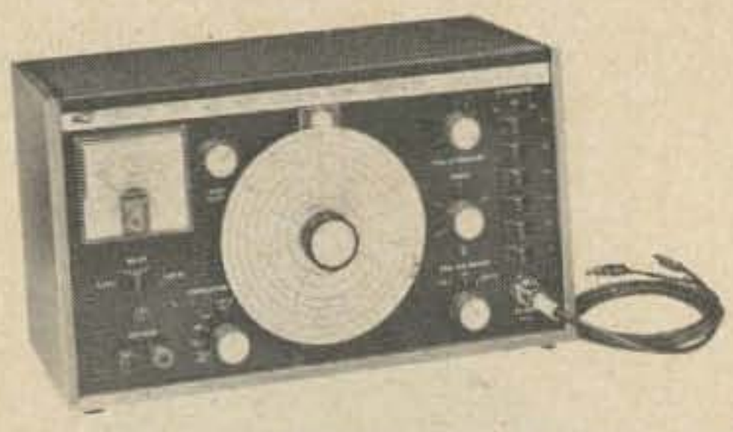

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Dick McDonald, K5WOR
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WR4ABR	Arlington	6.31-6.91
WR4ADZ	Bull Run	6.37-6.97
WR4ADV	Charlottesville	6.28-6.88
WR4AAD	Fairfax	6.19-6.79
WR4AFG	Fairfax	6.34-6.94
WR4ABU	Lexington	6.01-6.61 52.02-53.02
WR4ADY	Lynchburg	6.34-6.94
WB4QET	Roanoke	6.34-6.94 6.98-6.94
WR4AFE	Roanoke	6.28-6.88
WR4AEY	Vienna	222.34-223.94
WR4AAD	Washington D.C.	6.19-6.79
WR4ABR	Washington D.C.	6.31-6.91
WR4AFG	Washington D.C.	6.34-6.94
WR4AEY	Washington D.C.	222.34-223.94
WR4AAG	Washington D.C.	439.25-427.25 439.25-431.75

WASHINGTON

WR7	Colville	6.16-6.76
WR7ADB	Marysville	222.34-224.94
WR7	Orcas	6.13-6.73
WR7ACS	Puget Sound	52.70-53.16
WR7ACA	Puget Sound	6.28-6.88
WR7	Seattle	6.19-6.79
WR7ACD	Seattle	6.85-7.71
K7PBU	Seattle	449.85-444.85
WR7ACE	Spokane	6.34-6.94
WR7ACF	Spokane	6.28-6.88 449.85-444.85
WR7ACL	Spokane	52.525-53.290
WR7ACO	Tacoma	6.04-6.64
WR7ACU	Tacoma	6.16-6.76

WEST VIRGINIA

WR8ABM	Morgantown	6.16-6.76
WR8ACK	Weirton	6.34-6.94
WR8ABQ	Wheeling	6.16-6.76

WISCONSIN

WR9ABV	Lake Geneva	T1.95	6.37-6.97 6.34-6.94
WR9ABG	Superior		449.625-442.625

WYOMING

K7KMT	Casper	6.34-6.94 444.55-449.55
WA7KZC	Cheyenne	6.16-6.76 6.10-6.70

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VE1GH	Moncton	144.396-145.70
VE1VHF	Moncton	6.46-7.06
VE1PD	Crabbe Mt.	6.16-6.76
VE1KMT	Kintore Mt.	6.46-7.06
VE11E	Saint Stephen	6.28-6.88
VE1SMT	Scot Mountain	13-73

QUEBEC

VE2IU	Arvida	6.70-7.60
VE2SP	Chicoutimi	6.34-6.94
VE2UV	Granby	6.58-7.54
VE2RM	Mont Rigaud	6.40-7.18 444.00-449.00
VE2NY	Riviere-du-Loup	6.34-6.94
VE2AT	Trois Rivieres	6.07-6.67
VE1HI	Charlottetown	6.34-6.94 6.34-6.06

NOVIA SCOTIA

VE1BO	Bridgetown	6.46-7.06
VE7HR	Fraser's Mountain	6.16-6.76 6.28-6.88
	Gore	04-64
	Liverpool	6.46-7.06

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VE3RSB	Burlington	7.81-7.21
VE3TAR	Cobalt	6.34-6.94 6.46-6.94
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VE3NDT	London	6.34-6.94
VE3OSH	Oshawa	7.72-7.12
VE3OCR	Ottawa	6.25-6.85
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VE3YQT	Thunder Bay	6.46-7.06
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VE3TDX	Toronto	7.93-7.33
VE3TFM	Toronto	7.78-7.27 222.38-223.98
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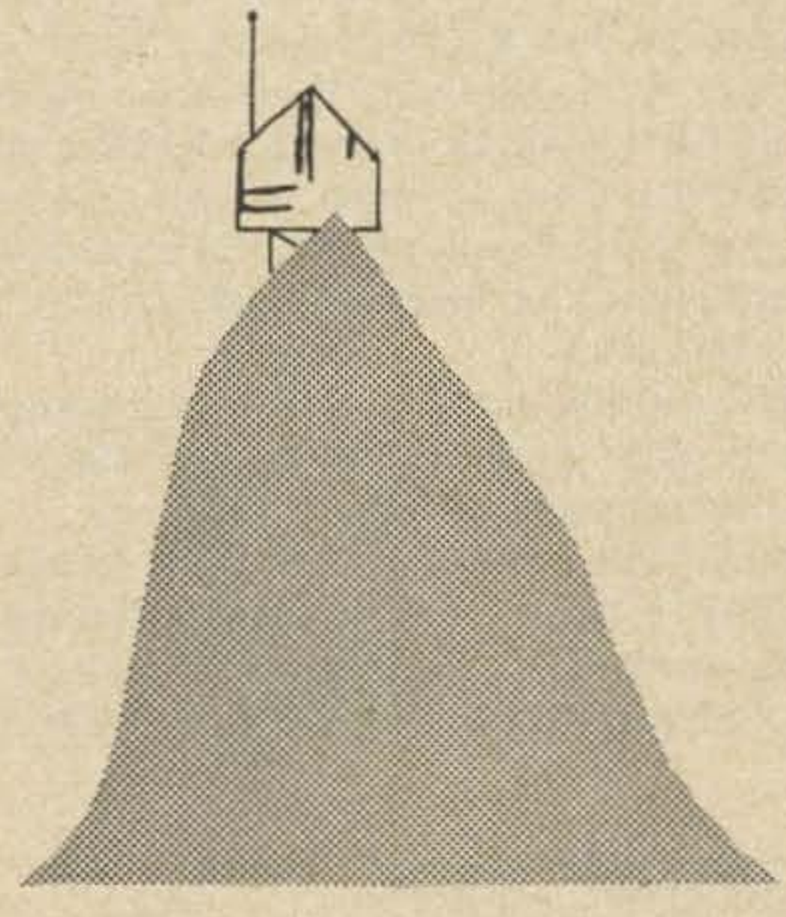

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*Manual Vertical Trigger Push-button allows re-start of scan at any time.
*Tuning Meter, instead of LED, to aid tuning in of SSTV signal.
*Noise immunity circuits and special filtering to allow for excellent "closed circuit" pictures under high noise conditions. Copy pictures with 3dB or less signal strength.
*The only SSTV Monitor with Transistors, ICs and Op Amps mounted in plug-in sockets on a G-10 glass epoxy-gold flashed printed circuit board.
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*Fully meets or exceeds all currently accepted SSTV standards-World-wide.
*Size: 15½" deep, 14" wide, 8¼" high. Weight 26 lbs. Color: Black and White or optional 2 tone gray when specified – no extra charge. Aluminum Cabinet.
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HCV70FSVFK Fast Scan Viewfinder Kit HCV-2A $69.95
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#MC-1 Microscope Adapter C-Mount				$ 6.95
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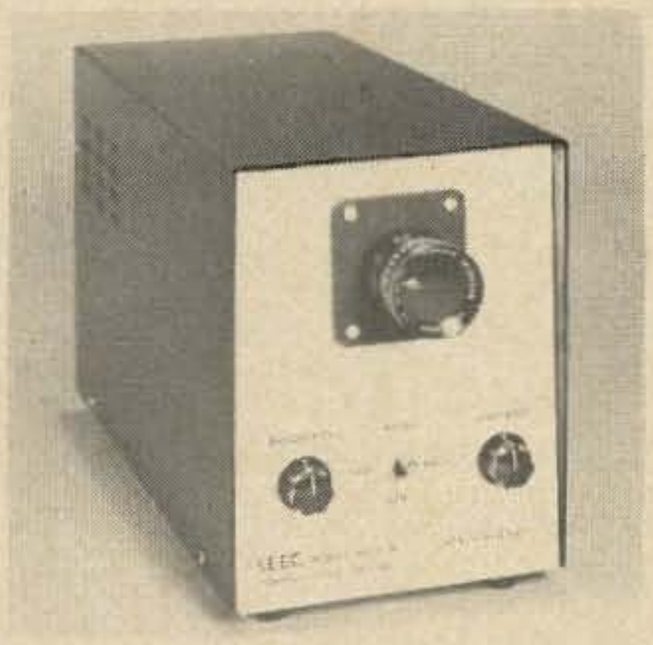

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Peter A. Stark K2OAW
196 Forest Drive
Mt. Kisco NY 10549

How To Make Nicads Behave

Nicad Care — A to Z

Many types of portable gear use nickel-cadmium rechargeable batteries (Nicads). Though these batteries last a long time if properly used and cared for, abuse them and you will find that they will die in a short time. Perhaps this article will show you how to treat them right.

Nicad Types

Nicads come in two types, vented and sealed. The vented types usually have a liquid electrolyte and therefore have to be kept upright. During normal operation (charging and discharging) there are gases generated in the battery, which leak out through the vent. You therefore have to fill the battery periodically with de-ionized water to make up for the electrolyte loss. In this respect, these vented cells are similar to the common lead-acid batteries used in cars. Sealed Nicads, on the other hand, can be used in any position and do not require the adding of water at any time. They also have a vent, but this vent is used only as an emergency pressure release in case the gas pressure inside gets too high due to improper use. Once some gas escapes, the battery starts to dry out and the electrolyte cannot be replaced.

Both of these types have their good points and bad points. The sealed cells are, of course, easier to use in portable equipment since you can turn them at any angle without worry. But since it is important not to generate enough gas pressure inside to cause venting, the sealed Nicad usually has to operate at lower currents. Vented cells may be more awkward to use, but they can be made more powerful and in larger sizes. Since the electrolyte can be replaced or added to, the vented cell can stand more abuse, larger charging and discharging currents. In fact, a common application of vented Nicads is to run the starter motor on large aircraft engines; they can stand tremendous currents, and are usually smaller and

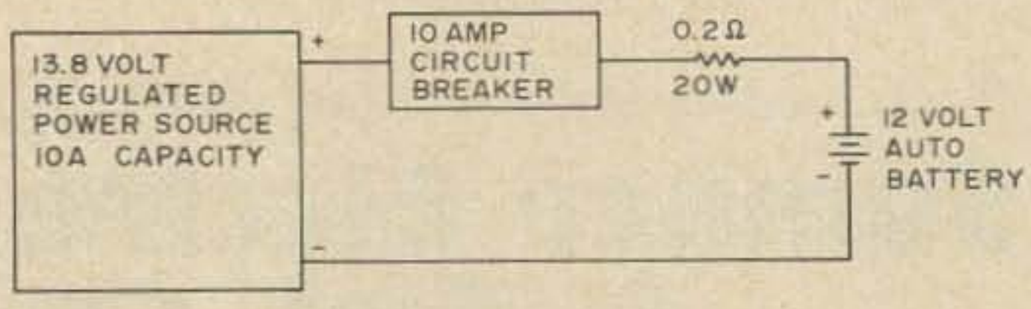

Fig. 1. Constant voltage auto battery charger.

lighter than lead-acid batteries of the same electrical capacity. In amateur applications, of course, we don't need such large currents, and so the sealed battery is the one commonly used. This article will cover the sealed type only; the most commonly used battery sizes are the standard AA, C and D sizes, as well as a few special purpose types such as the 15V batteries used in Motorola HT-220 2m rigs.

Nicad Voltage

Unlike the voltage of a standard dry cell, which starts high and steadily decreases during its discharge, the voltage of a Nicad is remarkably constant during its service life. Shortly after a full charge, the voltage of a Nicad cell may be as high as 1.45V or so, but shortly after that the voltage drops down to somewhere between 1.2 and 1.3V. It then stays there for most of its discharge until, when it reaches close to being completely discharged, the voltage suddenly starts dropping toward zero. When it reaches somewhere around 1.0 or 1.1V, depending on the manufacturer, it is considered discharged since from that point on its voltage is considered below a useful level. This 1.0 or 1.1V level is therefore useful in determining the overall charge the cell can store. Note that we are talking here about a single Nicad cell, in a battery consisting of many cells, the total voltage would then be the sum of all the cell voltages. In this discussion we are talking only about a *single* cell.

The interesting thing is that, even if you completely discharge a Nicad down to 0V, as long as you do it slowly and don't keep the load on for too long afterward, as soon as you remove the load the cell voltage will start climbing again to somewhere above a .5V. This is a strictly low-current condition, since any load placed on the cell at this point will simply bring the voltage back down to zero again. But it is a simple, useful test of a cell. As long as an open-circuit cell has at least .5V or more across it after you leave it sitting for a while, it is probably not dead. On the other hand, if the cell voltage is zero even under open-circuited condition, then most likely the cell is dead and no matter how much you try to charge it you won't get anywhere.

Nicad Capacity

The word capacity refers to the total charge that the battery can store and supply to its load per charging, and is usually measured in ampere-hours or milliampere-hours. For example, a 100A Hour battery (and that's big) should be able to supply 100A to a load for one hour, 10A for 10 hours; or 1A for 100 hours, before it goes "dead." This is a simple explanation, but there is more to it than that.

First of all, the faster you discharge a battery the less total energy you get out of it per charge. That 100A hour battery we are talking about here might deliver 100A for an hour, but with only a 10A hour load it might be good for 11 hours, rather than only 10. At a 1A load you might get 115 hours, rather than the originally assumed 100 hours. How do you then rate this battery — 100A hours, or 110, or 115? Different manufacturers would probably use different ratings.

Most manufacturers use discharge times between 1 and 5 hours for their ratings. For example, one manufacturer might rate his 450mA hour AA cell as being good for 450mA for one hour; another manufacturer might make a slightly weaker cell which will only deliver 450mA for 50 minutes; but since it might deliver 90mA for five hours, he too would call his cell a 450mA hour cell. It all depends on how you measure it.

Another question is, "When do you define the cell as discharged?" This brings us back to that 1.0 or 1.1V level. A manufacturer who uses 1.1V as his cutoff in figuring his ampere-hour rating might be able to squeeze a little more out of his cell if he let it go down to 1V; hence he is giving you more than the guy who uses 1V in the first place.

Discharge Current

In order to compare different size cells with each other in terms of current flow, we use something called "C rate." The C rate is a charge or discharge current equal to the milliampere-hour or ampere-hour rating of the battery. For example, for that 450mA Hour AA cell, the C rate current is equal to

450mA. The C rate current for a 1.2A Hour D cell is 1.2A, and so on. Then a cell that is discharged at its C rate will last about 1 hour before reaching its discharged state, assuming that the manufacturer used the 1 hour discharge rate in figuring his cell rating. If the manufacturer uses, say, the 5 hour rate, then he is basically using a C/5 (or 0.2C) rate for five hours of discharging. In the case of the 450mA Hour AA cell, that translates into 90mA (450/5 is 90, or .2 of 450 is 90, so the C/5 and 0.2C notations are identical) for a period of 5 hours.

Then the amp-hour or mA-hour rating is approximately equal to the C rate at which we discharge the battery times the number of hours that the battery will last before going discharged.

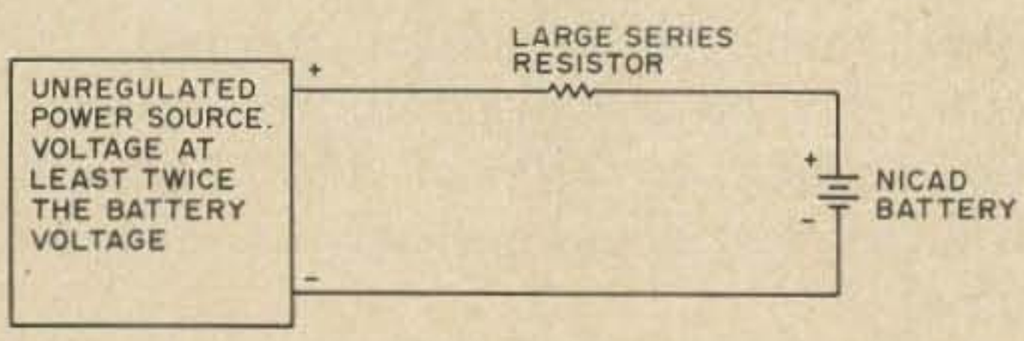

Fig. 2. Simple Nicad battery charging circuit.

But we have to be somewhat careful when we start talking in terms of batteries rather than just single cells. A battery is a number of cells connected in series with the intention of increasing the voltage. But since in a series circuit the current is the same throughout, then if we draw a current of, say, 100mA from the battery, the current through each cell is also 100mA. In other words, each cell in the battery is being discharged at the same speed. Therefore we should make sure that all the cells in series are of the same size and type.

But even then, some of the cells may be better than others. That means that the weaker cells will reach their discharged state earlier than the stronger cells, since all of them are conducting the same current. Therefore, eventually the weakest cell will reach 0V. If we were to disconnect the load at this time, the cell voltage would eventually drift back to .5 or more, and no harm would be done. But if we continue to draw current from the battery, this weak cell will slowly start being charged by the stronger cells – but in the opposite direction from its normal polarity. If this occurs for only a short time, the weak cell voltage will only go negative by a few tenths of a volt, and no harm will be done. But continue to do it for a longer time, and the cell voltage becomes strongly negative; at this time the chemical reaction in the cell changes, some heat and gas is produced, the cell vents to the outside, and in general becomes ruined. Do this long enough, and some of the other weaker cells go the same route, and you wind up with a battery which has some good cells and some bad ones.

The moral of the story is that a single cell will not be substantially harmed as long as it is discharged slowly enough to prevent excess gas pressure from forming inside, even if it is discharged down to zero. But a multi-cell battery can have some of its cells seriously damaged even though its total voltage may still be enough to operate the equipment it is connected to. Hence, if you build, say, a 12V battery out of 10 AA cells, you cannot really hope to get all 450mA hours of use out of it all the time; to be sure of not killing the battery you should stop discharging in plenty of time to avoid exceeding the weakest cell.

The problem is not as bad with a collection of separate cells as with a sealed battery where you cannot replace a cell at a time. But even with separate cells it is not a good idea to replace one cell at a time, because having a few good, new cells in the battery just increases the chance that someday they will kill the weaker ones. But there is a trick that some people have used for some time with supposedly good results: In a multi-cell battery, put a silicon power diode (whose continuous current rating is at least equal to the maximum load current you will draw) across each cell, *reverse-biased* (i.e., cathode goes to the positive terminal of the cell, anode to the negative). In normal operation, each diode is reverse-biased, and so draws no current. But if one of the cells starts being reverse-charged by the rest of the cells, the diode now keeps the reverse voltage across that weak cell from going above about 0.7V, the forward drop across the diode. This not only keeps each cell from being deeply reverse charged, but also provides a current path for the current through the battery. Hence as you start getting close to the end

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of the battery charge, and one cell after another slowly goes to zero and then to a reverse voltage, the total battery voltage will slowly decay towards zero, rather than take a sudden dive. You at least get some warning before everything goes dead.

While discharging cells, by the way, beware of short circuits across cells. Nicads have a much lower internal resistance than even dry cells – on the order of a fraction of an ohm. That means that an accidental short circuit may easily draw currents on the order of 10, 20, even 50 amperes, from relatively small batteries. In other words, it is easily possible to get discharge rates of 10C, 20C and more. There will, of course, be a lot of battery heating, which in general is not good for battery life.

Temperature Ranges

A Nicad can be stored in a wide temperature range, from -40°F to +122°F, almost indefinitely. Though it may eventually self-discharge through leakage, it can be recharged again with no harm. During discharging, however, the internal resistance rises at low temperatures and so the battery becomes less efficient below about -4°F, though it can be discharged below that temperature as long as the discharge current is low. At the high end it can be safely discharged at temperatures as high as 104°F, though at higher discharge rates there may be enough internal heating to increase the internal temperature above that point, in which case damage might occur.

But the most restrictive is the temperature during charging. As we will see in a moment, charging the battery produces gas; there is an internal chemical reaction which is supposed to absorb that gas, but this reaction does not work well at low temperatures. Hence charging should not be done below about 41°F, nor should the temperature get above 104°F. However, keep in mind that these higher temperatures have other side effects – cells discharge faster at the higher temperatures, and charging is not as efficient, this means it takes longer to charge to a given level at higher temperatures, and in fact it may not be possible to charge the battery to its full capacity at all.

The message is that room temperature is best for Nicads. Try to avoid very high or very low temperatures, and especially stay away from low temperatures during charging.

Charging Nicads

Here we finally get to the important stuff everyone wants to know. Why do some Nicads require charging for 14 to 16 hours, while others can be charged in 3 hours or less? Here's the scoop.

First of all, to charge a Nicad you always have to put more in than you get back out, usually about 50% more. For example, to charge a 1A hour cell you have to put into it 1.5A hours; to charge a 450mA hour AA cell you have to put in about 675mA hours. Thus the normal method of charging a 450mA hour AA cell is to charge at 45mA for 14 to 16 hours, which works out at somewhere near 675mA hours. For that battery, 45mA works out as 0.1C; most Nicad manufacturers say that the best way of charging their cells is at 0.1C for 14-16 hours, which works out to somewhere between 1.4 and 1.6 times their normal discharge capacity. Another way of looking at this is that about 2/3 of the charge you pump into the cell is stored for later use, while the remaining 1/3 is wasted, usually in the form of heat.

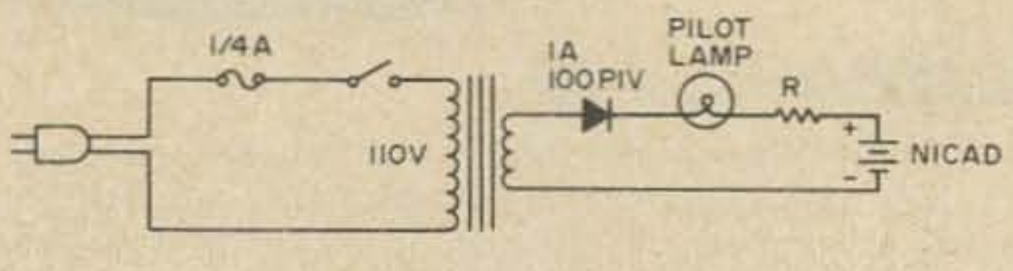

Fig. 3. Actual charger for Nicad batteries.

But charging at 0.1C for roughly 15 hours is not the *only* way to charge that cell. Remembering the total amount of charge you have to put into the cell, *IF YOU ARE CAREFUL AND KNOW EXACTLY WHAT YOU ARE DOING* you might be able to charge at half that rate for twice as long, or perhaps twice that rate for half as long, etc. Thus a C rate charge for 1½ hours, or 0.5C rate for 3 hours, or a 0.05C rate for 30 hours, all put the same charge back into the battery. But before you jump to conclusions and run off to build your new INSTA-CHARGER, read on. Let's go back to look at that 1/3 of the charge that gets wasted.

As you charge the cell, about 2/3 of the charge you are putting in is spent doing useful work – in a chemical reaction which results in energy being stored in the cell. The other 1/3 is wasted in useless side reactions, such as generating oxygen gas at the positive plate. The positive plate, however, is also supposed to be oxidizing one of the active chemicals at the same time, and this oxygen gas generation is competing for the available oxygen with the oxidizing process. At normal charge rates there's enough oxygen in the solution for both processes, and so no harm is done, since the amount of gas produced is very small. But at very low charge rates (0.01C or less) there simply isn't enough energy being poured in for both, and the gas generation wins out. Hence most of the "charging" really isn't doing any charging at all; it's just pushing some atoms back and forth in the solution. Thus charge rates below about 0.01C are useless; that 450mA hour AA cell would not soak up much charge at a current of 4.5mA (0.01C) for 150 hours.

Now, what happens to all that oxygen gas? Fortunately, the gas slowly finds its way to the negative plate where it slowly undergoes another chemical reaction and is converted back into useful stuff. During this conversion some heat is also generated at the negative plate. In this way the excess charge put into the cell is simply wasted as heat. This is lucky, since otherwise the gas pressure inside would build up to the point where the safety vent would have to open to prevent an explosion.

But if you generate oxygen gas too fast it won't move over to the negative plate and be absorbed fast enough, and the pressure will build up fast. In an effort to combat this problem, it is possible to make the negative plate larger than normal, which helps to reduce this danger but wastes space. Now we are ready to take a look at what happens when you charge a Nicad faster than the recommended 14-16 hours.

The faster you charge, the more oxygen you generate. As long as the battery isn't fully charged, though, the amount of oxygen isn't too large. Since the negative plate is usually a little oversize anyway, you can take advantage of this safety factor. I have charged small AA cells (450mA hours) at 0.5C and even 1C rates for five or ten minutes when they had discharged completely, and I wanted to get my 2m FM H-T back on the air fast. *BUT YOU MUST NOT OVERCHARGE!!!* I did it only when I knew the battery was completely discharged, and even then I was careful not to do it too long. It is probably safe to use a 1C rate on a *completely discharged* battery for perhaps a half an hour or three-quarters of an hour, but anything beyond that is foolhardy. (By making the negative plate really large, it is possible to absorb the oxygen gas extremely fast. Batteries with charge rates as high as 20C (five minutes for a complete charge) have been built. But a normal cell will be damaged by anything above 1C rate.)

Once again, YOU MUST NOT OVERCHARGE at these higher charge rates. Remember, while you are still charging a battery that is not quite up to full charge, 1/3 of the charge you pour in is spent generating oxygen gas and heat. Once the battery is fully charged, almost *all* the charge current is spent generating gas and heat. The pressure and temperature can rise very fast. At a C rate charge the pressure can go up at a rate of over 3 psig per minute, with the temperature rising at almost 10°F per minute. It takes just a few minutes to double the pressure and get really hot inside. These factors, combined with the fact that at fast charge rates (1C and better) the charging becomes more efficient (you need only overcharge by 20%, rather than by 50% as at lower charge rates), which means that you can get to the fully charged state faster than you expect and really do a lot of damage in a very short time.

This is why most manufacturers specify a charge rate of 0.1C for their cells. These cells are designed to allow overcharging at a 0.1C rate almost forever. The negative plate is big enough to absorb the gas and the temperature does not rise high enough to do damage. Hence a 0.1C rate charger is safe, since if you forget to remove the battery after 14 to 16 hours, you will still not damage the cell even though you are overcharging it.

But as soon as you go above a 0.1C charge rate YOU MUST NOT OVERCHARGE. There are only two safe ways of

fast charging a cell – either knowing ahead of time exactly how much charge there is remaining and then carefully timing your charging to make sure you don't exceed the fully charged state, or else building some sort of over-charge detector.

There is no simple way of telling how much charge is remaining in a cell; the only time you can be reasonably sure is if you know that the cell is completely discharged. But even then, beware – in a multi-cell battery you might think the battery is discharged when in fact some of the cells are still right up there. Fast charge this battery, and one or more cells (the good ones) will be overcharged before you know it. This is why I limited my 1C and 0.5C rate charges of my H-T batteries to five or ten minutes. I couldn't be sure of the state of the individual cells, since they are sealed inside the battery and I can't check them individually.

Similarly, there is no simple way of building an over-charge detector. Unlike an automobile lead-acid battery whose voltage rises at the end of charge, the Nicad cell voltage does not rise enough at the end of charge to be a sure .fire indicator. Cell voltage during charging depends on many factors, including cell temperature. The voltage would go up slightly during charging, except that as the temperature goes up this makes the voltage go down again. In other words, a voltage detector is not a safe way to avoid overcharging.

The only safe way of checking over-charging is to monitor either cell pressure or cell temperature. Pressure is the better method, but that requires putting some sort of strain gauge or other pressure detector into the cell, sealing it, etc., which makes it impossible to add it afterward. It is strictly a factory operation. Moreover, monitoring just one cell in a battery is not safe unless you carefully grade the cells ahead of time and put only matched cells into the battery. All of these make the pressure-type over-charge detection batteries expensive.

By far the most common method of over-charge detection is a temperature sensor such as a bimetal strip or thermocouple, mounted inside the battery in contact with one or more cells. Since the detector is not actually inside a cell there are no problems of leakage and sealing. The fast-charger is then built to charge at a high rate until the temperature starts to rise, or reaches some maximum value, at which time the charger either turns itself off, or more likely sets itself to a lower charge rate. This low charge rate, called a trickle charge, is often used to keep the battery from discharging if left in the charger for a long time afterward. In cheaper systems, the temperature detector, being not as accurate, turns off the fast charge before charging is actually completed, and then the charger reverts to a 0.1C rate to complete the process.

In any case, you might be able to add such a temperature detector to a single cell, but adding it to a multi-cell battery might be difficult. You might also have some trouble calibrating the system, as the type of case has a lot to do with how high the temperature gets inside. In short, it is not really practical to build a fast-charger for an ordinary Nicad, that being a job best left to the factory.

The various charge rates are usually classified as follows:

Trickle charge – 0.01C through 0.03C

Normal ("overnight") charge – 0.05C through 0.1C

Quick or rapid charge – 0.2C through 0.5C

Fast charge – 1C and up

The trickle and overnight chargers are usually very simple, consisting of just a few parts. Fast chargers are complicated since they have over-charge detectors. Quick or rapid chargers can be either, since it is possible to build a Nicad so it can continuously withstand overcharge rates as high as 0.2C or 0.3C, so a simple charger can be used.

Simple Nicad Charging Circuit

In all of the methods discussed above, it is important to control the charge current. Nicad chargers are generally constant current chargers, where the circuitry is chosen so that the charging current is relatively constant regardless of the condition of the Nicad. This is quite different from the

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ordinary lead-acid charger which is more of a constant voltage charger.

The difference in methods is important because it limits your choice of charging circuits. In a lead-acid battery, the battery voltage gradually rises as you charge the battery, starting at somewhere below 12V (for an ordinary auto battery) when the battery is only slightly charged, and finally reaching about 13.8V or so when the battery is fully charged. Hence the circuit of Fig. 1, would be a fairly good 10A charger for a car battery. When the battery voltage is slightly under 12V, the voltage across the 0.2Ω resistor is about 2V, and so the current is 10A. As the battery charges its voltage goes up, so that the voltage drop across the 0.2Ω resistor drops, and therefore the current drops. Eventually, the charge current slowly drops to zero as the battery voltage approaches 13.8V. (Of course, a well-regulated 13.8V source capable of delivering 10A is expensive, so this is not a practical circuit, but it would work.) The only reason it works, though, is that the lead-acid battery voltage is pretty well defined, and keeps going up as the battery becomes more charged.

The trouble with the circuit is that the charging current depends greatly on the difference between the regulated voltage and the battery voltage; if for any reason the battery voltage should drop, the current would go up. But this is exactly what happens in a Nicad. When the Nicad becomes fully charged, it starts heating up. This heat makes the battery voltage drop. In a constant voltage charger, this would increase the charge current further, leading to more heating. More heating leads to more current, and first thing you have is thermal runaway!

For this reason you need a circuit whose charge current is independent of the battery voltage. You *could* use some sort of a current regulator, but the easiest way is to start with a power source whose voltage is at least twice the Nicad battery voltage and then drop the excess voltage in a large series resistor. The larger the initial source voltage in relation to the battery voltage, the more the current stays constant (for example, Motorola chargers for their H-T batteries start with over 100V to charge a 15V battery). The resulting circuit is similar to Fig. 2. By the way, this explains why you cannot safely charge a 12V Nicad from the 12V car battery.

To give you an example of an actual charging circuit similar to Fig. 2, I will describe a charger I use for a 12V battery made up of ten 450mA hour AA cells in series. I use a 0.1C charge rate of 45mA, using a small adjustable dc power supply as my power source. I use a 330Ω 1W resistor in series with the battery. At the specified charge current of 45mA, the voltage drop across the 330Ω resistor is 15V; I therefore adjust the power supply to provide 27V output (15 plus 12). The power supply has a voltage meter and an adjustment pot, but no current meter; however, no current measurement is really needed with this system, as the current is automatically set by the series resistor.

The voltage source for charging Nicads need not be pure dc, but can also be rectified unfiltered dc from either a half-wave or full-wave rectifier. Since most small Nicads of the type used in amateur portable gear require small charging currents half-wave rectifiers with no filtering are perfectly suitable. Fig. 3 shows a typical charger circuit operating from rectified ac.

In order to show how to design this circuit, let's pick a typical case. Suppose you want to charge a 6V battery consisting of five 1.2A hour D cells in series. The capacity of this battery is 1.2A hours, and so the 0.1C charge rate will be 120mA.

First we pick a suitable transformer. We need one that will provide at least twice the voltage of the battery. A 12.6V transformer looks at first glance as though it might work, but if you look up the average voltage of a half-wave rectified sine-wave in a textbook, you discover that it is only about 45% of the rms value (actually, it is about 32% of the peak value, which works out to the same thing). Hence the average voltage of the rectified sine-wave will be only about 6V – hardly twice the battery voltage of 5V. So let's pick a larger transformer – how about a 24V 1A transformer? (Of course, a 500V transformer would work real well in a constant current supply, but heaven help

you if you accidentally touch the charger output leads while no battery is connected to it. Keep the transformer voltage reasonable.)

Now pick a suitable pilot lamp. We want a lamp which will light dimly at the charge current, and whose voltage rating is less than the amount we need to drop between the transformer output and the battery. The lamp actually serves several functions. If we should accidentally short the charger output leads, the lamp will light brightly to warn us and will perhaps act as a fuse as well. Second, it lights only if the battery is properly connected. If there is a bad connection, the lamp will not light and if we connect the battery backward, the lamp will light very brightly. Finally, if the battery is open or shorted, the lamp will tell us that too. In this case a 47 bulb may be a good choice since it is rated at 6.3V and 150mA. It should light quite well at 120mA, and will drop about 6V in the process.

Finally we need to select a value for R which will drop the rest of the excess voltage. Calculating its value is not easy, since the charging current flows in short bursts and also, the lamp resistance is not constant. Hence, the best way is trying different values until we get one that produces the right current. We want to start with higher resistances than required and work downward so as to avoid real large currents. As a first approximation we just assume that the transformer is providing 24V (which gives us a good safety factor), of which we drop 6V in the lamp and 5V in the battery, leaving 13V for the resistor. Ohm's law then says that R should be 108Ω as a starting value. Merely experiment with various resistors (using a series milliammeter) until you get one that provides the right amount of current. Once you get the right value you can put in a switch and a second resistor of a larger value which will provide a 0.01C rate for trickle charging. In each case, use the equation $P=I^2R$ to check the power dissipated in the resistor and make sure to use one with a high enough power rating.

One last comment and warning: The charger circuit here will work for single cells, and will work also for multi-cell batteries *as long as* all cells in the battery are connected in *series*, are of the same *capacity rating* and are all in roughly the *same discharged condition*. You *cannot* charge dissimilar cells in series, cannot charge new and old cells in series and cannot charge cells in parallel. If you want to charge several different cells at the same time, you can share the same transformer and rectifier among them, but each cell must have its own pilot light and series dropping resistor.

Reconditioning a Nicad Cell

As mentioned earlier, deeply discharging a Nicad cell, even down to zero volts, will not really harm it as long as it is not done at an excessive current load. (This is not true of multi-cell batteries, since the weaker cells will then be reverse-charged and seriously damaged). In fact, an occasional deep discharge may even be good for a Nicad under some conditions.

This is because a Nicad cell has a sort of "memory." If you repetitively use it in a certain way, day after day, the Nicad starts to remember that and acts accordingly. Specifically, it works like this. Suppose you have a Nicad whose capacity is such that you can power a monitor receiver from it for 10 hours per charge. But you get into the habit of using the receiver only 4 hours a day and then charge the battery for eight hours each night at 0.1C. After a while the Nicad starts to behave as though it only has enough capacity for four hours of operation. This is because only 40% of its capacity is used each day, with the remaining 60% of its chemicals lying idle. If one day you needed it for five hours of use, you would find that the battery dies after 4 hours.

To destroy this "memory" and bring the cell back to its full capacity, you simply deeply discharge it down to zero volts one or two times (slowly – don't exceed a rate of 0.5C or so, to avoid excessive heating), followed by a full charge at 0.1C each time.

A similar operation would work for multi-cell batteries, except that you must discharge each cell separately to prevent reverse-charging the weaker cells. This is easy if you have a multi-cell battery made up of separate AA cells or some other standard cells; but it is difficult to do for sealed batteries. I have used a reconditioning jig

made up of 10 AA-size cell holders, with a 2V bulb soldered to each holder. I simply insert a cell into each holder and discharge until the lamp goes completely out. Following the complete discharge of all cells, I recharge them for 15 hours at 0.1C (which can be done in series from one charger).

As mentioned above, only repetitive use of a Nicad will cause this memory effect. Most amateur applications will have enough of a day-to-day variety that this memory effect will not show up.

Final Comments

The above information applies to Nicad cells only, not to the newer rechargeable alkaline cells. The alkaline cells are much more critical and may be very easily damaged. In general, do not allow rechargeable alkaline cells to completely discharge at any time. Charge them before they go completely dead, but be careful not to overcharge (Wow, that sure is hard!). They come charged when new, and should not be charged before use (unlike Nicads which usually require charging before their first use). Finally, the maximum allowable charge rate for the alkaline cells is 0.05C for approximately 30 hours – do not try to charge them any faster.

Further information on Nicads may be easily obtained in a $2.50 booklet entitled "Nickel-Cadmium Battery Applications," publication No. GET-3148, available from the Battery Products Section, General Electric Company, P.O. Box 114, Gainesville, FL 32601, as well as from similar applications books available from other Nicad manufacturers.

In addition to the electrical do's and don'ts above, be careful not to throw Nicads into a fire, don't solder to a cell, don't replace cells in a multi-cell battery unless you have the knowledge to properly match the replacement cell to the older cells and be very careful not to short a cell out by placing it on a metal surface or letting it touch metal tools, rings or coins. Due to the extremely low internal resistance short circuit currents can be very large and cause sparks and heat.

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How To Get Zillions of Parts for Nothing

Ya gotta have a junkbox. I mean, there is nothing more embarrassing to a basement experimenter than beginning a new gizmo and discovering he hasn't a 47K, half-watt resistor to his name.

I found myself at just about that point not long ago. The League recommends politely wheeling and dealing local TV repair shops out of burned-out chassis for a dollar or two apiece. Value for value, they say; after all, the poor guys are out to make a buck.

So I spent an afternoon visiting local repair shops with a buck or two in my pocket and an innocent look on my face.

One man politely told me he didn't run that sort of shop; another said old chassis attract cockroaches. One guy *did* offer me a 1957 RCA chassis minus tubes, tuner, CRT and half of everything else – for five dollars. I said no thanks, went home, and began composing a thoughtful rebuttal to the League article.

Little sister WN9OVO wandered by. "No luck, huh?"

"Value for value," I kept mumbling. "This country oughta go on the junk chassis standard."

"Put an ad in the paper," she said. "Begging busted TVs from TV repairmen is like buying sand in the middle of the Sahara."

She had a point there.

The ad read: WANTED: BROKEN RADIOS, TVs, PHONOS, ANY JUNK ELECTRONICS NEEDED BY YOUNG RADIO AMATEUR FOR EXPERIMENTATION. I WILL HAUL AWAY. Call 763-1376 EVENINGS.

I placed it in a local supermarket-and-drugstore ad flyer with a circulation of perhaps two thousand middle class families within ten blocks or so. It cost me fifty cents, and I expected half a dozen old TV sets and maybe a clock radio or two to cannibalize.

Once again, I had underestimated middle-class America. By suppertime of the day the flyer hit the mailboxes I had eleven calls scrawled on the back of a pizza board tacked to the wall by the telephone. Lots of junk in the neighborhood, apparently. I thought it was funny. The next morning Little Sister and I borrowed my father's station wagon and began the rounds.

We put it all in the garage. There was no other place to put it. Every respondent, it seemed, had a black and white console TV set gathering dust in the basement which he was too old/lazy/busy to cart out in front on garbage day. Most were nice old ladies who approved of my conservative haircut and wondered what on earth I was going to do with all that junk.

Never use the word "ham" in channel 2 land. I had a little speech about preparing myself for a useful career in electronics through construction of small transmitters and receivers. They liked that, and marvelled that I wasn't out on the streets breaking windows like most college kids. And the calls just kept coming in.

They came in hot and heavy for almost a week. The garage was filling with alarming swiftness. The callers began to offer not one TV but two or three. (One pleasant old gentlement gave me five, adding that he couldn't see too well anymore and anyway, there was some (expletive deleted) radio ham down the street who always messed up the picture. He told me he was glad I was going to be a disk jockey.)

I began to lose track of some of the calls, forcing the callers to call back, asking if I had forgotten. One persistant woman called me five times until I emptied her basement of a TV and three grungy phonographs.

The calls occasionally got a little weird. One lady with a raspy voice asked if I wanted to buy two manglers for 25 dollars. I figured a mangler was a 300 watt CB linear or something, but had the curiosity to ask. A mangle (bless her heart) is a 200 pound rotary ironing machine that literally squishes the wrinkles out of things. Producing a lot of TVI too, no doubt. I told her I was broke and hung up before she could offer them to me for nothing. Another chap had five hundred three-transistor radios to sell in a hurry for a hundred bucks. He refused to give me his phone number and is probably still at large.

Contributions were not always broken. Two of the TVs worked excellently, and I donated them to apartment-hunting friends who enjoy the mind-rot machine. One sour fellow handed me a 40 watt tube-type stereo amp, and told me it had worked fine for years, but recently had begun blowing the house fuse every time he plugged it in. He thought I might be able to get a few parts out of it. I looked down at the line cord and noticed that the insulation had crumbled right where the cord entered the cabinet. The wire had been twisted, and. . .of course I could get a few parts out of it, thank you, sir. A little soldering-gun work and it's been pumping John Denver into my speakers beautifully ever since.

Another man gave me several working tuners and amps which were "just cluttering up the house." The only cost to me was half an hour spent complimenting the bass response of his new system. Value for value? You bet!

Perhaps the best deal of all came from a retired gentleman who led me to a basement corner and pulled a dusty bedsheet off an enormous 1937 Zenith all-band floor-standing receiver, complete with magic eye tuning indicator and flawless darkwood cabinet.

"Bet you'll have some fun ripping this ol' bugger apart," he said to me with a grin. I agreed and carted it home. Just for kicks I plugged it in behind the garage, expecting it to blow itself to kindling. Instead, with the antenna lead clipped to an aluminum ladder, I copied a VE7 on 20 meter CW, without a bfo. No trace of AC hum. And a tremendous bass response which is wasted on our gutless AM broadcasts.

A similar Zenith, needing only a filter capacitor, came to light about a week later. I have gotten fantastic offers for both of them from the antique radio freaks.

Nor were the giveaways limited to home entertainment devices. An elderly ham spent half an hour picking through his junkbox, filling eight boxes with 1625s, substitution manuals, ancient transmitting variables, relays and more than 200 pounds of power transformers, modulation transformers, and bathtub capacitors.

A second ham gave me an old but spunky Knight T-50 transmitter. A third sold me a mint-condition Central Electronics 10B exciter and 458 vfo for ten bucks, telling me to "get the heck off of CW." That was the only thing I paid a penny for.

It went on and on. I answered more than 50 calls, which continued drifting in for better than 5 weeks. Of those 50 I visited 36. The final box-score (kept with pain-staking accuracy by WN9OVO) turned up as follows: 31 broken TV sets, 2 working TV sets, 19 broken clock radios, table radios and transistor radios, 7 working clock radios, table radios and transistor radios, etc. 2 salvageable "antique" type radios, 3 unsal-vageable "antique" type radios, 8 broken radios, 3 working amplifiers, 3 broken ampli-fiers.

Also, 4 working tuners, 1 broken tuner, 2 broken eight-track tape players, 4 broken intercom sets, 3 usable speaker cabinets with speakers, 1 working ham transmitter (not including the 10B), 1 broken photoflash

strobe unit, 1 broken oscilloscope, 1 working 650V power supply, several old Spike Jones records, about a dozen boxes of loose parts from a ham and a man whose son had once played with "that stuff."

It took about eight weeks (i.e., most of the summer) to reduce all that junk to its component parts. I have a fairly respectable junkbox now, although I admit I have a few more 6AL5s and 5U4s than I'll probably find use for. But I saved all the deflection yokes, pried the copper out of them, and got 23 bucks for the lot. Beats hoarding pennies any day.

We're still crunching resistors out in the garage, and I suspect that the mice in the foundation have nests woven of greasy hook-up wire gorged by the pound from the bowels of yesteryear's boob tubes. My mother took a call on the ad as recently as Labor Day. She told the nice man I was out of town, and warned me that if I so much as thought about doing it again, I had better be out of town – if I value my skin.

So, you poverty-stricken squawkbox-builders out there, I would recommend ignoring the League's suggestion to con TV repairmen out of totally blitzoed chassis for "a dollar or two."

Why buy sand in the middle of the Sahara? All the world's a junkbox, OM!

Dig in!

WB9MQY

Radio Waves Frighten Thousands

Guglielmo Marconi needed police protection from people who threatened to kill him because they thought his radio waves were harmful. Frightened people complained that the radio signals were passing through their bodies and making it impossible for them to sleep. A wealthy woman charged that the waves made her feet itch. A German man publicly made plans to go to England and shoot Marconi but he was turned back by British authorities.

The hostility toward the inventor came after years of being ignored. In 1894, the 20 year old electronic pioneer coaxed his crude equipment to send a signal a few feet across his room. Next year his signals spanned the length of his father's home in Bologna, Italy. When Marconi patriotically offered his invention to the Minister of Posts and Telegraphs, he was snubbed.

Marconi packed up his equipment, and with his Irish mother, sailed to England. Surely, he thought, the world's greatest maritime power could use ship-to-shore communications. British customs officials ignored his frantic efforts to explain that his radio was not a bomb. The delicate instrument was damaged by their forcing it open.

The following year a family friend helped him gain the attention of the British Postal authorities and he demonstrated that he could send a signal from the General Post Office to a nearby building. The press and public showed no interest in the feat.

Marconi then constructed a bamboo tower that thrust his transmitter 90 feet into the air and sent his wireless signals nearly two miles. He had built something too big to be ignored and the press took notice. Years later, he sadly observed, "The calm life is over."

The publicity aroused fears in a previously indifferent public about the possible harmful effects of radio waves. A flood of crank mail – some containing threats on his life – came pouring in. Guarded by police, Marconi moved his operation to Wales in 1897. Soon he was transmitting signals out 25 miles, then to 150, and in 1901 had spanned the Atlantic with his wireless signals.

It was more than two years after this that the public outcry diminshed enough for Scotland Yard to withdraw the police guards protecting the man who developed radio for the world.

Reprinted from the Two Rivers ARC (Pennsylvania) "Spark Gap" – via W6SD CARRIER.

Karl Ditsch DK8SQ
D-7336 Uhingen 5
Teckstrabe 16

C31 or Bust!

The call Charlie thirty-one ("PX" up to 1969) is no longer a real DX-rarity. The small princedom, situated high up in the Pyrenee Mountains between France and Spain, is not hard to reach now from France, thanks to a new road. European DX-peditions often go there for a few days. There is no difficulty in obtaining a license from the Perpignan PTT. However, there is still a certain demand for this call on the air, especially in CW, as the recent expedition of amateurs from Goppingen, South Germany, has shown.

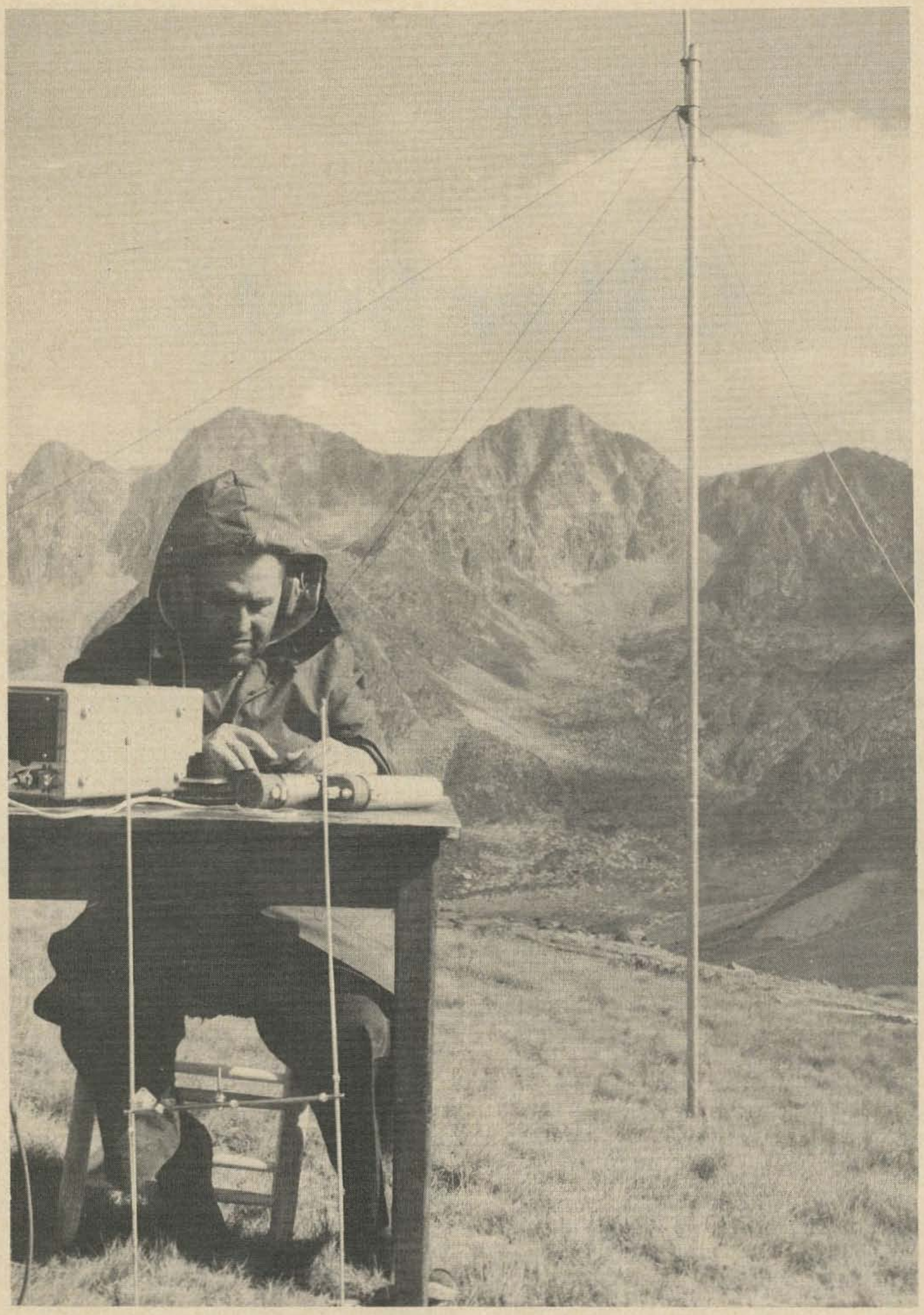
With DJ9NA on CW and DK8SQ on SSB, the amateurs were busy in the first week of September under the calls C31HF (CW) and C31GM (SSB). More than 1200 QSOs on CW and 186 on SSB were made, many of them with U.S. stations.

The amateur stations were established on the "Col d' Envallira," at an elevation of 2500 meters (around 8000 feet). The location was about one mile away from the commercial "Sud-Radio" station, operating on 370 meters with 900 kilowatts AM output, so there was some difficulty on the receivers with copying at these QRM levels. In some transmissions, the OM on the other side of the ocean asked me to turn my radio in the shack down, because it was too loud. But there was no radio playing in my "Voltz" which served as a shack, it was hf picked up from Sud-Radio in the transmitter, and carried along.

On September 5, around 22 GMT, I had the good luck to hear W2NSD putting forth on one of his pet subjects, Oceanus. He took me up and left me the frequency after a short QSO. Now it seems that just about everybody in the U S. had been listening in to Wayne, because I had a beautiful pile-up immediately following his signing "off and clear." Thirty-nine QSO's with W's and K's were possible inside an hour, before the band closed down around midnight local.

No special difficulties were encountered on the technical side. The 220 V generator supplied both transceivers, and so there was some interference when both stations were operating simultaneously. For future expeditions to this QTH I would recommend taking a heavy sledge hammer for setting up the antennas, and also a pair of gloves – touching a wire there with naked hands becomes a problem. The 900 K AM from the nearby transmitter cause sparks up to an inch in length when making connections – or via the fingertips.

There are only three Andorran OM's licensed in the call-book, and the help of C31AH, employed at Sud-Radio, was much appreciated by our group. Next spring, we hope to be able to go there again, for an even better repeat performance. . . .**DK8SQ**



Lothar Leberecht sits huddled at his station high in the Pyrenee Mountains during a recent expedition of amateurs from Goeppingen.

H.C. Sherrod W5ZG
4715 Crockett Blvd.
Galveston TX 77550

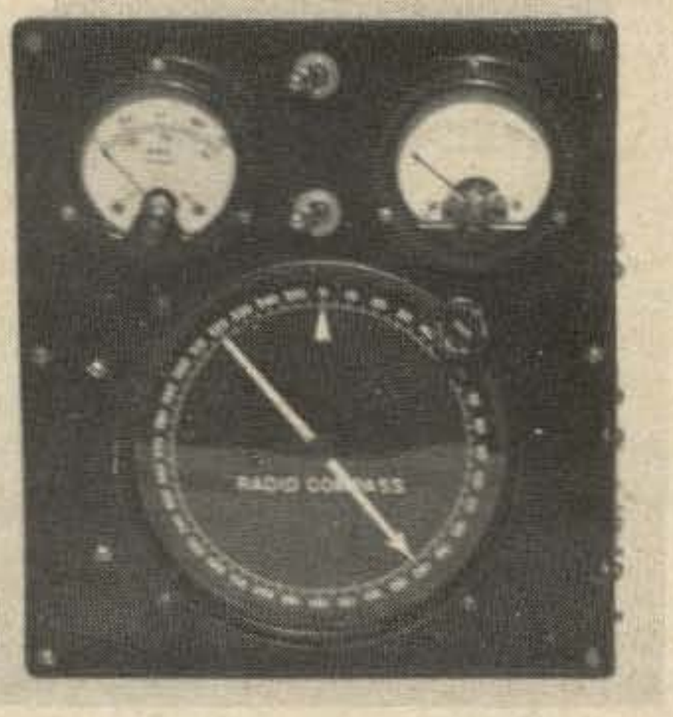


Fig. 1.

Wind Indicator for Your Shack

At those amateur radio stations located on or adjacent to the seacoast, it is advantageous to know the wind velocity and wind direction. During the hurricane season the information provided by wind velocity and wind direction indicators is certainly helpful and, if such information can be obtained from a number of locations in the affected area and co-related, a good estimate of the approximate location of the disturbance can be made. However, few amateur radio stations have these facilities and one of the reasons for this is the cost of the instruments.

The subsequent description of the wind velocity and wind direction indicators constructed and installed delineates a reliable and effective facility that can be constructed for approximately $35.

After some preliminary investigation, it appeared that the two major problems involved were: The method of sensing wind velocity and wind direction; and the manner of housing the sensing instruments to protect them from the weather.

For sensing the wind direction, the use of a selsyn transmitter connected to a selsyn indicator appeared to be the obvious answer.

From further consideration, it appeared that the employment of a selsyn as a velocity transmitter was possible. In this application, if the single phase winding of the selsyn is energized by a constant direct current, the three phase windings would deliver a three phase alternating voltage directly proportional to the speed of rotation of the selsyn shaft. Preliminary experiments revealed that within the range of dc currents the single phase winding could tolerate, the three phase ac voltage delivered was inadequate throughout the estimated operating speed range. Further experiments, however, revealed that employment of a three phase step-up transformer bank would overcome this objection and, after rectification of the ac voltage, the filtered dc voltage could be effectively applied to an indicator.

Housing the wind velocity and wind direction selsyn transmitters in such a way as to not impede their movement by the wind and at the same time to completely protect

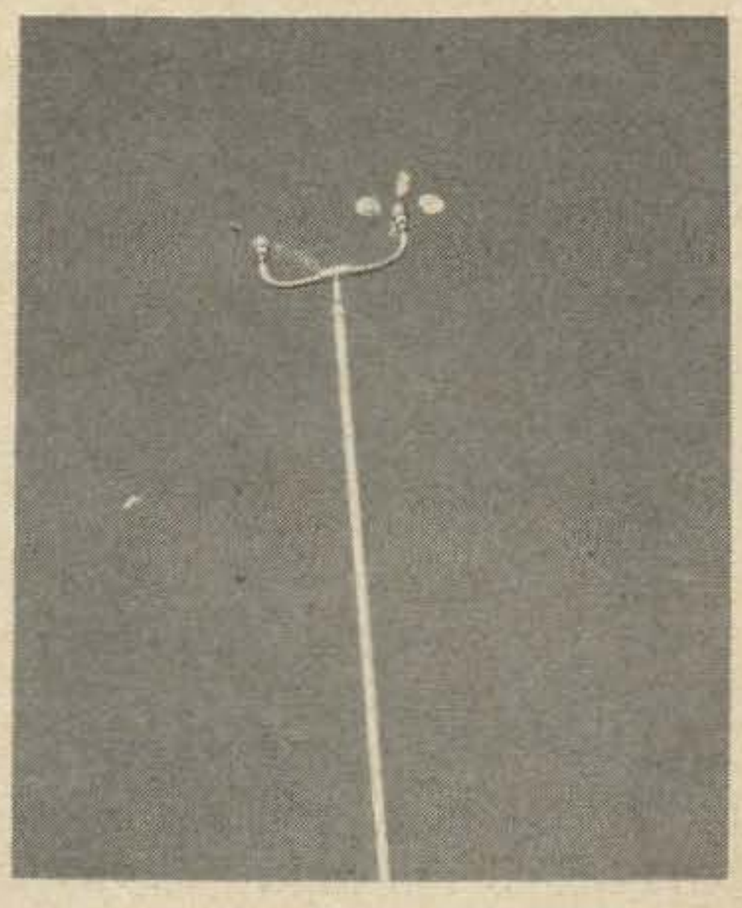
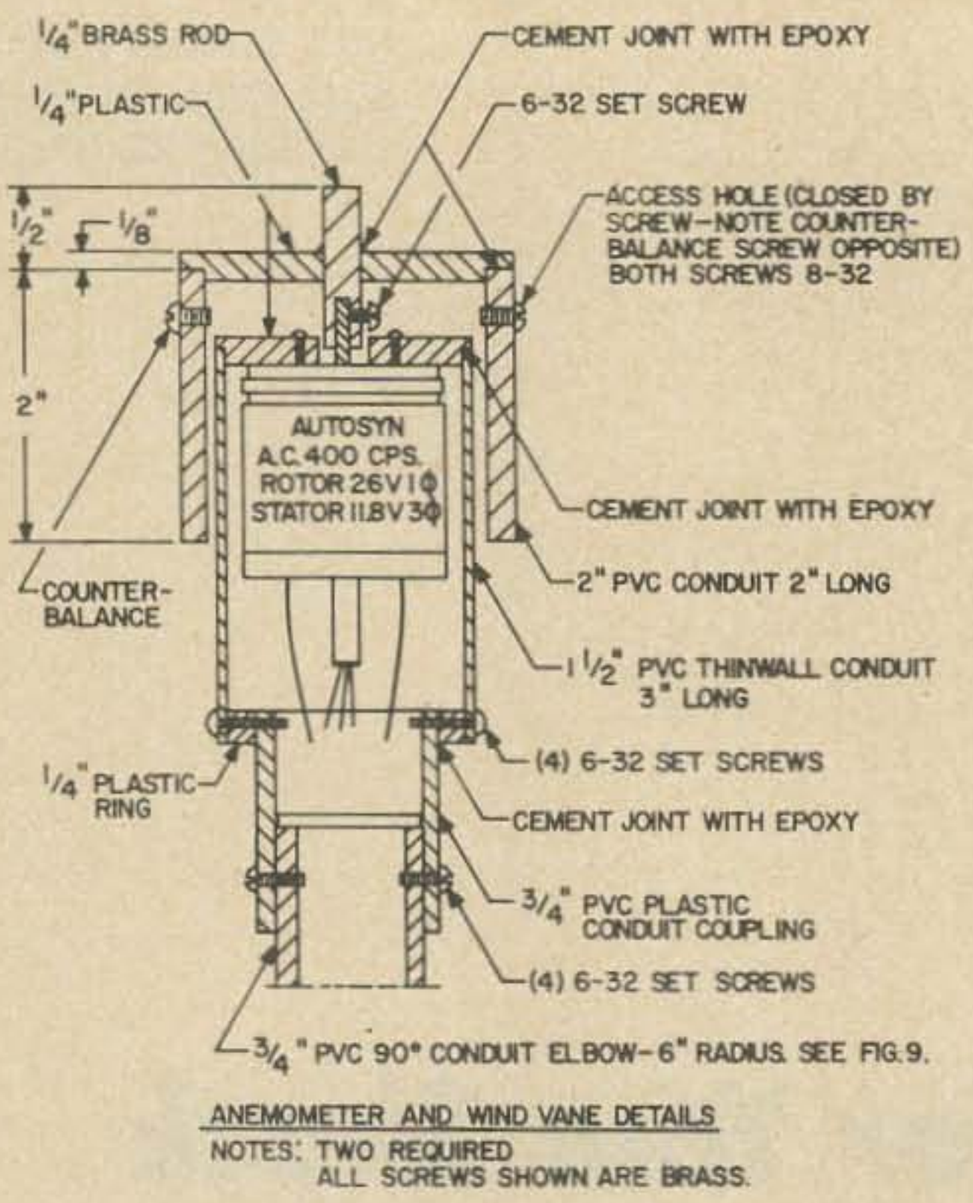


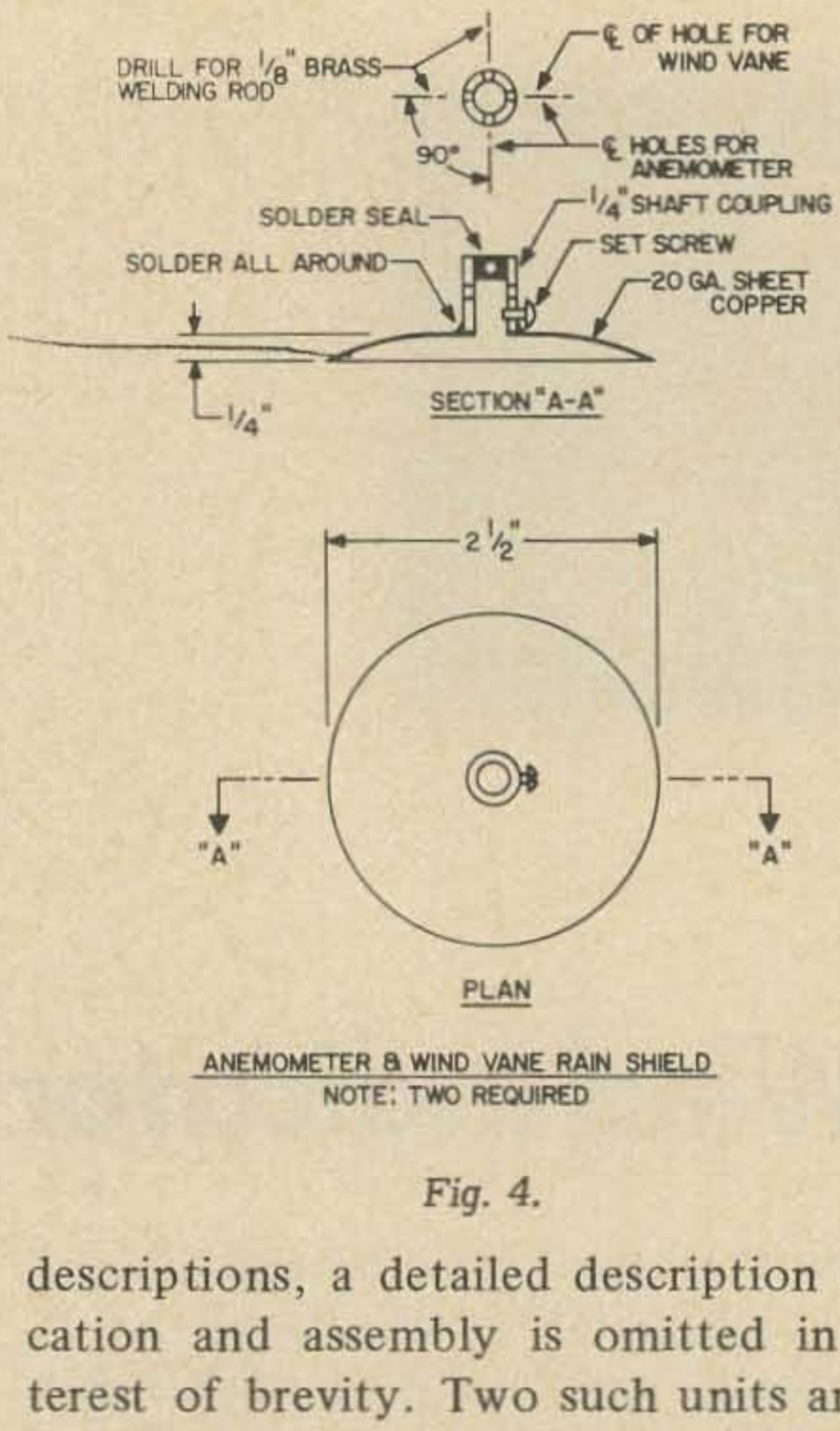
Fig. 2.



ANEMOMETER AND WIND VANE DETAILS

NOTES: TWO REQUIRED
ALL SCREWS SHOWN ARE BRASS.

Fig. 3.



ANEMOMETER & WIND VANE RAIN SHIELD

NOTE: TWO REQUIRED

Fig. 4.

them from the weather was solved very effectively by the fabrication of plastic housings made from plexiglass sheet and polyvinyl chloride (PVC) electrical conduit. PVC conduit is impervious to sunlight, rain, and corrosion and this material can be fabricated with simple tools. The two housings subsequently described were fabricated with a hacksaw, drill press, and a bar cutter. While a lathe would have made a better job possible, one was not available.

The basic components of the system are the indicator cabinet shown in Fig. 1 and the wind velocity and wind direction sensors on their mast as shown by Fig. 2. The sensors are subsequently referred to as the anemometer and the wind vane.

Anemometer and Wind Vane Details

The anemometer and wind vane sensors are identical with one exception, which will be described.

The selsyns employed are 400 cycle "autosyns" having a 26 volt single phase rotor and an 11.8 volt three phase stator. These selsyns are 1-9/16" long x 1-1/2" in diameter and are readily available on the surplus market at about $3.95 per pair.

A cross section through the sensor housings is shown by Fig. 3. The location of the "autosyn," the general arrangement, and the construction details of the housings should be readily apparent. As in all subsequent descriptions, a detailed description of fabrication and assembly is omitted in the interest of brevity. Two such units are necessary and each will require a rain shield as shown in Fig. 4.

The two sensors are identical with the exception of drilling the shaft coupling shown in Fig. 4. For the wind vane, only one hole is drilled in the shaft coupling to pass 1/8" welding rod. For the anemometer two holes, 90° apart, are drilled in the shaft coupling to pass 1/8" welding rod.

Figure 5 shows details and dimensions of the wind vane. In fabricating, the 20 gauge sheet copper wind vane should first be soldered to the 1/8" welding rod. After passing the rod through the hole drilled in the shaft coupling on the rain shield, the rod should be inserted in a hole drilled in the fishing sinker and soldered in place. By supporting the shaft coupling and sliding the vane rod, a point can be found where the weight of the fishing sinker pointer balances the weight of the copper vane. At this point, solder the rod to the shaft coupling.

The details of the anemometer cups are shown in Figs. 6 and 7. The anemometer cups are white plastic; cup dimensions shown in Fig. 6 are furnished to facilitate identification. These cups were obtained at the local dime store. Their resistance to weathering and deterioration is notable.

The mounting details and dimensions of

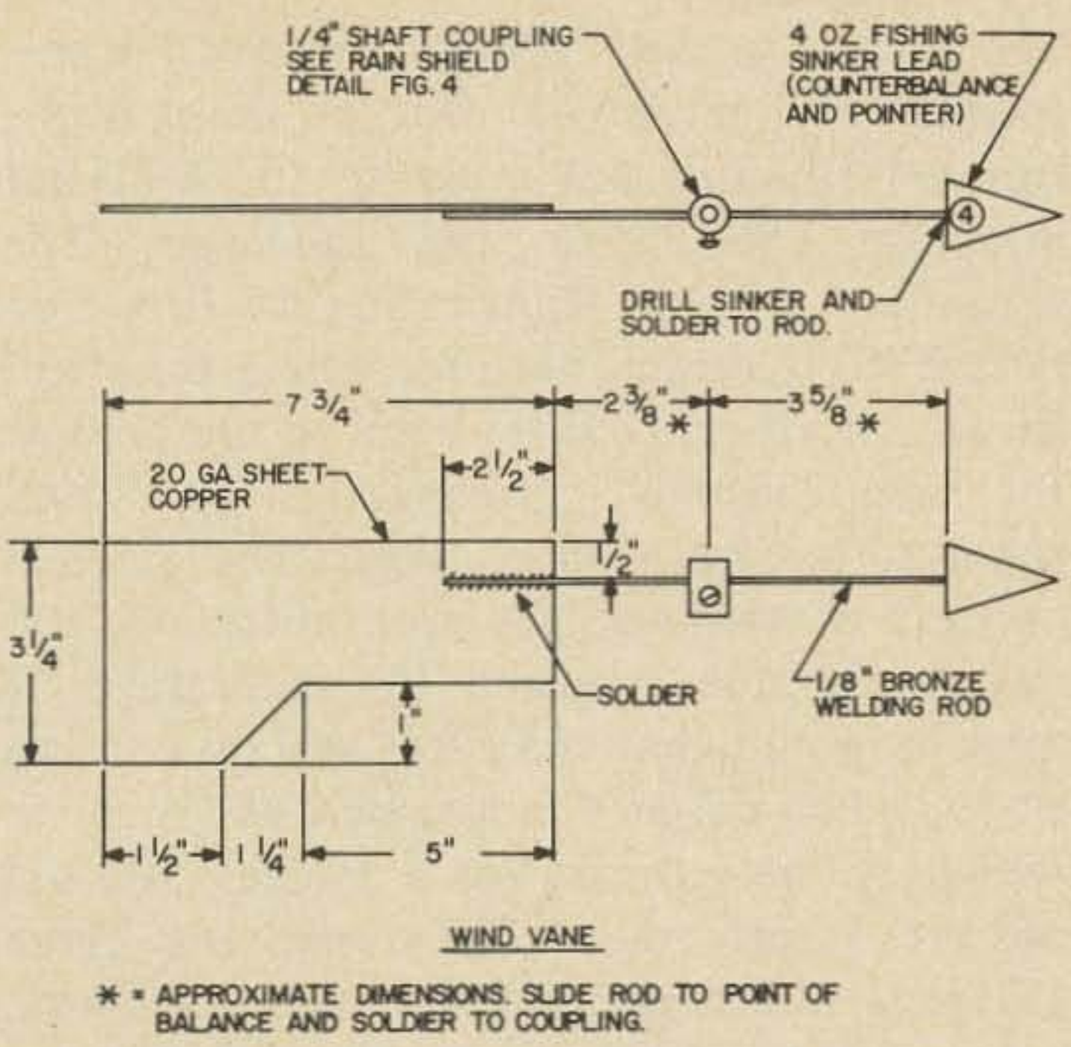


Fig. 5.

the anemometer cups is shown in Fig. 7. After constructing to dimensions shown, balance the whole by adding or subtracting the number of brass washers under the heads of the 6/32 bolts that attach the cups to the arms.

The anemometer and wind vane are connected to the indicator cabinet by a ten wire cable and the connections of this cable are shown in Fig. 8. Terminals 15 and 16 are bridged within the plug connecting the cable to the indicator cabinet. This arrangement breaks the 110 volt ac supply when the plug is removed from its socket.

Figure 9 shows the assembly details of the anemometer and wind vane.

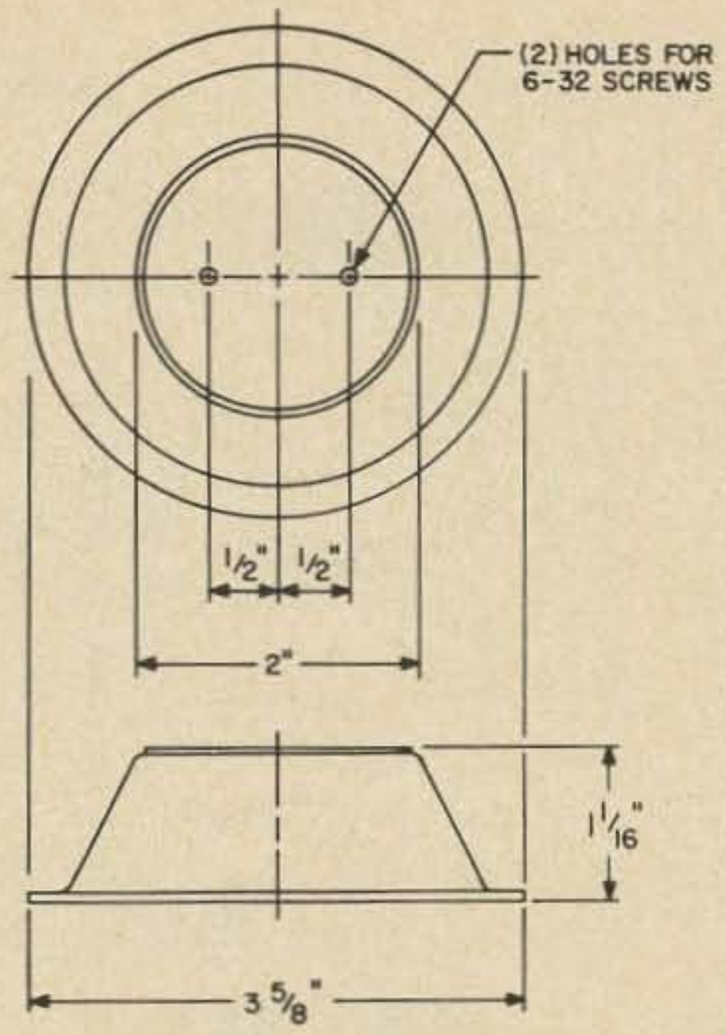


Fig. 6.

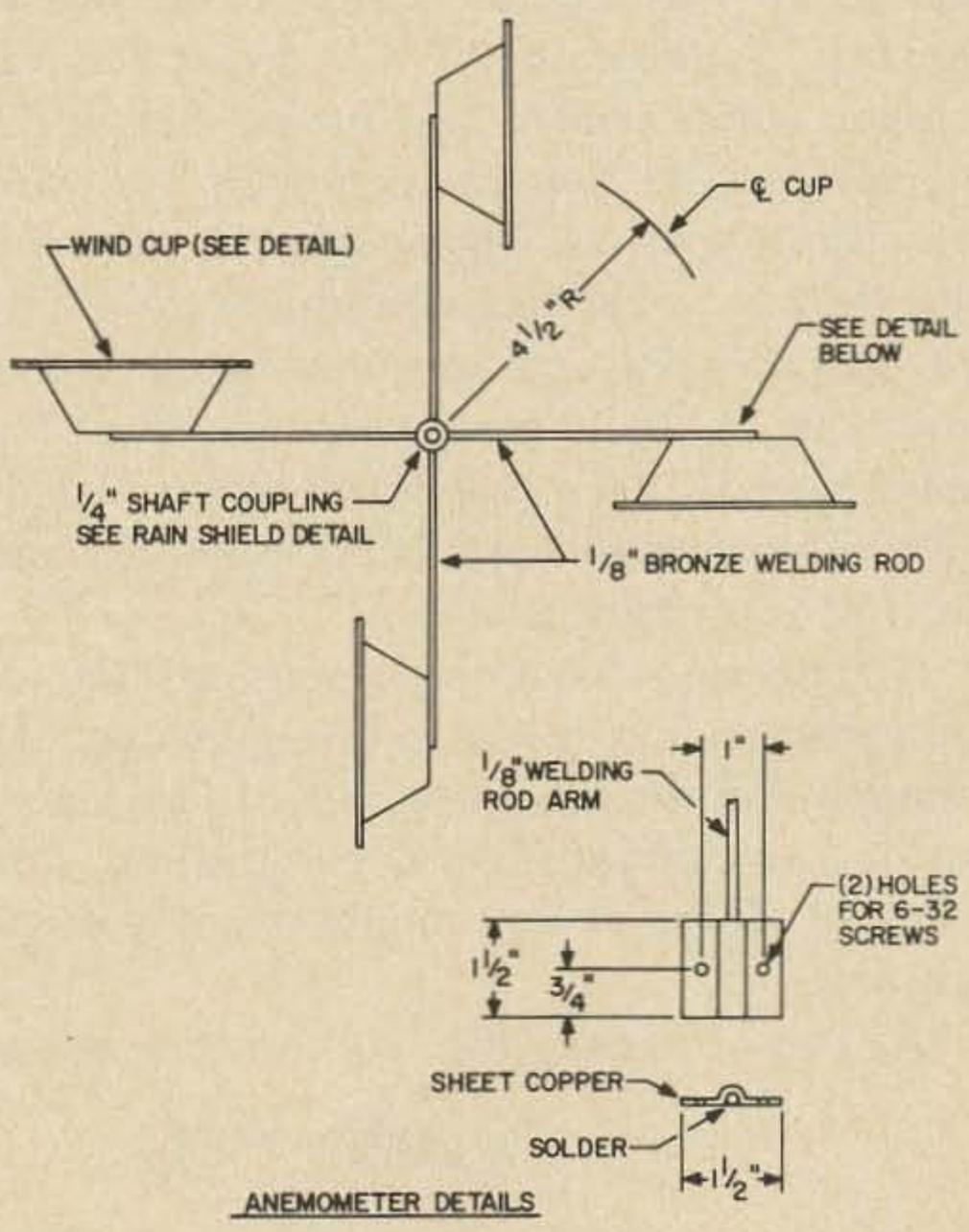


Fig. 7.

Indicator Cabinet

Figure 1 shows the exterior details of the indicator cabinet. Figure 10 shows the diagram of connections. The wind direction indicator is a surplus I-82 radio compass. In order to permit placing the radio compass in the cabinet, it is necessary to remove and disconnect the socket on the rear of the instrument and remove the sheet metal cover over the selsyn proper. In Fig. 1 the wind direction indicator is the large indicator at the lower center of the panel. The wind velocity indicator is a Weston Model 506, 0–100 mA dc meter. It has an internal resistance of 1000Ω and has a new scale showing miles per hour in accordance with calibration data shown in Fig. 11. The wind velocity indicator is located on the panel to the upper left. At the upper right of the panel is the milliammeter indicating the dc field current to the wind velocity transmitter. This instrument would best be a 0–200 mA dc instrument. As none was available, a 0–50 mA meter was shunted with a five times scale multiplier. This instrument serves two purposes. One is to indicate that the field current is 100 mA as the velocity calibration is based on this amount of field current. The other purpose is to show that

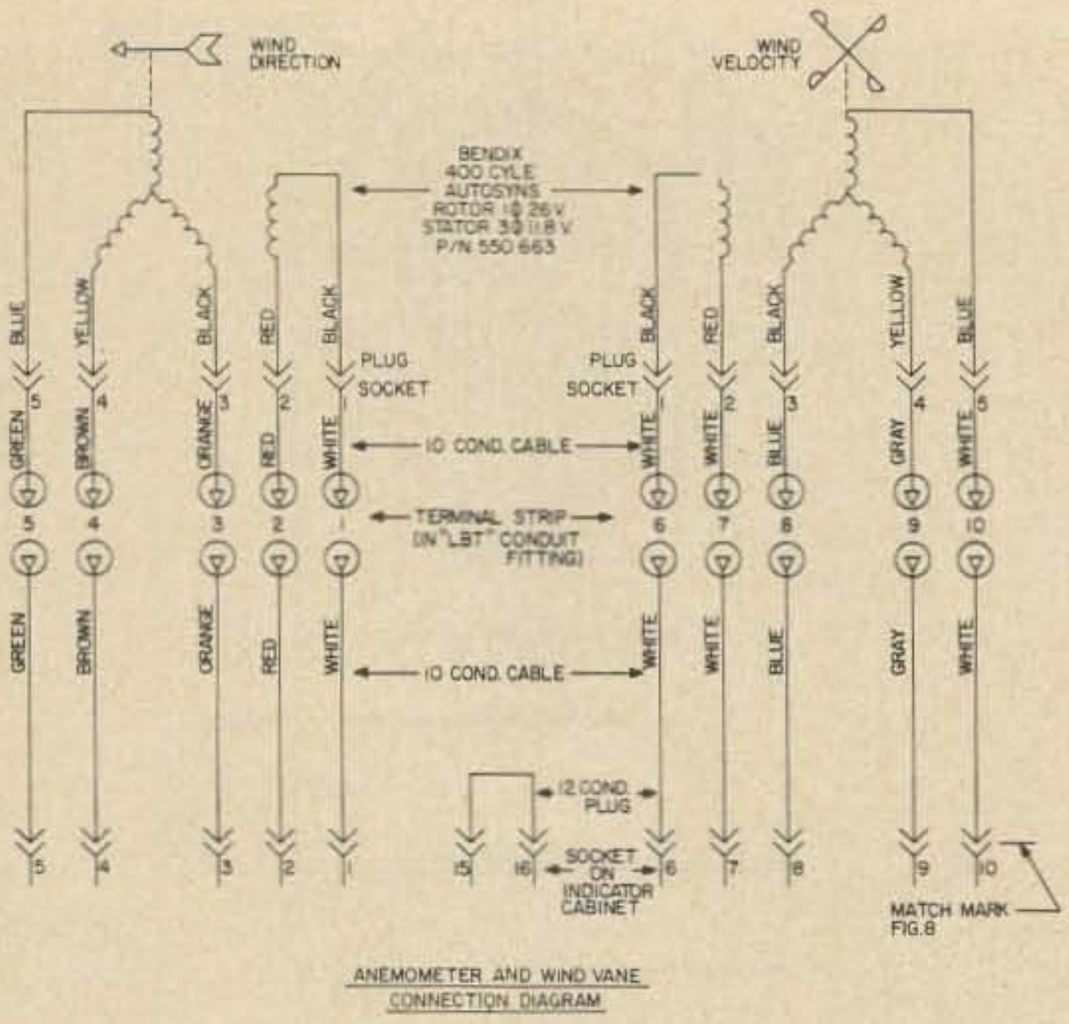


Fig. 8. Anemometer and wind vane connection diagram.

the selsyn field is energized. In Fig. 1 the switch at the upper center is S2 which controls application of ac power to the cabinet components. The switch below S2, S1, selects the low or high scale for wind velocity indication. The socket for the cable plug and a fuseholder containing a 1A fuse are on the rear of the indicator cabinet which is of moulded black bakelite. The cabinet is 3" deep x 8-3/8" high x 7-3/8" wide. This cabinet has a blank bakelite panel drilled for mounting screws.

Arrangement of components within the indicator cabinet is left to the individual. All components shown in Fig. 10 can be placed within the cabinet shown, but it does "take a bit of doing." You might want a larger cabinet.

As can be seen in Fig. 10, four 6.3 volt to

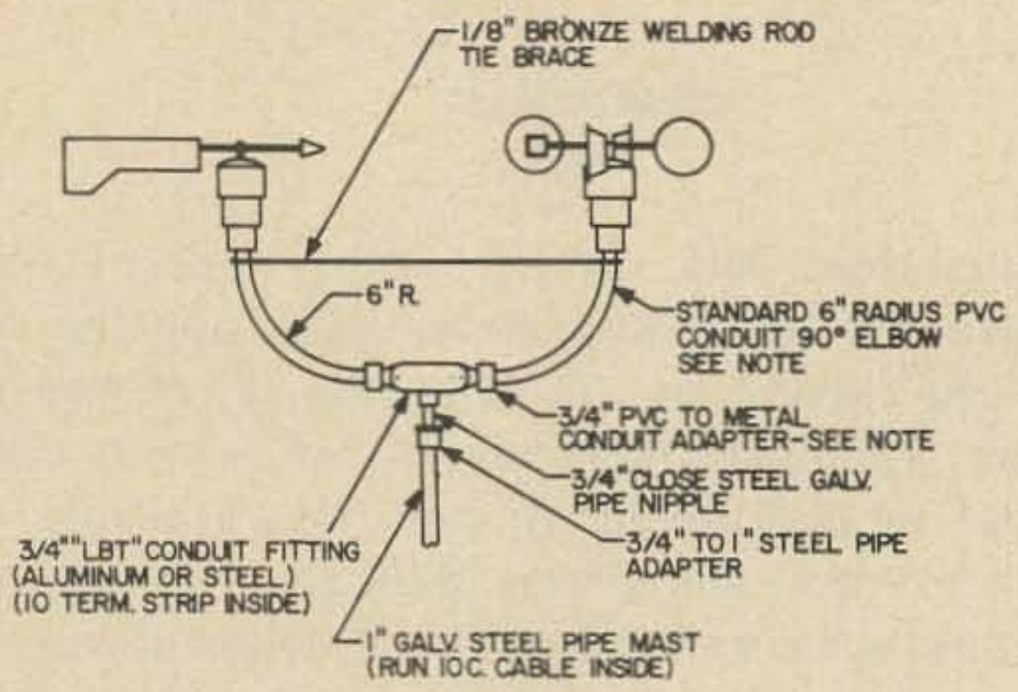


Fig. 9.

110 volt (at .6A) midget filament transformers are employed. One of these transformers supplies 6.3 volts ac to the wind direction transmitter and indicator. The secondary of this transformer is also connected to a bridge rectifier which supplied, through a filter, four dc volts to the field of the wind velocity transmitter. The 50Ω rheostat is employed to adjust the dc field current of the velocity transmitter to 100 mA; the value required by calibration. It may be noted that the filter system consists of four 100 μF 35V condensers and a choke which is the primary of a midget 500/4Ω output transformer. The remaining three filament transformers, connected delta-wye, step up the voltage from the wind velocity generator and deliver this voltage to six 1N34 diode rectifiers. The dc voltage from the diode rectifiers is filtered and delivered to the 0–100 μA meter. The arrangement of the wind velocity indicator, the 500 and 666.67Ω resistors and switch S1 is such that the load on the wind velocity generator is the same for both positions of switch S1.

Anemometer Calibration

If all of the following requirements are met, the calibration data shown in Fig. 11 may be employed in making a new scale for the 0–100 microammeter:

a. The wind cups conform with details, dimensions, and arrangement shown by Figs. 6 and 7.

b. The same type of selsyn ("autosyn") is employed for the wind velocity transmitter.

c. The field (single phase winding) current of the wind velocity transmitter is 100 mA dc.

d. The connection diagram and all values shown in Fig. 10 for the wind velocity indicator are duplicated.

e. Details shown by Figs. 6 and 7 are duplicated.

If *all* of these requirements are not satisfied, individual calibration of the wind velocity indicator will be necessary.

Temporarily install the wind velocity transmitter on an automobile. This can be conveniently accomplished on a car equipped for mobile radio operation by attaching the wind velocity transmitter to a

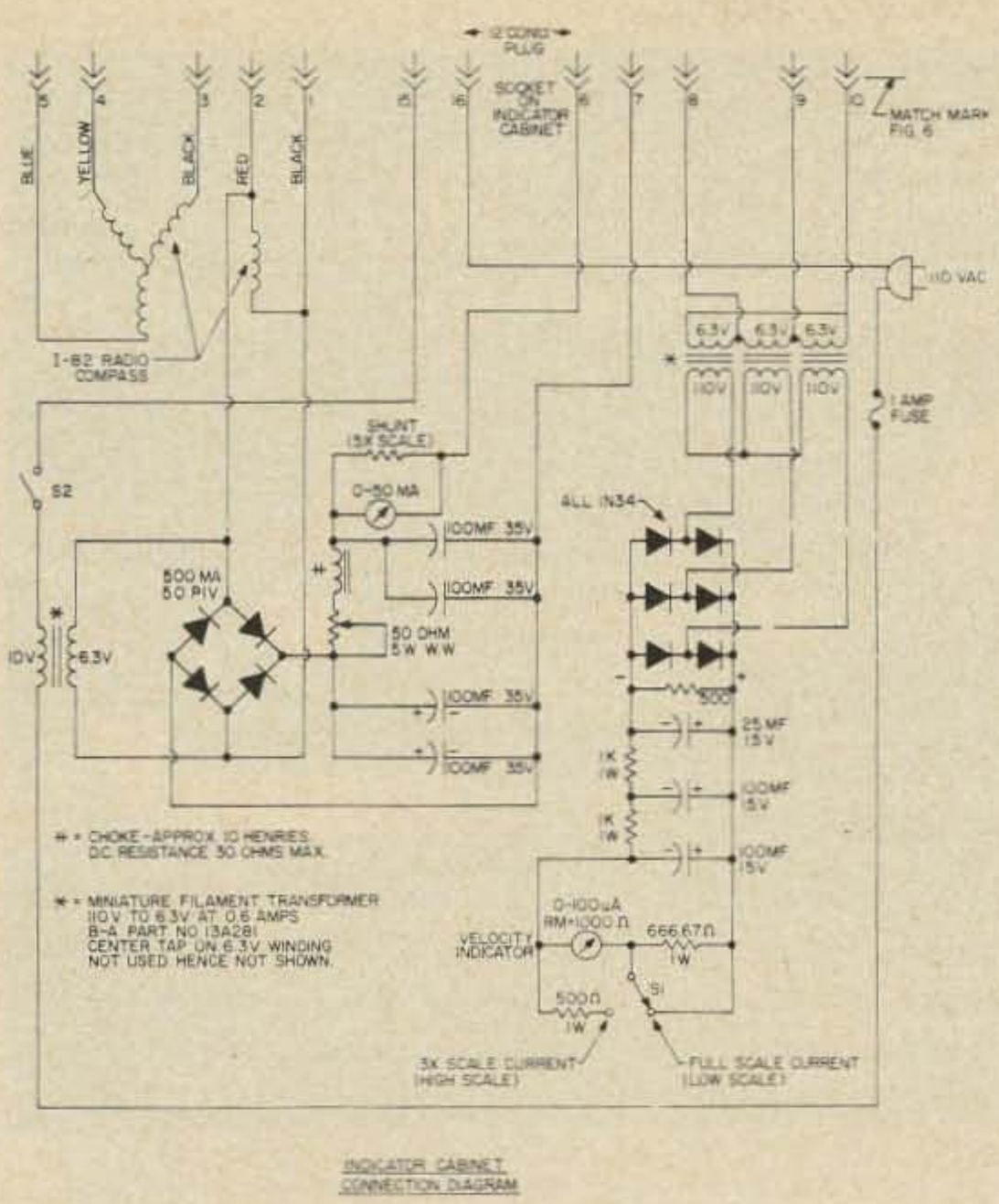


Fig. 10. Indicator cabinet connection diagram.

24" mobile antenna base extension and screwing the extension into the antenna mount on the car turtleback. This will place the wind velocity transmitter above the level of the roof of the car. Run a five conductor cable from the wind velocity transmitter through the rear window of the car to the corresponding terminals on the indicator cabinet which should be on the front seat. In the indicator cabinet, disconnect the dc leads from the bridge rectifier (500 mA 50 PIV diodes). Bring these leads out of the cabinet and connect a 50Ω rheostat in series with one lead to provide adjustment of the field direct current. The direct current to excite the field of the wind velocity transmitter is obtained from the car storage battery and this voltage (12V dc) is conveniently available at the cigarette lighter. When calibrating the wind velocity transmitter, it is important that the field current be exactly 100 mA. Adjustment of the field current to 100 mA is easily accomplished by adjusting the 50Ω rheostat referred to and which, incidentally, is additional to the one in the indicator cabinet and shown by Fig. 10.

Have someone drive the car for you as you will be entirely too busy taking readings to be able to drive. For most accurate calibration a *straight* road approximately 3

WIND INSTRUMENT
WIND VELOCITY METER
CALIBRATION DATA

SW S1 Position
Low Scale

Meter Indication μA	Wind Velocity Miles per hour
0	0
3.5	5
7.5	10
11.5	15
17.5	20
27.0	25
39.0	30
55.0	35
74.0	40
93.0	45

SW S1 Position
High Scale

Meter Indication μA	Wind Velocity Miles per hour
0	0
2.5	10
5.8	20
13.0	30
24.7	40
37.3	50
49.3	60
61.3	70
73.3	80
85.7	90
97.3	100

Meter Weston 0—100 mA Model 506, internal resistance 1000Ω. Velocity generator field current 100 mA dc.

Fig. 11. Wind velocity indicator calibration data.

miles long and free of obstructions is necessary. Note that the calibration accuracy will be no better than the accuracy of the automobile speedometer.

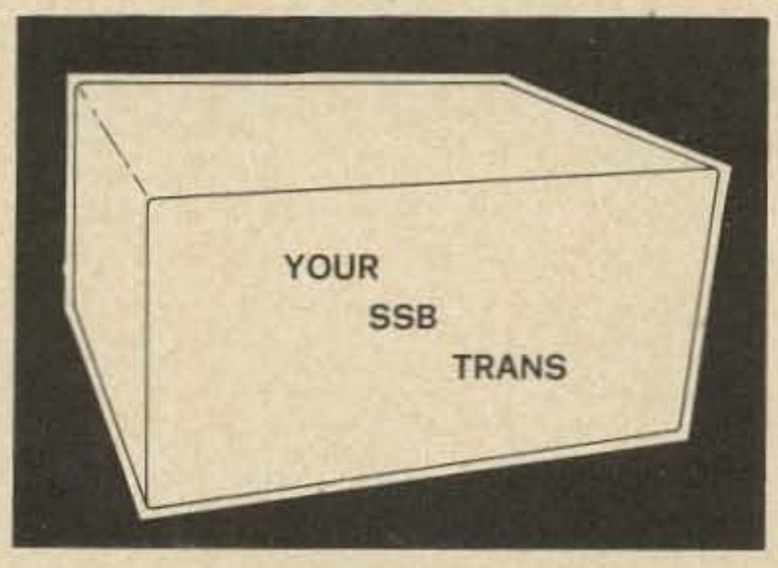
Start at five miles per hour and increase speed in five miles per hour increments up to the legal speed limit. Tabulate the microammeter reading corresponding with the original five miles per hour speed and each five mile per hour increment. Turn the car around and start at the legal speed limit and decrease speed in five miles per hour increments down to five miles per hour. Tabulate the microammeter reading corresponding with the legal speed limit and each five mile per hour increment. Repeat the entire process.

You will have four microammeter readings for each tabulated speed of the car.

Adding the 4 readings and dividing the answer by 4 results in the average microammeter reading corresponding with the car speed. By plotting the microammeter readings (average) against the car speed in miles per hour a calibration curve for the wind velocity transmitter may be constructed. In the instrument described, the calibration curve became a straight line at speeds above approximately 35 miles per hour. As a consequence, extrapolation of the calibration curve to 100 miles per hour was no problem. A new scale for the microammeter calibrated in miles per hour can be drawn from the calibration curve.

In the foregoing, a detailed description of the fabrication and construction of the various components has been intentionally omitted. It is believed that the details shown by the various figures provide sufficient information.

. . . W5ZG



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Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

A Modified WB8DQT Weather Satellite

After several months watching APT weather satellite pictures from the ATS and ESSA 8 satellites using the video converter unit described in *73* last month, it was decided to investigate the possibility of modifying the units to permit display of pictures from the new generation of weather satellites in the ITOS (Improved Tiros Operational Satellite) series. The ITOS system, presently in use on the NOAA 2 satellite and scheduled for operational use well into the late 1970s, does not use a vidicon camera to produce its pictures but relies on an ingenious mechanical scanning system to perform this function. As the satellite moves along its orbital track, a mirror, rotating at 48 rpm, scans the earth from horizon to horizon at right angles to the satellite's line of motion. An optical system focuses a narrow beam of visible and infra red (IR) energy, picked up by the mirror, to a series of sensors. One sensor responds to light in the visible spectrum while the other responds to energy in the infra red. As the mirror scans the earth the output of the IR sensor modulates the video subcarrier. While the mirror is back scanning on the spacecraft, the data from the visible sensor, stored on a tape loop during IR transmission, is used to modulate the video subcarrier. The video modulation is identical to the APT format in that minimum amplitude of the 2400 Hz subcarrier represents black and near maximum amplitude represents white. The end result of this time multiplexed format is equivalent to a 96 line per minute video signal consisting of alternate lines of visible and IR data. Vertical scanning for the system is provided by the movement of the spacecraft along its orbital path. The picture is not broken up into a series of discrete frames but rather is built up in the form of a continuous vertical readout as long as the satellite is in range of the ground station. Each line of video represents the area immediately below the spacecraft at any instant in time.

Despite the rather pronounced difference

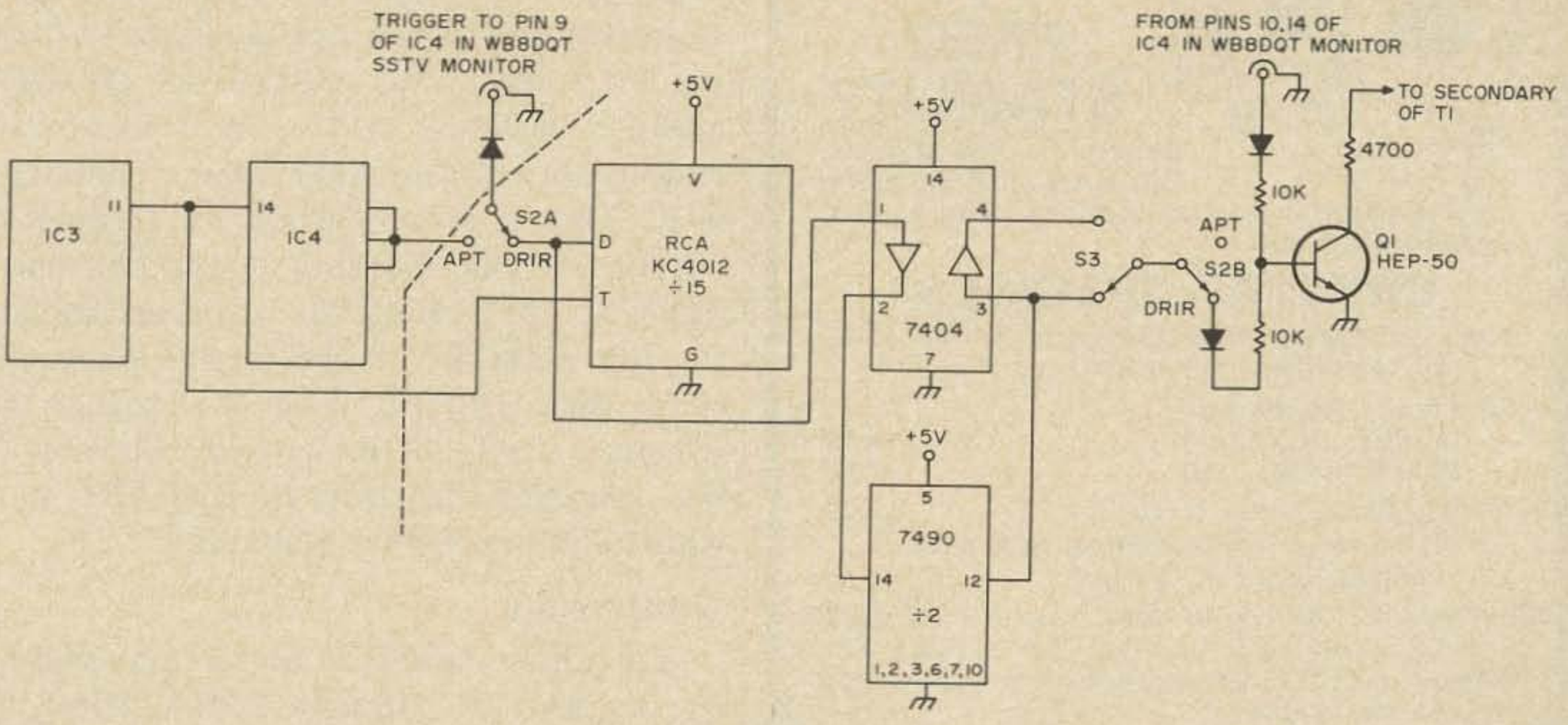


Fig. 1. Modifications to the WB8DQT weather satellite video converter. Original converter components left of dotted lines refer to original circuit for complete connections and other components. New circuit additions in red. The RCA KC-4012 module should be wired to divide by 15 following the instructions with the kit. S2 – APT/DRIR mode switch. S3 – visible/IR display selector. Unmarked diodes – 1N457, 1N914, etc.

between the ITOS DRIR (Direct Reading Infra-red Radiometer) system and the conventional APT format, it proved quite easy to modify the video converter to allow display of the ITOS picture signal. No modifications of the video circuit are required since the 2400 Hz subcarrier is modulated in a similar fashion for both the APT and DRIR modes. The first requirement is to provide a line triggering signal at the 96 line per minute (1.6 Hz) rate. In the original adapter the 4 Hz APT trigger rate was derived via a count-down chain from the 2400 Hz satellite subcarrier using a phase-lock loop as the signal source. Most of this circuitry is also used in the DRIR mode. The output (pin 11) of IC3 in the original adapter is 24 Hz. If this 24 Hz signal is divided by 15 the proper 1.6 Hz signal will be produced. There are many ways in which the divide by 15 circuit could be set up but I chose to go a simple route. RCA markets a number of interesting little IC kits that are available through most of their distributors. One of these, the KC 4012, is a digital counting module that can be wired to perform a number of different counting functions following the wiring hookup enclosed with the components. One of these options is a divide by 15 mode which is used as part of the converter modification. The output of the module, interfaced with the original circuit as indicated in Fig. 1, is routed to a dpdt switch along with the normal 4 Hz from the converter count-down chain. The switch is used to select either the APT or DRIR trigger rate to drive the horizontal monostable in the monitor. The other half of the switch performs another function to be outlined shortly.

The next problem to be solved was how to select the proper video display, either visible light or IR, since it is impractical to observe them both simultaneously. After quite a bit of midnight experimentation the following procedure was adopted. The output of the divide by 15 module (1.6 Hz) is routed to one section of a 7404 hex inverter whose output is then fed into ½ of a 7490 decade counter in the divide by 2 mode. The output of the 7490 or an inverted version of same, obtained by feeding another section of the 7404 hex inverter, is applied to the base of a blanking transistor, Q1, which shorts the video to near ground potential whenever its base goes positive. The end result is that every other line of video is effectively blanked and the blanking sequence is deter-

mined by whether the inverter or non-inverted 7490 signal is used. The original converter circuit did not incorporate blanking but since it was required for the DRIR mode I decided to let the transistor do double duty and provide retrace blanking as well. This is accomplished by feeding the output of the monitor horizontal monostable to the base of Q1, blanking the video for the duration of the retrace pulse. The other side of S2, used for trigger rate selection (APT/DRIR) is used to disable the line blanking function in the APT mode while retaining retrace blanking.

Construction

The entire modification circuit consisting of the KC 4012 module, 7404, 7490, and the HEP-50 used for Q1 can be mounted on a small piece of perf board and interconnected to the original adapter. The APT/DRIR selector (S2) and the Visible/IR selector (S3) should be mounted on the front panel. A new phono jack will be required for the horizontal blanking signal and this can be mounted on the rear apron. The monitor will also require a new jack for the blanking trigger.

Since the DRIR sweep rates are even slower than those used in the APT mode, still more capacitance will be required in the monitor discharge circuits. The original article described the addition of a 1000 mf capacitor in the vertical discharge and 1.5 mf in the horizontal discharge circuits. These capacitors are retained in the modified version but a dpdt center "off" switch is now used to switch them into service. In the center "off" position the monitor functions normally as indicated in Fig. 2. In one "on" position the APT capacitor values are switched into the circuit and in the other "on" position the DRIR capacitors (2000 mf vertical and 3 mf mylar for the horizontal) are switched in. The value for the horizontal circuit can be obtained by paralleling several units of lesser capacitance.

Operation

NOAA 2 transmits on a frequency of 137.5 MHz and future satellites in the series will alternate between this frequency and 137.62, the frequency presently in use on ESSA 8. Place S2 in the DRIR position. The

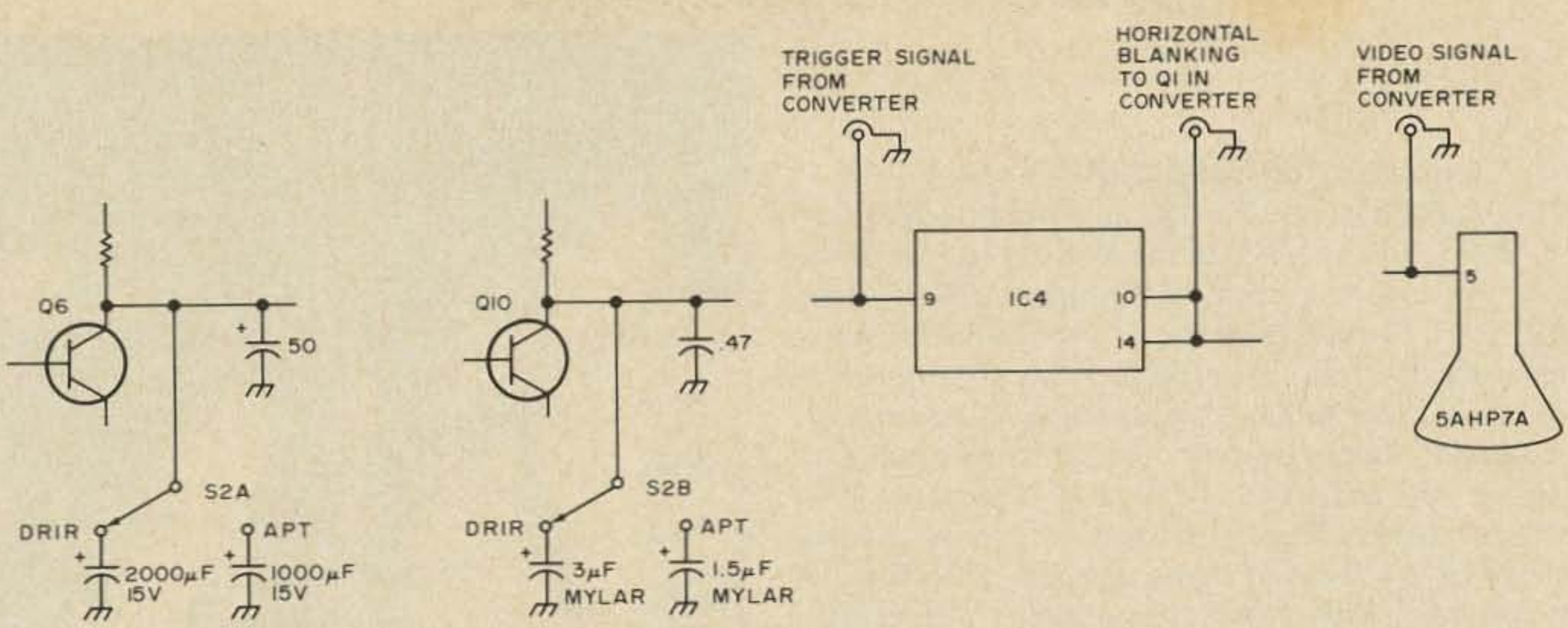


Fig. 2. Complete WB8DQT SSTV monitor modifications for APT and DRIR service. Modifications outlined in the original APT converter are in blue while additional components for DRIR/ITOS service are in red. S2 in the original article was a simple dpdt toggle switch. In this version a center "off" dpdt toggle is used. In the "off" position the monitor functions normally in the SSTV mode. In the APT position the APT discharge capacitors provide proper sweep for that mode while in the DRIR position other capacitor values are used. The trigger, blanking,and video jacks can be mounted on the rear apron with S2 mounted on the front panel.

position of S3 is not important at this time. The monitor horizontal size and centering controls should be adjusted for a sweep that extends slightly beyond the margins of the viewing bezel. The vertical sweep should be set to require approximately six minutes to sweep from top to bottom on the monitor screen. Apply a NOAA 2 signal to the adapter and phase the picture as you would the APT display. A bright seven pulse sync train precedes the picture and can be lined up just off the left hand side of the picture. Adjust the recorder gain control for best contrast. Now observe the region immediately following the sync pulse train. It will be black for the visible light channel and white (cold) for the IR channel. This narrow strip represents the view of space just before the sensor scans across the earth. If you are watching the IR view and want to see the visible light channel simply move S3 to its other position. If you started out with the visible channel then the other position of S3 will provide the IR channel. S3 has no universal calibration – it simply chooses the alternate display to whatever is being viewed at the moment.

During daylight passes, when the satellite moves from north to south, both IR and visible data are available. North will be at the start of a daylight picture sequence. At night the satellite passes overhead going from south to north so the bottom of the picture represents north and the photo should be inverted to show the correct geographic relationships. Night passes produce excellent IR pictures but the visible channel will be black due to insufficient light to effect the visible sensor. The visible light view can be interpreted just like the APT pictures but the IR channel is a little different. The parameters of the IR sensor and associated circuitry are set up so that the coldest objects (space, clouds, etc.) appear white while warm objects are black. Clouds will usually appear white in the IR view but the appearance of the land and water features in the pictures will change during the season depending upon the relative temperature differences in your climatic area.

Due to the geometry of the scanning system only those areas immediately under the spacecraft orbital track, equivalent to a line drawn down the center of the photo, will appear to have the proper aspect ratio. Objects out toward either horizon will be foreshortened. If you have a scanning receiver or an XYL who can switch channels for you, it is fun to record both ESSA 8 and NOAA 2 passes for a given day and compare the results. This is the best way to actually see the optical effects introduced by the scanning mirror of the DRIR system. Such a comparison is shown in Fig. 3. I use a Heath

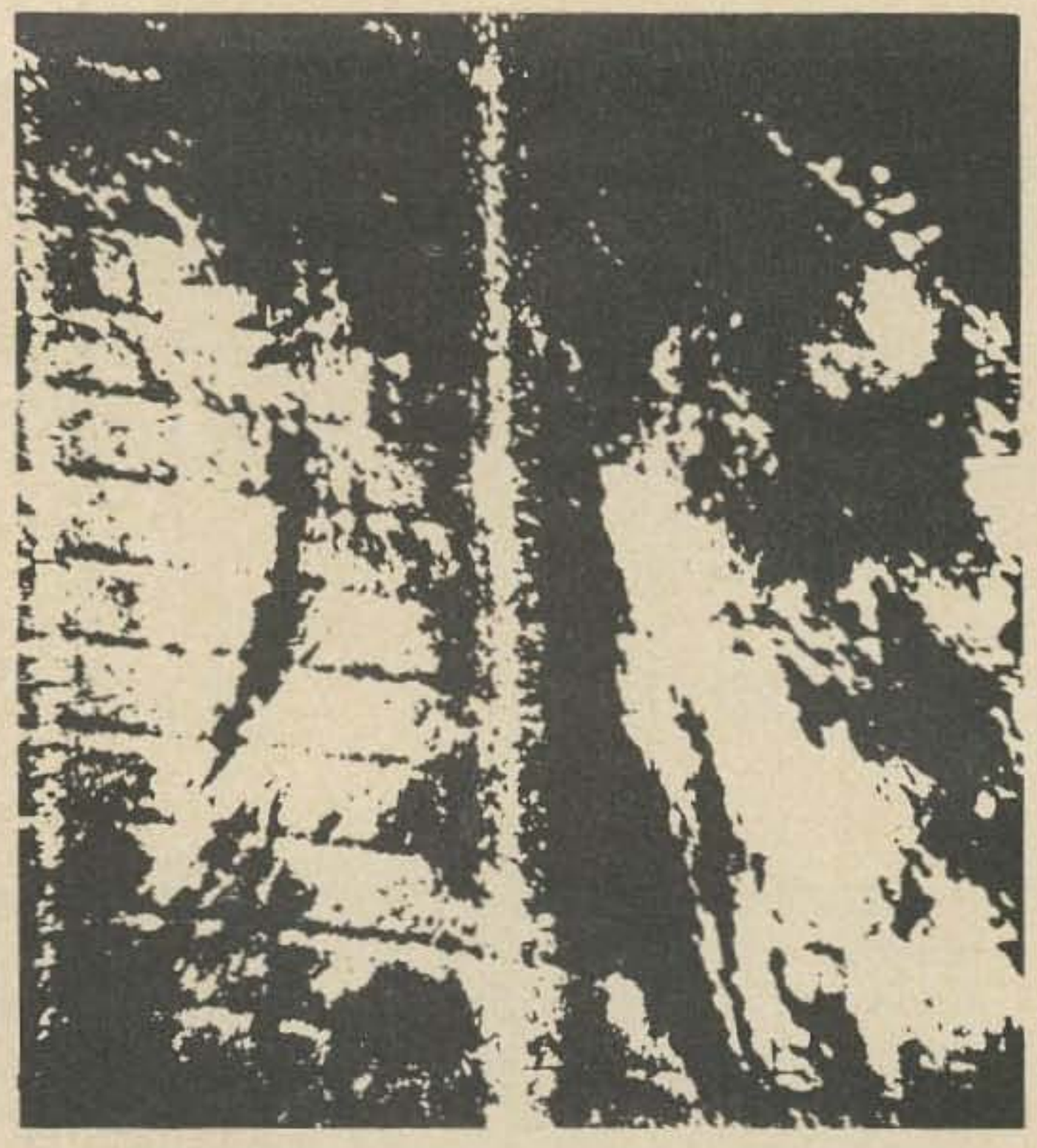
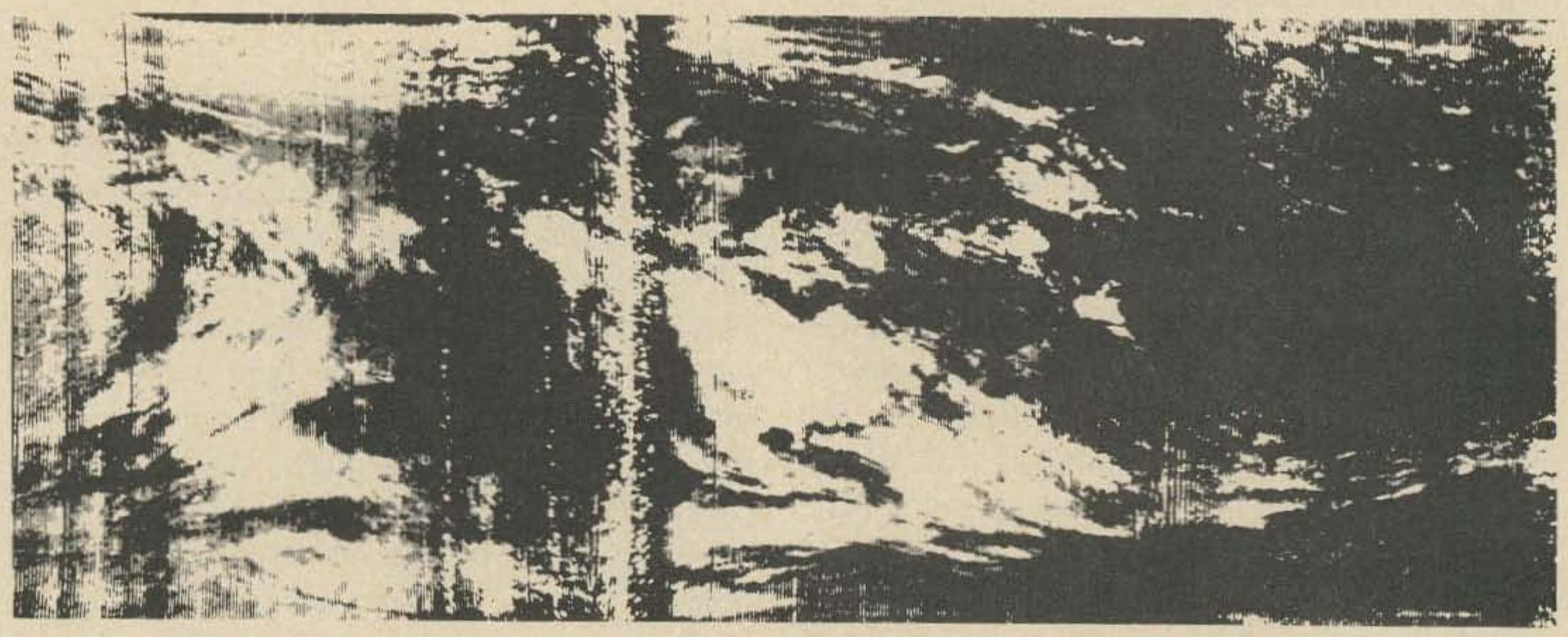


Fig. 3. Comparison of ESSA-8 (APT) and NOAA-2 (ITOS/DRIR) pictures for the morning of November 3, 1973. Both satellites made close to overhead passes over the author's Michigan QTH. The ITOS/DRIR format consists of a continuous strip of coverage for the entire period the satellite is in radio range. The ESSA-8 photograph is essentially a "snapshot" taken at one point in time and read out over an extended (200 sec.) period. The prominent band of noise in each picture is caused by a null in the fixed antenna pattern. The IR view from NOAA-2 was rather uninteresting during this pass due to the overall cooling that was taking place on that day. Similar cloud patterns are present in both satellite views and the pronounced foreshortening of features toward the horizon is clearly evident in the NOAA picture. North is to the right in both pictures.



GR-110 scanning receiver with a preamp and an audio actuated relay that turns on the recorder whenever either satellite breaks the receiver squelch. Maximum flexibility with this type of unattended operation required a good omnidirectional antenna and a mast-mounted preamp. If you desire precise information on the recorder "on" periods use a stereo recorder and put CHU or WWV on the alternate channel. In general, the NOAA satellite will be found to have a stronger and more consistent signal. Despite the unusual optical effects, the DRIR system actually works out better in the long run than the older APT format. ESSA 8 is spin stabilized in orbit so much of the time it transmits a tone between pictures while it is rolling to a proper attitude to take another picture. It's very frustrating to hear this inter-picture tone coming in loud and clear for several minutes only to have the satellite pass through a null in your antenna pattern just as picture transmission begins – ask my wife who monitors the language drifting out of the basement during the evenings! With the DRIR system you get usable video whenever the satellite is coming in – there is no dead air time.

Adding this modification will provide you with a video display system which is compatible with all the weather satellites currently in use. Since DRIR systems of the ITOS/NOAA type will be flown well into the end of this decade you've lots of time available to use the unit! Grab your atlas, weather map, and tape recorder and come up and join the fun!

. . .WB8DQT

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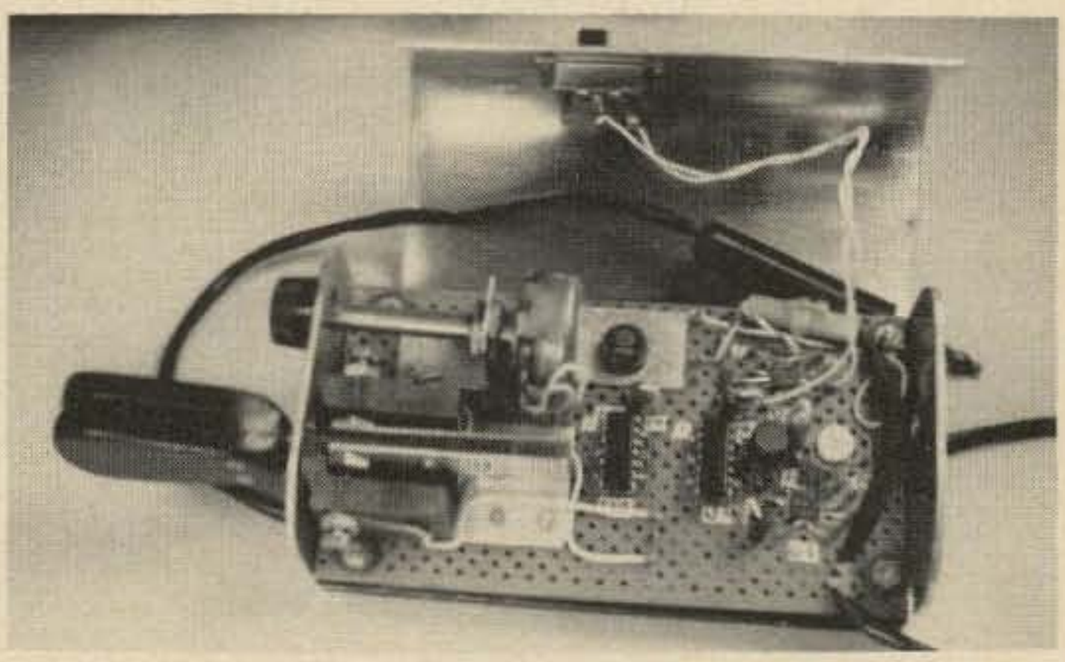
Can a Keyer Be Logical ?

A keyer made principally of ICs is hardly new to most people, but if you have not made one, you've missed a lot. They are very easy to wire and the circuit logic is surprisingly easy to understand. All this makes it practical to change things around many ways so that your keyer is tailor made to fit your needs. The one described here is designed to get rid of every pain in the neck trouble that used to bother me while keying my rig. It will complete any dot or dash started every time. You cannot start a dot or dash until the one being made is complete and is followed by a space. Also, the speed can be adjusted from 1 WPM to 35 WPM. It will key a -110V dc grid-block system and handle up to 30mA. Its power requirement is 5V dc at an almost constant 30mA making the power supply very simple.



Circuit

The circuit is not hard to understand because things just go on and off at a logical time. However, it is necessary to be familiar with the way the various components go about it.

Starting at the beginning. A silicon control rectifier (SCR) will not conduct from anode to cathode until a small positive power is applied to its trigger lead. When it starts conduction the trigger loses control and it will not stop until the anode to cathode voltage is either removed or reduced to a very small magnitude. A unijunction transistor will not conduct B2 to B1 until a positive voltage just about as large as its supply voltage is present at its emitter. But, unlike the SCR, it will stop all conduction after the emitter power is removed. A NAND gate will have an output of practically 0V when its input terminals are open circuit or connected to the supply voltage. When any one of the inputs is grounded to the common side of the power supply, the output snaps up to the supply voltage potential. A JK flip flop output terminals are called Q and $\overline{Q}$ (A and non-Q) and are never at equal potential. One is always at the supply voltage potential and the other practically 0V. Q and $\overline{Q}$ will switch potentials each time the clock pulse (CP) terminal changes swiftly from the supply voltage to ground potential, providing that all other inputs are either open circuit or connected to the supply voltage. The set, preset and reset (S, PS, RS) will determine the Q and $\overline{Q}$ potentials when they are held on ground and

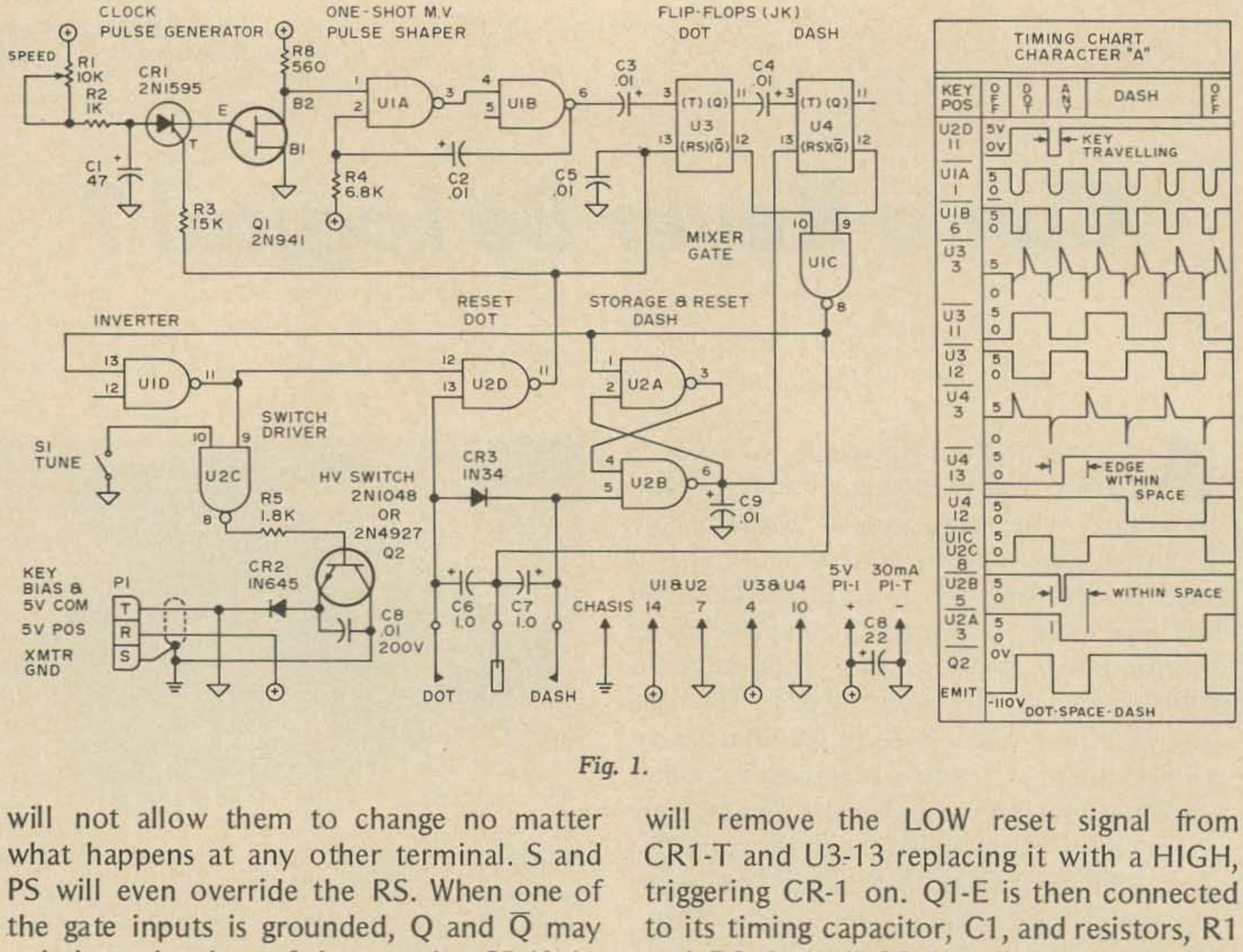


Fig. 1.

will not allow them to change no matter what happens at any other terminal. S and PS will even override the RS. When one of the gate inputs is grounded, Q and $\overline{Q}$ may switch at the time of the negative CP if the proper gate is selected, or remain unchanged if the other gate is grounded. Finally, a NPN transistor will conduct collector to emitter when its base is positive in relation to its emitter.

When these components are connected as shown in Fig. 1, they will snap on and off, making dots, dashes and spaces as directed by the key location. The operation begins when the key armature supplies a 0V signal (as measured from the keyer power supply common) from U1C-8 to U2D-13. Hereafter we shall call this kind of signal LOW and one measuring the supply voltage potential HIGH instead of 0 and 1 as in computer talk. If the key was in the dot position, this will remove the LOW reset signal from CR1-T and U3-13 replacing it with a HIGH, triggering CR-1 on. Q1-E is then connected to its timing capacitor, C1, and resistors, R1 and R2 through CR-1 and a series of pulses are formed. The number of pulses depends upon how long the key is closed, but will never be less than two, the number required to make one dot. The negative pulses are fed to U1A-U1B where they are shaped and given a very fast fall time. C1 is discharged at the end of each pulse causing CR1 to be cut off. In order to make sure that a second pulse is always formed, after C1 recharges through R1 and R2, it is necessary to keep CR1-T at a HIGH even if the key is released or moved to the dash contact. As shown in the Timing Chart, Fig. 1, this is accomplished by U3 being flipped by the first pulse causing U1C-8 to be set HIGH, which sets U1D-11 LOW, which sets U2D-11 HIGH which keeps CR1-T and U3-13 at a HIGH. When U1D-11 is LOW (or S1 is closed) U2C-8 is HIGH and Q1 will conduct until U3 flops. This action will make the Dot Reset line LOW again, Q2 snaps off (if S1 is open) and the system is in the OFF state and ready to respond to the key again.

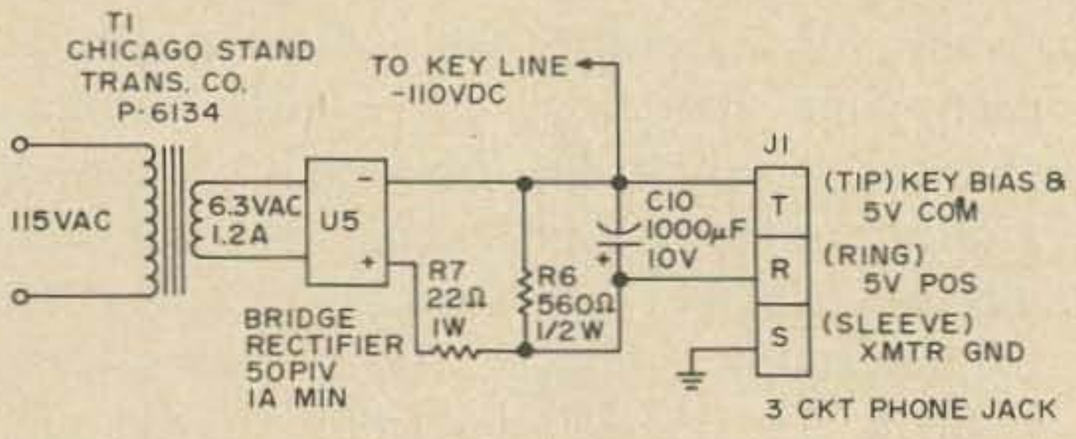


Fig. 2.

The keyer power supply, Fig. 2 uses a 6.3V ac filament transformer connected to a

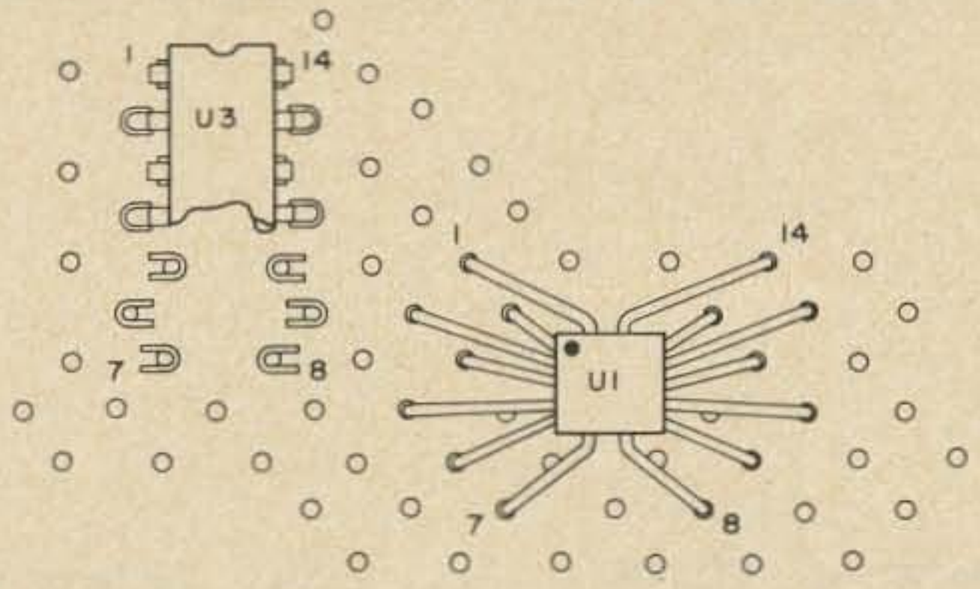


Fig. 3.

bridge rectifier and simple filter circuit. It is designed to be mounted inside the transmitter so that one cable will run to the keyer.

Keyer Construction

The keyer construction is a two part project, electronic and mechanical. Both can be completed with around the shack tools and materials. All electronic components and the key are mounted on a 6.2cm x 12.7cm (2 7/8" x 5") piece of Vectorboard which has 1.6mm (.062") holes with 5m (.2") on center spacing.

One of the goals of this project was to devise a practical way of mounting the flat-pack type IC gates without a printed wiring board. They mount neatly and are easy to wire by staggering the Vector flea clips seven along the side in a diamond pattern with three pins diagonally below and to the side of the diamond,as shown in Fig. 3. The flat-pack leads are fanned out, cut to length, pushed through the clip holes and soldered in place. The long TO-116 flip flop IC packages were given the same treatment by staggering seven clips down a side with their large ends toward the IC and their tabs alternately turned in and out. This pattern is also shown in Fig. 3. Most of the wiring is under the board and should be 28 to 22 AWG insulated with a solid conductor for the best appearance.

Key Assembly

The key assembly has a paddle made of tempered masonite with its shaft bolted or rivited between two 5.1cm (2") long aluminum angles 2.5cm (1") high, 1.2cm (1/2") bottom flanges, and .6mm (.025") thick. The bottom flanges are cut off for 3.1cm (1 1/4") until only a 1.2cm (1/2") strip remains at the top to be fastened to the paddle stem. This assembly is fastened to an aluminum plate along with a 2.5cm (1") cube of insulation cut out in the center making it a "U" shape with .6cm (1/4") walls. Holes are drilled and taped into the sides to provide for adjustable dot and dash contacts made of brass bolts. These line up with another brass bolt passing through the metal of the paddle assembly and is the armature contact. Cutting a slot toward the back of the angles, making them look like a block letter "L" is how the spring action of the key is adjusted. Two other metal parts are bolted to the circuit board. The 1.9cm (3/4") wide angle that holds the large, rugged pot, R1, and a small piece of aluminum to heat sink the switch transistor, Q2.

The base of the keyer is about 8mm (5/16") thick and is made by pouring about 3 pounds of melted fishing sinkers into a mold. With rubber pads on the bottom of the base this key, it will not slip around the operating desk. The circuit board is mounted to this base with spacers and bolts in each corner, along with the back and front panels of the cover. These panels are 5.1cm (2") high, 1.6mm (1/16") thick aluminum with corners rounded to fit the wrap around top. The slide switch, S1, is fastened to the side of this top. The call letters and QTH are cut out of your QSL and cemented to the top, making it a very personal keyer.

My keyer is connected to the transmitter with a 61cm (2") piece of two conductor shielded wire with a three circuit phone plug on its free end. I connect the shield to the plug sleve, the 5V dc positive keyer power to the ring, and the key bias line along with the 5V dc common to the tip.

Conclusion

There are no adjustments required to make the keyer work properly, but if troubleshooting is required it can be carried out at slow speed with a multimeter or an oscilloscope at high speed. My keyer has been chugging along for months without a sign of trouble and I do not expect any within the next decade.

. . .K3QKO

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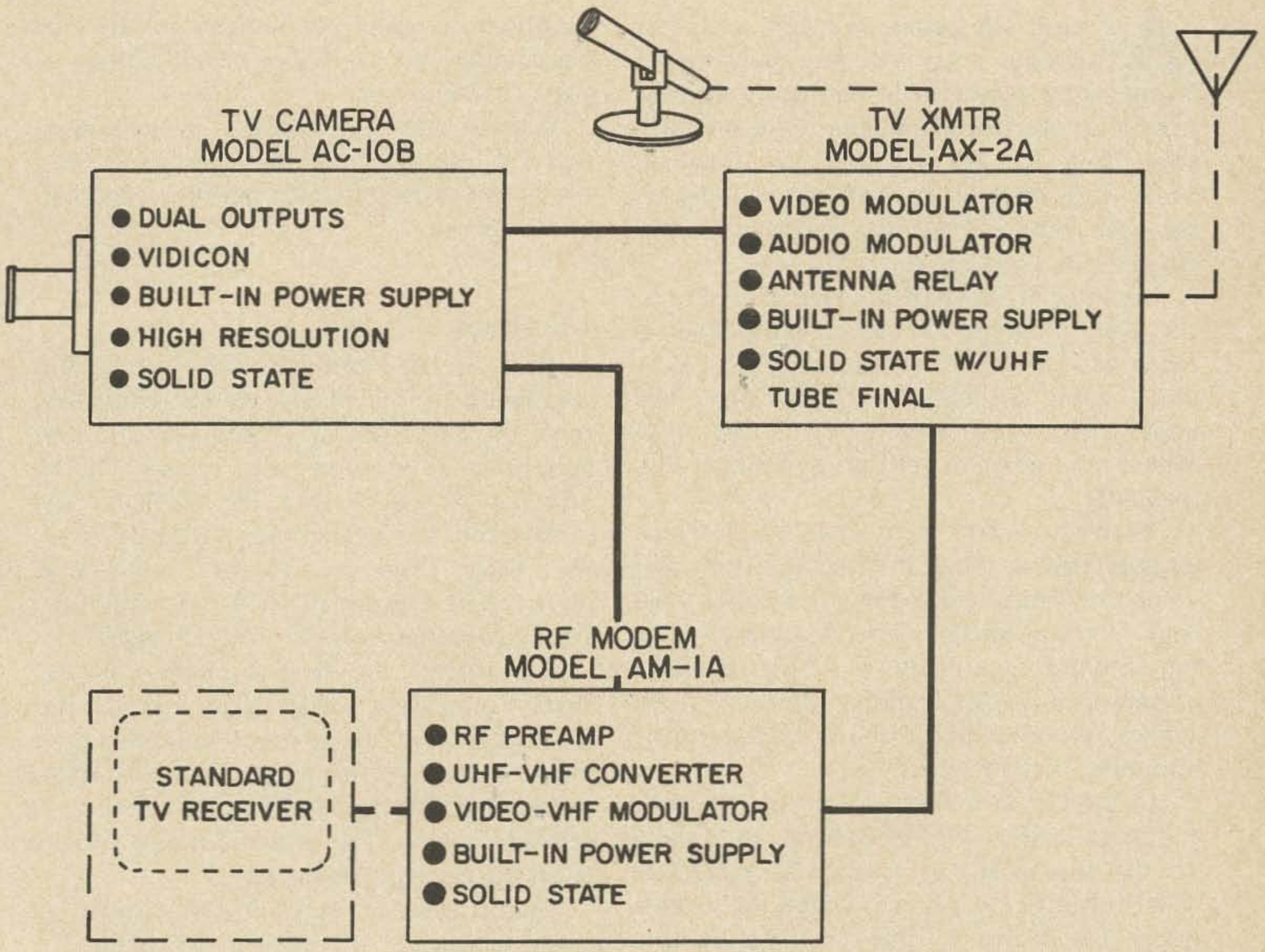

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The Perils of Reaching Novicehood

As any old timer will tell you, it's "awfully" easy to get your Novice license. Any ten-year-old can do it with no trouble at all. Unfortunately, it's also deceptively easy for the old timer to forget all those little difficulties that he encountered back when he was starting. Problems nearly always look simple in hindsight.

Looking at things from the other side of the coin, though, the average newcomer is faced with a wide variety of problems. How am I going to learn all this theory? The code? Who's going to give me the test? Where am I going to get the equipment? Buy or build?

There are many study manuals available to help answer some of these questions, but somebody must guide the prospective amateur to the manuals in the first place. After all, money is usually a rather precious commodity for the beginner, and any study guides of value aren't cheap enough to be found by trial and error.

In the last two years, I've made the slow climb up from Novice to General, and finally to the Advanced, so I can well appreciate just how difficult it is, and where the trouble spots lie. Many a time I've wished that someone had guided me through the easier paths.

As with any beginner I often encountered little articles, such as this one, that made nice general statements about how to become an amateur, but few dealt with the subject on the poor man's level where most of us start. You don't just "go" and buy $50 worth of parts to build a transmitter that's supposed to save you money in the first place, and you can't just "find" a ham to give you the exam.

It's not that easy, and it is in these areas that I'd like to throw in a few ideas. So if the above problems seem painfully familiar, then read on.

The Theory

Back in 1973 the FCC did some serious revamping of the Novice exam. Until that time, the emphasis was placed on radio laws and procedures, with only enough theory involved to assure that the Novice could understand the regulations. Little by little, the theory crept in, first with some schematic related material, then electrical laws, finally culminating in the 1973 changes.

Essentially, the Novice exams changed from something that you could just memorize for, to a more comprehensive exam requiring an application of actual knowledge. Memorizing was out and so it remains today. The student must actually learn the necessary material.

There are two fundamental sources of information for the prospective ham. The first, an actual study guide specifically intended to prepare the beginner. Such a guide assumes that you possess little more than a desire to learn, no prior knowledge is required.

Several are available. The newest is the 73 Magazine publication *The Novice Class Study Guide*. Because of its newness, this appears to be the most comprehensive and

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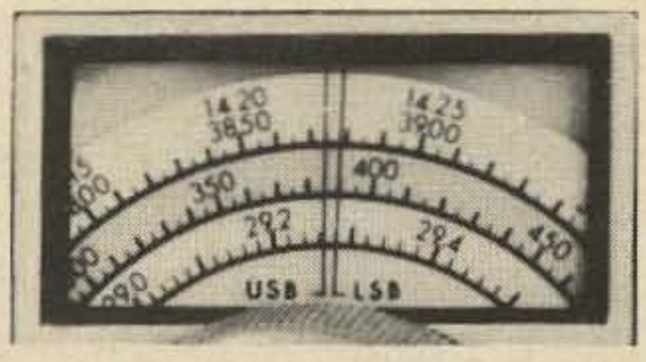

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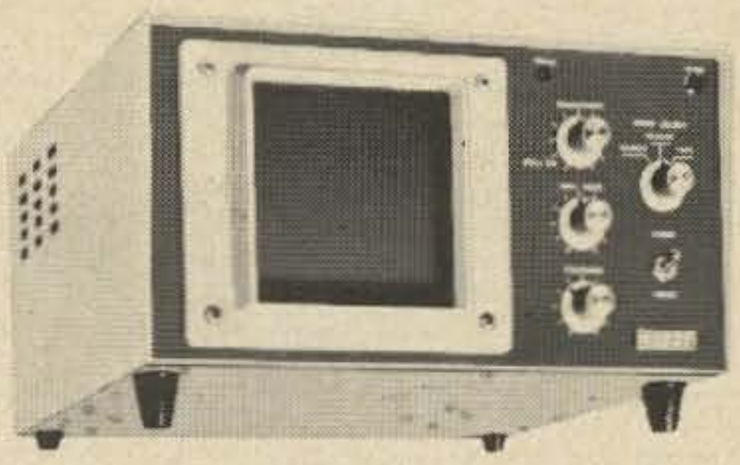

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up to date course available at this time. Additionally, if you want to spend the money, 73 also has a new cassette theory course on the market that allows you to absorb the information while still keeping your hands free.

This can be an excellent way to learn because you can play the tape over and over again until the contents sink in, instead of having to reread a book again and again, which quickly becomes pretty tedious. Not only that, the tape will allow you to do something else while you're listening so you can play it on your way to work or whenever a spare moment presents itself.

The American Radio Relay League (Newington, Conn. 06111) also offers a course called "Gateway to Amateur Radio." The ARRL manuals have gotten thousands through the old style Novice exams. One caution though, make sure that you get a recent manual, otherwise you might find yourself studying old material dating back to before the exam change.

Numerous other companies offer various reprints of FCC question lists, with appropriate answers, but the FCC tends to rephrase most of the sample questions quite liberally, so that won't really help you quite as much as a study guide would. If you really know the theory behind the answer, then you can handle virtually any re-phrased version of a question; but if you only know one stock answer for one stock question, then you're practically bound to fail because you'll hardly ever see the stock question.

The second way to learn is to locate a nearby amateur radio club that is offering Novice theory classes. The best people to contact about this are the local hams, and you have to find them first, so more about that later.

Before you go out and buy anything, though, it certainly would be a good idea to check the public library, especially if you're in a big town, because most of the guides I mentioned are well enough known to possibly be there.

The Code

The International Morse Code is a requirement that still lingers around the amateur exams. There's no easy way around it, only actual practice will help you to finally master the code, but don't give up hope if you're having difficulty, hundreds of thousands have conquered it, and you will too. It just takes some people longer than others.

If you have a receiver, one of the best ways of learning is to copy actual on-the-air CW. Eighty meters has the reputation for harboring the slowest operators but don't neglect the other bands, there are always some slow people there too, especially on 15.

The ARRL offers on-the-air code practice at the five wpm and up level every day, either in the morning or night. A stamped self addressed envelope to The American Radio Relay League, Newington CT 06111 will get you an up to date schedule of the code practice times and frequencies.

If you don't have a receiver yet, and you do have a tape recorder, Radio Shack and 73 Magazine both market an excellent code practice tape. The 73 tape will save you $2 and is a more grueling course, with the useful reward of being prepared for something a lot harder than you will actually find. This is more of a help than a hindrance because you'll be pretty nervous while you're taking that code test so it helps to be more than ready.

Also essential is a key and code practice oscillator. These gadgets will allow you to try your hand at sending the code yourself. Remember, this is also an important part of the required test, but don't let it worry you. Once you're able to copy the code (transcribe the sounds onto paper as the proper letters), sending will be a lot easier than it might otherwise seem.

The secret is to memorize the Morse alphabet not as, for example; 'U' is two dots and a dash, but as 'U' is a particular sound, "dididah." If you differentiate between letters by stopping to count the number of dots and dashes then you won't be able to copy fast code. However, as you gain experience, the more you listen to it the more you will tend to move away from the "counting" method.

Radio Shack sells a beginners key at approximately $1.50. For about three dollars more, a workable code practice oscillator can be constructed from a battery and the high frequency buzzer or transistorized oscillator module, also available from Radio Shack.

By the way, if you have neither receiver nor tape recorder, the next best thing is to coerce a friend into becoming interested in amateur radio. That way you'll at least have someone to practice with. As with the theory, check with the local hams to see if there is a club that may be offering code courses for prospective amateurs. Such classes usually meet once or twice a week for several months (often during the school summer vacation) and you need only pay for your books, otherwise there's often no charge.

Finding A Ham

So you need some advice, some help with equipment, or a person to give you your license test? You know that you need a ham, but you can't find one. Well, if you happen to have access to an amateur Callbook then you're in luck. The Callbook may be found in the larger libraries, or, if you can afford $9.95 plus 50¢ for postage it's available from Radio Amateur Callbook Inc., 925 Sherwood Drive, Lake Bluff IL 60044.

Chances are you would buy one anyway, once you get your license, so it will be a good investment for the future. A careful search through the entire (yes, the entire) listings under your call area will usually turn up quite a few hams in your town.

Remember, a ham is addicted to the local parts emporium. A visit to the local radio supply stores could well be rewarding. Talk with the owner and see if he will give your name and address, and describe your plight, to any hams who might be willing to help.

In fact, you'll probably find that the guy is a ham himself. (All hams secretly want to own their own parts stores, for convenience if nothing more.) If this doesn't pan out, look for ham antennas. This can indeed be a little hazardous, you will probably run into a couple hundred CBers before you finally hit a ham.

The only hint that I can give is that hams generally have larger antenna systems, but don't count on it. Most of all, don't discount any possibilities. Also try looking for license plates with amateur calls.

It would also be a good idea to send your name to the 73 "Ham Help" column. Only a small percentage of the hams who read that column will be in your immediate area, but you never can tell. Above all, don't be bashful. If you find a ham, don't be afraid to ask for help. The worst thing he can say is "No," and usually he will be more than happy to give you a hand.

The amateur population has been dropping lately, and few hams will discourage a beginner. Politeness counts, after all hams are people so you're bound to meet some good ones and some bad ones.

Equipment

The buy or build question has been pretty much beaten to death ever since commercial equipment appeared on the market. Basically, it all comes down to the amount of money you want to spend. Homebrew equipment isn't as inexpensive these days as it once was. Especially if you buy completely new parts. The secret to home building is to be a good scrounger. It all depends on what you will settle for. If you want a good all band rig that will serve your needs when you get your General, then expect to pay accordingly for the necessary components. If, on the other hand, you can tolerate a two band rig (say 40 and 15 meters for best versatility), then a reasonably decent 75 watt rig can be thrown together at considerable savings over its commercial equivalent.

Parts can be obtained at auctions, flea markets, from TV repair shops or, for that matter from the dump. Ask your friends if they have any old radios or TVs they might have stashed away in the attic. It's surprising what can be cannibalized from an old TV set. If nothing else, the power supply in the older sets will comfortably run a hundred watt rig. Visit the local repair shops, most of them aren't taking used TVs in trade anymore but there's still a slim chance that they may have something to get rid of. In fact, here's where the dump comes in. If the sets aren't being traded in, then they must be

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222.34	223.90	146.10	146.52	52.525	52.525
222.38	223.94	146.12	146.61	52.70	52.60
223.14	223.98	146.16	146.70	52.76	52.64
223.26	224.74	146.19	146.72	52.82	52.68
223.30	224.86	146.22	146.76	52.88	52.72
223.34	224.90	146.25	146.79	52.92	52.79
223.50	224.94	146.28	146.82	52.96	52.80
		146.34	146.85	53.15	53.05
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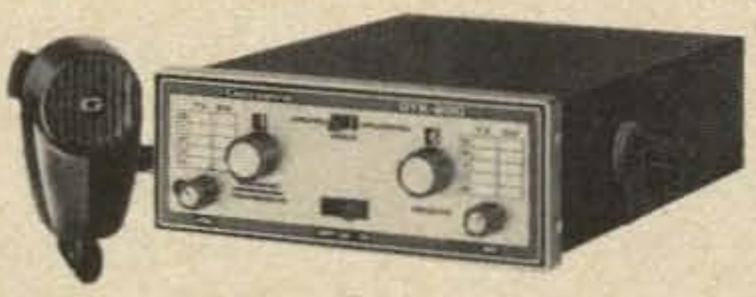

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going somewhere. I've heard of several people who have picked up quite a few working sets this way. Unfortunately, some dumps willingly accept donations but aren't particularly keen on parting with anything.

In the long run you can only get so much from a TV, so some of the higher power stuff, like 6146 finals and air capacitors probably will be somewhat more difficult to find. Such components can be picked up for around a dollar at most auctions, as can low power transformers, so don't overlook this possibility. Nearly all hams are parts collectors, so if you find one, he may have some of the things you need. An offer to pay for the stuff may be turned down, but it certainly is a good idea to offer none the less. Some people value their junk box more highly than others, and quite rightly so. Good parts are sometimes hard to find.

There is only one major problem with building your own station from scratch. If it's your first project, you can get very discouraged if it doesn't work right off the bat. This is especially true if you have decided to build your own receiver, which I certainly wouldn't suggest as a beginner's project. Don't expect instant success. Few pieces of equipment work immediately after they are built. Overhauling is nearly always needed unless you did a very exacting job. If you've decided to buy the transmitter and receiver, it's a good rule to follow to buy the best receiver you can afford, even if you have to overextend yourself a bit. The old maxim "if you can't hear them, you can't work them" is painfully true, as many bargain hunters have discovered, much to their dismay.

Once again, auctions are an excellent place to pick up a complete Novice station for under a hundred bucks. Occasionally, although it can't be counted upon, an old DX-100 or Apache transmitter will be available for about 50 bucks. Similarily, a National NC-109 or Hallicrafters receiver might also go for around $50. However, be wary of second-hand equipment in general. Quite often it's necessary to put considerable work into the gear before it will operate properly or reliably. Don't let this turn you off, just be careful in your selection. Try visiting any hams in your area, too. Many people keep their old Novice station, or have an old AM and CW rig that they may want to part with for a lot less than you could buy it elsewhere. (Sideband made many such rigs nearly obsolete, so there is hardly a market for them anymore.) As I've said before, don't be bashful, you can save a lot of money this way.

Conclusion

It may seem to take an intolerably long time to get everything ready to go on the air. You may even have to save for years to be able to afford the kind of equipment that you want. You may not be lucky enough to hit any bargains and it might cost considerably more than you expected to get everything needed.

Even after you've finished preparing for the test, it takes at least two weeks between the time you send in a 610 form (filled out by the ham who will give you the test, it can be requested in advance from the nearest FCC office), before the actual exam papers will arrive. To top that off, if you pass, it will take up to six weeks (and contrary to what the FCC claims) maybe more, before your license will arrive.

Despite this dismal situation, it is well worth while to pursue, and obtain, the Novice license. It is the stepping stone that will allow you to gain needed experience, and the necessary code speed to pass the General exam.

The Novice bands are crowded and you will occasionally lose a contact due to interference, but it's all a part of a really rewarding learning experience. People tend to disparage the Novice Class because it looks easy in comparison to the General, but they forget the fact that the license requires a raw beginner to learn quite a great deal of information. You not only need to be familiar with how the equipment operates, but with how to maintain it, and stay within the regulations.

Indeed, the Novice license is an achievement that can be looked at not only as an accomplishment in and of itself, but also as the beginning of a path that leads you into a lifetime of enjoyment in the field of amateur radio.

...WA1SNG

Paul Schuett WA6CPP
Box #10
Wallace CA 95254

FM Simplex - Can It Be Solved?

These words came over my 2-meter FM set one evening as a couple abrasive characters captured the frequency on which I was communicating with W6YKS. Several frequencies for simplex 2-meter FM operation have become popular in central California, one of them being 146.46. The "gentlemen" in question operate remote bases (of questionable legality since they can be operated from mobile control points, not permitted under the rules) who consider this particular frequency to be theirs. We were advised that other types of operation on that frequency were illegal and that we were not cooperating with the CARC. It seems the CARC specified that frequency for remote base intercom, although most of the remote bases clobber everybody on 94 or 52.

It would be nice if everybody would cooperate with everybody else. We would be able to turn the Pentagon into a museum and put Mr. Kissinger on a pension – or at least a different assignment. It seems the CARC starts the non-cooperation by not recognizing the standardized simplex channels suggested by the ARRL, CARC's sponsor. A number of repeater inputs and outputs are located in the simplex areas. This is really unfortunate, since one of the things sorely needed on 2 meter FM is a good supply of simplex channels. There really is no reason to tie up a repeater with crosstown contacts which could easily be done on simplex, saving the repeater for more demanding uses and saving the ears of those monitoring.

Another unfortunate gaffe is the habit of the manufacturers of installing 94 simplex in new rigs. 94 actually is not allowed as a simplex channel, but as a repeater output. In the early days, of course, when only a few people were on FM, one could use simplex or the repeater and nobody would mind, but now we have dozens of repeaters available in most parts of the country, a lot of people using the band, and little room. Working 94 is about like trying to carry on a contact on 75 in the early evening – it is almost impossible. Too many stations plus repeater outputs, everybody doubling, capturing, etc., etc. 52 is supposedly a simplex channel in the allocation plan, but it suffers from much the same problem. . .everybody tries to get on at once, and the gutter tactics usually reserved for working 20 meter DX phone come into play – name calling, excessive power, etc.

Another simplex frequency popular here is 147.54. Not being too crowded, it is easy on the ears to monitor with only a few signals coming through from time to time. This fits both the ARRL and CARC plans, so everybody can cooperate with everybody on this channel.

One simple solution would be to use simplex frequencies in the 145 MHz portion of the 2 meter band. There is some AM activity left, but not too much; FM'ers and AM'ers would, of course, want to cooperate with each other. When I first got on the air 145.35 was the hot AM frequency on 2 meters, but I hear very little activity around here any more. Some of the diehard AM'ers have purchased FM rigs and have joined the crowd. For many good reasons, of course: low ignition noise; minimal QRM, since the offender captures the channel; and more-or-less agreed-on channelization which makes finding each other easy, especially with crystals. Various areas could agree to

cooperate on using several channels in a particular area. In this area, we have five generally-used simplex channels so it is quite easy to find anybody you may wish to locate (or to avoid anybody you may not wish to hear). Cooperating with the generally-accepted plan, everybody authorized for 2 meters could use 33 extra simplex channels:*

145.02	145.17	145.32	145.47
145.05	145.20	145.35	145.50
145.08	145.23	145.38	145.53
145.11	145.26	145.41	145.56
145.14	145.29	145.44	145.59
145.62	145.77	145.92	
145.65	145.80	145.95	
145.68	145.83	145.98	
145.71	145.86		
145.74	145.89		

**Holders of general class and higher licenses can use 30 additional channels from 144.12 to 144.99 and still cooperate with the plan. The 2-meter DX'ers and sidebanders might not consider all this as cooperating with them, however.*

To avoid intermodulation and other rf-type problems, I would suggest taking one line per area (02, 17, 32, 47, etc.) for use. That is, Sacramento use one line, Stockton another, Modesto a third, and so on.

I can visualize the situation getting to be like the AM broadcast band in a few years with the low-level machines, high-level machines, etc., all demanding room and some QRM protection. The broadcast band is divided into three types of channels (clear, regional, local) for service to the intended geographical areas. If the amateurs can work something out by cooperating with each other it will forestall the day when the government and Mr. Walker will step in and take care of the situation for us.

I have found one location where monitoring 94 can be fun. That's Winnemucca, Nevada. There are three (3) licensed amateurs there. W7JZ says he can monitor the frequency all day and hear only a few voices from time to time as people drive through town and mash down on the PTT to see if anybody is around. After a 10-minute QSO, the mobile has driven out of range. Joe says you meet a lot of interesting people that way.

. . .WA6CPP

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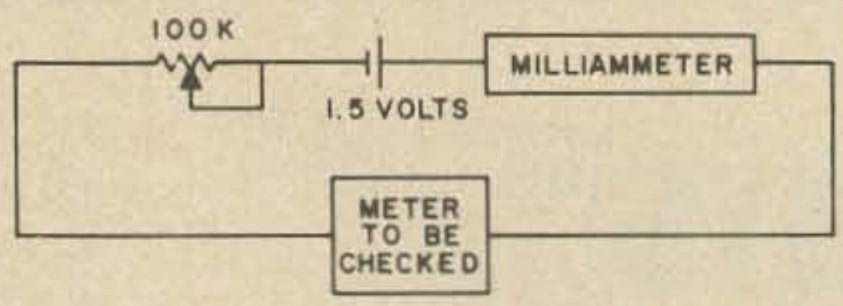
Meters and Meter Faces

Meters never seem to have the proper faces or sensitivity and there is an occasional need to modify them. A simple but most effective way to do this is to take the meter apart very carefully, remove the screws which hold the meter face and slide it out from under the pointer. Take a soft rubber eraser and gently rub off the printing which is not required (see the half-erased meter face). You must not scrub through the white surface but merely the printing, or you will leave dark marks. You now have only the printing you want to keep, so you can now put the new printing on the meter face by using Datak Instant Lettering (Newark Corporation, 223 West Madison St., Chicago IL). These can be instantly transferred by rubbing a pencil over them. One box will do any number of meter faces, and you will also be able to letter your front panel, etc. If you want to remove them from the meter you simply lift them off with the sticky side of cellophane tape (see the converted meter face).

When you reassemble your meter, slide the face under the needle and screw it down, gently blowing your breath on the needle to see if it moves freely and goes across the dial. This is merely an added refinement to make certain you haven't fouled the meter movement.

Before you change the face to a new scale you must adjust the meter movement to match the new scale. Generally a dc meter has a small coil inside the case suspended between two pieces of magnetized metal. This is the most common and is called the De Arsonval movement. The first thing you must know is the basic meter movement, which is the voltage and/or current needed to deflect the needle full scale. When you take the meter apart look inside at the meter terminals coming through the case and see if there are any extra components, either in series or in parallel, across to the moveable coil. If there are other parts, snip them out. You can do this by carefully reaching down inside the meter magnet, but do not attempt to remove the movement from the back of the case. This will give you the basic meter movement tied to the meter terminals.

Starting with all the resistance in the circuit, put a known milliammeter in series with the meter, a 100,000Ω potentiometer and a 1½V battery such as:



Adjust the 100K potentiometer until the meter you are checking reads full scale. Read the current on the milliammeter. You now know the full scale current of the meter movement.

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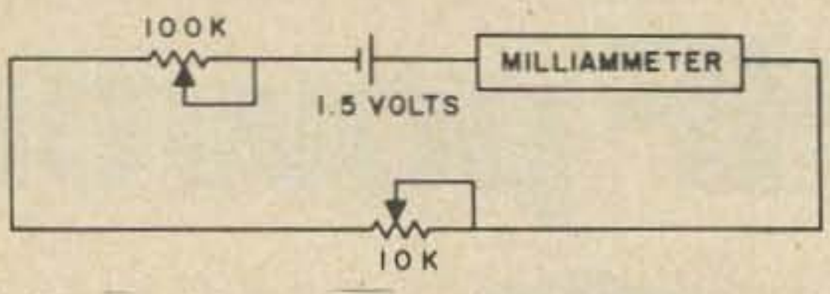
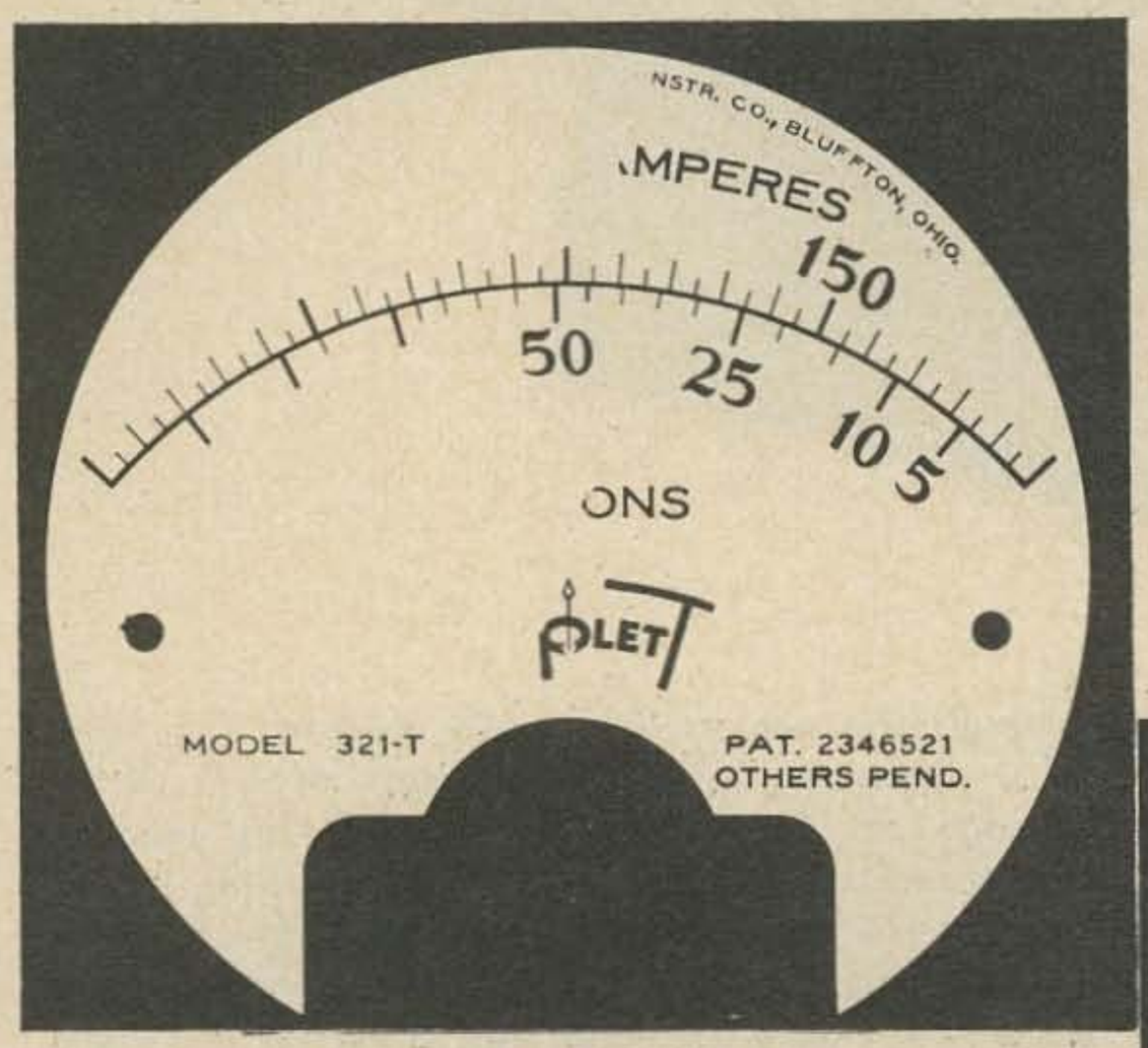
Remove the meter and insert a second 10,000Ω potentiometer in place of the meter you are checking:

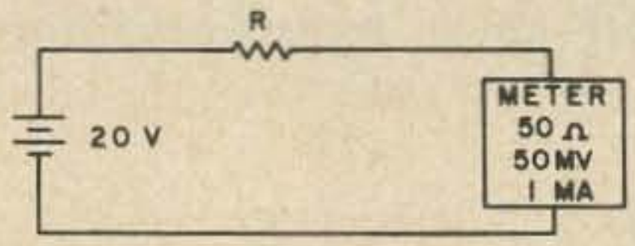


Adjust this 10K pot until you have the same current reading on the milliammeter. Now remove the pot you just put in and measure its resistance. This is the resistance of your meter. Now, simple ΩE=IR, or meter current times meter resistance, will give you the voltage needed to drive your meter full scale.



Partially erased meter face.

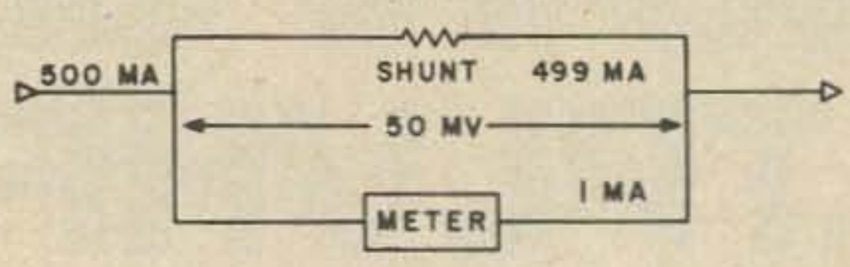
Now you can make either an ampmeter or voltmeter out of your basic meter movement. For example, suppose you find that your meter has 1 mA full scale current and 50Ω of resistance, and has 50 millivolts full-scale voltage defection. Now suppose we want a 20V meter. The circuit would appear this:



R = E/I = 20 - .05/.001 or simply 20/.001 = 20,000Ω; therefore, R = 2-,000 - (resistance of meter) 50Ω = 19950Ω.

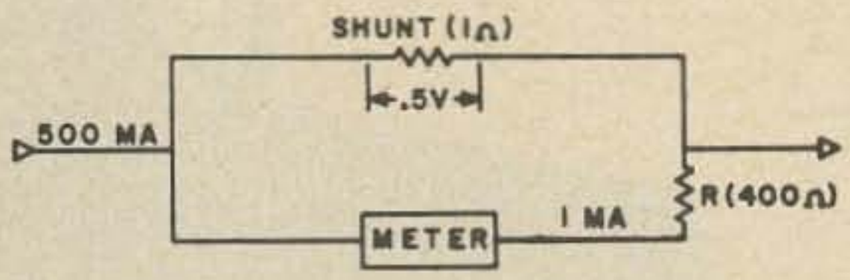
However, there would not be much error in using the 20,000Ω resistor. The better the resistor the less error; a 1% tolerance would be very good.

Suppose you want a 500 mA meter. The basic circuit would be:

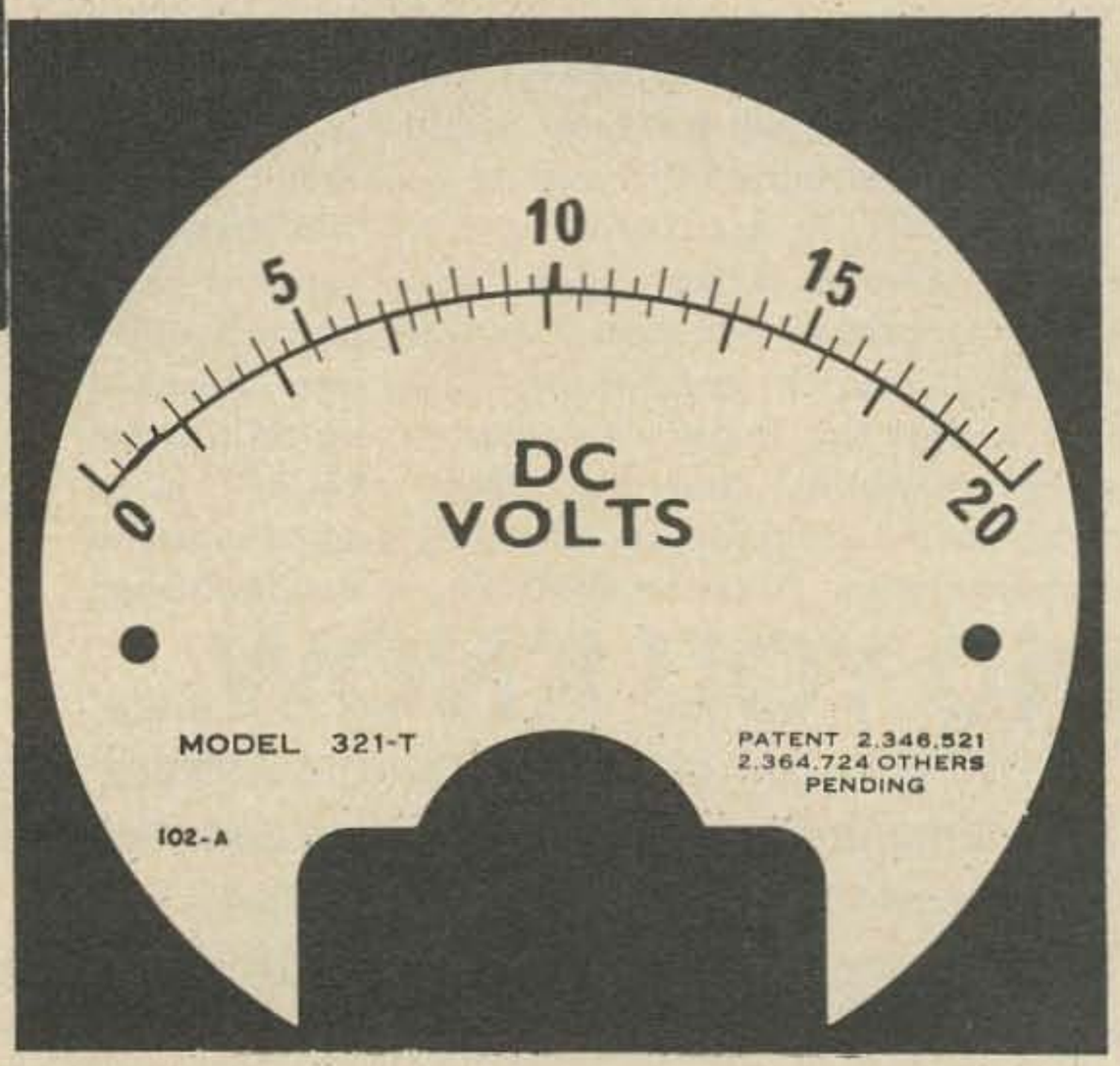


and you could arrive at a value for the shunt resistor:

R = E/I = .05/.499 = approximately .1Ω. However, the meter movement would be sluggish since the movement acts like a small motor when the needle moves and the shunt shorts it out. The way to get around this problem is to use this circuit:



Pick a shunt of 1Ω; the voltage across this would be E = I X R = .5 X1 = .5V. Now the meter is used as a voltmeter to read the .5V, and R_1 would be R = E/I = .5 - .05/.001 = .45/.001 = 450Ω - 50Ω = 400Ω. This is actually the same thing as using a system described to make a voltmeter.



Convertered meter face.

You can now change your meter face and movement to meet your particular requirement. Of course some reasonable thought must be given this; you would not use a basic 1 amp movement to measure 1V, nor would you use 1a 10 mA basic movement to read 100 μA.

. . . **W5IUR**

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Slow Scan Tape Secrets

Sooner or later just about everyone who is involved with SSTV winds up recording SSTV signals on magnetic tape. The reasons are most likely these three: (1) it's easy, (2) it's cheap and (3) it's versatile. TV broadcast stations use magnetic tape for much of their program material for the same reasons. You can buy a reel of tape that will let you record an hour's worth of SSTV for an extremely reasonable price. And it's easy. Hooking up a tape recorder to record and play back slow scan video is no more difficult than hooking up a stereo component system. Some commercially manufactured SSTV monitors even provide the necessary switching and signal routing facilities inside the monitor, so all you have to do is literally plug it into your rig and a tape recorder.

Once a tape is prepared you can sit back and relax while you transmit a series of pictures to the guy on the other end of the QSO.

And tape is very versatile. Once you have "stored" your pictures on tape, you can rearrange, delete, add, create special effects, or build a "program" of video material for transmission. Also, you can record all received signals and form a magnetic tape QSL file on all those exotic DX stations you work, ready to play at any time to convince the assembled skeptics. By editing the tape you can save the very best frames of each DX QSO and eliminate the ones with QRM, noise, fading, etc.

To do the best job I recommend using a splicing block and single-edge razor blade to cut the tape. Those all-in-one splicers are O.K. for most home audio recordings, but are not quite as precise as the block and blade method. The all-in-one units most often use special blades and have a more complex mechanism, which might be more likely to develop trouble when they grow old. There's not much that can go wrong with a block of extruded aluminum.

I'd also recommend using a regular reel-to-reel type tape machine to do your editing, rather than the cassette recorders. It is possible to edit tape in the cassette format, but it takes too long and requires too much precision. Cassette tape is only 1/8" in width, making it really too narrow to handle easily. Also, cassette tape is recorded at such a slow speed (1 7/8" per second) that it is difficult to edit well with cassettes. It *can* be done, but you have to mark the tape very carefully, fish the tape out of the cassette,

cut, splice and then pull it back into the cassette for *each splice*. Cassettes, of course, are convenient; you can slip a cassette in and out of a machine in less time than it takes to tell about it. They *are* great, however, for storing things you don't want to edit, such as CQ's, standard QSO information, sign offs, and so on. But when you want to edit tape, reel-to-reel is the best system to use.

Record your TV material at the highest speed you can. This makes the editing easier, since the video information will be recorded on a physically longer piece of tape. One frame of video takes 15" of tape at 1 7/8 ips; at 7½ ips, the same frame takes 60" of tape – 5'. Therefore, any errors in editing the tape represent a much shorter interval of time at 7½ ips than any slower tape speed: a ½" error is about one line of video at 7½ ips, but at 1 7/8 ips, the same ½" is four lines of the picture. Editing tape is *much* less critical with material recorded at 7½ ips.

Editing the tape will be very easy if you have a way of disengaging the pinch roller (idler wheel) that drives the tape against the capstan. The capstan is the rotating metal shaft which is near the tape heads. Some tape machines have this facility built into them, usually it is called a "pause" control. The advantage of this little gizmo is that it lets you stop the motion of the tape while the machine is still in the playback mode. Then you can shuttle the tape back and forth across the playback head by hand while listening to the video at the same time. With a little practice you will be able to hear the vertical sync tone – it sounds like a low-pitched boop which is much longer in duration than all the other tones on the tape. The vertical sync tone marks the start of a video frame.

When you have located a frame of video that you'd like to isolate, (either to save for another tape or to remove because it's defective) move the tape by hand until you can hear the sync tone. Then, carefully move the tape backwards until you hear the sync tone again. I find that the best way of shuttling the tape is to use two hands – one on each reel – and turn both reels very slowly to find "the spot." Now that you've located the frame that you want to edit, you'll have to mark it. Most popular of the marking devices is the china marker or grease pencil. Some of the new felt-tip marking pens can be used also. Carefully put a line across the width of the tape at the spot that is right over the *center* of the playback head – that's the one closest to the take-up reel. Be sure to mark only the back of the tape, the side facing you, and take care not to get the grease all over the playback head. It might make the tapes sound muddy.

It's probably going to take a bit of practice for you to find the edit spot if you have never edited magnetic tape before. Having your monitor patched into the tape machine will no doubt help you since you'll then be able to anticipate when the sync tone will come by looking at the picture. That vertical sync "boop" is mighty small. At 7½ ips, a 30 millisecond burst of audio uses about ¼" of tape. So you've got to be careful not to miss it altogether. It doesn't matter too much if you clip a line or two at the bottom of the picture, as long as you have a complete vertical sync tone to reset the electron beam sweep back to the top of the screen.

After you've marked the tape at the two spots you want to cut (it's usually easier to put *both* spots on the tape before you cut the tape) turn one of the reels backward by hand to allow the tape to be pulled away from the machine, but leave the tape reels still on the machine. Put the tape into the splicer with the marked spots right over the diagonal cut in the splicing block. Then, cut the tape with the single-edge razor. Don't guillotine the tape – that is, cut it by pushing straight down on the blade, but rather, draw the blade across the tape through the diagonal cutting guide. This way, you are much more likely to keep the angle of cut the same from one cut to the next, and thereby provide a smoother transition from one frame to the next.

If the frame that you have removed from the original tape is one that you want to save, put a mark of some kind with the marking pencil on the tape to indicate the beginning of the frame or the direction of tape travel so that you don't accidently get the tape spliced into the "program" reel

backwards. Unless, of course, you want the tape to be backwards, for a novel effect. More on that later.

Now that the frame has been removed and either saved or discarded, you will probably want to rejoin the two ends of tape that are left dangling from the tape machine. Put both ends into the carved channel in the splicing block and tap it gently into the block. The curvature of the block will hold the tape so it won't fall out. Slide the two ends toward each other until they just touch. If your tape cuts are smooth and consistant, the diagonal edges should mate perfectly. Then, carefully put an inch or so of splicing tape over the cut, making sure that it is lined-up evenly with respect to the edges of the tape. Press the splicing tape onto the magnetic tape and then finish the splice by rubbing it with your fingernail. Now you will have a splice that is almost as strong as the original tape.

After you've gotten the hang of cutting and splicing tape, you might like to try to assemble a "program" or two. You can splice together those pictures that you would show to someone on the first QSO. For example, you could start a program with an ID frame or two, then two or three frames of a picture of yourself, the shack, the QTH, your spouse and offspring and so on. All of this should take about two minutes or so of transmitting time, which is plenty. Don't forget that your final has been working pretty hard for those two minutes. SSTV signals are 100% carrier as far as your rig is concerned. So make sure you don't exceed the key-down limitations for your particular rig.

There's plenty of room for experimenting, too. You don't *have* to edit the tape by complete frames. You could use half of one frame from one shot, and the second half of a frame from another shot to create novel or comic effects. Also, as mentioned earlier, you could splice a frame in backwards – that is, tail end first. I did it once by accident. The picture then comes out upside down. Some guys devise very elaborate programs, "zooming-in" from one frame to the next, giving a kind of motion effect. Another idea is to change the viewing angle of your camera from one shot to the next. This is especially good when you are sending pictures of a person recorded from a "live" camera. All you have to do is select the best frames and splice them together in the sequence that you like.

There is another way that you might take advantage of to edit your tape: tape-to-tape re-recording or "dubbing." If you have two tape machines with "pause" controls, you can do a form of electronic editing by recording only the portions of the original tape that you want to save. This works out OK if you have segments that contain quite a few frames. The technique is similar to the cut-and-splice method: cue the original tape up to the point just before the vertical sync pulse; start the "record" machine, then start the playback machine. After you've recorded the frames that you want, stop the playback machine, then the record machine. You should, however, use tape machines of good quality, since wow and flutter problems only get worse as you dub a tape from one copy to another.

So, some evening when the band goes out early, plan to go through all your DX tapes and remove the bad frames – the ones that got blasted with hetrodynes or noise or miserable QSB, and so forth; first, go through the entire tape to see exactly what it is that you have. If you have a lot of material, it might be a good idea to jot down on a note pad the various scenes that are on the tape. Then, by looking over your "program notes" you can decide what the best arrangement might be for the material you have on tape. You might be able to take on an hour's worth of QSO's and condense it down to just a few minutes. When you've done that, put a label on the new tape so that you know what material is recorded on it. I find that the self-sticking press-apply labels are very good – they're easy to apply and easy to remove.

When you have some good "programs" assembled, I think you will find that people will show a great deal of interest in SSTV. Hams and non-hams enjoy a good TV program. Think of this as your chance to get back at the networks and Madison Avenue!

. . . K2ULR

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Check Logic With This Simple Probe

The beauty of digital logic circuits is in their simplicity. Even though your super repeater function and command decoder may look like something from Star Trek, most likely it is composed of simple AND, OR, NOR and NAND gates. It probably also includes flip flops. The reason I call them simple is that every point in the circuit will be at either a HIGH or a LOW potential. Assuming positive logic, a HIGH will be +5V and a LOW will be 0V or ground potential. In circuit descriptions, a HIGH will be termed a 1 and a LOW will be termed a 0. From this you can see that trouble-shooting digital circuits should not be too difficult. The easiest piece of test equipment to use would be a logic probe. A logic probe is a device which gives an indication of 1 or 0. Described herein is a simple, inexpensive logic probe which should cost under $3.00 to duplicate. It uses one Quad Dual Input NAND Gate, the 7400. Two LEDs are used for indicators, one for HIGH and one for LOW. I used a plastic cigar tube to house my probe. It makes a handy probe-sized chassis. I used a nail for the probe point. Power is derived from the circuit under test. Two alligator clips connect to +5V and ground of the circuit under test.

As you can see from the schematic in Fig. 1, the logic probe is made up of 3 dual-input NAND gates. A NAND gate will have a LOW output only when both inputs are HIGH. A NAND gate with one input HIGH will act as an inverter and one gate is used in just this fashion in the logic probe. A red LED indicates a HIGH and a green LED signifies a LOW. All wiring is done on a 14 pin DIP socket. Wires run to the LEDs mounted on the wall of the cigar tube. A hydraulic press for cramming the IC and associated parts into the cigar tube is most helpful.

One the logic probe is completed, it is ready to test. Connect +5V to the power lead of the probe and ground the (-) lead. At this point, you should see either the green LED or smoke. If the green LED is lit, touch the point of the probe to +5V potential. The red LED will light. If you do not get the results indicated and find you made a mistake wiring the chip 7400s are available for 29¢ in single units.

To use the logic probe first determine whether a point should be a HIGH or a LOW in a properly operating circuit. Then touch the probe point to the terminal. The red LED will indicate a HIGH and the green LED shows the presence of a LOW. Now that you have a logic probe, there is no excuse for your repeater ID to be on the bench for 2 years.

. . .WA3SWS

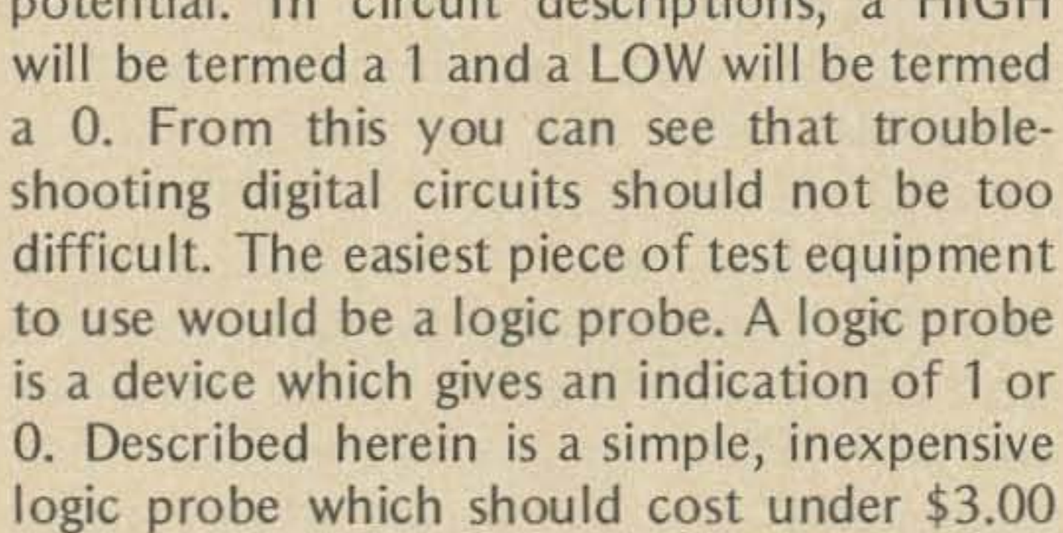

Fig. 1. Logic probe.

MEET THE STATE OF THE ART ON 2 METERS... THE ITC MULTI-2000 CW/SSB/FM TRANSCEIVER

Whether your interest is simplex, repeater, DX or OSCAR the new ITC MULTI-2000 lets you get into all the action on all of the band. Fully solid-state and employing modular construction, the MULTI-2000 enjoys features found in no other 2m transceiver.

FEATURES

- PLL synthesizer covers 144-148 MHz in 10 kHz steps
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- Three selectable priority channels
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- Built-in AC and DC power supplies, noise-blanker squelch and rf gain control
- Selectable 1W or 10W output
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Herb Schoenbach W9DJZ
6724 Briargate Drive
Downers Grove IL 60515

Public Service Band Converter

Hear 152-165 MHz on your 2m receiver.

Have you ever been disappointed with the low priced monitor receivers on the market? If so, read on. Here is a simple and inexpensive way to monitor any frequency in the 152–165MHz Public Service Band (PSB). If you have a good 2m FM receiver or transceiver just make a converter to heterodyne a desired frequency to 146.94MHz, or a quiet channel if you prefer. No crystals are needed because the local oscillator will operate at a comparatively low frequency, around 8MHz. You get all the benefits of your high quality receiver such as noise operated squelch, good limiting and AM rejection, good selectivity and near crystal stability.

This won't be a step-by-step construction article. You may use almost any common converter circuit as long as you follow the general outline of Fig. 1. The schematic of the converter I am using is shown in Fig. 2, and is shown as a guide to get you started.

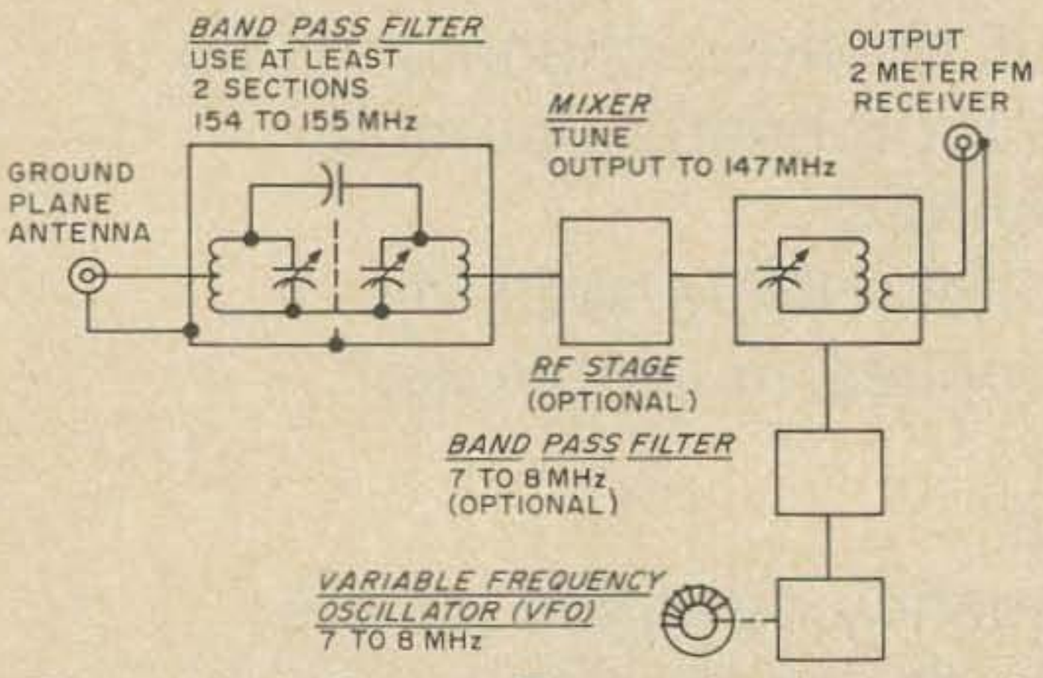


Fig. 1. Block diagram. Frequencies shown are for example only, and may be varied to suit your needs.

As you can see, the circuit certainly is simple enough, but the performance amazed me! Notice the local oscillator tuning range of 7–8MHz. 1MHz is all the range you can tune comfortably. With a vernier dial you can reset it to a previously used frequency even when no station is on, and be sure of hearing it when it does transmit.

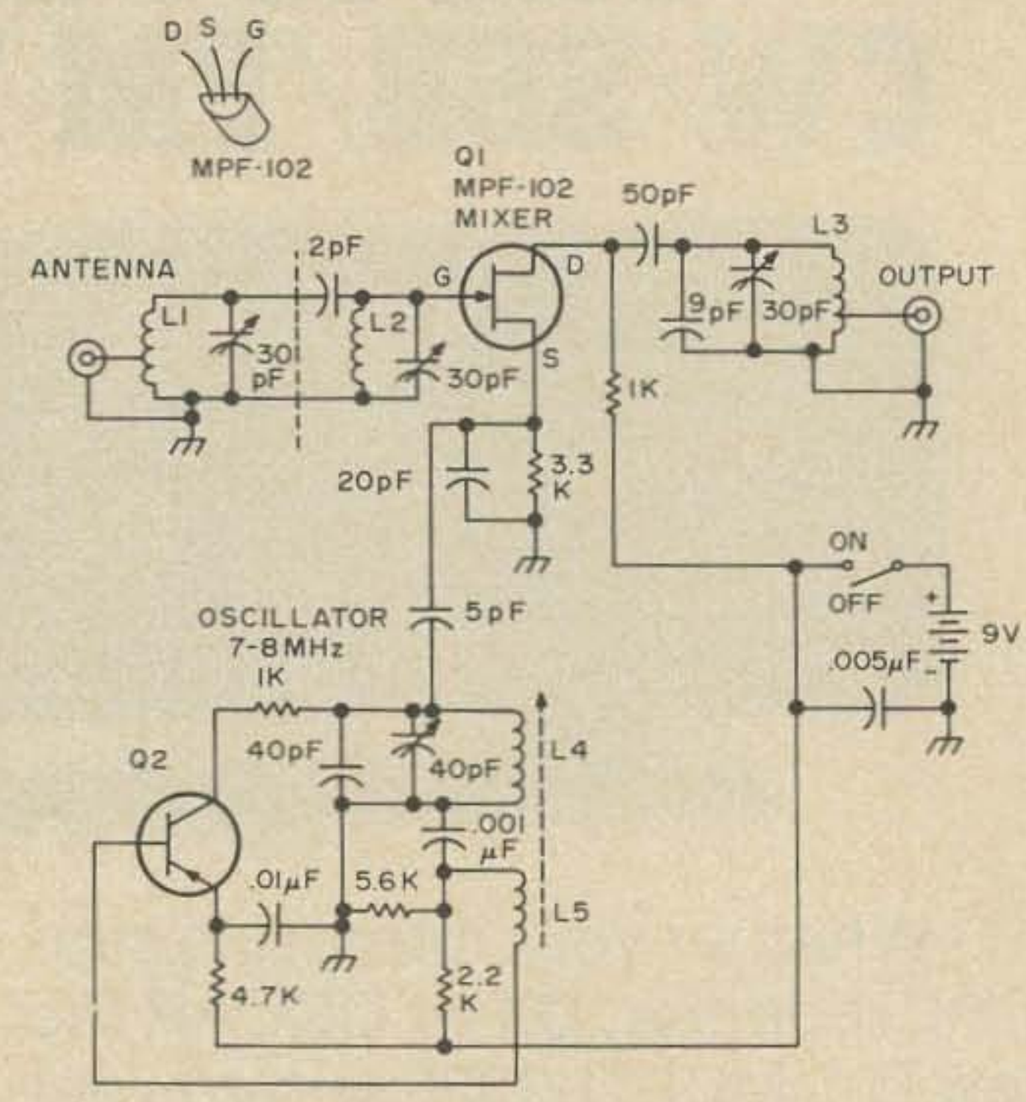


Fig. 2. Schematic diagram. The 40pF variable capacitor should be of good quality; it is the tuning capacitor. The 30pF variable capacitors may be ceramic trimmers, or mica compression type. Q2 is a germanium PNP high frequency transistor. Wind coils as follows: L1, L2 and L3 – 4½ turns #20 bare wire, ¼" i.d., spaced 1.27cm (½"). L1 tap at 1 turn; L3 tap at 1½ turn. L4 – 36 turns #26 enameled wire on 80mm (5/16") slug tuned form. L5 – 3 turns insulated hookup wire (#22) over L4.

No rf stage was needed for full quieting from stations 10 miles away using a ground plane antenna. A double tuned input circuit serves to reduce image response fairly well and i-f feedthrough to a lesser extent. The image in this case is receiver frequency minus local oscillator frequency, or desired frequency minus 2X local oscillator frequency. The i-f feedthrough will be on 146.94 or whatever channel you decide to use. Remember your receiver is now the first i-f stage.

An interesting thing about this set up is that when the desired PSB station is not transmitting, you will hear local (nearby) activity on .94. Unless the .94 signal is much

stronger, however, the PSB station will override. This is where front end selectivity comes in. Personally I like this ability to monitor two channels without a scanner. To get away from this effect, simply select a 2m channel not used in your area.

Interesting thing number two: At one spot on the tuning dial I was able to hear our local weather station KWO39, on 162.55, better than I ever got it before. Another bonus! With a really sharp front end this wouldn't happen but it seems that the second harmonic of the local oscillator brings this in. Getting rid of this "feature" takes a little more doing, like more tuned circuits at the input, a tuned circuit between the local oscillator and mixer, optimum local oscillator injection level, etc. This would take you right out of the simple and cheap class fast.

CAUTION! And this is important. DO NOT TRANSMIT WHILE CONVERTER IS CONNECTED TO YOUR TRANSCEIVER! If you are forgetful about warnings like this, better buy a good monitor receiver instead. One push on your transmit button could burn out the converter and also damage your transceiver.

Just a few more suggestions before you start building. Don't give in to the temptation of trying to cover a large tuning range. 500kHz to 1MHz and a vernier dial is reasonable. If only one PSB frequency interests you, a good quality trimmer capacitor like an APC type will do as the tuning adjustment. You can cover a greater range than 1MHz if you use a tunable FM receiver, of course. For a weather station monitor only, make the local oscillator tune 15–16MHz and tune the front end to weather frequency.

If you decide to design your own converter, or use a standard circuit, keep in mind th. benefits of a MOSFET mixer. Use as many tuned circuits or helical resonators in the antenna circuit as needed to get the desired performance. As for a power supply, I use a 9V 2U6 battery. At 3mA I get many, many hours from a battery. For 'round the clock monitoring try to steal the 3mA from your receiver. If you want to simplify still further, try a diode mixer! Good luck.

...W9DJZ

Reprinted from JULY 1974 **73 MAGAZINE**

WILSON

2m FM Transceiver

The basic circuit of the Wilson transceiver has evolved from the Ken unit a year ago to the Henry Tempo FMH – and now it is the Wilson. But there are changes – substantial changes – and all for the better. The Ken was a lot of transceiver for its price, but some amateurs wanted a hotter receiver and wanted a little more poop in the output. The Wilson has a new front end and it is a hot one. It also has a better rear end for more poop on transmit.

There are some other benefits to this rig when compared with other HT's on the market – things like the netting capacitors on all of the crystals, both transmit and recieve. This makes it a lot easier to get the unit right on channel. And all of the crystals are plugged in too, not just some. The earlier Ken units had two channels soldered in – which was not serious where you had a use for both 34/94 and 94/94 – but these days, with no 34/94 repeater in New York, Chicago, Washington, Boston, Los Angeles, etc., that turned out to be a rather serious wasted channel. And in the 34/94 areas, the 94/94 pair wasn't all that valuable. Better that all crystals can be plugged in as in the Wilson. The fact is that a five channel HT with two soldered in channels is a three channel radio.

The Wilson has six channels – and that is none too many in most areas. It is none too few either, for seldom are you inan area where you can reach more than six repeaters with an HT. Considering the size of the HT – and there is more than a little resistance to the larger HT's such as the Unimetrix – more than six channels would begin to crowd things inside so the unit would have to be bigger. You want a unit that is comfortable to hold in the hand – that will fit in the pocket – or on the belt.

Speaking of holding in the hand – one of the really annoying things about most HT's is that if you have any kind of noise level you have to hold the speaker up to your ear and then quickly swing the HT down to speak in the loudspeaker when it is your time to transmit. This little maneuver usually takes longer than the time between transmissions on the repeater, so you are aced out. With some ops you have to be mighty fast of finger to break in and that part of a second it takes you to swing the HT from your ear to your mouth you'll lose out. The Wilson has thymike mounted toward the bottom of the unit, right where your mouth comes when you put the speaker to your ear.

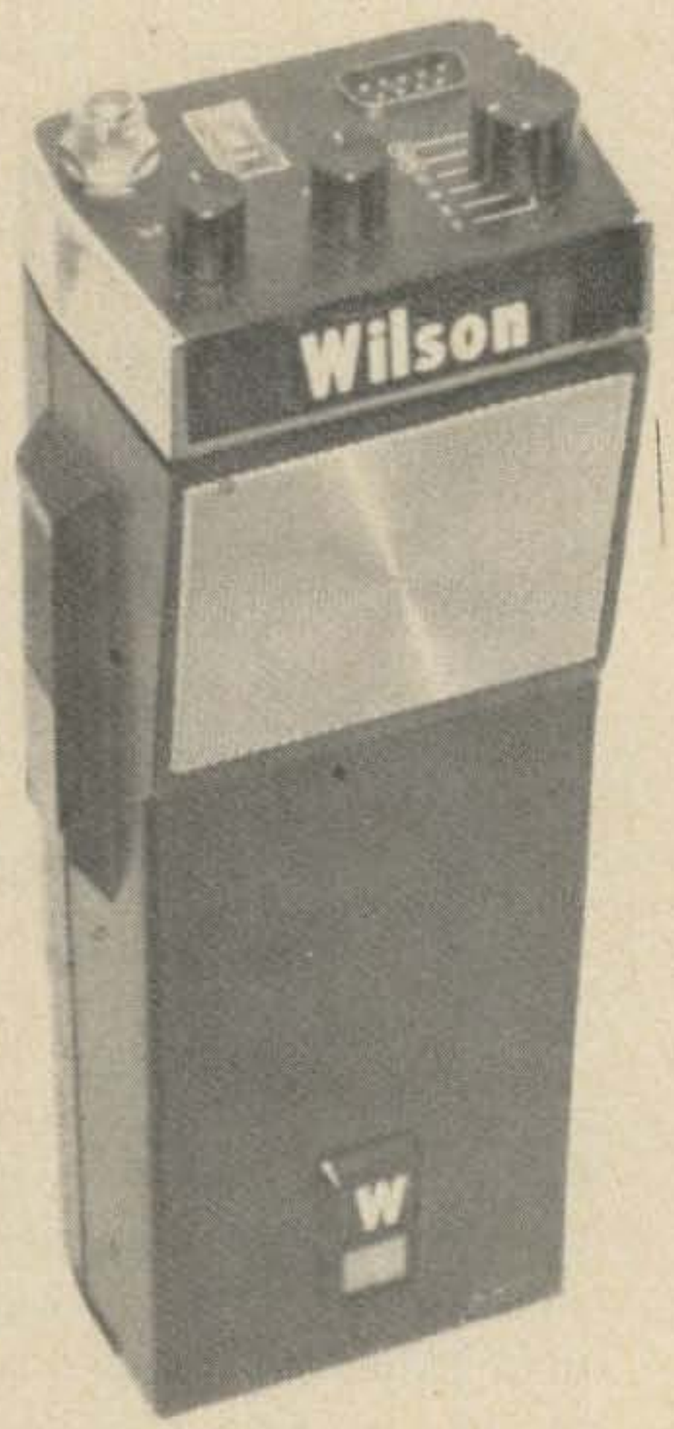
The use of the separate mike (such as you'll find on the late Motorola HT's) results in considerably better audio. You'll find that reports are most gratifying on your audio.

Another big hassle with the Motorola units are those incredibly expensive nicad battery packs they use. The Wilson uses those low cost AA size nicads (you can put in regular AA flashlight batteries in an emergency) – these batteries sell at every Radio Shack or Lafayette store for peanuts – or you can even catch someone like Hal Babylon (advertised in 73) with surplus nicads for a fraction of the Radio Shack price!

When you use your HT on your belt – for instance at hamfests – you want a remot mike that plus into the unit. The Wilson has a plug for this – and it also feeds out the audio fro the loudspeaker which you can hear from a small speaker which is mounted right in the mike case!

The S-meter is handy when you are in a weak signal area and want to peak up a repeater in order to be sure to get the best signal back into it. It doubles as a battery indicator so you won't run your nicads down too far and reverse them. Nicads don't like that.

The circuit board for the Wilson is the size of the case – and this means that everything is easy to get at for servicing. If you've ever tried to fix a Motorola HT-220 you will appreciate the room in the Wilson for work –



and the use of small, but not invisible parts.

One problem with the earlier Ken units was a weakness of the internal molded track for the battery pack – it often broke when the HT was dropped – and who doesn't drop one now and then? The Wilson may break if you try hard enough, but it will take an incredible beating before giving up.

Obviously the Wilson is quite a rig – and one would expect it to come through at around $280 or so. Wilson is selling them for only $199 for reasons best known to themselves. It would seem prudent to get one of these radios before the folks at Wilson wise up.

. . .STAFF

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Tuned Diode VHF Receivers

Test receivers and transfer oscillators.

This article describes tuned dipole receivers from 20 to 500 MHz. I have used them for several years to tune up local oscillators, multiplier chains, crystal oscillators and transmitters. Also included are two "quickie" tuneable oscillators from 130 to 500 MHz, for calibration and transfer purposes.

It is always important to know just which harmonic you're on, and whether you're doubling, tripling or maybe sextupling. These handy pieces of low cost test equipment will tell you.

What will a tuned diode receiver (hereafter TDR) do for you. When you are building a new crystal oscillator, the first thing you would like to know is whether it is oscillating or not, and if so, on what frequency. Also, is it noisy, or maybe even "squegging" (super-regenerating)? In multiplier chains and in transmitters, it is *very* easy to overdrive a base input and what this does to the output sounds real bad. So listen to the output as well as measure it. The TDR will tell you these things and more. It will give you relative rf output power, and how much energy is on the desired frequency.

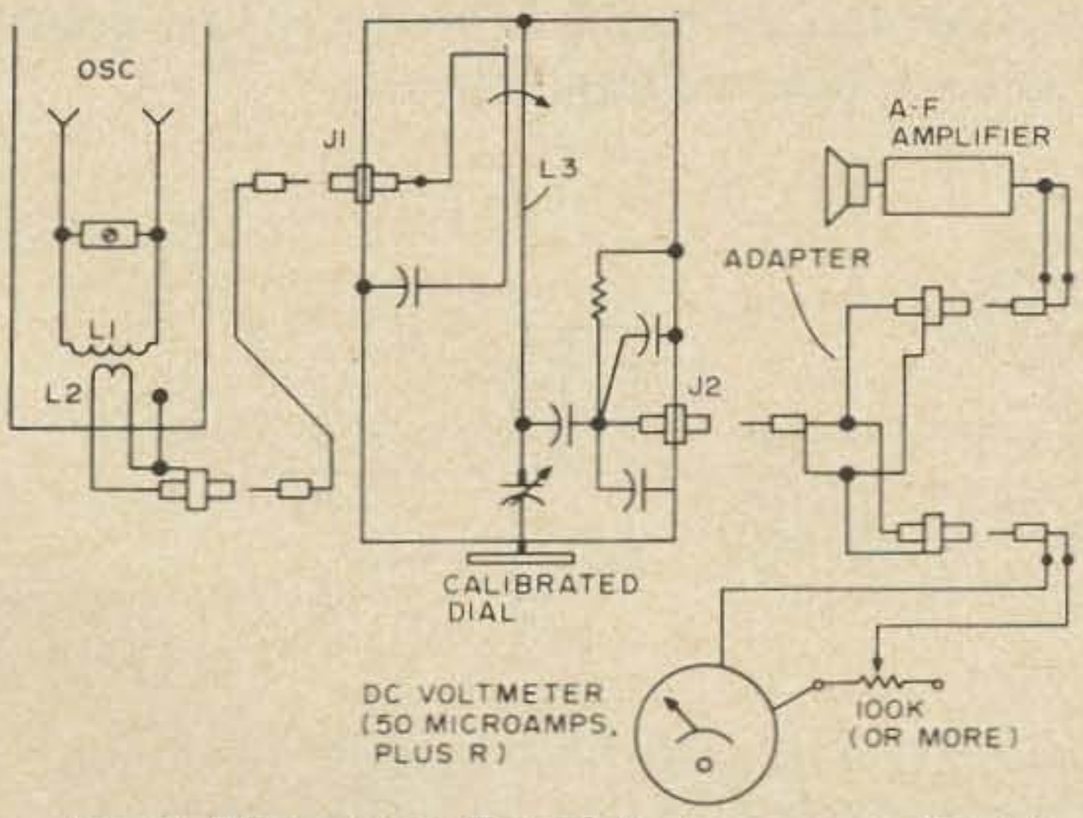

Fig. 1. Test set up. Tuned diode receiver (TDR).

Hopefully you do have a main energy output. I personally have seen an oscillator right here on my own well-worn bench that was putting out almost equal power on one frequency and on the second harmonic. Fig. 1 shows the essential set up. I always have on hand a phono jack with a small L2 attached, plus a 2.54cm (1") wire from the cable shield side of the jack which you can solder the baseboard and hold L2 near, or around, or inside of, L1. L1 may be the output inductance of an oscillator, or other item under test. You can thus move L2 easily from stage to stage of a multiplier as you progress with its build up, and also change the TDR for higher frequency ones as you go. I often use two at the same time, one to watch a lower frequency, the second to see where the multiplier is landing. This is particularly advantageous when the multiplication factor is high, such as a quintupler.

After a while you will find yourself with quite a collection of adapters and probes, cables, plugs, etc. Fig. 2 shows an untuned diode detector unit. This is good for adjusting a tuneable oscillator for maximum power and frequency range. No tuning is needed. It just shows rf power, period. Don't forget, it will show *all* the power at the output, including the sum of all the harmonics too! Such as they are.

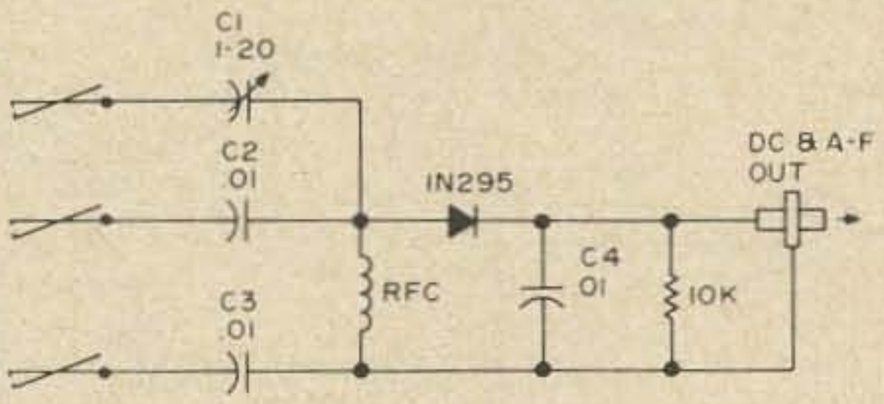

Fig. 2. Untuned diode unit. RFC should be very good and have a lot of inductance to be useful down to kHz range.

Back on Fig. 1 the 100K pot in series with the meter should be calibrated with full scale points for .1V (no resistors), .5V, and more if you wish. Other types of attachments are shown in Fig. 3 with clips, an "antenna" type probe and a loop for magnetic pick up.

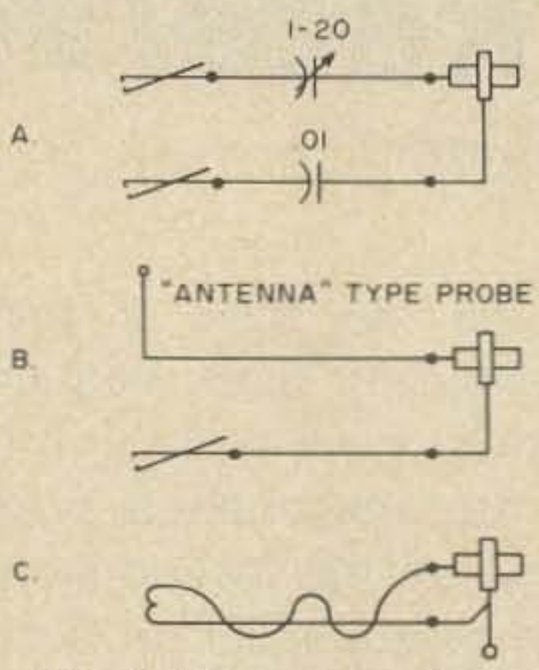

Fig. 3. Rf cable probes.

I also use absorption wavemeters to check on the rf energy. With the TDR meter showing energy either as in Fig. 1 or as in Fig. 2, the wavemeter coil, when resonated against L1, will make the meter dip. If you have a "grid-dipper" it can be used with one or two turns of link coupling around the grid-dipper coil, and over to the oscillator under test via cable No. 1. Use the dipper in the "diode" mode for this test. Most of these, however, do not cover the 450 MHz band.

That about covers operation. Construction of the individual units and the oscillators follows.

Construction

Now I will describe the construction of the tuned diode receivers. For the low bands, these are just plain "crystal detectors" of course, dressed up a little for the purpose of checking oscillators and multipliers, but up towards 450 MHz things get a little different. Fig. 4 shows the 2 to 12 MHz unit. This is useful for 8 and 12 MHz crystal tune ups, and as an AM detector for a 10.7 MHz i-f strip. A very useful one of these is shown in Fig. 5. In the HF range of the unit shown in Fig. 4, practically nothing is critical. A good Q is handy, so I used an airwound coil for L2. Miller coils, which are magnetically shielded as well as electrostatically, are also very good, and their inductance is adjustable by a well made

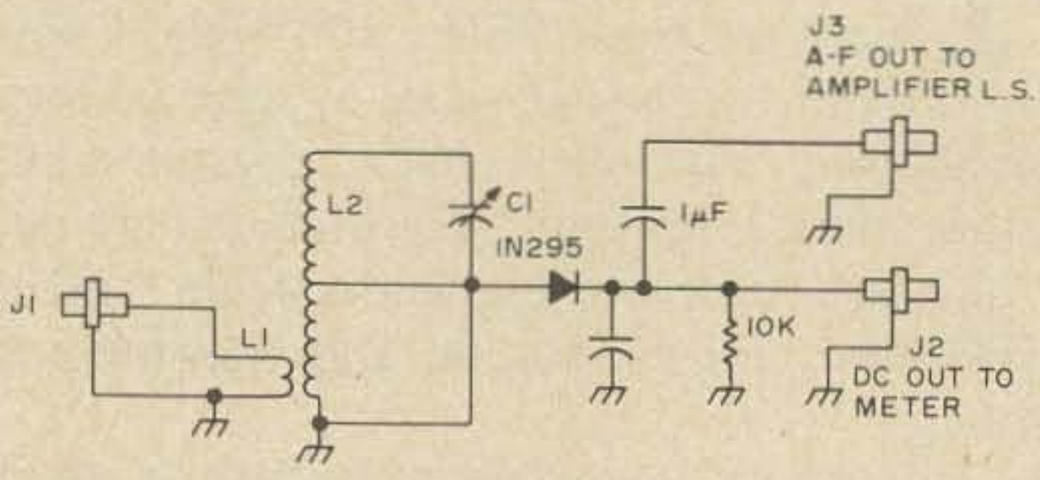

Fig. 4. Tuned diode receiver, 2–12MHz. L1 = 2 turns around L2. L2 = airwound coil, 32 turns per inch, 2" long (not critical) ½" O.D. divide top at center. C1 = about 365pF. For more range use a two gang broadcast job with about 730pF.

positive acting threaded core inside, which helps to set the desired band more easily. The rest of Fig. 4 is very plain. If any 2 to 12 MHz energy is present in the shack, this one will show it on the meter!

Fig. 5 shows (for the benefit of new readers) an outboard i-f stage using an IC, which goes well with the TDR of Fig. 4. It is also useful, of course, for checking to see if you have enough gain in a 10.7 Mhz i-f strip or chip. The Motorola 590 is a compound amplifier in the cascode mode, with very low internal feedback, so no neutralization is needed. And it has a lot of gain too. Positive voltage applied to pin 5 produces very good AVC control, without detuning.

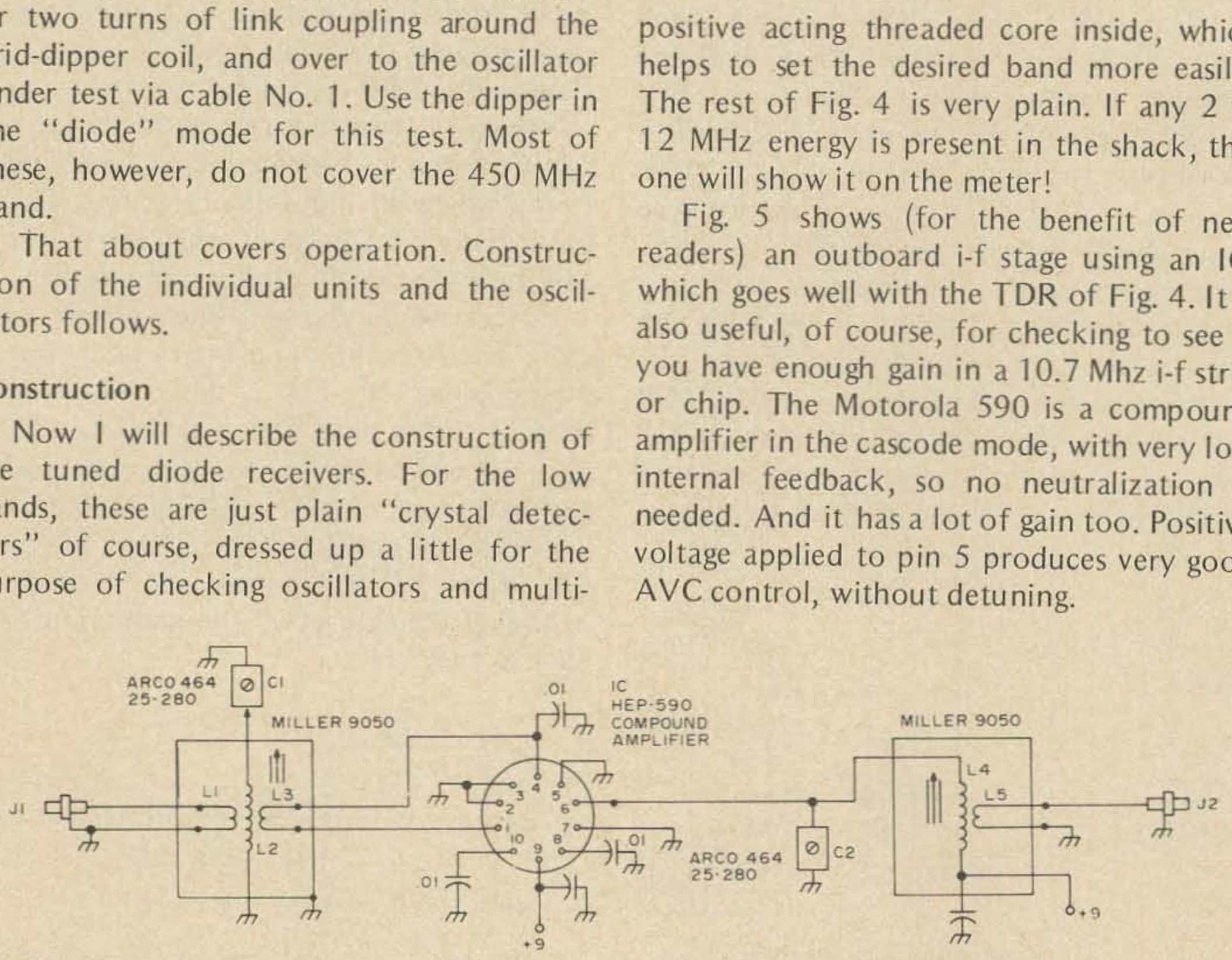

Fig. 5. Outboard 10.7 MHz i-f amplifier for gain checks. Use in front of Fig. 4 for example. L1=3 turns around cold end of L2, L2 = miller 9050, L3 = 3 turns around cold end of L2, L4 = miller 9050, L5 = 3 turns around cold end of L4. Note: open miller coil aluminum shield to wind on L3 and L5.

The TDR for 21 to 75 MHz is shown in Fig. 6, and is little changed from the one in Fig. 4, except for L2, C1 and the tuning range. This one covers the 6m band and most 2m FM receiver oscillators near 45. The extra stage amplifier of Fig. 5 may be also used with this TDR for i-f and rf checks in this range, by changing coils in it to suit. The 590 goes very well on 6m.

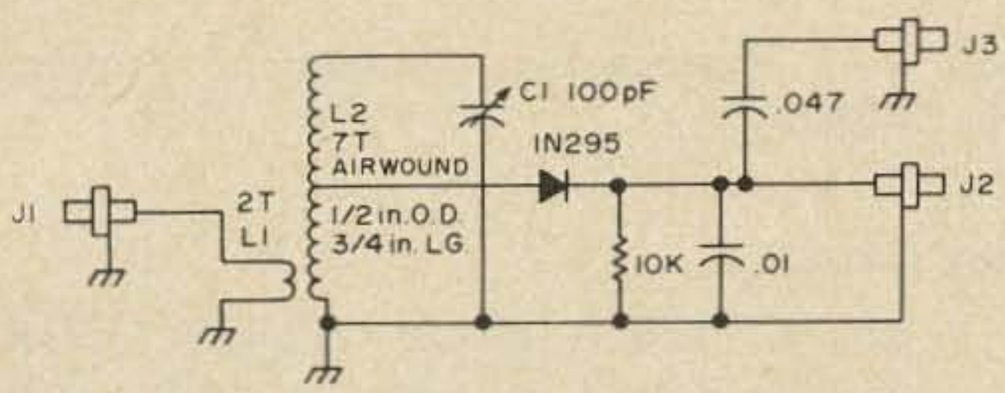

Fig. 6. Tuned diode receiver 21 to 75MHz. L1 = 2 turns, L2 = 7 turns, airwound, ½" O.D., ¾" long. C = 100pF.

TDR for 65 to 130 MHz

This one I use mainly on BC-FM work but you may at any time land in its range while tinkering with multipliers, so here it is in Fig. 7. Again, quite similar to the others shown so far. C1 has a long pointer knob, 5.08cm (2"). Very good also for tuning up "Echo-Listeners." (Little hi-fi FM transmitters for bird-listening!)

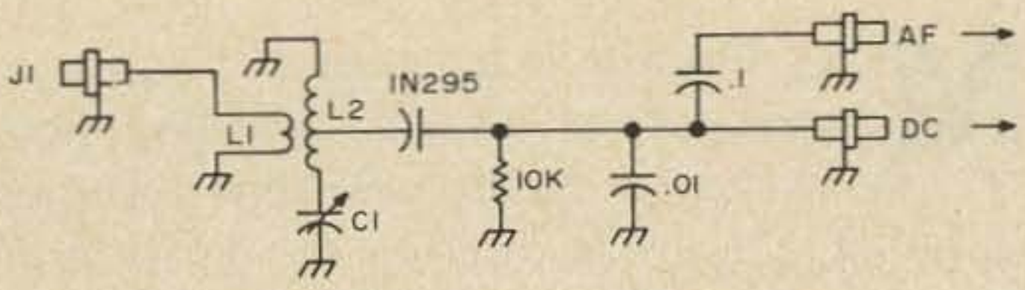

Fig. 7. Tuned diode receiver 65 to 130MHz. L1 = 1 turn, adjustable around L2. L2 = 5 turns no 12 copper, 1" long, 5/8 O.D. C1 = MAC-30 Johnson. 30pF, miniature type.

TDR for 110 to 200 MHz

Particularly useful from 135 to 148 MHz. This one is a little different, using a hybrid trough-line cavity for maintenance of Q up to 200 MHz. Don't be disturbed by the word cavity though. You can cut this one out of thin (or thick) copper-clad and solder it together as a box in less than an hour, as you can see in Fig. 8. The copper face is placed inside the box for soldering together. C1 and L2 are about 3.81cm (1½") from the bottom of the box. Also the same from the top. This unit can be calibrated with a signal

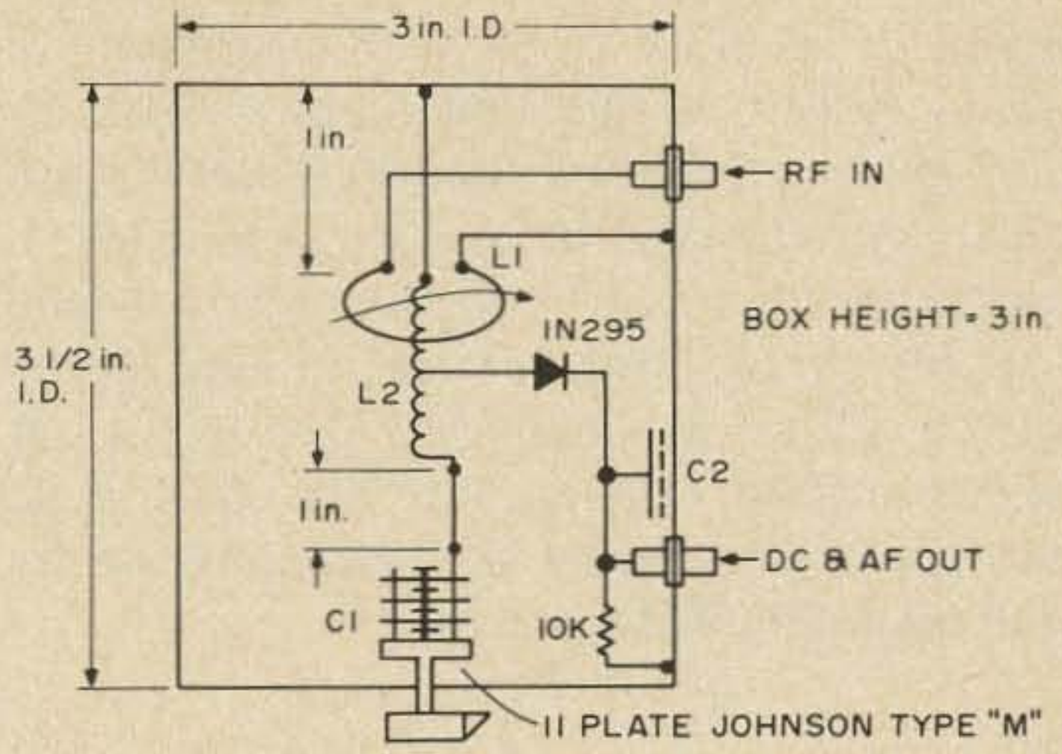

Fig. 8. TDR hybrid through line cavity 100–200MHz. L1 = one turn adjustable per L2. L2 = 4 turns, airwound, 8 turns per inch, ½" long, ½" O.D. C2 = Brass plate, 1" x 2", with .005 teflon sheet and nylon bolts and nuts. Note: C2 can be two or more .001 tiny caps, as in Lafayette catalog.

generator up to around 200 MHz, and for 2m by transmitters in the 2m band, 146 to 148 MHz. It is especially useful from 135 to 148, checking L.O.'s near 135 and transmitters near 147 MHz.

TDR for 160 to 500 MHz

This one is a great help on the 220 and 450 bands. Fig. 9 shows the construction.

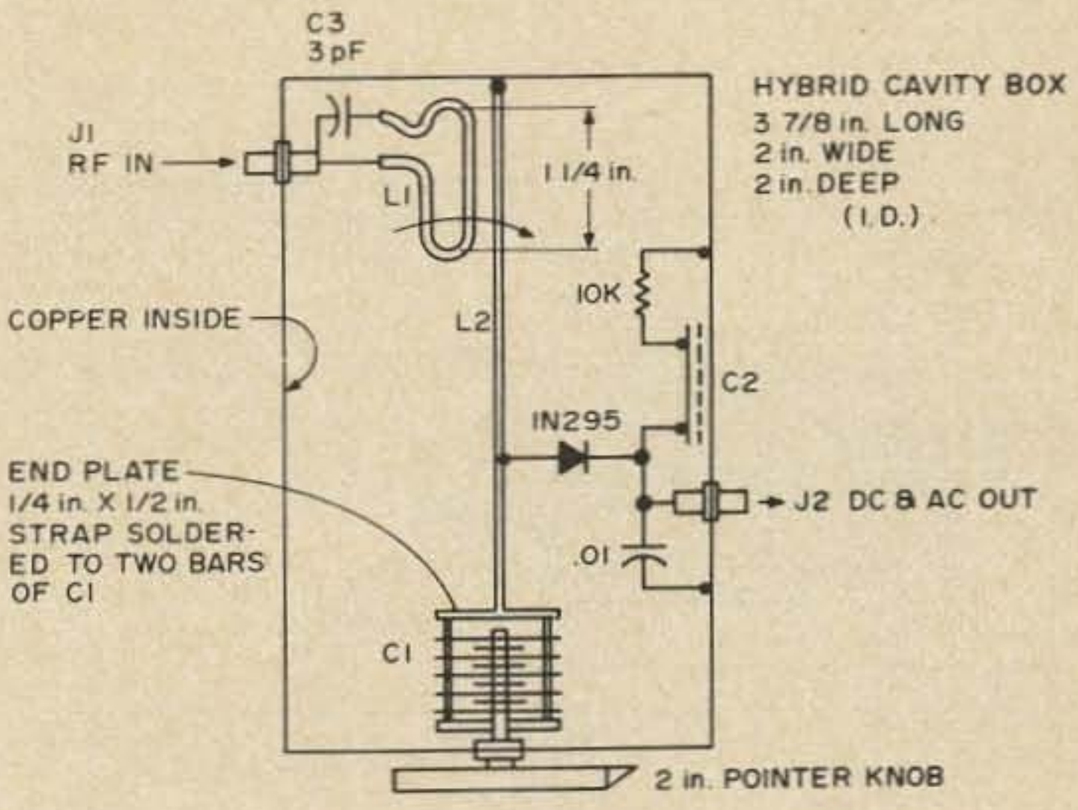

Fig. 9. TDR for 160–500MHz. L1 = Copper strap, 1" wide by 3" long. C1 = 10 plate Hammarlund, type "MAPC" 25 (may also be similar type 25pF of other make). C2 = 1" by 2" brass plate, nylon bolts and nuts. Insulated with .005 nylon or teflon sheet or mica.

Now *this* one calls for a little attention to *shape* and special work, because 500 MHz is getting up towards microwaves where everything really changes radically. L2 is now a

straight strip, and C2 must be especially made of a brass plate with insulation of nylon, teflon, or mica. Nylon nuts and bolts also must be used. L1 should be semi-adjustable, and the 3pf series capacitor helps to match the test cable into the unit. A 1-10pf variable for C3 will provide an even better match. C2 takes care of 500 MHz bypassing, and the 10k resistor and the .01 on J2 provide a reasonable af time-constant for demodulating AM signals.

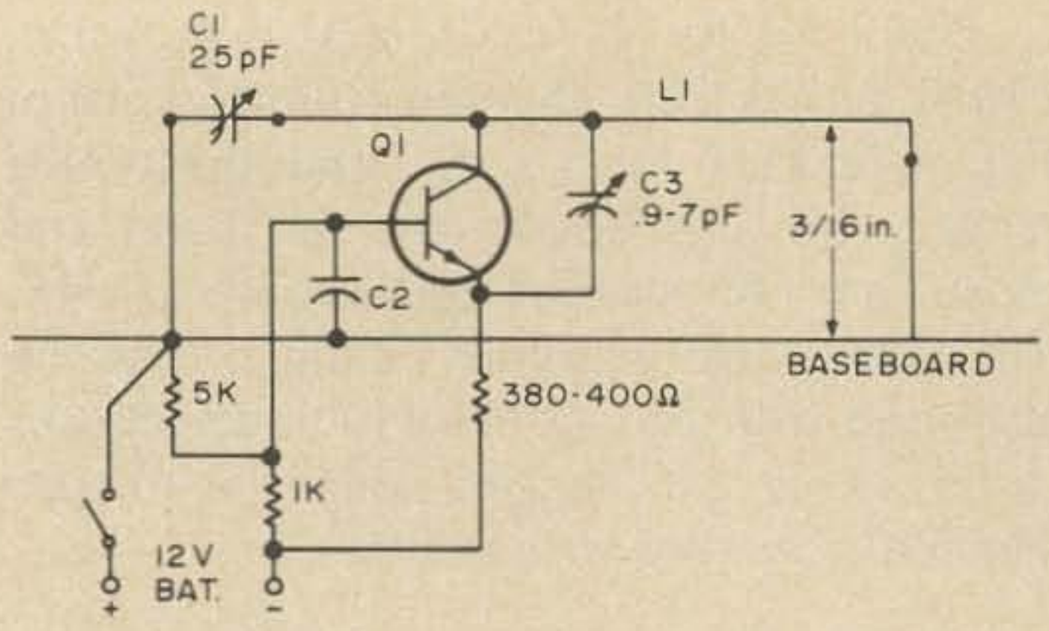

Fig. 11. Schematic calibration oscillator 130–500MHz.

Calibration

This gets to be more of a problem. So, I have built up a very low cost and simplified test oscillator for the range 160 to 500 MHz, which is shown in Fig. 10 and Fig. 11. There are sufficient notes on these figures for construction. Do not rely on a sensitive receiver for calibration. Use an absorption wavemeter, or a "dipper" in the diode mode. A buddy with a 432 signal also helps. Once the oscillator is calibrated, you can transfer the calibration to the TDR easily. You can build two oscillators, or do your TDR calibrating on the 200 to 500 MHz range first, and then change L1 to the lower range, 130 to 200 MHz.

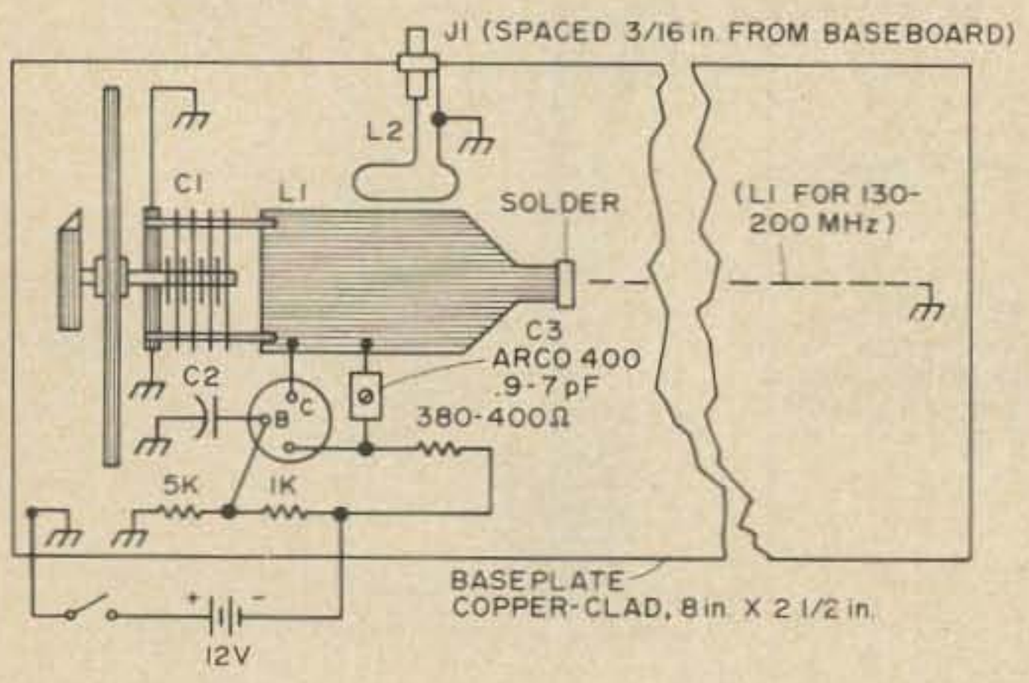

Fig. 10. Pictorial layout calibration oscillator. For 130 to 200MHz, L1 is ¼" "STRAP, 5¼" long, from bar ends of C1 to soldering point on baseboard. For 200 to 500MHz, L1 is 2-1/8" from the ends of bars on C1, to the soldering point on the base plate. (1) Transistor Q1 is a 2N3600, 918 or similar UHF device. (2) Note that the base plate is at 12V+. C1 is MAPC Hammarlund 25pF or similar of other make. Be sure and make two short connections to ground from the rotor.

Conclusion

A set of tuned diode receivers (TDR) has been described to help you with tuning up of multipliers, L.O. units and other transmitters. I use them constantly here, and you too may get to like them.

. . . K1CLL

Marty Hartstein WB6NWW
5349 Abbeyfield Street
Long Beach CA 90815

FINDING THE HEIGHT OF A TREE, POLE, OR TOWER

Many times it is necessary to know the height of an already standing pole, tree, or tower for antenna raising purposes. Climbing the pole or tree to measure its height can sometimes prove difficult as well as dangerous; however, there is a much easier way to find the height. By using the laws of similar triangles, it is quite easy to derive the height of the pole or tree in question.

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$$\text{Tree height} = \frac{\text{TV mast height} \times \text{Tree shadow length}}{\text{Length of TV mast shadow}}$$

. . . WB6NWW

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Terry Mayhugh W6OTG
537 West Church Street
Ridgecrest CA 93555

The Automatic SWR Computer — Part II

Digital readout of your SWR.

Last month I began the description of a special purpose hybrid computer that a ham could construct to read out his SWR. The builder has the option of using a panel meter readout or a digital readout. This article concludes the instrument with a description of the A/D converter and display. Even if the readout isn't desired for the SWR computer, it could be built as a separate module for various other uses around the shack.

This portion of the computer which is actually a digital voltmeter is different from most types that hams are familiar with. It is a tracking A/D followed by a binary-to-BCD converter and display. There is no inherent low frequency updating to display a new value. The display follows the changing analog input instantaneously. This speeds up the tuning procedure since the operator doesn't have to wait for a lagging display to catch up to his tuning change.

I do not have a PC layout available for the digital portion. I mounted the ICs on a half of a standard DIP board and wired the ICs point to point underneath with #22 formvar wire. The 3 LED numerical displays were mounted in DIP sockets which were fastened on end to the DIP board with 2-56 screws.

Circuit Description

Fig. 1, is a schematic of the digital portion of the computer.

The voltage output from the analog computer is buffered by U4. The D/A converter (DAC) U22 is part of the tracking A/D converter. The input voltage from U4 is compared with the DAC output voltage by comparator U5 which generates a count-up or count-down directional command to the up/down counters. The binary counter outputs are D/A'd by the DAC and compared with the analog input voltage. The feedback within the loop is such that the error voltage seen by the comparator dithers about zero by an amount equal to ½ LSB of the D/A. Therefore the outputs from the counters is a binary coded representation of the analog input. One half of U13 is used as an oscillater to provide the internal clocking. The counter outputs are inverted and fed to a 9 bit binary to BCD converter (U9, U10, U11, U14). The LSB output from the counters is dropped so that the display will not dither in the last digit. The BCD outputs drive 7 segment decoders and finally the 3 digit LED display.

The DAC used in the readout is made by Precision Monolithics, 1500 Space Park Drive, Santa Clara, CA 95050. You can contact them for their nearest distributor to you. The IC number is A1MDAC-100CC-Q1. In addition to the ±15V supplies, a 5 VDC logic supply at 1A is needed for the digital display. A bridge rectifier and an LM309K regulator were used in the prototype.

Alignment

The alignment is pretty straight forward. The input to U4 is grounded and R55 is adjusted to give 0.00 on the display. Then 8VDC is applied to U4 and R54 is adjusted to give a reading of 8.00. The steps may have to be repeated a few times until consistant results are obtained.

The measured linearity of the completed converter and display was better than .1% over a 0 to 8V range. All that remains is to connect this module to the unit described last month and you will have a first rate SWR computer. SWR's as high as 8.88 can be displayed. (If your SWR is higher than that you're probably tuning by nulling the temperature of your coax anyway).

. . . W6OTG

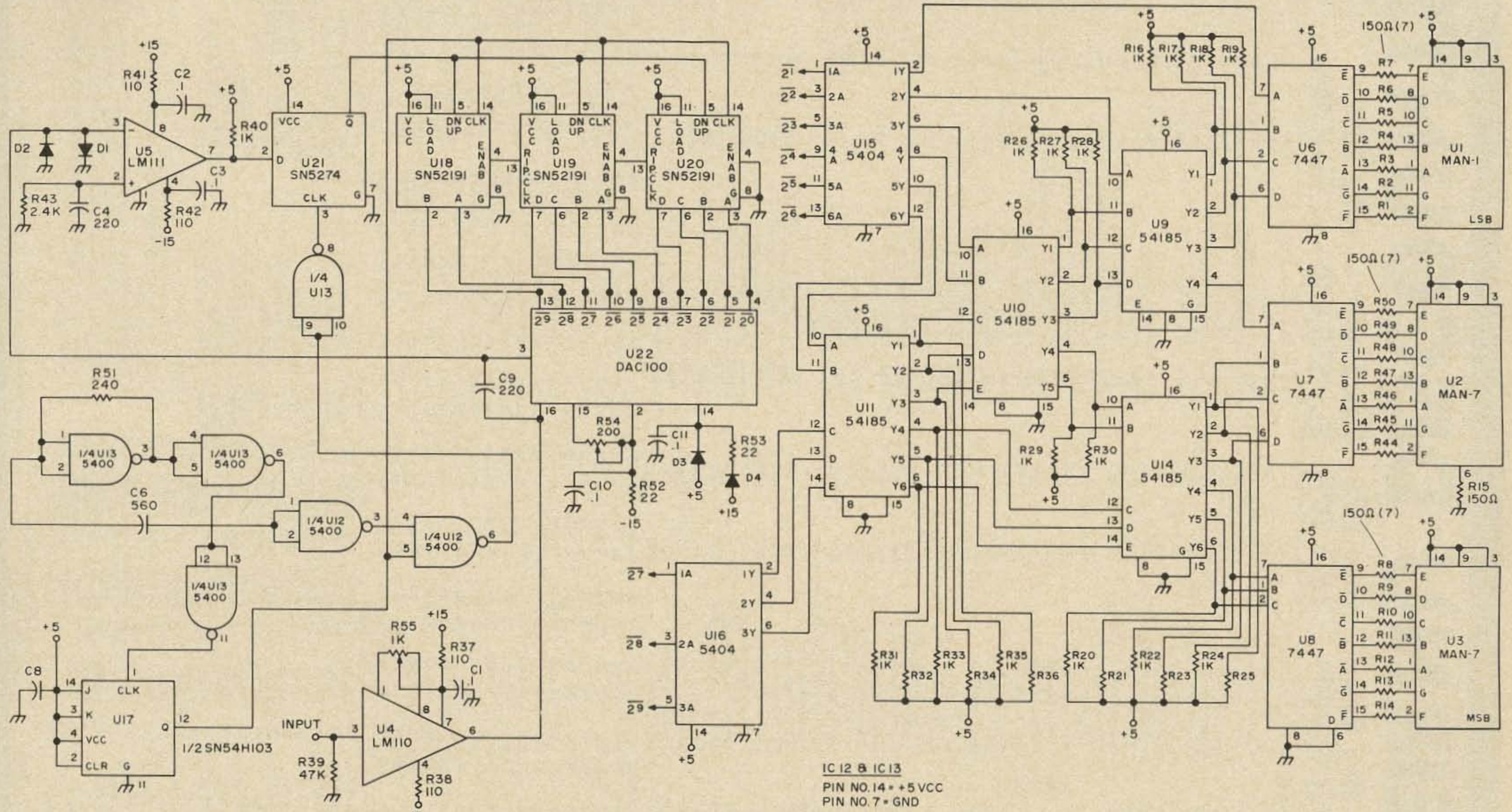

Fig. 1. Digital computer section tracking A–D with display.

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S00	.50	L06	.50	16	.40	37	.35	51	.20	70	.30	H78	.80	94	1.00	126	.70	160	1.50
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H01	.30	08	.20	20	.20	39	.50	H51	.30	H71	.50	83	1.00	L95	1.25	S140	1.50	L161	2.00
02	.20	H08	.30	H20	.30	40	.20	H52	.40	L71	.50	85	1.50	96	1.00	141	1.50	162	1.50
L02	.30	09	.20	L20	.30	H40	.30	53	.20	72	.35	L85	2.50	L98	2.00	145	1.25	163	1.50
03	.20	10	.20	S20	.50	S40	.50	H53	.30	H72	.50	86	.35	100	1.50	150	1.25	164	2.00
L03	.30	H10	.30	H21	.40	41A	1.00	54	.20	L72	.50	L86	.50	107	.40	151	1.00	L164	2.50
S03	.50	L10	.30	H22	.40	42	.90	H54	.30	73	.40	S86	.80	109	.90	152	3.00	165	2.00
04	.20	S10	.50	S22	.50	L42	1.50	L54	.30	H73	.55	88	5.00	S112	1.50	153	1.00	L165	2.50
H04	.30	11	.20	23	.40	43	1.50	L55	.40	L73	.55	89	3.00	S113	2.00	S153	1.50	166	1.50
L04	.30	H11	.30	25	.40	44	1.50	H55	.40	74	.45	90	1.00	S114	2.75	154	1.50	170	3.00
S04	.50	S11	.50	26	.40	45	.90	60	.30	H74	.60	L90	1.25	121	.50	155	1.00	173	2.00
05	.20	12	.50	27	.40	46	1.50	H60	.50	L74	.60	91	1.00	9601	.40	156	1.00	L173	2.50
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175	2.00	193	1.50
S175	3.00	L193	2.00
176	1.00	194	1.50
177	1.00	195	1.00
178	3.00	L195	1.50
179	3.00	196	2.00
180	1.00	197	2.00
181	3.00	198	2.00
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949	Quad 2 Gate	.18
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74C30	.50	74C192	5.00	CD4018	4.75
74C42	2.75	74C193	5.00	CD4019	1.20
74C73	1.50	74C195	3.00	CD4020	5.25
74C74	1.10	74C901	1.25	CD4021	3.75
74C76	1.60	74C902	1.25	CD4022	4.00
74C83A	3.25	74C903	1.25	CD4023	.50
74C85	3.25	74C904	1.25	CD4024	2.75
74C86	1.25	80C95	1.50	CD4025	.50
74C89	12.75	80C97	1.50	CD4027	1.60
74C95	3.50	CD4001	.50	CD4029	5.75
74C107	1.60	Cd4002	.50	CD4030	1.10
74C151	3.00	Cd4006	3.75	CD4035	2.75
74C154	5.00	CD4007	.75	CD4037	2.75
74C157	2.50	CD4008	3.75	CD4040	4.75
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Power Pole — The El Cheapo Tower

Poles may be available for the taking.

Gilbert C. Ford W7OXD
415 East Sherman
Nampa ID 83651

If you have to choose between a good beam antenna and high power, take the antenna. We have all heard that sentiment expressed many times, and most of us hams believe it, but a lot of us are still putting up with a 40m inverted vee 7.62m (25') high in the middle and 3.05m (10') off the ground at the ends. One of the constraints holding back many from installing an antenna system that is really efficient is the cost of the tower. A guyed steel tower will run $200 to $300, and a self-supporting one can set you back anywhere from four hundred dollars to well over a thousand. Sometimes a person is lucky, and buildings or trees will be located just right and sufficiently high enough to serve as adequate supports for a superior antenna installation, but most of us have to provide our own means for supporting antennas.

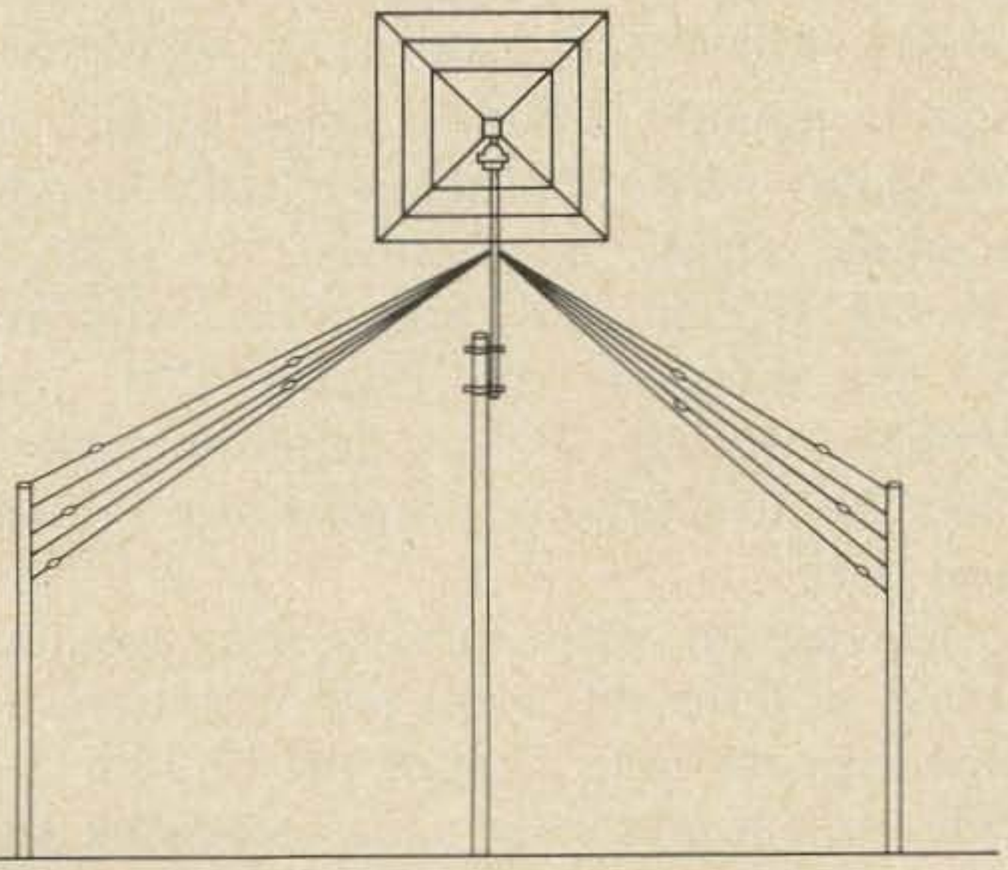

Fig. 1. A 60-foot power pole with a water pipe extension is used to support the quad and the center of the multi-wire inverted vee doublets for 80 and 40 meters. The ends of the doublets are attached to the 40 foot poles.

In my case, I wanted to have a two element tri-band quad for 20m, 15m and 10m at 21.34m and a multiwire inverted vee system for 80m and 40m with its center at 19.82m (65') or so. I felt that these heights would be the minimum for the really outstanding antenna performance that I wanted. The angle of radiation from the quad would be sufficiently low to produce superior results with DX, and all the antennas would be adequately clear of surrounding power lines, houses and trees.

Availability of Power Poles

A look at the prices quoted in tower catalogs and ads quickly convinced me that a solution other than a commercial tower would have to be found. The thought then came that I had heard somewhere that used electric power poles could be obtained very inexpensively. When I asked a local power company official about the possibility of getting a pole, he told me I could have one for no cost if I could haul it away from the site at which it was removed. Poles having many years of useful life are occasionally taken out of service when highways are widened, new buildings erected and the like. Unless the power company re-sets these poles in the ground at another site almost immediately, the part underground will deteriorate badly when the pole is finally re-used. For this reason the poles are free for the taking, but they must be re-set quickly if they are to last well.

After a further planning session I decided that what I needed was one quite long pole in the 18.29m – 24.39m (60' – 80') class to support my quad and the center of the inverted vees, and two 12.20m (40') poles for the ends of the inverted vees.

Moving The Poles

Almost immediately two 12.20m (40') long poles became available just three blocks away from my house. The short distance

involved simplified the transportation problem. A chain was wrapped around one end of the pole. Then each pole was dragged in turn with a truck the short trip home. This simple method is not recommended if the poles must be moved more than a few blocks. The wear produced on the surface being dragged might be enough to damage the pole. Also there is some risk of damaging street surfaces, especially if they are asphalt.

Some weeks later I was notified that a 18.29m (60') pole could be mine if I would haul it away during the next two days. This one was about two miles from my house, and much heavier than the 12.20m (40') ones. I had thought they were big, but this new one made them seem like ordinary fence posts. The butt end was at least 45.72cm (18") in diameter, and 18.29 (60') really seemed long all laid out on the ground. Dragging with a chain for two miles would never work. After enlisting the help of a friend with a small truck and scrounging up a set of small wheels on an axle, the possibility of actually moving the pole began to seem more in the realm of probability. Fortunately, the pole was located only a block from a small manufacturing plant where I was well acquainted, and I was able to engage the free services of a fork-lift truck and operator for a few minutes. With the fork lift, the heavy butt end of the pole was lifted up onto the truck bed and chained into place. The lighter end of the pole was lifted and the set of small wheels and axle were chained into position under the pole about 4.57m (15') from the small end. After affixing a red flag onto the trailing end of the pole, all seemed in readiness for the move. About this time I noted a police patrol car parked a half block away, and I realized that if he were not already interested in our activities, he undoubtedly would be as soon as we started to pull our 18.29m (60') monster out into the street. Firmly believing that the direct approach is best, I walked down the street to his car and asked his opinion of our proposed expedition. To my surprise, he seemed only mildly concerned about our activities and declined my invitation for him to escort us through the traffic in the two rather heavily traveled intersections that lay just ahead. He seemed content merely to admonish us to be sure we had a red flag on the end of our pole. So, with his statement that the power company people move poles like mine all the time, we parted. As I thought of the behemoth pole, I just hoped his confidence in us would be justified.

The trip began quite successfully. Before long, however, we realized that we had a serious steering problem. The wheel-supported end of the pole had a disturbing tendency not to follow the truck, but to swing dramatically to the right or left into the next lane of traffic. This problem was solved when friend Merv suggested that he ride the pole just behind the wheels and steer them with a rod inserted into the axle mechanism. With considerable attention from curious onlookers, we made the two-mile trip and finally deposited the pole in the alley alongside my back yard.

Erecting The Poles

Before erecting a power pole you need a hole. How deep should it be? A depth equal to 12 to 13% of the total pole length should be about right. Or, if you prefer, simply match the depth used by the power company on your particular pole. Although the power company has beautiful power-driven augers which can produce a neat-looking hole in minutes, I had to resign myself to a few hours with a shovel and a hand-operated posthole digger. Surprisingly, the hole for the big 18.29m (60') pole went faster than did the ones for the 12.20m (40') pole, mainly because it was large enough in diameter to allow me to get down into the hole itself.

Because of their varying sizes and locations, a different approach was used for erecting each pole. One of the 12.20m (40') poles which was in an easily accessible spot was lifted and shoved with a large forklift truck until the big end began to slip into the hole. While the pole was supported temporarily in this position by another vehicle, the forklift was pulled away from the pole,

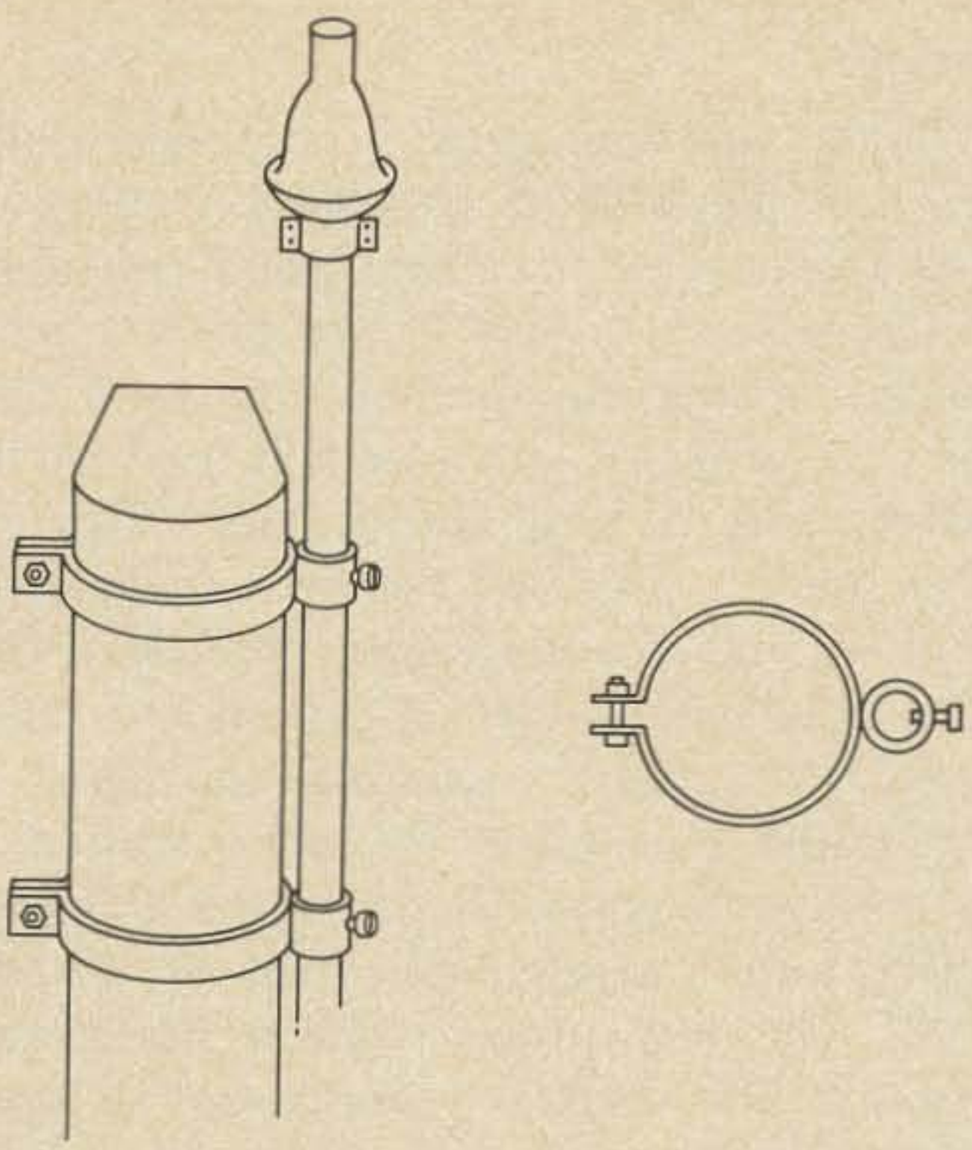

Fig. 2. The water pipe is not pulled up to full height until after the rotator and quad are mounted. To the right are the clamps used to fasten the pipe to the pole.

and while the forklift prongs were in their highest possible position, they were re-chained loosely to the pole. The shoving process was repeated until the pole dropped into its hole.

The hole for the second 12.20m (40') pole was located in a more awkward spot. To erect this pole, we used a truck having a large tripod and chain hoist mounted on the rear end. The pole was picked up near its center of gravity, a point about 4.57m (15') from the heavy end. Once the center of gravity of the pole was 4.57m (15') in the air, the pole was rather easily swung into an approximately vertical position and dropped into its hole.

Forklifts and tripods on the end of a truck are just not suitable for a large 18.29m (60') pole. Fortunately I have a friend in the construction game who has a large crane. He volunteered after some hinting from me to send his crane over one Saturday morning to do the job. For the first time, my 18.29m (60') pole seemed light and small. Once in position, the crane had the job done in five minutes.

Make sure the pole is really vertical before re-filling the hole with dirt. If the pole is not perfectly straight, position it so that the center of gravity of the part of the pole out of the ground is directly over the hole. Be sure to stamp the dirt in thoroughly when replacing it around the pole. People who know say not to use concrete to refill the hole. Dirt is better.

I must admit that a power pole is not an attractive object to most people, but after investing as much thought, time and effort as I have in securing and erecting mine, they have taken on a very special rugged sort of beauty.

Extensions

As you remember, I originally started on my antenna support project with a goal of a minimum height of 21.34m (70'). A 18.29m (60') pole with 2.13m (7') in the ground leaves only 53 feet. My solution for getting up to 21.34m (70') was to extend the power pole with a 6.40m (21') section of 3.81cm (1½") I.D. galvanized water pipe. An overlap of a meter or so (several feet) between the pipe and the pole still allows for a total height of 21.34m (70'). Clamps were used to fasten the water pipe to the pole.

Climbing The Poles and Installing The Antennas

Access to the tops of the poles is easy if you have a pair of climbers and know how to use them. I had the climbers, but I didn't know anything about using them. Luckily my good friend, W7PSC, is an expert.

First, a small pulley was fastened to the top of the tall center pole. A small rope through this pulley was then used to pull up, one at a time, the pole clamps, water pipe, rotator, quad and finally, the 80m and 40m dipoles. The quad and rotator were mounted on top of the water pipe, while the pipe was in a lowered position in the pole clamps. The small rope was then tied to the bottom of the water pipe and the pipe-rotator-quad assembly was pulled further up and clamped in position.

Since the three poles are not quite in a straight line, the two legs of the inverted vee dipole system can act as two of the guys of a three-guy system. The third guy is a stranded galvanized wire running off in the appropriate direction.

Results

Some unsympathetic onlookers may question the wisdom of your owning your own private electric power poles, but don't let them bother you. Power poles make a sturdy, inexpensive antenna support system, and a good set of antennas will improve the performance of your station more than any other factor. This fact has been made quite vivid for me recently during three-way contacts in which another local ham and I have asked DX stations to compare the signals of his 1000W transmitter feeding a vertical at an average height with the signals from my 100W to a two-element quad at 21.34m (70'). The low power station has always received the better report. Get a good antenna up in the clear, and you will be pleased with the improvment in your signals.

. . .W7OXD

QSL - STK

One of the problems facing hams on the move is what to do with old QSL cards after resuming operation at a new location. After a recent move to a new QTH, I found myself with several hundred perfectly good, yet inappropriately addressed QSLs.

The problem was solved with the aid of self-stick labels obtained from an office supply store. The ones I used were intended for file folders, but they come in a variety of shapes and sizes. The label was used to cover the old QTH, while the new address was rubber-stamped over it. The result was a neat card that had the appearance of being printed. This allowed me to exhaust my existing supply of QSLs, as well as tide me over until new ones arrived.

Even if no move is in sight, there is a good possibility that QSLs printed with the home QTH could be altered in this manner for operation from vacation tops or mountaintops during field day. The rubber stamp, by the way, has numerous uses around the shack, such as for correspondence. The self-stick labels are also great for marking ownership of gear that might be loaned out.

. . . **K1YJC**

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Kent A. Mitchell W3WTO
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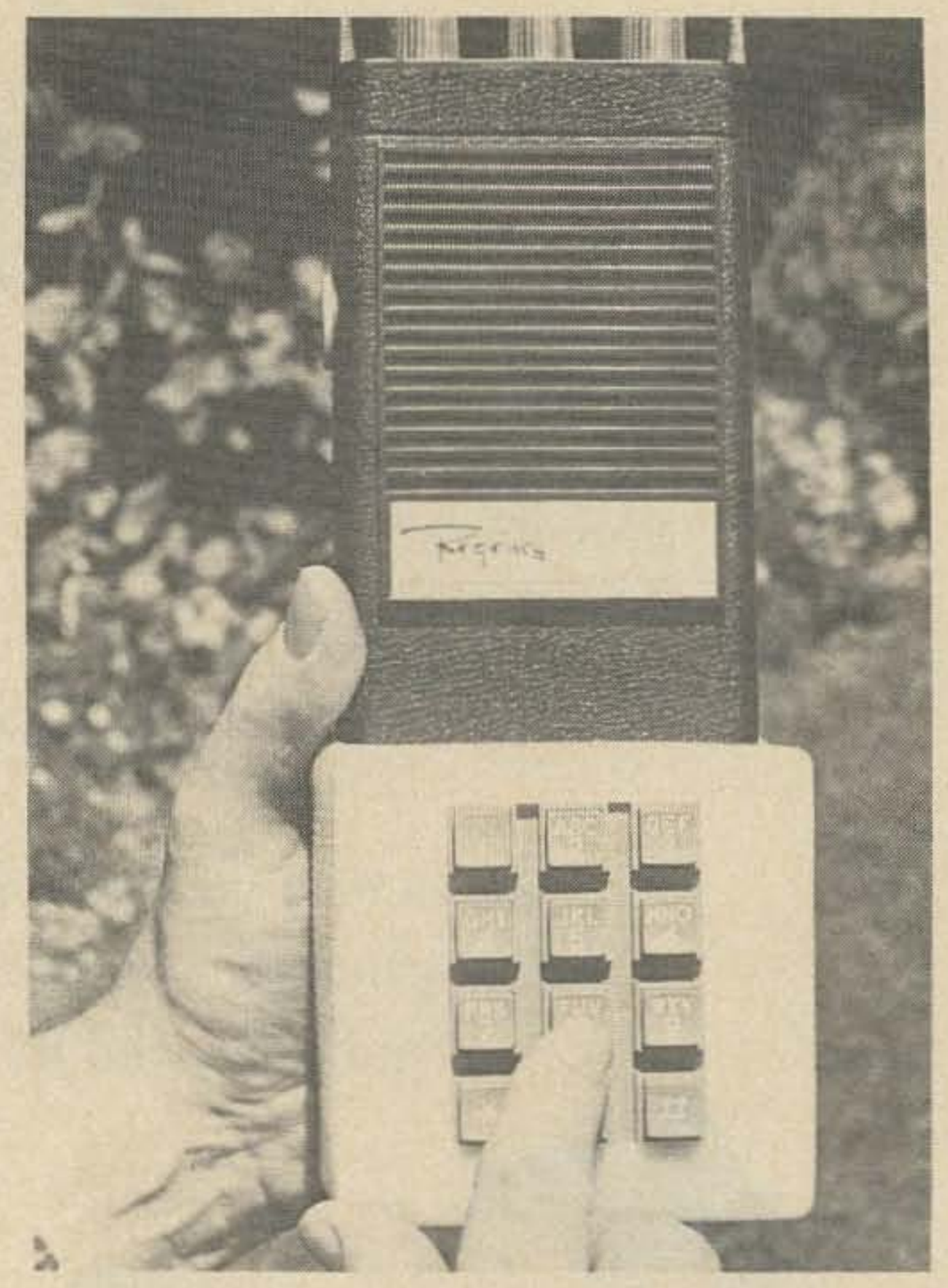
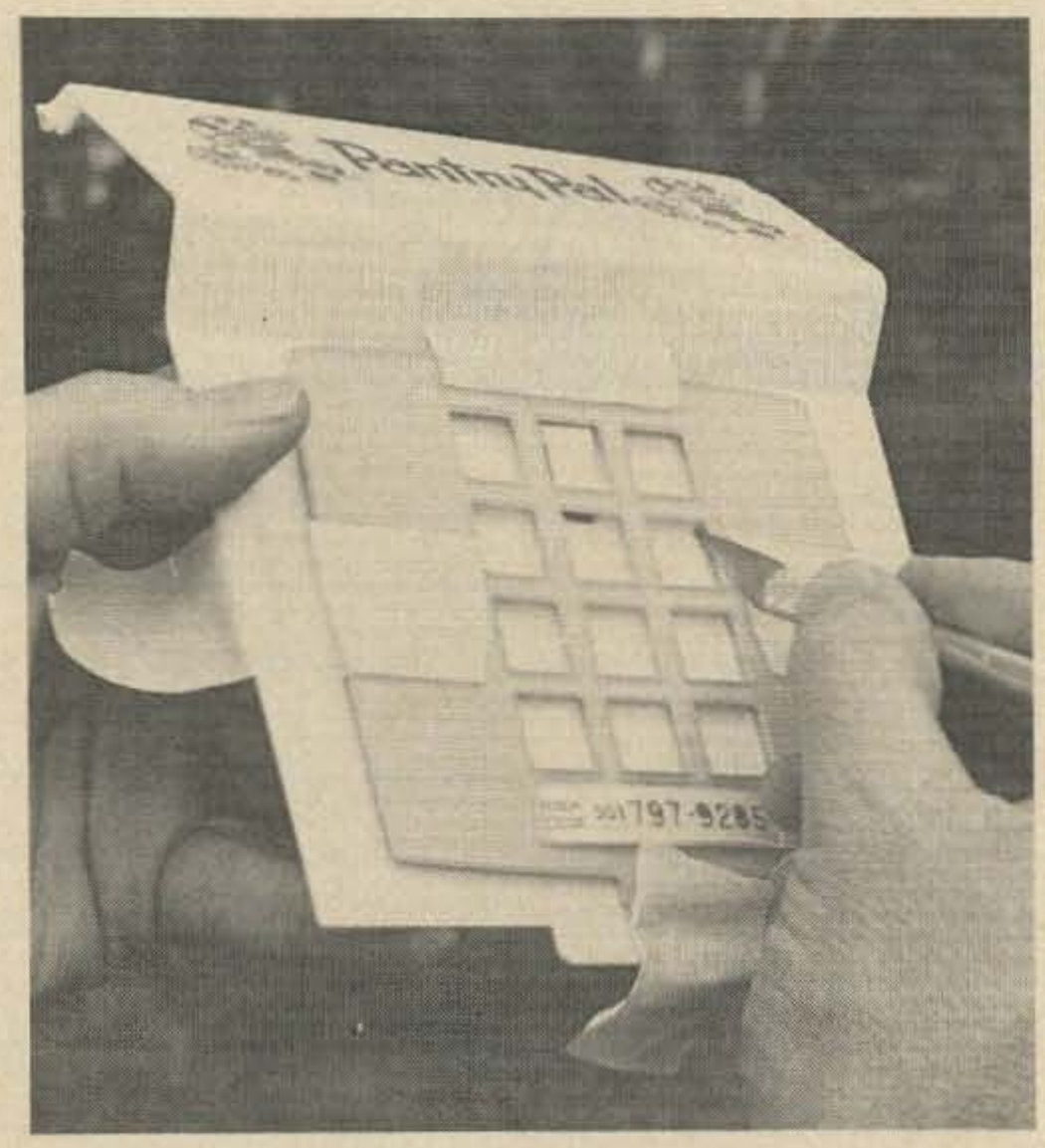


Installing a touch-tone pad in a 2-meter FM mobile or fixed station setup (for autopatch or repeater two-tone access) is often quite a chore. Not only are small metal boxes difficult to locate and expensive — cutting those 12 little square holes requires extreme care and patience, if a neat mounting is to be obtained. Spending hours with a drill and file is not my idea of an ideal evening, especially when one goof means a botched job.

However, one recent day while wandering through a local store pretending I was going to buy something (when I was actually looking at bra-less YL types in skin-tight hip huggers), I found myself in the kitchen wares department.

This not being my usual environment, I was surprised to find a whole counter full of potential TT pad boxes — and in quite a variety of sizes and shapes! Albeit, these boxes are constructed of plastic, but because of this they are easy to cut and above all they are cheap! A slight error is of minor concern — just throw that box away and start on another!



For example: 10 of the quart size refrigerator and freezer containers can be obtained for slightly less than two dollars. These are readily adaptable for use as a TT pad mounting on a handie-talkie. Another item, a "Recipe Box" makes a dandy sloping panel box for mounting a pad to be used on your operating table. These sell for about a buck.

To assist in laying out the 12 hole pattern on the plastic container you have selected for your project, disassemble the nearest telephone and utilize the Western Electric Touch Tone cut-out as a template for marking. Your felt tip pen works fine for this. Then, with an X-acto knife, scribe a light line around the perimeter of each opening. Keep retracing each line, going deeper each time, until the opening is cut through. Any lettering on the plastic boxes can be removed with solvent.

...W3WTO

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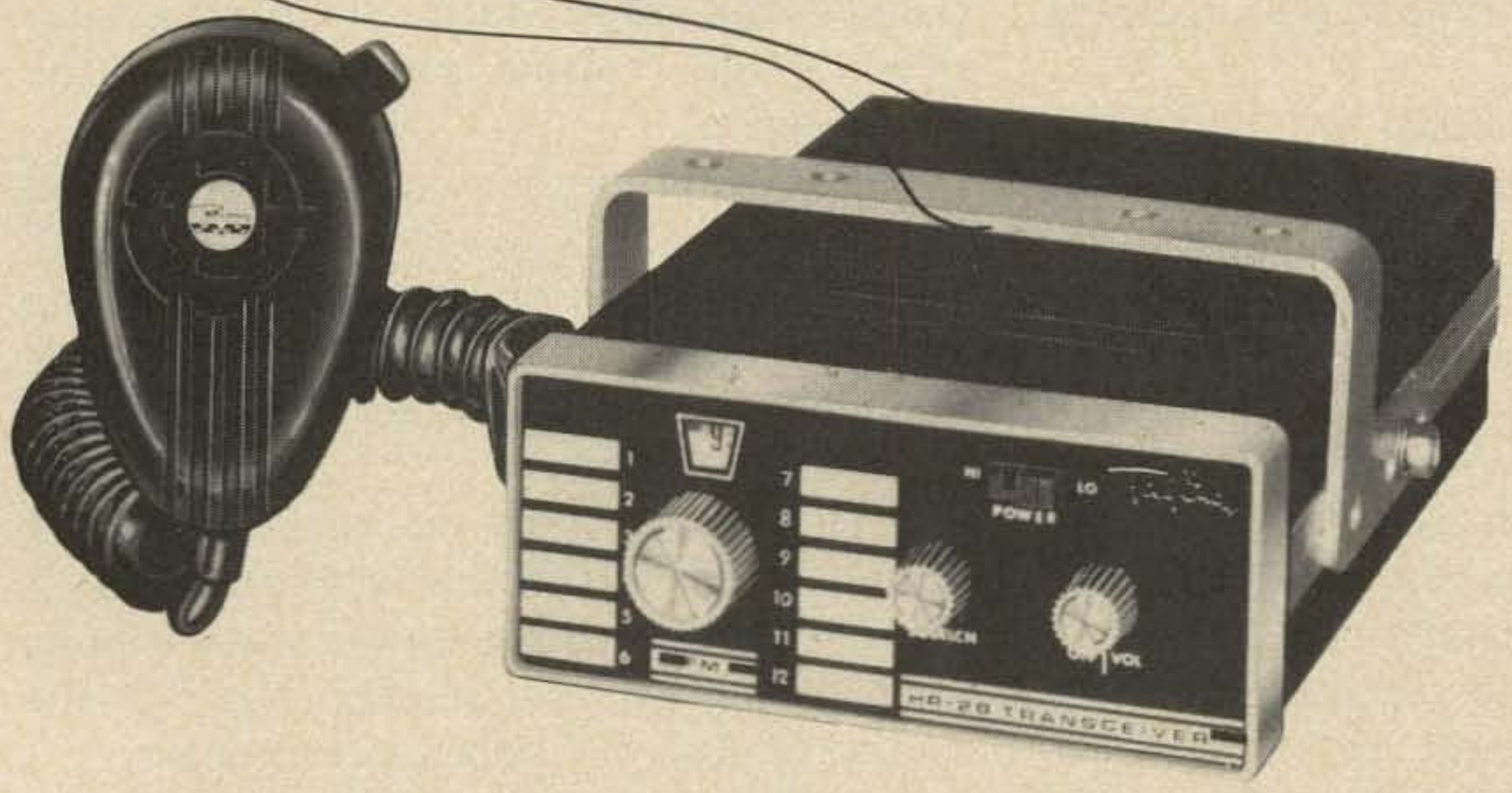

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Wheeling and Dealing at Hamfests

Get rid of it!" She had said this before, but now her words had the ring of authority. I will have to admit that there was beginning to be reason for my wife's concern. The garage was getting rather full. It was bad enough when we could not get the Cadillac in, and worse when the Volkswagon would not fit, but now that my son is complaining about having to leave his Honda outside, I suppose it is time to do something about getting rid of it.

She was talking about my wonderful collection of radio paraphernalia, including receivers, transmitters, Teletypes, generators, coax, box after box of tubes and parts, all carefully hoarded after many years of endless scrounging.

I reluctantly agreed with my frustrated XYL that we must get rid of it. There was nothing left to do, except pack it up and take it to the Shelby Hamfest.

Getting ready for the trip was not as easy as I thought it would be. I had the Volkswagon half loaded with goodies when the XYL came to check on the progress.

"What do you think you are doing?" she shrieked when she saw what I was doing.

"I am loading the Volkswagon with this stuff you call radio junk." I offered meekly, since I knew what was coming.

"You are not going to get rid of anything by loading the Volkswagon, load the Cadillac!" she insisted.

"If I load the Volkswagon, we can at least get the Honda in the garage," I volunteered half heartedly.

I unloaded the Volkswagon and began loading the Cadillac. What to take? I suffered a thousand deaths as I tried to decide what to part with.

I finally gave in, and jammed everything I could into the car and then called the XYL for a last minute check of my progress.

She grinned from ear to ear, and an evil looking grin at that, when she saw the wide open spaces left in the garage.

"This is wonderful, now Junior can get his Honda in the garage again," she exclaimed and then added, "Perhaps we can even find room enough for the Volkswagon."

"Uh huh," I muttered unintelligibly. I did not have the heart to tell her about the 17 Teletype machines I had bid on recently at a surplus sale. I wondered where I was going to put them, but now there was plenty of room in the garage.

The XYL inspected the car carefully and found a roomy gap in the back seat. Before I knew what was happening she was emerging from the garage with another item that she tucked neatly away into the extra space.

I started to explain to her that this was my war surplus 2300 MHz antenna tuner, and you just didn't find those anywhere. I knew however that she did not understand about such things, and I also knew that she was determined to get rid of it. Besides, I rationalized, I was having trouble getting on 2m, let alone 2300 MHz, so I let it go into the car with the other goodies.

About halfway to Shelby a highway patrol car pulled along side with his blue light blinking. I wasn't speeding so I was naturally concerned about why the patrolman was stopping me.

"What have you got in the trunk?" he demanded.

"Radio equipment," I responded meekly.

"Open it up!" he ordered gruffly, as though he didn't believe me.

When his inspection revealed only the radio equipment, he explained that they had been having trouble with some bootleggers, and he thought my car was too low to the road, so he expected that it might have been loaded down with booze.

I couldn't resist telling him that I knew a few bootleggers but they were not the kind he was looking for.

"Say, what are you going to do with all of this stuff," he asked.

I explained about going to the hamfest, and that I was going to trade or sell it there.

"I sure would like to have a good radio like that," he was pointing to the antenna tuner. "A friend of mine, Dennis, has a ham rig and he tells me that it is a lot of fun." He continued, "Do you happen to know Dennis?"

"Sure everyone knows Dennis," I replied. "If you want a good radio I could sell you this one," pointing to an old black BC-348, for $50.

He looked at all of the knobs, and I could tell that he was impressed.

"It's a deal!" He pulled out his wallet, and handed me a fifty.

As I drove off, I chuckled to myself. It was the first time I had ever been stopped by a cop, and collected money. I had a feeling right then that this was going to be a great hamfest.

Finally arriving at the site, I sought out and found an ideal spot to spread out all of the items I had brought along.

Even as I unloaded, groups of curious hams began swarming around the car to inspect the goodies. I heard one fellow remark, "It has been years since I have seen anything like this stuff."

Among the items were a BC-653, a BC-733, a BC-105, ten BC-604s, a BC-432, some BC-221s and ten boxes of tubes, mostly 807s. A young fellow asked if the BC meant Before Christ. When I put the TCS-12 on the table the car was empty.

I ignored the wisecracks from curious onlookers, who seemed determined to heckle me about the vintage of my stuff. Despite this heckling I managed to sell a couple of ARC-5s before lunch time. I had to admit however that business was not as good as I expected.

It was obvious to me that hams nowadays did not appreciate this fine old equipment. Old timers would stop and comment on the good old days. They complained about how they didn't build equipment like that anymore, but they didn't want to buy any of it.

About one o'clock a fat little fellow walked up, grinning and shaking his head as he inspected the assortment of goodies. He took me by surprise when he said, "I'll give you $200 for everything you have."

"Two hundred dollars for all of this stuff. Why it must be worth at least $2,000" I responded in a hurt tone.

"Maybe, but how much of it have you sold," he countered.

I thought about this for a moment, and also about having to face the XYL if I carried it all back home. This was better than nothing, and besides I needed that space in the garage for my new Teletype equipment.

But to part with all of those wonderful treasures for a measly $200. It was unthinkable! Nevertheless I thought some more about listening to my wife's greeting and about loading all of the stuff into the Cadillac again. It didn't take long. Looking the man straight in the eye I announced, "It is yours."

With the stuff sold I was able to look around and see what everyone had brought for sale or swapping.

I almost bought a BC-610, but I gave up the idea when I couldn't figure out how to carry it home in the car.

Suddenly something attracted my attention. It was a sign with the words hastily scrawled: *GREAT CONVERSATION PIECES: HARD TO FIND EQUIPMENT: REASONABLE: BUY WHILE YOU CAN.*

Whoever it was had a great attraction, people were crowding around pushing and shoving to get a better look. I finally got close enough to see what it was. There was the little fat man selling my equipment. The people were not just looking they were buying and the man did not have very much left.

I grumbled to myself, "Conversation

pieces, huh. Well he might be right," and I thought of the conversations the stuff had inspired between the XYL and myself. "I wish I had thought of the idea myself," I muttered.

"Hard to find, baloney!" I kept on mumbling. "I still have two thirds of a garage full. Just wait until next year."

I was really disgusted about the whole thing and took off for home.

I kept thinking about being outsmarted and I did not have my mind on driving.

About halfway home, as I thought about the deal for the 101st time, a blinking blue light attracted my attention. All at once I realized that he wanted me.

I pulled over, and my friend from earlier in the day pulled along side.

"You know you were going 10 miles over the speed limit," he announced with a very friendly smile.

He had obviously recognized me, and I felt easier until he continued.

"The Judge will charge you $5 a mile for each mile per hour you were over the limit," he informed me.

"You can come to Court Monday night, or you can give me $50 as a bond and go on your way." He kept grinning all of the time.

I pulled out the fifty, handed it to him, and bid him politely goodbye.

All the way back, I kept wondering to myself, if that patrolman wound up with a free radio.

Carl C. Drumeller W5JJ
5824 N.W. 58th Street
Oklahoma City OK 73122

Listener-Designed Speech Filters

The USAF, at its Cambridge Research Laboratories, has made a thorough study of the effect of speech filters upon intelligibility. Some of the findings are just what one would expect from one's amateur radio experience. Some, though, are not.

The effect of a speech filter varies directly with the bandwidth used by the transmitting system. If the bandwidth is 6 kHz, the improvement in intelligibility may be as much as 10 dB, with about 6 dB more commonly realized. As the bandwidth is narrowed down, the filter becomes less effective, dropping to 1 dB increase in intelligibility when the bandwidth is 2 kHz. At 3 kHz, which is about the maximum used in amateur SSB transmission, an advantage of 3 dB can be obtained.

This may not sound impressive, but 3 dB is just what you'd gain by doubling your power output; so perhaps it's more impressive when thought of in such terms.

The responsive curve found to give best results is one that produces a 3.5 dB per octave boost, starting at 500 Hz. On the low-frequency end, there's a similar boost between 500 Hz and 200 Hz. One somewhat astonishing finding is that speech processing should occur *before* any limiting or compression. Not astonishing, though, is the conclusion that the transmitter should be modulated to its peak capability by the peaks of the signal at the output of the filter.

Another conclusion which runs contrary to general thinking is that filtering at the receiving end is not effective. In fact, it may decrease the intelligibility. This conclusion runs parallel with the findings of a previous study which came up with the amazing report that maximum bandwidth and maximum intelligibility ran hand-in-hand! So revolutionary was this finding that it was quietly disregarded, with the hopes that it would soon be forgotten.

. . .W5JJ

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RHOMBICS - Are They Really Worth It?

Every amateur always wants a little bit better antenna than the one at his present installation. Occasionally, he will think that a rhombic would really fit the bill, if only there were enough space, height, etc. After thinking about this for a time, he looks over what reference material there may be immediately available, then goes about his business to think about antennas another time.

Many amateurs, SWLs and others think of the rhombic as the Rolls Royce of antenna systems, the absolute ultimate, or the panacea for the problem of elusive DX. It is unfortunate that more information on this antenna is not more readily available to the average person. The *ARRL Antenna Book* contains some information, as does the E&E *Radio Handbook*; but substantive information is usually available only in exotic sources and when located is often in such terms as to be unintelligible to anyone without an EE degree.

Confronted with the choice of antenna structure to erect on my 5½-acre QTH, I

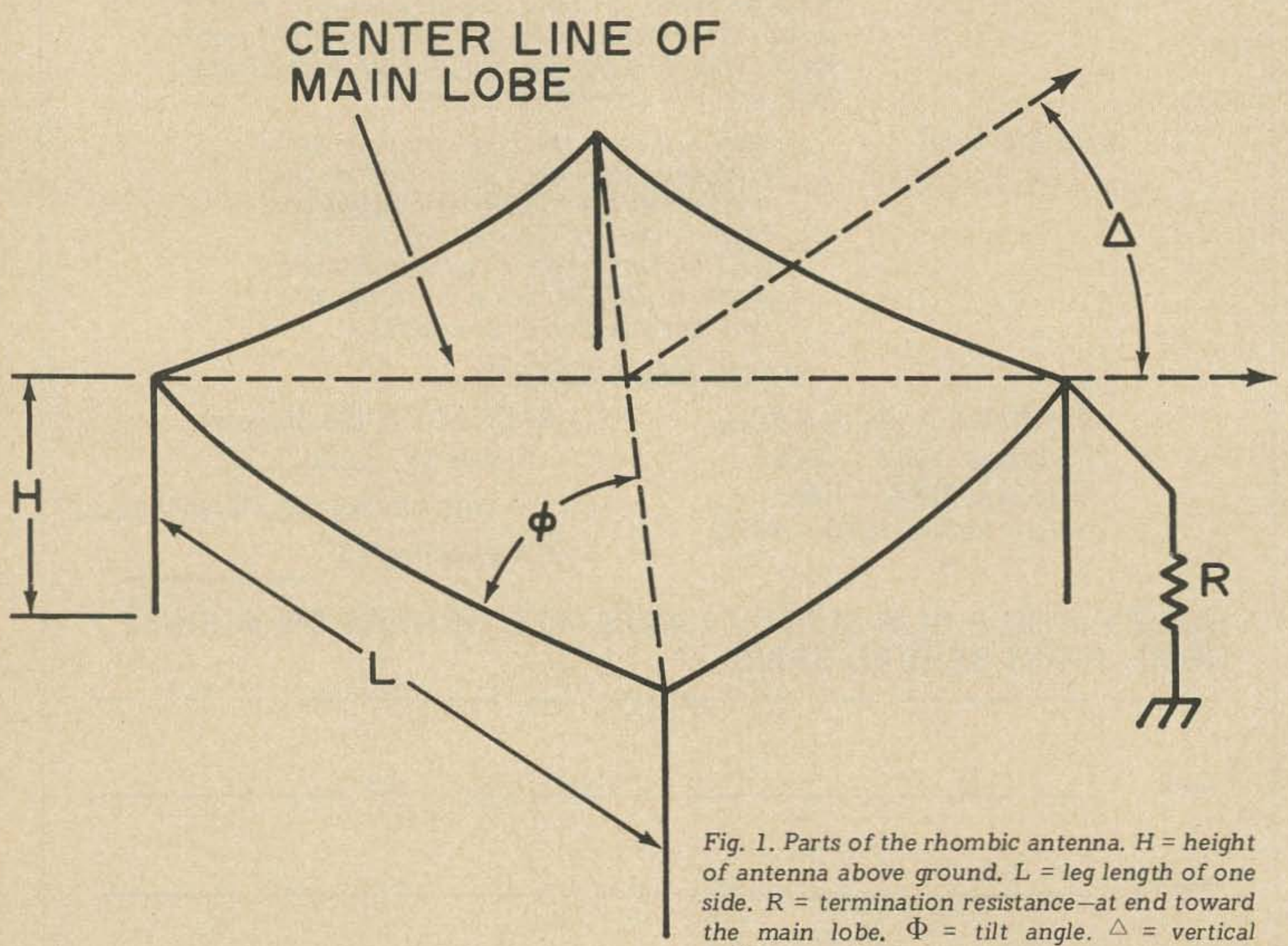
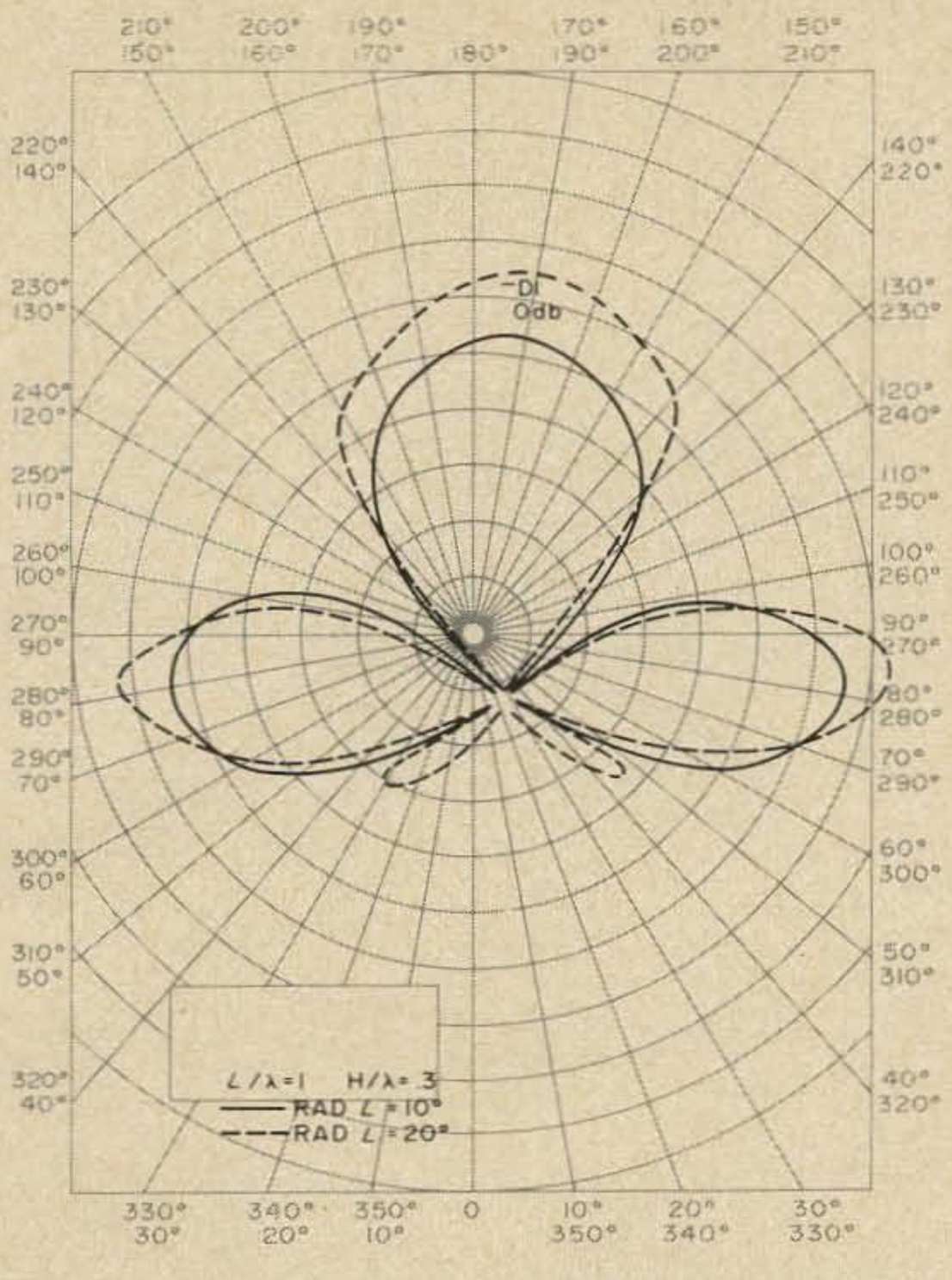
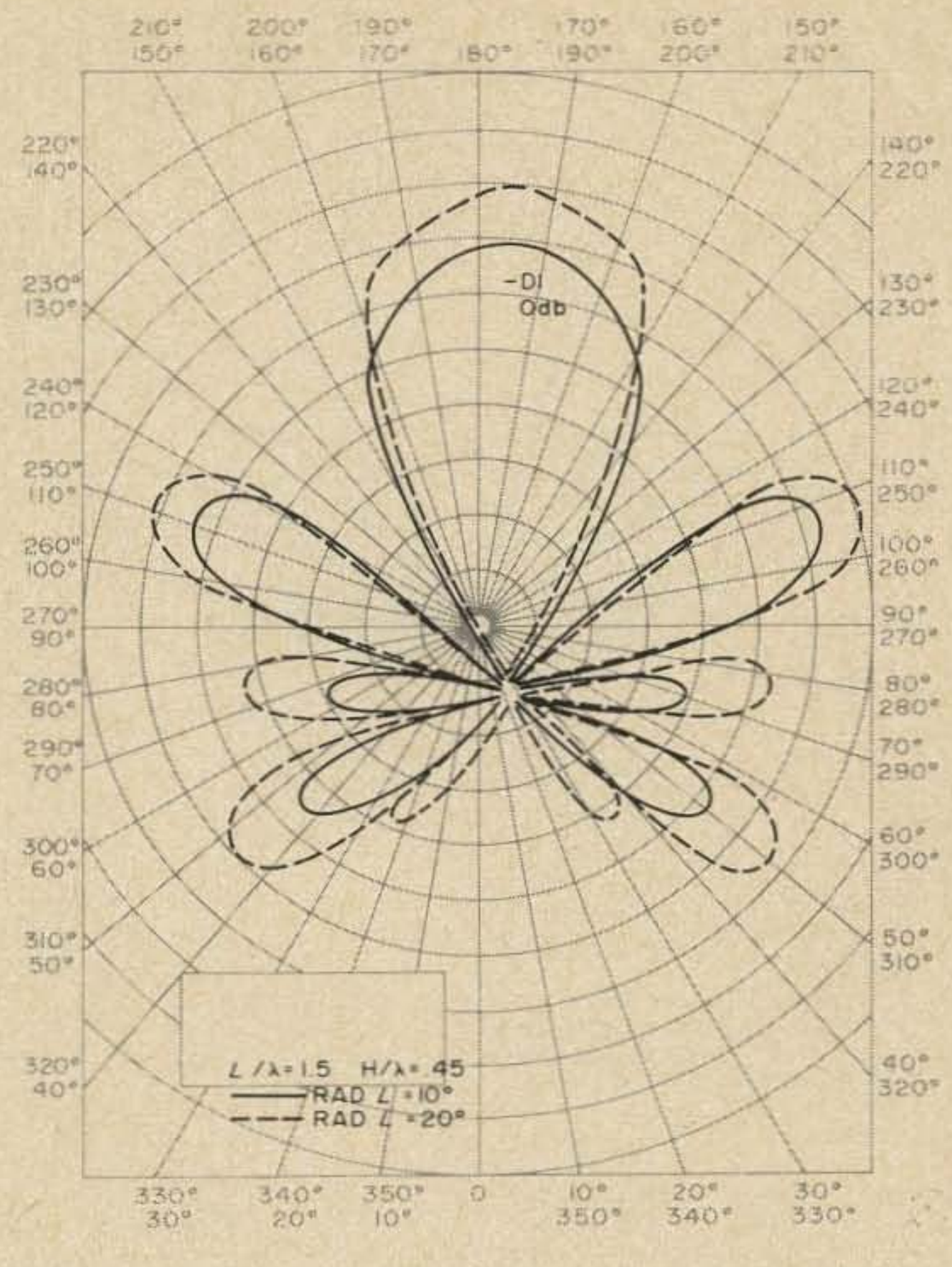


Fig. 1. Parts of the rhombic antenna. H = height of antenna above ground. L = leg length of one side. R = termination resistance—at end toward the main lobe. Φ = tilt angle. △ = vertical radiation angle.





considered a number of different designs, including the rhombic. It was confusing to see terms such as *tilt angle*, not the tilt of the antenna in respect to the ground, but the "tilt" of the geometrical figure in relation to a square — a tilt angle of 45° would result in a square; 0° and 180° would produce a straight line, see Fig. 1.

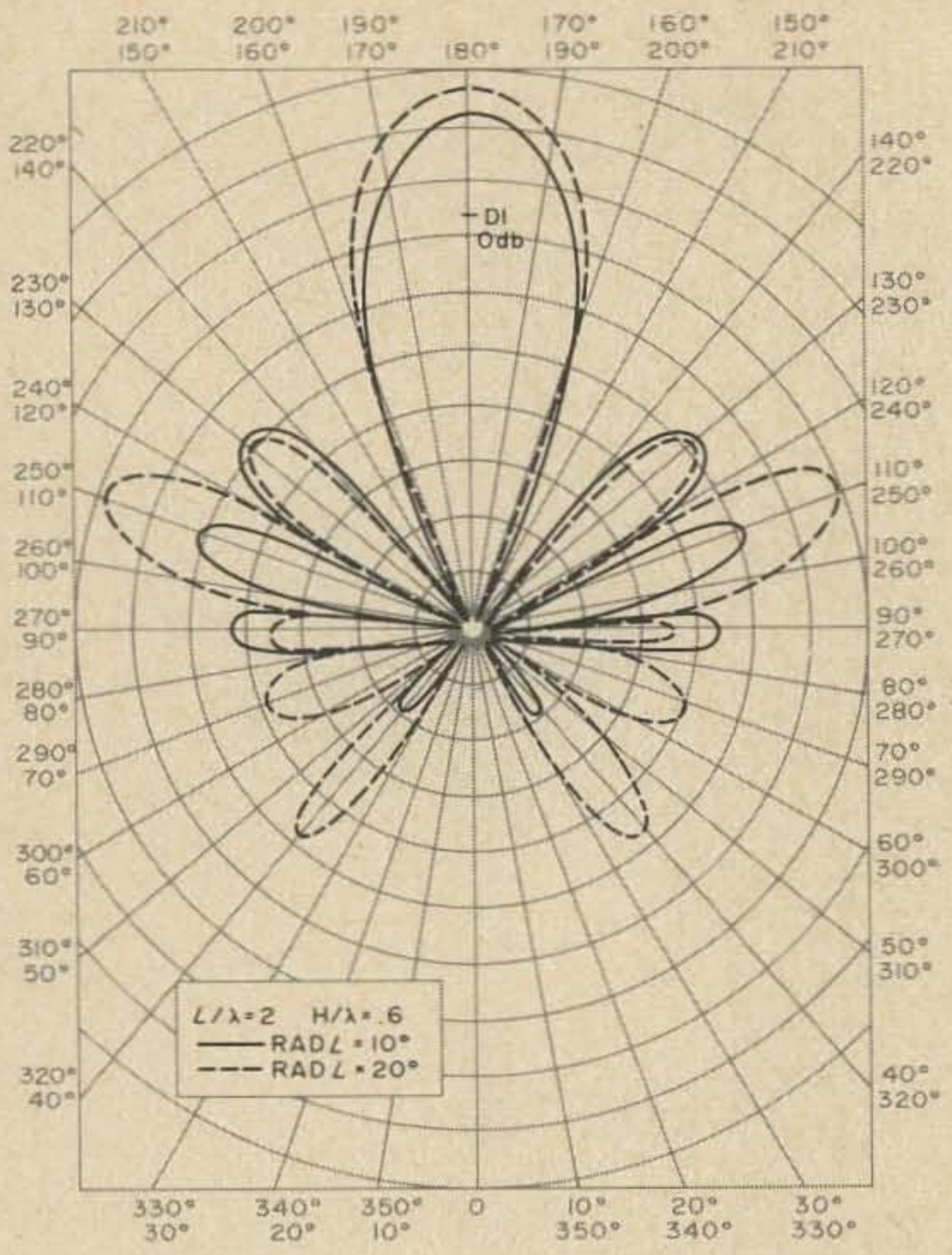
H = height of antenna above ground
l = leg length of one side
$\emptyset$ = tilt angle
R = termination resistance — at the end toward the main lobe.
$\triangle$ = vertical radiation angle

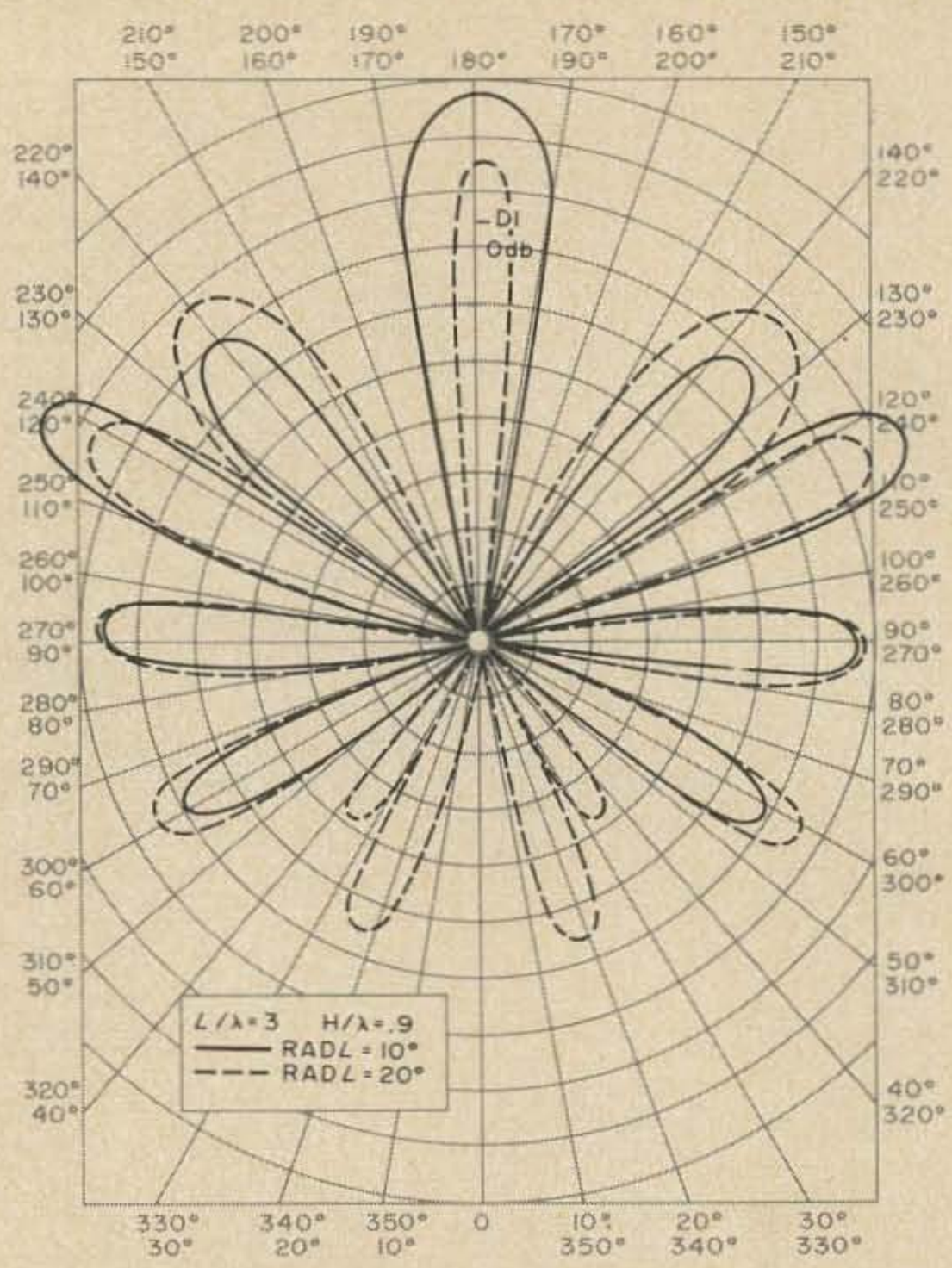
This information, coupled with complicated mathematical calculations immediately discourages all but the most determined of the fraternity. It is possible, fortunately, to calculate theoretical radiation patterns for a given set of parameters; we'll get to these in a moment.

The rhombic is a "travelling-wave" antenna, contrasted with the more common "standing-wave" or resonant antenna, such as the dipole. A travelling-wave antenna is non-resonant at any particular frequency, being useful over a wide band of frequencies. As a result, the impedance of the antenna does not vary nearly as much as it does on a standing-wave antenna. Calculating the impedance variations of a rhombic, it is theoretically useful over about a 5:1 frequency range. Other factors enter in, however, so that commercial users find that the practical useful range is over about a 2:1 frequency ratio.

The average rhombic weighs in with a characteristic inpedance of around 800Ω. Antenna experts found that this impedance can be lowered by using multiple conductors on the legs. These conductors are together at both ends of the antenna, but separate as they go toward the sides, where they will be a meter or so apart. The capacitance will vary in a manner which maintains a constant impedance. At the sides, the center wire will appear to be outside the upper and lower wires, because each wire is of identical length. Most commercial users have a 600Ω antenna.

A properly built rhombic system contains the terminating resistor at the opposite end from the feed point. This resistor gives the system the characteristic front-to-back ratio, the big selling point of the rhombic. The resistor should be matched to the characteristic impedance of the antenna and should be capable of dissipating half the power





applied by the transmission line (which, naturally, should also match the antenna impedance). At amateur power levels there is no great problem in building a resistance network to take the heat, but commercial users use "dissipation lines" rather than fixed resistors.

The average radiation efficiency of a terminated rhombic is around 67%. This compares with the radiation efficiency of a dipole at substantially 100% – but remember the power dissipated in the termination resistance.

It would be possible to use reams of polar coordinate paper calculating radiation patterns for rhombic antennas at various tilt angles, leg lengths, heights, etc. Probably a computer could be programmed to spew forth thousands of these in a few minutes. For the purposes of this discussion, we will look at ten patterns obtained from the same antenna. The patterns start at a leg length of 1λ and go to 4λ; the height starts at 0.3λ and goes to 1.2λ. This is the same antenna operating at several frequencies with the radiation patterns given for 10λ and 20λ radiation angles.

Note: the diagrams contain ticks on the major axis for 0dB gain in relation to isotropic and for 0dB gain for dipole, identified as 0dB and DI respectively.

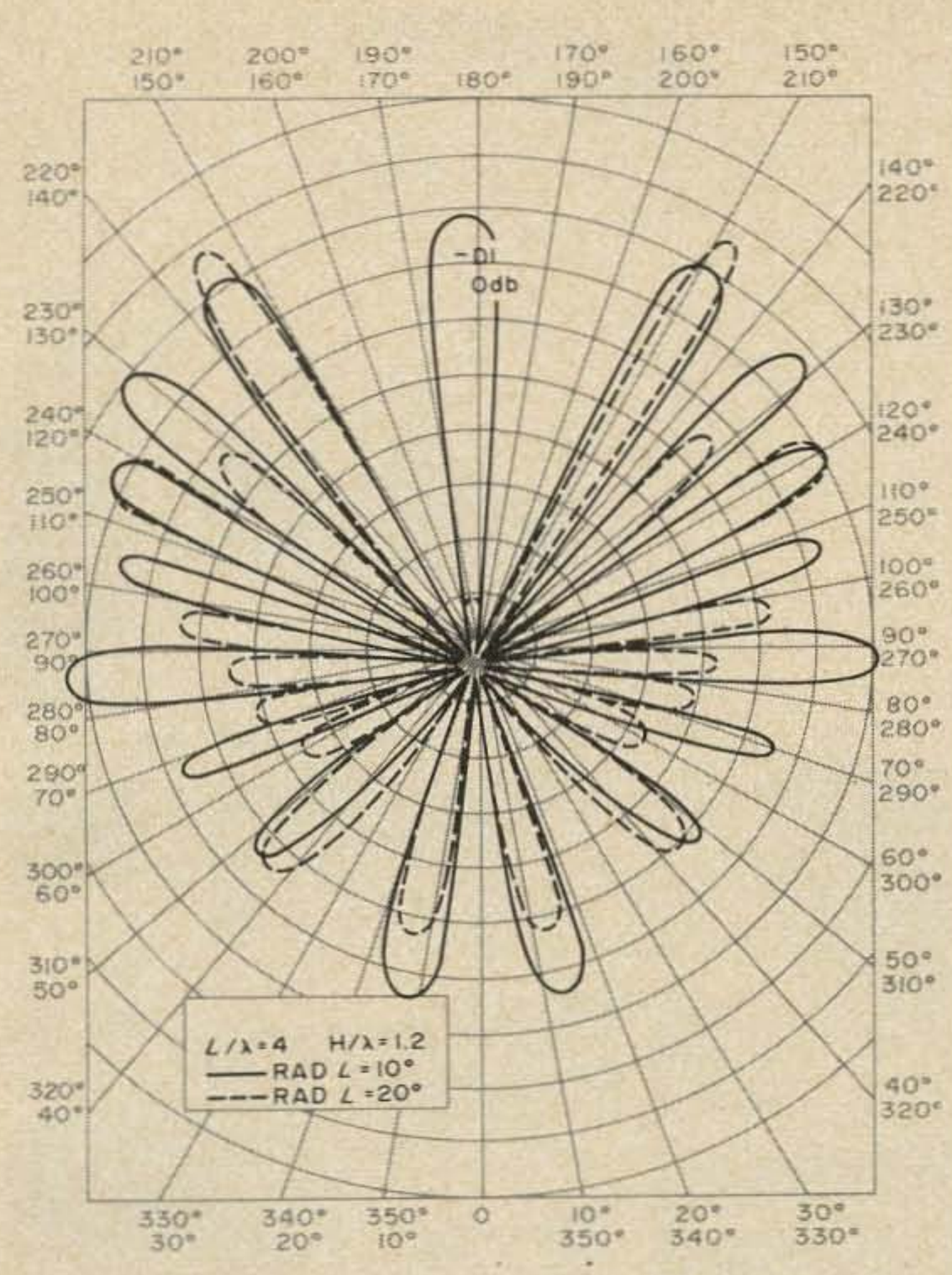
Disadvantages

1. Radiation pattern shows considerable change over frequency range.
2. Very poor front/side ratio.
3. Power lost in terminating resistor.
4. Antenna cannot be rotated for typical amateur use.
5. So what if you want to make a contact within 400 miles?
6. System requires enormous quantity of real estate.
7. Four supports are essential.

Advantages

1. Impedance varies little over considerable frequency range.
2. Very high front/back ratio.
3. Power concentrated in desired direction.
4. Ideal antenna for point-to-point communications.
5. Antenna excellent for low-angle, long-distance communication.

Rhombic users have developed several variations of the system. For additional gain, it is possible to stack two rhombics. For use on more than 2:1 frequency range, it is possible to build a rhombic inside another rhombic, saving one support (the "nested"



rhombic); to suppress undesirable side radiation; two rhombics can be interlaced, adding gain to the main lobe and cancelling the side lobes. The radiation angle can be changed by tilting the plane of the wires away from the plane of the ground. See Fig. 2.

After considering the problem of where to point it and the various other problems, I decided not to build a rhombic, since I wanted a more flexible system. I ended up with a phased array, even though suitable for only one band, the side supression will be better and I really don't need the extreme front-to-back ratio.

The next time you think about an ideal antenna, remember the rhombic may have excellent forward gain, but it also has considerable side radiation (and reception) and is inflexible, which quality alone would make it questionable for most amateurs.

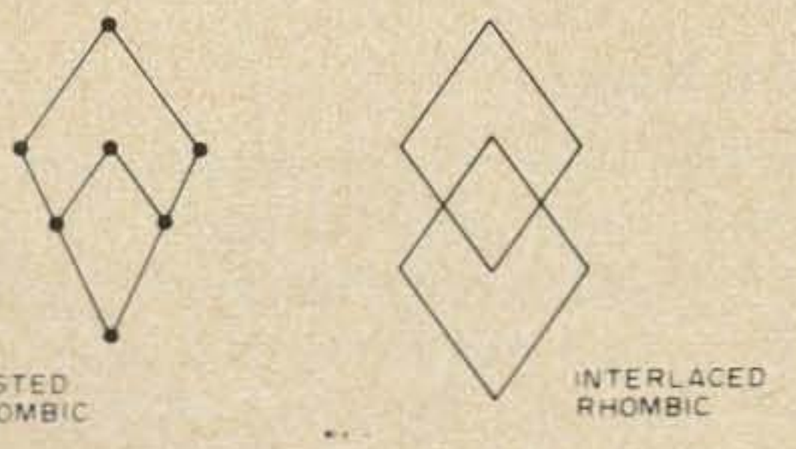


Fig. 2

. . . WA6CPP

Computerized DX CHASING Made Easy

Chaz Cone W4GKF
535 Windsor Parkway N.E.
Atlanta GA 30342

OK. I've seen articles in ham magazines about computers, but how can computers help hams enjoy their hobby more?

This article describes how the Southeastern DX Club (SEDXC) uses an IBM System/3 computer to help its members work more (and rarer) DX. Before you go on to the next article, you should know that these programs are available to any ham organization, and that the computer time to run them can usually be obtained for *nothing* (or next-to-nothing) anywhere in the country.

The Southeastern DX Club, which has about 50 members mostly from the Atlanta area, has been in existence for more than 20 years and, as you might expect, many of the Old Timers already have 300+ countries confirmed. Late last year the club decided to try to attract new members who were just beginning to work DX; these programs were designed to help *all* club members work countries they needed – whether they needed two countries or two hundred.

With 50+ members obviously a great deal of listening is done on all DX bands. If there were some way to let the membership know about a DX country that *he* needs, those 100 pairs of ears (more or less) could really give the club member an edge on finding those elusive prefxies.

How It Works

Briefly then, this is the way that goal was reached. First, each member was asked to turn in a list of countries needed; in the case of those who had confirmed only a few, he could turn in the ones he had and the computer would indicate that he needed the rest. From this information up to five

DATE--- 6/22/73 SOUTHEASTERN DX CLUB 'COUNTRIES WANTED' LISTING ---PAGE 1

PREFIX	COUNTRY	BEAM	ALL MEMBERS NEEDING THIS COUNTRY -- CONSULT N/A ROSTER
A2,ZS9	BOTSWANA	103	W4UYC WA4VWV WB4UPC W4JII W4MIA K4PGM K4JAG W4OJI WA4QQO W4REI WB4NFF W4DJD WA4DWN K4EXE WB4IIJ
AC3	SIKKIM	007	W4UYC WB4WMG WA4VWV WB4SEQ WB4RUA WB4UPC K4KOZ K4TBN WA4NIB WB4NVH K4RCS W4JII K4PGM W4MIA W4OJI W4KNW K4JAG WA4QQO W4REI K4QEI WB4NFF K4BAI W4BOJ K4OJC W4OJD WA4DWN W4DXI K4EEK W4EJN K4EXE W4GIW W4GKF W4GTS WB4IIJ
AC4	TIBET	004	W4UYC WB4SEQ WA4VWV WB4WMG K4TBN WB4RUA WB4UPC K4KOZ W4YWX WB4NVH WA4NIB WB4NFF K4RCS W4JII W4KNW K4PGM W4MIA W4OJI WA4QQO W4REI K4QEI K4JAG K4BAI W4BFR W4BOJ K4OJC W4OJD WA4DWN W4DXI K4EEK W4EJN K4EXC K4EZ W4GIW W4GKF W4GTS K4GXO WB4IIJ
AC	BHUTAN	006	W4UYC WB4SEQ WA4VWV WB4UPC K4TBN WB4WMG WB4RUA K4KOZ K4JAG WB4NVH WA4NIB WB4NFF K4RCS W4JII K4PGM W4MIA W4KNW W4OJI W4REI WA4QQO K4QEI K4BAI W4BOJ K4OJC W4OJD WA4DWN K4EEK K4EXE W4GIW W4GKF W4GTS K4GXO WB4IIJ
AP	EAST PAKISTAN	006	WB4RUA WB4WMG W4UYC WB4UPC WB4SEQ WA4VWV K4TBN K4KOZ K4QEI WA4NIB WB4NVH K4JAG WB4NFF K4PGM W4JII W4MIA W4OJI W4REI WA4QQO K4BAI W4BFR W4BOJ W4OJD WA4DWN W4EJN K4EXE W4GIW W4GKF K4GXO WB4IIJ
AP	WEST PAKISTAN	029	K4KOZ WB4WMG W4UYC WB4SEQ WB4RUA WB4UPC K4TBN WA4VWV W4REI W4MIA WB4NVH WA4NIB K4JAG W4JII K4PGM WB4NFF W4OJI WA4QQO W4BOJ W4OJD WA4DWN K4EXE W4GIW W4GKF WB4IIJ
BV	FORMOSA	334	K4KOZ WB4WMG WB4UPC W4UYC K4TBN WB4RUA WB4SEQ WA4VWV W4REI WA4QQO W4MIA WB4NVH WA4NIB K4PGM W4OJI W4KNW K4JAG WB4NFF W4BOJ W4OJD WA4DWN K4EEK K4EXC W4GIW W4GKF W4GTS WB4IIJ
BY	CHINA	344	WA4VWV WB4SEQ K4KOZ WB4UPC WB4WMG W4UYC K4TBN WB4RUA W4OJI K4JAG W4KNW WA4QQO WB4NFF W4REI K4QEI W4JII K4RCS WA4NIB WB4NVH K4PGM K4BAI W4BFR W4BOJ K4OJC W4OJD WA4DWN K4EEK W4EJN K4EXE W4GIW W4GKF W4GTS K4GXO WB4IIJ
C2,VK9	NAURU IS.	281	WB4RUA WA4VWV WB4WMG WB4SEQ WB4UPC W4UYC WA4QQO W4REI WB4NFF K4JAG WA4NIB W4OJI WB4NVH W4BOJ WA4DWN K4EXE WB4IIJ
C3,PX	ANDORRA	055	W4UYC WB4RUA WA4VWV WB4SEQ WB4UPC WB4WMG WA4QQO W4REI WB4NFF K4JAG W4OJI W4DJD WA4DWN K4EXE W4GKF WB4IIJ
CE	CHILE	168	W4UYC WB4UPC W4OJD K4EXE WB4IIJ
CE9AA-AM,KC4,VP8,ETC.	ANTARCTICA	180	W4UYC WB4UPC W4REI W4OJI W4OJD WA4DWN K4EXE
CEOA	EASTER IS.	204	W4UYC WB4SEQ WB4WMG WB4UPC W4REI WB4NFF K4PGM W4OJI K4JAG W4OJD WA4DWN K4EXE WB4IIJ
CEOZ	JUAN FERNANDEZ	176	WB4RUA WA4VWV W4UYC K4KOZ WB4SEQ WB4WMG K4TBN WB4UPC K4JAG W4OJI WA4QQO W4MIA WA4NIB W4REI WB4NVH WB4NFF K4PGM W4BOJ K4OJC W4DJD

Fig. 1. SEDXC "Countries Wanted" listing.

96-column punched cards were prepared containing:

- Call sign
- Name, address
- Telephone number
- An indicator showing whether the member is interested in Phone, CW or both
- Time-of-day after which he does not wish to be telephoned about the appearance of a needed country
- A series of punches indicating which countries the member *does not* need

A number was arbitrarily assigned to each valid country on the ARRL Country List and a card column assigned to each one. VP1 (British Honduras) was assigned number 419. If the member did not need VP1, then a punch was placed in column 19 of card number 419 and so on. That's all the data preparation the club member needs to do.

These punched cards are processed by the programmer which creates a magnetic disk record for each country needed by each member. This file of records is then electronically sorted by the computer and a listing is produced showing: prefix, country name, beam heading (from Atlanta, of course), and the call sign of *all* members needing that country.

The same data file is again electronically resequenced and a list is produced showing each member and *all* the countries *he* needs. This listing serves as a checklist against the keypunching from his original list, as well as a document on which he can mark off new countries as he works them. The three-digit IBM number makes things easier for the keypunch operator. For example:

AC3 Sikkim 007 210

means that Sikkim is assigned card column 10 in card number 2 (007 is the beam heading from Atlanta – neat, huh?).

These same cards are used to print the membership roster and mailing labels for the monthly bulletin. The roster and the "Countries Wanted" lists are distributed to all club members.

How To Use It

Suppose W4MCM hears a station in

Botswana (A2C) on 20m at 14.210 MHz. Now, Bob doesn't need Botswana so he just tunes right on by, right? Before the computerized DX system, he might have; but now he looks at the "Countries Wanted" list and discovers that fourteen club members need the Country. He looks up K4JAG (for example) and finds that John has a General Class ticket (remember, the Botswana station was at 14.210 MHz) so he looks again and calls W4DJD on the land-line and Frank hops on the frequency like gangbusters.

It's terrific! Every club member is another pair of ears for every other club member. Whether he calls one guy, two, or more, the chain is started and suddenly the DX station is swamped by Southeastern DX club members.

Obviously, W4MCM is going to *make* a lot more telephone calls than he will receive (he only needs Iraq and Heard Island to have 'em all) but the "Old Timers" in the club tell me that this program has given them renewed interest in ham radio. It gives them something productive to do while they

DATE--- 6/22/73 SOUTHEASTERN DX CLUB 'WANT LIST' FOR K4BAI

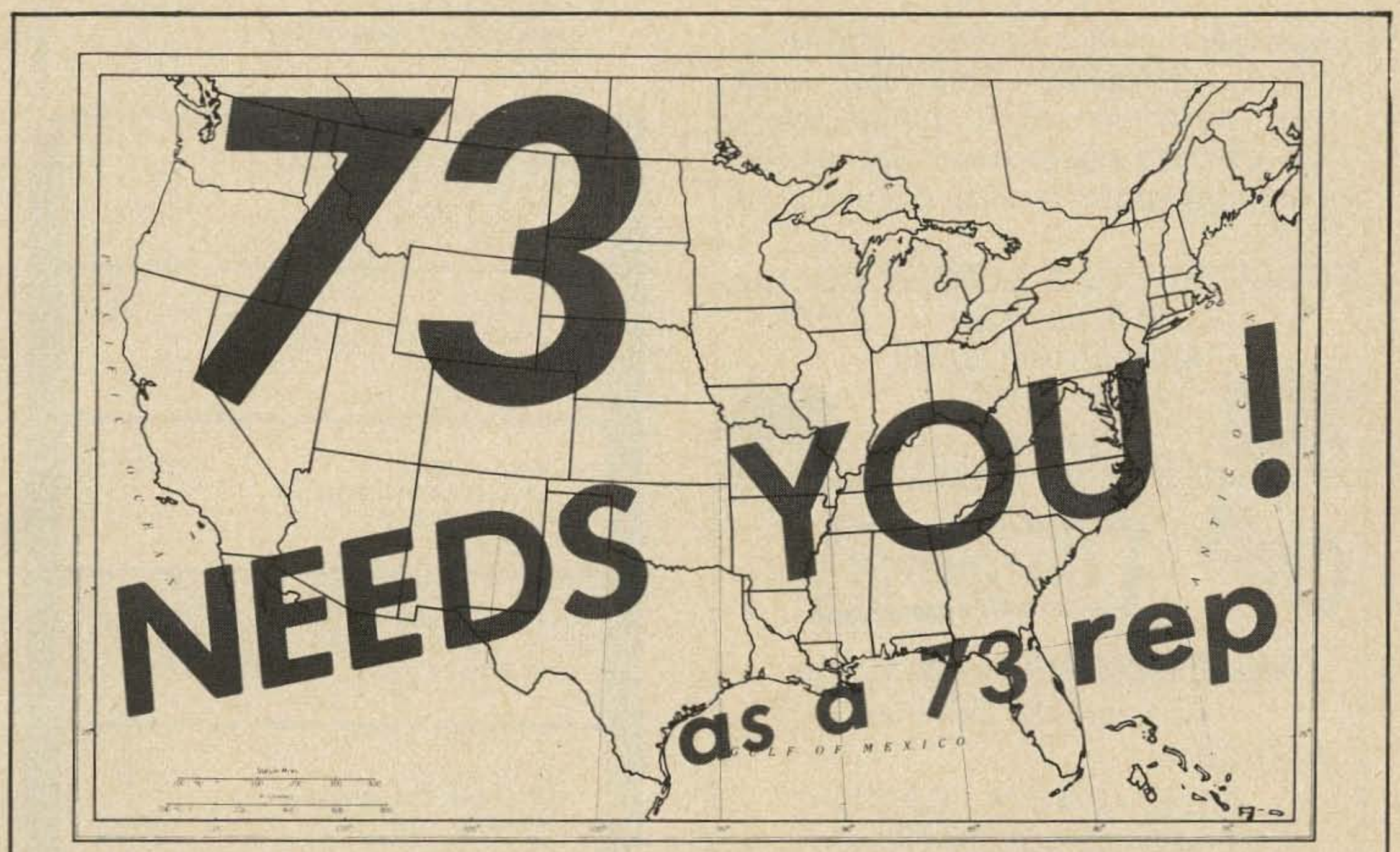
PREFIX	COUNTRY		IBM NO.
AC3	SIKKIM	007	210
AC4	TIBET	004	211
AC	BHUTAN	006	212
AP	EAST PAKISTAN	006	213
BY	CHINA	344	216
FB8Z	AMSTERDAM & ST PAUL ISL.	111	250
FB8W	CROZET ISL.	124	251
FH8,FB8	COMORO ISL.	079	255
FO8	CLIPPERTON ISL.	229	259
FR7	GLORIOSO ISL.	075	262
FR7	JUAN DE NOVA	084	263
FR7	TROMELIN	075	265
HK0	MALPELO ISL.	175	285
KG6R,S,T	MARIANA ISL.	307	321
PY0	ST. PETER & ST. PAUL'S ROCKS	124	361
PY0	TRINDADE & MARTIM VAZ ISL.	128	362
VK	LORD HOWE ISL.	253	416
VK9X	CHRISTMAS ISL.	336	418
VK9Y	COCOS ISLS.	356	419
VK0	HEARD ISL.	147	423
VP8,LU-Z	S. SANDWICH ISL.	153	440
VQ9	CHAGOS ISL.	043	448
VQ9	DESROCHES	045	449
VQ9	FARQUHAR	045	450
VS9K	KAMARAN ISL.	055	462
VU	LACCADIVE IS.	030	466
XT	VOLTAIC REP.	084	469
XU	CAMBODIA	347	470
XZ2	BURMA	000	472
YI	IRAQ	042	474
YJ,FUR	NEW HEBRIDES	264	475
YK	SYRIA	046	476
ZK1	MANIHIKI ISL.	254	493
ZL	CHATHAM ISL.	232	496
ZM7	TOKELAUS	261	511
ZS2	PRINCE EDW. & MARION ISL	125	514
1S	SPRATLY ISL.	352	517
3W8,XV5	VIETNAM	344	522
3Y,LA/G	BOUVET ISL.	040	524
4W	YEMEN	054	527
8F,PK,YB	INDONESIA	337	546
8Z4	SAUDI ARABIA/IRAQ NEUTRAL ZON	044	550
	ABU AIL, JABAL AT TAIR	062	564
	BLENHEIM REEF	---	565
	GEYSER REEF	079	566
VK9	MELLISH REEF	261	568
SY	MT. ATHOS	047	569

Fig. 2. SEDXC individual member "Want" listing.

6/22/73 --- SOUTHEASTERN DX CLUB MEMBERSHIP ROSTER --- PAGE 1

CALL	NAME AND ADDRESS	LICENSE CLASS	INTERESTED IN: PHONE	CW	MEMBERSHIP CATEGORY	TELEPHONE NUMBER	CALL AFTER 7:00 AM AND NO LATER THAN:	CALL	MEMBER?
K4BAI	JOHN T. LANEY, III	GENERAL	*	*	200-299	NEVER		K4BAI	X
W4BFR	BRUCE E. MONTGOMERY	EXTRA	*	*	300- UP	255-1348	22:00 LOCAL	W4BFR	X
W4BMG	JAMES H. MILLARD					233-0278		W4BMG	X
K4BOE	JOHN GREEN					435-4059		K4BUE	
W4BUJ	GORDON MORGAN	ADVANCED	*	*	100-199	355-9694	ANYTIME	W4BUJ	X
W4BYU	EDWARD H. MAU					872-0530	23:00 LOCAL	W4BYU	X
WA4DAA	BILL COX							WA4DAA	
K4DJC	E.W. SLEIGHT	EXTRA	*	*	200-299	766-4050	23:30 LOCAL	K4DJC	X
W4DJD	FRANK JORDAN	ADVANCED	*	*	000-099	458-9987	ANYTIME	W4DJD	X
W4DMB	DUB DAWKINS							W4DMB	X
WA4DWN	DON FLENNER	ADVANCED	*	*	000-099	926-2386	23:00 LOCAL	WA4DWN	X
W4DXI	CLAY GRIFFIN	EXTRA	*	*	200-299	753-0601	23:30 LOCAL	W4DXI	X
K4EEK	WHIT RUSSELL	ADVANCED	*	*	300- UP	366-7997	ANYTIME	K4EEK	X
W4EJN	JAMES W. FIELDS	ADVANCED	*	*	200-299	349-2063	23:00 LOCAL	W4EJN	X
K4EXE	JOHN OLSON	GENERAL	*	*	000-099	373-0553	20:00 LOCAL	K4EXE	X
K4EZ	BEN R. ADAMS	EXTRA	*	*	300- UP	636-1010	23:00 LOCAL	K4FZ	X
W4GIM	VAN FAIR	ADVANCED	*		200-299	939-7045	23:00 LOCAL	W4GIM	X
W4GKF	CHAZ CONE	ADVANCED	*		100-199	255-2660	23:00 LOCAL	W4GKF	X
W4GTS	PHILIP J. LATTA	ADVANCED	*	*	300- UP	233-4939	ANYTIME	W4GTS	X
WA4GWN	WAYNE CLINTON							WA4GWN	
K4GXO	TOM BRADLEY	EXTRA	*		300- UP	634-7228	ANYTIME	K4GXO	X
WB4IIJ	PETER D. BERRY	GENERAL	*		000-099	261-4761	23:00 LOCAL	WB4IIJ	X
K4JAG	JOHN HARDEN, JR.	GENERAL	*	*	100-199	351-1309	ANYTIME	K4JAG	X
W4JII	JOHN F. LARKIN	ADVANCED	*	*	200-299	761-3756	21:00 LOCAL	W4JII	X
W4KNW	JACK MC CLAIN	EXTRA	*	*	200-299	938-3787	22:00 LOCAL	W4KNW	X

Fig. 3. SEDXC membership roster.



How would you like to see all your trips to Hamfests start paying for themselves?
How would you like to earn enough money to buy that new gear you've had your eye on?
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Director of Marketing
73 Magazine
Peterborough, New Hampshire 03458

We're interested in all the following areas.

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Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota
Texas
Wisconsin

NORTHEAST
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Deleware
Maine
Maryland
Massachusetts
New Jersey
New York
Pennsylvania (Eastern)
Rhode Island
Vermont

SOUTHERN STATES
Alabama
Arkansas
Georgia
Louisiana
Mississippi
North Carolina
South Carolina
Tennessee
Virginia

PACIFIC STATES
Alaska
California
Hawaii
Nevada
Washington

ROCKY MOUNTAIN STATES
Idaho
Montana

ALL CANADIAN PROVINCES

GORDON MURGAN W4BOJ
2635 HYDE MANOR DRIVE
ATLANTA, GA 30327

EDWARD H. MAU W4BYU
1130 CUMBERLAND RD.
ATLANTA, GA 30306

BILL COX WA4DAA
550 FOREST HILLS DR NE
ATLANTA, GA 30342

E.W. SLEIGHT K4DJC
4165 WILLIAMSBURG DR
COLLEGE PK, GA 30337

FRANK JORDAN W4DJD
4070 EULA CIRCLE
DORAVILLE, GA 30340

DUB DAWKINS W4DMB
702 COLUMBIA DRIVE
MARIETTA, GA 30060

Fig. 4. SEDXC mailing labels.

listen for hours looking for the few countries they need; if they don't hear what *they're* hot after, at least they can help a fellow DX club member.

It really works. I made a mistake in my own record (the old computer adage: "Garbage In, Garbage Out") and showed on the "Countries Wanted" listing that I needed Japan. The first week after the list came out I received thirty phone calls about Japan being heard on 20m!

Quarterly each member submits a new list showing the countries worked since the last printing and new lists are produced. We reduced all the lists to 8½" x 11" for ease of use and 3-hole drilled them – you might want to do the same.

In the year that the system has been in operation, more than 300 countries have collectively been added to members' country totals. The competitive edge the club membership has over the DXer working alone has resulted in practically every serious DXer in the Atlanta area joining the SEDXC.

The system removes none of the challenge of getting in the pile-ups and hollering your lungs out; and every one of us has been called by friends to alert us to DX openings, computer or not. But with the SEDXC system, you only get calls when it's a country you *need* and when he's operating in a band segment where you are licensed to operate.

The package of programs is available from the SEDXC, Post Office Box 11555, Atlanta GA 30305 for $25 postpaid anywhere in the U.S. The programs (for you computer buffs out there) are written in IBM RPGII and require a minimum disk IBM System/3 Model 10. The entire operation should take about an hour to run once you've punched your cards.

Ask around – one or more of your members has access to the required computer configuration and most companies will happily provide the time.

Here's a way to efficiently work more DX with the aid of one of mankind's best tools. Good DX!

. . . **W4GKF**

Elliott S. Kanter W9KXJ
3242 W. Hollywood Avenue
Chicago IL 60659

HEATHKIT GR-78 General Coverage Receiver Test/Review

When I first read the ad for Heath's GR-78, I was immediately enthusiastic about both its specifications and its very reasonable price. After all, it has many features not usually found in receivers costing less than $200. I arranged to acquire one from Heath to give it the skeptic's "I'm from Missouri. . .show me!" test.

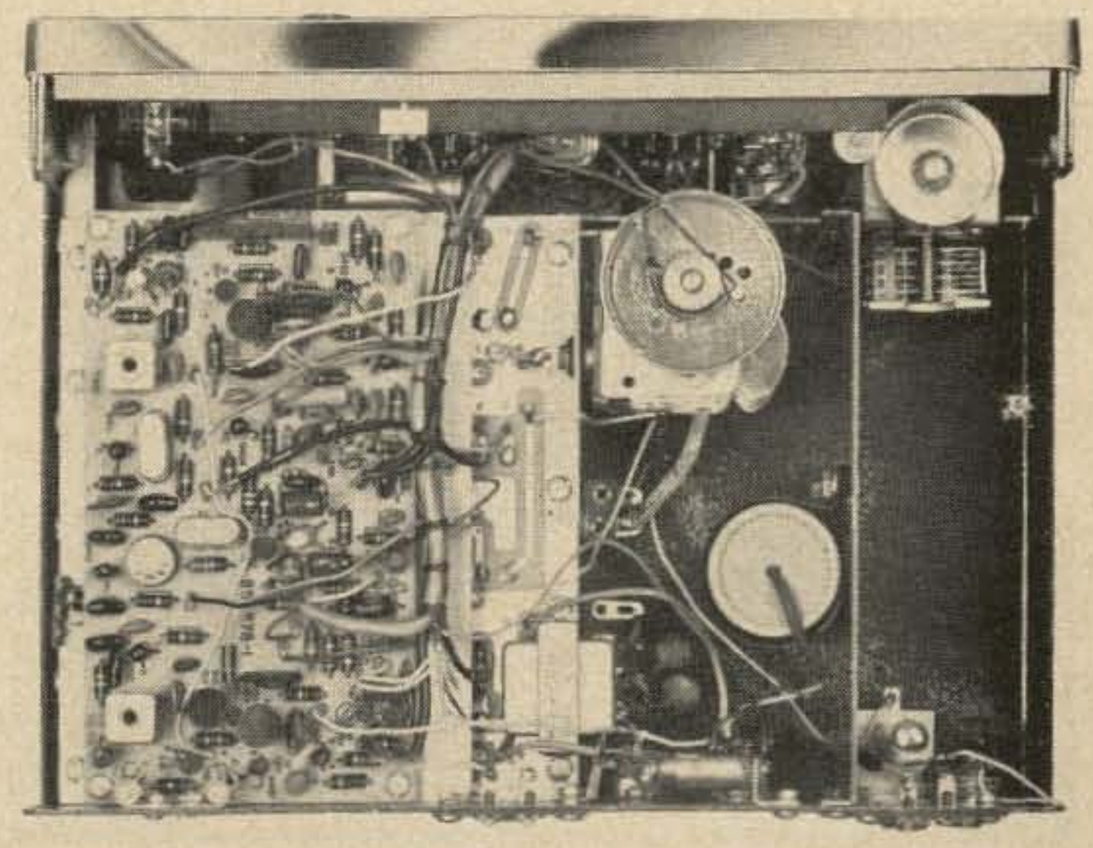
When my GR-78 arrived, the first thing I noticed was the way it had been packaged, Each component relating to a specific stage in construction was in a special box with a number keyed to a portion of the comprehensive instruction manual.

According to the specs, the GR-78 is a solid state portable (internal nicad battery) or home receiver operating on *either* 120/240V ac. Its coverage span is 200 kHz–30 MHz in six divisions. According to Heath, the receiver is designed primarily for amateur or shortwave listener use. A selection as to band spread coverage desired (ham or SWL) is made during construction and two calibrated band spread scales are included, one for ham use, the other for SWL'ers. The internal battery is "floated" across a unique charging circuit which insures that it will be fully charged providing the receiver is operated a few hours or so in the ac mode. This feature means that in case of power failure, you are still on the air as far as your receiver goes, and for field day, hurrah! no more generators, you just operate from the internal battery.

The receiver is designed to receive AM/CW/SSB transmissions with a front panel selector switch selecting the mode desired. A built-in whip antenna will suffice for many applications, but provisions are incorporated into the rear panel for an external antenna.

That a greal deal of thought went into the GR-78's development is evidenced by such features as a collapsible carrying handle, battery-saving switching for panel lamps, integral 500 kHz calibrator, ceramic i-f filters and an excellent noise limiter. Plug-in modulator circuit boards complete with single wafers of the main selector switch aid in simple, accurate assembly and cut the time required to wire this kit to around 35 hours, not counting calibration.

The all solid state circuitry includes 13 silicon transistors, five of which are FET's, two germanium transistors (audio stage), and a separate FET product detector to provide excellent CW and SSB reception. The audio circuit is novel (see schematic); its transformerless audio output circuitry combined with the all solid state receiver circuit



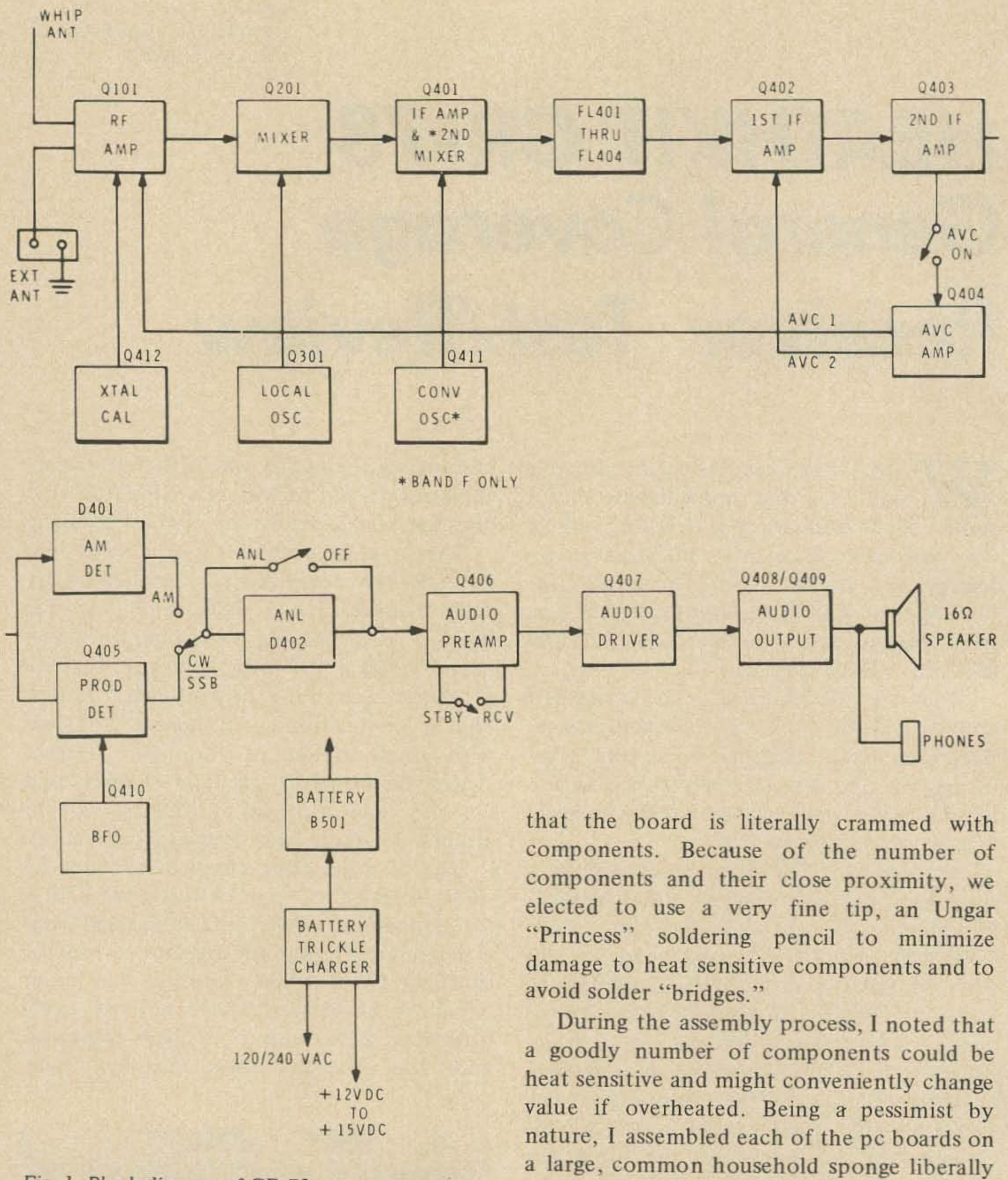


Fig. 1. Block diagram of GR-78.

provides excellent reproduction while conserving on power drain (most important when operating from the battery).

The majority of the components allied to the receiver including crystals, i-f filters, and the audio stage mount to the receiver circuit board. This board is wired first and contains a number of steps whereby the component density is increased gradually until you finish assembly, at which point you will note that the board is literally crammed with components. Because of the number of components and their close proximity, we elected to use a very fine tip, an Ungar "Princess" soldering pencil to minimize damage to heat sensitive components and to avoid solder "bridges."

During the assembly process, I noted that a goodly number of components could be heat sensitive and might conveniently change value if overheated. Being a pessimist by nature, I assembled each of the pc boards on a large, common household sponge liberally moistened with water. The board was placed on the sponge component side down and soldering operations carried out. The sponge acted as a giant heatsink and conducted possibly damaging heat away from the components. The purist who never uses heat sinks might be made a believer by the sound of hissing emitting from that sponge. This hint might save a few hours of trouble shooting later. Besides, the sponge makes an excellent work surface and holder for the pc board.

Referring to the block diagram (Fig. 1) and the schematic (Fig. 2), we note that rf signals received from either the whip antenna or an external antenna are coupled to the input tuned circuit for Band A. The circuit consists of antenna coil L1, trimmer capacitor C1 and the first section of capacitor C501A. The signal is then coupled to gate 1 of FET Q101 via a tap on L1. Bias voltage for Q101 is obtained from the AVC amplifier and applied to gate 2. Source resistor R103 and rf gain control R501 provide the proper drain current for normal operation.

The amplified signal from Q1-1 is fed to a tap on rf coil L101 which together with trimmer capacitor C101 and capacitor C501b form the input tuned circuit of the first mixer stage Q201.

The first mixer, Q201 is a dual gate FET featuring excellent freedom from cross-modulation, overloading and the pulling effect on an oscillator that a strong signal frequently has. The amplified signal from Q101 is applied to gate 1 of Q202 through capacitor C111. The local oscillator signal from Q301 is applied to gate 2 of Q201 biased by resistors R203-204. The dc operating point is established by source resistor R205.

The incoming signal and the oscillator signal are heterodyned in Q201 resulting in an i-f frequency and mixer product. On bands A through E the output of Q201 is fed to a tap on coil L201 resonating with capacitor C201 to provide a 4.034 MHz output signal.

The output from Q201 is coupled through capacitor C205 to gate 1 of FET Q401, which operates as an i-f amplifier on Bands A–E and as a mixer (2d mixer) providing double conversion on Band F. Operating bias for gate 2 is provided by resistors R-401-402. When the band switch is in the Band F position, a 3.579 MHz injection signal from conversion oscillator Q411 is applied to gate 2 of Q401.

This signal combines with the 4.034 MHz signal from the 1st Mixer Q201 and results in an output of 455 kHz plus the mixer product frequencies. This output signal is then coupled through capacitor C410 to ceramic passband filters FL401 through FL404. These filters serve to shape the bandpass and attenuate all frequencies except the i-f frequency of 455 kHz. This i-f signal is coupled to the base of the first i-f amplifier stage Q402.

Bias for Q402 is obtained from a voltage divider network comprised of resistors R415 and R418. Resistor R431 supplies an avc voltage from avc amplifier Q404 which will correspond in value to the changes in incoming signal strength.

I-f amplifier stage Q402 also contains the relative strength metering circuitry. The meter is connected between the emitter of Q402 and the meter's zero adjust control R408. The zero-adjust control is connected to a positive dc supply voltage and can be adjusted to give a zero indication on the meter. The meter also monitors avc action and provides a visual method of indicating the relative changes in avc voltage and therefore indicates relative signal strength.

The amplified signal from Q402 is coupled through capacitor C415 to the base of Q403 (i-f amplifier–2d stage). Bias for this stage is obtained via a voltage divider network made up of resistors R419 and R420. Transistor Q403 is also stabilized by emitter resistor R422 which is bypassed to ground by C416.

The receivers' local oscillator Q301 is a single-gate FET. The oscillator tuned circuit consists of coil L301, trimmer C301 and tuning capacitor C501C. Oscillator injection voltage is coupled through capacitor C308 to gate 2 of mixer Q201. This Hartley oscillator operates 455 kHz higher than the received signal on Bands A, B, C and D and the 455 kHz lower in frequency than signals on Band E and 4.034 MHz higher on Band F.

Detection is provided when a portion of the output signal from Q403 is applied to AM detector D401 for amplitude-modulated reception. The output signal is also applied through C429 to gate 1 of product detector Q405 for CW/SSB reception. Q405 is a dual gate FET with excellent isolation characteristics between gate 1 and 2 to eliminate BFO oscillator "pulling" or overloading on strong signals.

Injection voltage coming from BFO oscillator Q410 is applied to gate 2 of Q405 for CW/SSB reception. The i-f signal and the BFO signal are mixed, the resultant output is

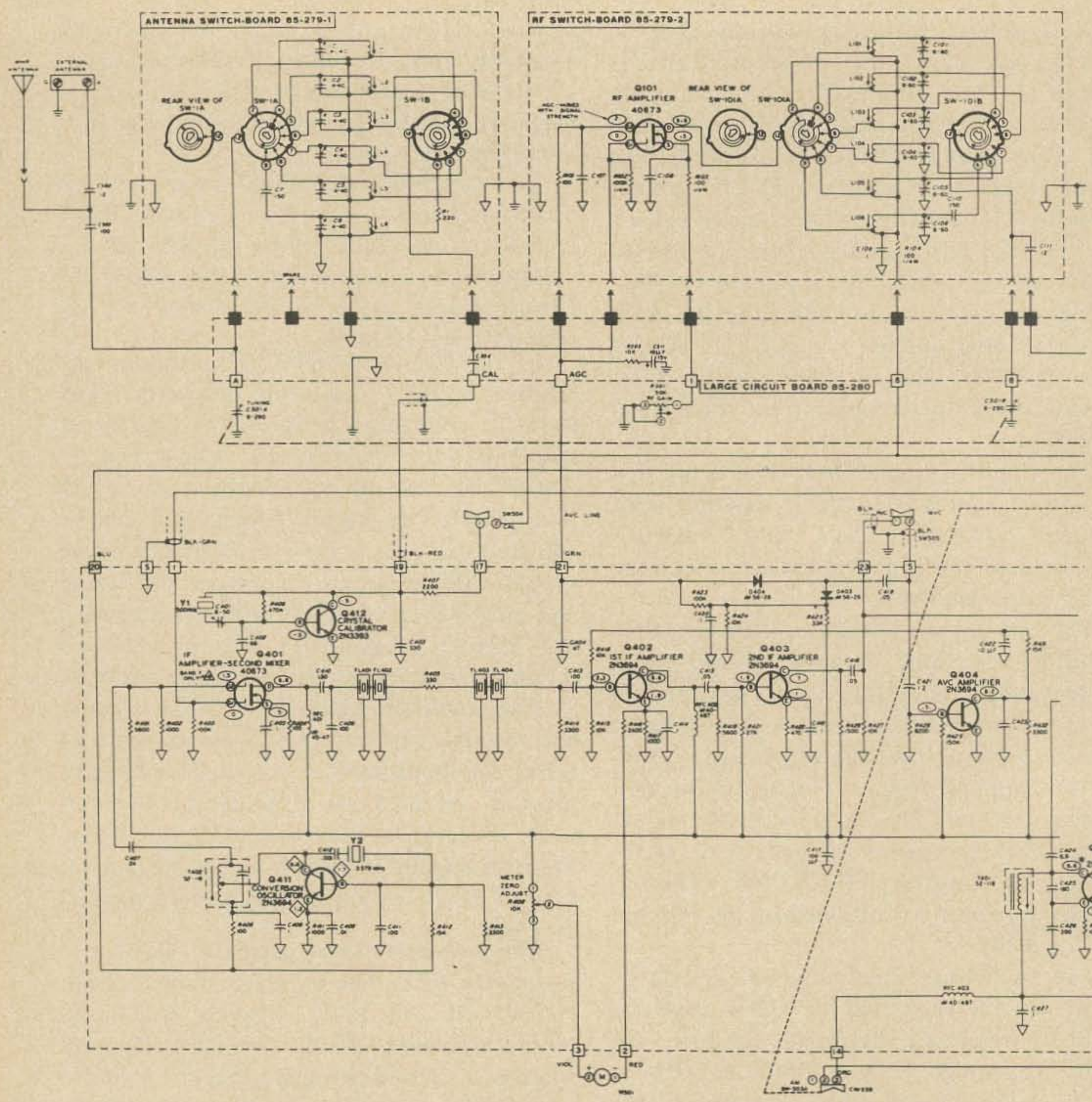


Fig. 2. Schematic, GR-78.

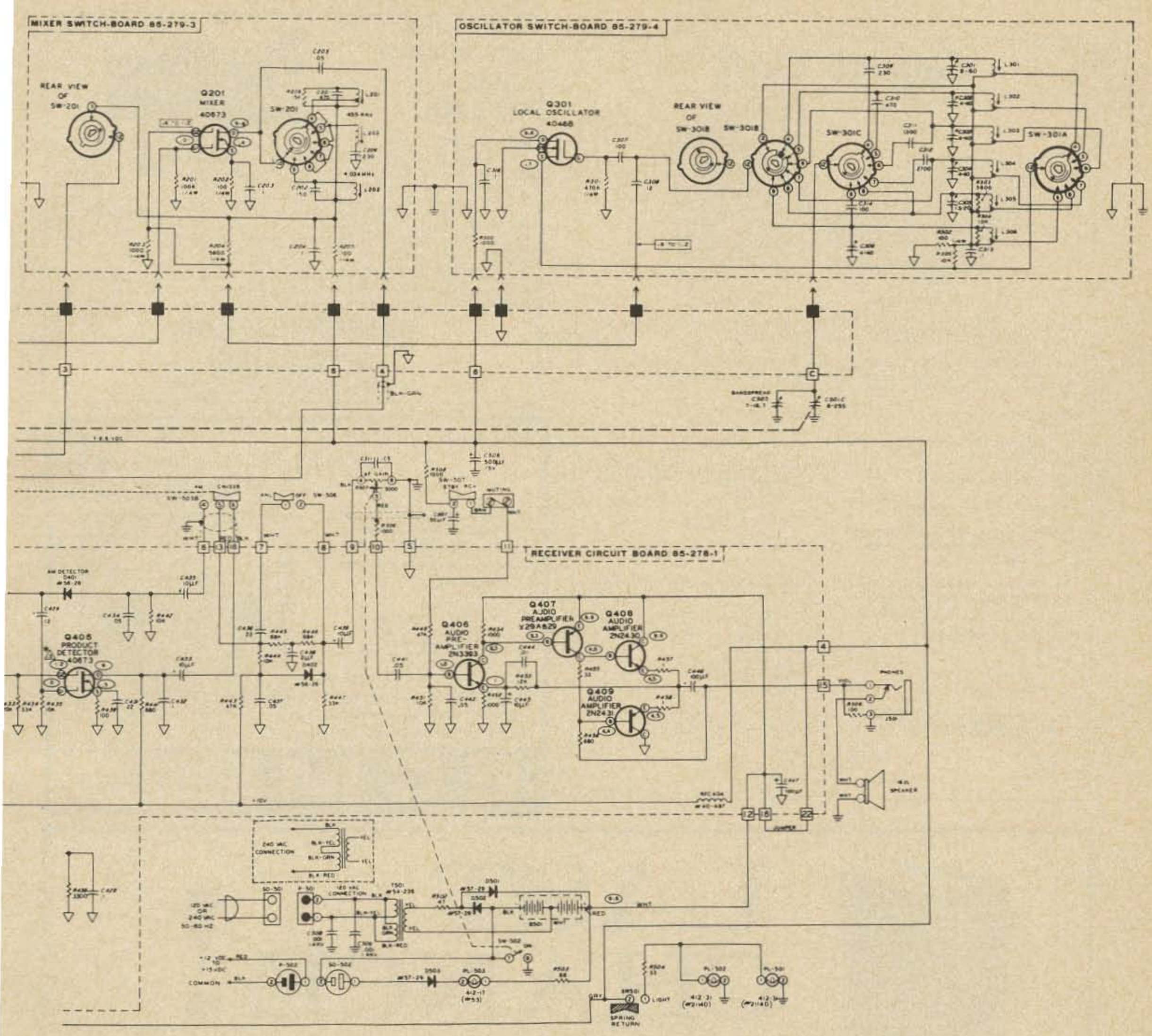
an audio signal developed across R441 and coupled through C433 to selector switch SW503B.

The BFO is a Colpitts oscillator made up of Q410, C425 and C426 to provide the proper feedback for oscillation and to form a tuned circuit with T401 to resonate at 455 kHz. Resistors R437-438 form a voltage divider and apply dc biasing to the base of Q410. Emitter resistor R436 provides temperature stabilization for the transistor. Injection voltage is coupled to gate 2 of Q405 through C424. The BFO is actuated by the AM/CW/SSB switch in the CW/SSB position which applied dc operating voltage through RFC403.

The audio signal coming from R505 is coupled through C441 to the base of audio-pre-amp Q406. The audio output is developed across the load resistor R454 and directly coupled to driver transistor Q407. The output of Q407 is directly coupled to a complementary pair of transistors Q408-409 with audio output coupled through C446 to either the 16Ω speaker or a headphone jack. A portion of the output is fed back to the emitter of Q406 to aid in stabilization of the stage and minimize distortion.

Miscellaneous Circuitry

Transistor Q412, crystal Y1 and associated circuitry form a 500 kHz calibration



oscillator which is switched on by the front panel calibration switch SW504. The oscillator provides very accurate calibration markings every 500 kHz for dial calibration and band edge marking.

The charging circuit requires that the battery be electrically divided in half for charging from ac. When the ac plug is inserted into a power outlet, the ac voltage from the secondary of T501 is applied through diode D501 on one-half cycles to charge one-half of the battery. The other half-cycle of the voltage is applied through D502 to charge the other half of the battery.

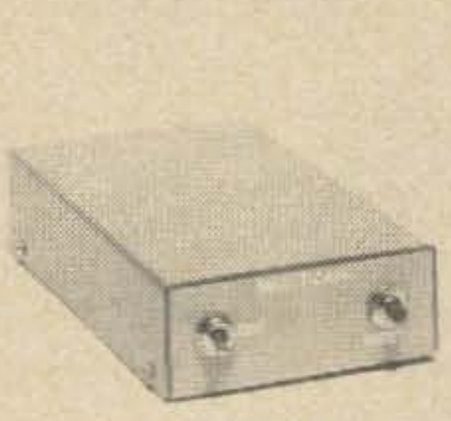
Comments

It would take many more pages to fully explore and expound upon the virtues and the features of the GR-78, and for that reason several portions of the circuitry were left undescribed. It should suffice to say that with simple adherence to the manual, calibration per the manual and operation with a fairly decent antenna, this receiver will surpass many if not all of the receivers available today in its price class and probably a few of the higher priced models.

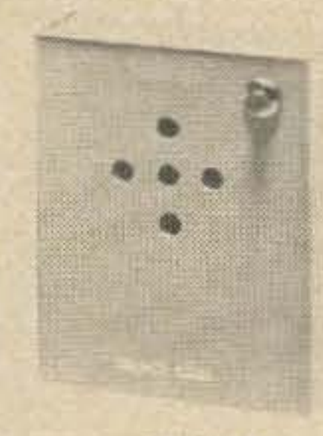
I would say that the receiver is not a kit to be wired by a novice, who has not yet wet his "teeth" so to speak on other kits, but, the GR-78 has returned countless hours of operating pleasure for those few enjoyable hours of construction. Like my musician buddies might say. . ."The GR-78, Man, it's a gas!"

. . . **W9KXJ**

Select Call



DECODER



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HOW DON GOT HIS MAGIC CARPET

Don Taylor WAØYAH is a quad. In ham lingo, a "quad" is one of two kinds of narrow-beam, high-gain antennas Don Taylor is not an antenna. "Quad," in this case, means all four limbs are paralyzed. He had an accident that severed the spinal cord.

Don Taylor is a Handi-Ham – a member of a group of handicapped people in Minnesota either working toward a "ticket" (ham license) or helping others work. His equipment has been loaned him by other Handi-Hams and the Minnesota Society for Crippled Children and Adults, Inc. (MiSCCA).

When Don wrote a Handi-Ham friend that he was interested in getting on the air, a receiver was placed with him. A month later, a tape recorder and the first tape of the code training course was sent him. He was given the ARRL Gateway series of texts as well. In a very few weeks he passed the Novice tests. When his call came, a transmitter was added to his station, and the tape recorder went to another student.

WAØYAH and his magic carpet.

Don's progress has been rapid. He was a regular traffic man before six weeks had passed, and passed his General tests within months.

The Handi-Ham System is active on 3.930 kHz, Saturday afternoons.

. . . KØGKI

LEE ADDRESS. . .

Continued from Page 2.

By a fortunate coincidence, the series of sunspot maxima during the period since 1900 has been in an increasing progression. As you examine the plots of the curves you can see an undulatory waveform which peaked during cycle No. 20 in 1956, with the highest sunspot number ever recorded of 205. Of course, you know we are now on the downhill side of cycle number 21 and the experts still aren't sure just when it will "bottom out." According to some predictions, we are in for a long "dry-spell" of sunspot activity. One prediction is that the next maximum above 100 will not take place until about the year 2015.

So most of our communication developments were occurring during this three quarters of a century. Had it not been for favorable ionospheric conditions, some of our knowledge might not now be available. Thanks to many of you here tonight we have a very sophisticated telecommunication system in the world today. In recent years it has been expanded by the construction of additional multi-channel, advanced submarine cables with several thousand voice-channel circuit capacities, augmented by a satellite communication system with which of course you are familiar through its use in bringing television programs to us from any place in the world.

All of this is a quantum leap from that first trans-Atlantic transmission back in 1901. Therefore today we have a new "ballgame" in telecommunication with emphasis being on the newer modes of transmission, utilizing techniques which only a few years ago had not been even envisaged. This is not to suggest that the older methods of communication are passe, because there will be continuing needs for use of the high frequencies by those countries not so fortunate to possess a satellite earth station or a cable terminal, as well as for back-up facilities.

You old timers can still "smell" the ozone from your old spark gaps. After spark you went after CW with the same zeal (when amateurs were denied the wave-lengths above 200 meters). All of you remember the thrill of getting your first vacuum tube to oscillate on about 200, 160 or 80 meters . . . watching the chemical rectifiers spark as you keyed your "now-silent" transmitter, and sat fascinated by your Poller-Smith hot wire ammeter which was supposed to measure your "radiation."

Amateur radio is a consuming avocation in ones' youth; often an indispensable foundation for a professional career in electronics, and a source of tremendous pleasure and interest later in life. As time marches on, we find a critical eye turned on almost every service which uses the spectrum, searching into whether they use the allocation in their best interests as well as the public's. Amateurs are not immune to these pressures which come from various sources and directions. You know how much interference there is in your HF bands today, with the ever-increasing "sharing" with other services.

In some bands it has gone beyond the bounds of "sharing," because the permitted high-power and high-gain antennas of the high frequency broadcast service, for example, results in an output from a single transmitter of several megawatts of radiated power. Amateurs with a one kilowatt limit (in the United States) cannot compete with such signals. So you have to dodge around and in between their signals, which are spaced every 5 kHz, or give up in disgust. In the VHF, you know that a proposal has been made to initiate a new Class E Citizens Radio Service in one of your bands from 220-225 MHz. In other VHF and UHF amateur bands, requests are constantly received for temporary sharing of the frequencies for specialized, and often highly classified, purposes.

The Commission is seriously studying a "no-code" amateur license . . . . .

So in the tempo of the times, it would be well to realize that Amateur Radio is subject to scrutiny. You all know about the squeaking wheel that gets the grease. The louder the squeak, the more the grease. The loudness of the squeak depends a lot on how many wheels are squeaking! You may not be aware of it, but the Amateur population in the United States is decreasing at the present time by about 350 licensees per month. This is happening while all other services are increasing. The Citizens Radio Service is approaching the 1 million rank. I think this is a serious matter for Amateur Radio, because it tells me something is wrong.

I can't believe that the allure of "ham radio" has disappeared, nor that our youth are so blase in the space age that they no longer get a thrill out of having their own private laboratory with which to field test their equipment on the air. So while most other services are increasing their numbers several fold, the median age of the typical Amateur is now over 40 years. While I am not in a position to suggest a total cure for this situation, it does seem to me that there are some potential remedies which might increase the "squeak factor" of the Amateur Radio Service.

The Amateur and Citizens Division of the Commission is seriously studying a re-structuring of the Amateur Service which, among various things, would make provision for a "no-code" amateur license authorizing operation above 144 MHz. In addition, it would amend the license structure so as to enable licensees in the VHF/UHF region, after further qualifying, to eventually merge and amalgamate their interest and operations with those whose interest are primarily in the HF portion of the spectrum. You are aware, of course, of the tremendous interest being shown in VHF activity, especially on 144 MHz. This is commendable, but not sufficient in view of the other VHF and UHF bands which have been allocated for amateur operation for many years and which are relatively unused.

If I had to ascribe a "merit

factor" to domestic use of the spectrum in light of the demand for communication facilities, I would have to say that the very high and ultra high frequencies are greatest in demand . . . so much so that the Commission has authorized sharing UHF television channels 14 through 20 with land mobile stations, in 13 metropolitan markets throughout the country.

The Commission has been engaged for the past few years in rulemaking involving allocation of 900 MHz frequencies to both common carrier and private industry for provision of new communication circuits, because the lower portions of the spectrum are so congested. These are only two examples of the importance of spectrum space for our domestic requirements. There is a philosophy among allocators that says, " . . . if you don't use it, you lose it." I'm not predicting the loss of Amateur Radio operations in this portion of the spectrum, but I would urge you to engage in long range planning to ensure that the "use it or lose it" philosophy doesn't grab you while you're not looking.

Amateur Radio has a tremendous value to mankind, not only in this country where we permit and encourage amateurs to participate in emergency communication, but in relation to the other aspects of the "Basis and Purpose" of Amateur Radio. One of the paragraphs in that Section of the Amateur's Rules and Regulations refers to the

"Expansion of the existing reservoir within the Amateur Radio Service of trained operators, technicians, and electronic experts."

No one likes to think of our country ever being in a holocaust which would certainly result from a nuclear war.

In March 1943 Goring stated, "We smashed up the amateur radio ham clubs and wiped them out . . . and now we need them."

You might be interested, in hindsight, in one of the reasons that the western nations won World War II. Not long ago I was reading a book entitled "The Rise and Fall of the Luftwaffe" by David Irving, which is an account of the life of Field Marshal Erhard Milch. In one portion of the book there was a discussion among several high ranking German officers about the ineffectiveness of their "Wurtzburg" radar, operating at about a half-meter wavelength. At that time the British and Americans had begun air-drops of aluminum foil "window" cut to a half-wavelength of the German radar frequency. They were very effectively jamming the German radar. Both Hermann Goring and Milch accepted that the German electronics industry had fallen far behind that of the Allies. A basic reason for this was that Britain, and particularly America, had actively encouraged Amateur Radio; while in Germany, Amateurs had been systematically persecuted by the Reich authorities. In March 1943 during a conference on the German electronic industry, Goring stated:

"The main blame belongs to Ohnesorge (Minister of Posts) — he never wanted to relax his grip on anything. We smashed up the amateur radio "ham" clubs and wiped them out, and we made no effort to help these thousands of small inventors. And now we need them."

Thank God we have always encouraged Amateur Radio in America, and the work of many amateurs such as John Reinhartz, Bill Eitel and Jack McCullough, and countless others is tribute to the wisdom of that principle.

What about the future of Amateur Radio? You know that there is scheduled a General World Administrative Radio Conference of the ITU in 1979, at which the entire radio spectrum will be studied, evaluated and considered for reallocation among the various users. In this country we have already begun our investigation of the required spectrum for all our services. This will continue for the next several years, until we decide what the United States' position will be at the Conference. No one can say yet what the U.S. position will be for the Amateur Service. I know the preliminary proposals to the Committee working on the problem are:

- the return of the 160 meter band to amateurs;
- eliminate sharing in the 80 meter band;
- expand 40 meters and eliminate sharing with HF broadcasting;
- establish a new amateur band at 10.1-10.6 MHz;
- expand 20 meters and eliminate sharing with the Fixed Service;
- establish a new amateur band at 18.1 MHz;
- expand the 15 meter band by 100 kHz;
- establish a new amateur band from 24-24.5 MHz, and
- make no changes in the existing ten meter band.

"I have reservations whether the United States should continue to support so strongly the ITU as it is now constituted."

With bands so located, Amateurs would have frequencies about every 3 MHz throughout the spectrum, and their communication efficiency would improve dramatically. Only time will tell whether it is possible for these requests to be incorporated in the United States' position to the 1979 conference. This is your first hurdle. Without the backing of the United States, Amateurs of the world are at a distinct disadvantage at such a conference. In my experience in I.T.U. conferences, I have learned that there is no substitute for advance preparation. There is no magic that can take the place of planning and liaison with other countries. This is especially true today with the voting structure of the I.T.U. As long as we determine allocations on a voting basis, which I question, there is just no other way to further your proposals.

I have reservations whether the United States should continue to support so strongly the I.T.U.

Continued on Page 129.

Voxpoop

While we are to some extent a prisoner of the authors of the articles – if they don't write them we can't print them – still we do like to know your reaction to what we do publish so we can keep trying to bring you what you enjoy the most. In the interests of science then, please let us know which articles you enjoyed the most and which you disliked most. The author of the article with the most votes will get a check for $50 extra to encourage him to get busy and write more.

WOW!

UGH!!

VOXPOOP, 73, Peterborough NH 03458

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Several months ago Dick Smith W1FTX made a suggestion that on the OSCAR 7 two-to-ten meter translator we attempt to set up a certain portion of the passband for CW and another portion for phone and other types of emission. In this way some of the QRM caused by the general incompatibility of different modes, which has been very prevalent on AMSAT-OSCAR 6, would be alleviated.

As everyone probably knows by now, in OSCAR 7 the downlink for the two-to-ten meter translator is 29.40 to 29.50 MHz, with the beacon at the high end on 29.50MHz. The corresponding uplink is 145.85 to 145.95 MHz. What is proposed is to encourage CW stations to use the sub-band 29.445 to 29.495 MHz (5kHz is reserved for a guardband for the beacon) except when wishing to contact a specific phone station operating below 29.445. Phone stations and all other modes, such as SSTV and RTTY, are asked to stay below 29.455 MHz. Thus, the 10 kHz band 29.445 to 29.455 MHz will be sort of an "everyman's land." The reason that the high end, rather than the low end, was selected for CW as is usually the case on the HF bands, is that the beacon is on the high end in OSCAR 7 and it is felt that CW stations will pose less of a QRM threat to the beacon. Also, many people on CW on OSCAR 6 are crystal controlled, whereas almost everyone on phone (SSB) is VFO. Using the high part of the OSCAR 7 passband for CW will mean that many crystals useful for OSCAR 6, can also be employed when working through OSCAR 7.

We think that this plan is worth trying and hope that all OSCAR 7 users will get behind it and make it work. Those not adhering to it should be GENTLY reminded.

Spacecraft Description

AMSTAT-OSCAR 7 is a small communications satellite designed to operate with small stations in the amateur service on a non-commercial basis. The spacecraft contains two basic experimental repeater packages, redundant command systems, two experimental telemetry systems, and a store-and-forward message storage unit. The spacecraft is solar powered, weighs 65 pounds, and has a three-year anticipated lifetime. It contains beacons on 29.50, 145.98, 435.10 and 2304.1 MHz.

Communications Repeaters

Two types of communications repeaters are aboard the spacecraft, only one of which operates at a time. The first repeater is a higher power, two-watt version of the one-watt two-to-ten meter linear repeater that flew on the OSCAR 6 mission. This unit receives uplink signals between 145.85 and 145.95 MHz, and retransmits them between 29.4 and 29.5 MHz on the downlink. A 200 milliwatt telemetry beacon provides telemetry data on 29.502 MHz. Approximately — 100 dBm is required at the repeater input terminals for an output of 1 watt. This corresponds to an eirp from the ground of 80 watts for a distance to the satellite of 2,000 miles and a polarization mismatch of 3 dB.

The second repeater, constructed by AMSAT Deutschland e.V., AMSAT's affiliate in Marbach, West Germany, is a 40-kHz bandwidth linear repeater. It employs an 8-watt PEP power amplifier using the envelope elimination and restoration technique to maintain linear operation over a wide dynamic range with high efficiency. This repeater has an uplink from 432.125 to 432.175 MHz, and a downlink from 145.925 to 145.975 MHz. Since the uplink band is shared with the radio location service, an experimental pulse suppression circuit is incorporated in the repeater to reduce the effects of wideband pulsed radar interference in the uplink. Developmental versions of this repeater have flown in high-altitude balloon experiments in Germany, and aircraft flight tests of the repeater prototype unit. A 200 milliwatt telemetry beacon on 145.975 provides telemetry data. Approximately 80 W. eirp is required to produce 3 watts of repeater output at a range of 2,000 miles assuming a polarization mismatch of 3 dB.

The two repeaters are operated alternately by means of a timer arrangement, but repeater selection and output power control can also be accomplished by ground command. Each of the repeaters includes a keyed telemetry beacon at the upper edge of the downlink passband to provide housekeeping data and to provide a frequency and amplitude reference marker to assist the amateur in antenna pointing, Doppler frequency compensation, and setting uplink power level. The cross-band (146-to-29.5 and 432-to-146 MHz) design of the two repeaters will permit the amateur to monitor his own downlink signal easily, and consequently, he can adjust his power and frequency to continually compensate for changing path loss, repeater loading and Doppler shift. It is anticipated that such a method of self-monitoring and control can eventually be made automatic through closed-loop frequency and power control circuitry that can be developed for the ground terminal equipment. Both repeaters are designed for use by as many as one to two dozen single-sideband amateur stations, all transmitting simultaneously, where downlink self-monitoring will minimize interference between users and will also permit duplex operation as well as self-control of power balance.

Oscar 6 Orbiting Information for December

Orbit	Date (Dec)	Time (GMT)	Longitude of Eq. Crossing °W
9722	1	0126.7	70.1
9734	2	0026.7	55.1

9747	3	0121.6	68.8
9759	4	0021.5	53.8
9772	5	0116.5	67.5
9784	6	0016.4	52.5
9797	7	0111.3	66.2
9809	8	0011.2	51.2
9822	9	0106.2	64.9
9834	10	0006.1	49.9
9847	11	0101.0	63.7
9859	12	0001.0	48.6
9872	13	0055.9	62.4
9885	14	0150.8	76.1
9897	15	0050.8	61.1
9910	16	0145.7	74.8
9922	17	0045.6	59.8
9935	18	0140.6	73.5
9947	19	0040.5	58.5
9960	20	0135.4	72.3
9972	21	0035.4	57.3
9985	22	0130.3	71.0
9997	23	0030.2	56.0
10010	24	0125.2	69.7
10022	25	0025.1	54.7
10035	26	0120.0	68.4
10047	27	0020.0	53.4
10060	28	0114.9	67.1
10072	29	0014,8	52.1
10085	30	0109.7	65.9
10097	31	0009.7	50.8

LETTERS

Continued from Page 13

the "Shades of 1931" that horrified ex-K3IEW. You know, Wayne, just because a technique has been known or available for many years is not an infallible indication of the utter worthlessness of the technique!

So it proved in this instance. The Hartley oscillator (built in 1929. . .not 1931) plus a simple lamp indicator performed what "state of the art" devices had failed to do: Indicate resonance on an antenna with high induced resistance.

As for the amazing techniques outlined as prime information by ex-K1IEW, are they in any manner different than those employed in common use by those who are aware of their sharp limitations? Not to mention by a much larger number of persons who are not aware of such limitations. It's the later group that comes up with some of the wild and totally baseless ideas about the performance of antennas and transmission lines.

In his bombastic effort to establish his omniscience, ex-K3IEW completely overlooked (or ignored) the one simple, basic principle: Keep it simple. An amateur who doesn't have access to a stack of laboratory equipment (or, in my case, even one who does) can make effective use of equipment on hand (or that can be built from any hellbox) to perform evaluative measurements.

Thank you, Wayne, for listening to my explanations.

Carl C. Drumeller W5JJ

IRS AND FCC

Just wanted to add a bit of encouragement in your efforts with the FCC and the IRS. I feel that these two bodies have harassed rather than encouraged the public and in so doing have violated their primary assignments. Nuf said.

L. M. Brooke W9LSS

GRR GRREEN

Japan is passing us by. . .

The big ham magazine in Japan is called "CQ Ham Radio" and when we say big we're grossly understating the situation. Would you believe 500 pages a month? Right! Their average issue makes that November book sized issue of 73 look thin. How would you like to try and get through 500 pages a month?

Have you thought much about why most of the ham products you see these days come from Japan? Consider where we would be in low band gear without Yaesu, Collins, SBE Trio (Tempo) and Kenwood. And look at the VHF equipment from Drake, Swan, Standard, Icom, SBE, Audioland (Beltek), ITC (FDK), and Yaesu.

A substantial percentage of the ham gear sold in the U.S. is now designed and made in Japan — and there is a lot more to come. The fact is that they have a lot more gear available over there that we haven't even seen here yet — stuff that would make your mouth water — fantastic things like the Icom IC-30, an incredible 450 transceiver — all kinds of things.

The Japanese magazine is filled with articles on activities of clubs and groups — an almost infinite number of construction projects — it is obvious that things are really happening over there.

What has brought about this boom in activity — the explosion of equipment? You may have heard that there are now more amateurs in Japan than in the U.S. — over 300,000 — and almost all of them are active. All this has happened just in the last few years — just since the Japan Amateur Radio League (JARL) got clubs to set up classes to get youngsters interested in amateur radio and get them licensed with the new code-free ticket. These clubs have been turning out thousands upon thousands of enthusiastic amateurs. There is more activity on the VHF bands in Japan than in the U.S., even on two meters — and they all have to work simplex there so far. That's right, even without repeaters two meter FM has taken hold. They have many times our level of activity on six meters — and certainly rival us on 450 MHz. They're even outdoing us on slow scan television, and this has just very recently been permitted there.

Our present policies are obviously bankrupt. . .

As Walker pointed out recently in a talk, the number of amateurs in the U.S. has been dropping off at the average rate of about 350 per month. Contrast this with the growth in Japan and the reason is clear for the large percentage of Japanese equipment being sold in the U.S. The bigger market in Japan has made it possible for manufacturers there to develop and sell ham gear that U.S. manufacturers can't afford to build.

Can anything be done to reverse this before it gets worse? And obviously the situation, if unchanged, can only get worse for us as the Japanese ham population passes 500,000 while ours sinks to around 100,000 active amateurs. That should put the last few U.S. manufacturers out of business.

Outside of hurting our national pride, perhaps there is nothing wrong with our buying all of our equipment from Japan. But we do have a lot to lose in the long run, as a country, if we do nothing to reverse this trend. It is no news to you that one of the industries with the largest growth potential for the future is electronics. We will be seeing electronics used everywhere — for sophisticated communications beyond present day imagination — for replacing our outmoded mail system — banking — news — opinion — buying just about everything by remote control from a home terminal — traffic control — the list is endless.

How much of this electronics growth is going to be coming from Japan and how much from the U.S.? You've already seen them take over the transistor radio market, a good part of the television set market, much of the hi-fi market and a substantial part of the hand calculator market. With hundreds of thousands of youngsters going into the Japanese electronics industry in the next few years you can bet that they are going to be able to pin our economic ears back even more than they have so far.

Japan is already exporting more electronics than the U.S. The satellite earth station in Jordan was built by Nippon Electric, not RCA. And this is happening everywhere — and it is going to do nothing but get worse (from our standpoint) unless we counter in some way.

One practical move would be to admit that Japan is one up on us hamwise and take a page out of their book — set up our code-free license — get our clubs to set up licensing classes and do everything within their power to get youngsters into those classes. Demos and education about amateur radio in the schools, the shopping centers, on television and radio all will work for us. It is very difficult to do this without any direction on a national level — and so far the ARRL has been implacably opposed providing this direction — and totally dedicated to stopping anyone else who tries. New faces in the ARRL Directors' chairs won't hurt.

With or without the League every club in the country can get going on a program for bootstrapping amateur radio. The effort might just do a lot to pull some

faltering clubs together and give them a real sense of purpose. Until we do get a code-free license the 73 code tapes are an almost painless way of teaching the code. Hundreds of clubs are using them with spectacular success. The 73 guides are by far the simplest way of teaching the theory.

If your club decides to get going on this please be sure to let us know at 73. How about a picture of your study classes – even if it is a Polaroid (black and white, not color)? If you find any new way of getting the information across – write about it so we can pass the knowledge along. If you find a way of getting youngsters recruited into the classes, send us pictures and write about it. We'd love to fill a good deal of the magazine with ideas and enthusiasm for getting amateur radio off dead center in the U.S. Perhaps the day will come when we, too, will have a monthly 500 page magazine filled with pictures of clubs doing fun things, and hundreds of construction projects.

With a little work on all our parts we can look forward to amateur radio growing to over a million active hams – and think of what that can do for our electronics industry, not just as consumers, but as engineers, technicians and scientists.

Will we have room for all these multitudes on our bands? Lordy, yes! Right now the six meter band is virtually vacant – and that is four megaHertz of perfectly good ham channels. Half of two meters is just plain vacant – two more MHz. Need I remind you of the five MHz up on 220? And how about the 10m band? When have you heard 15m really full? Oh, parts of 20m may get a lot busier – but that could be just what is needed to get us off our duffs and into designing circuits to solve the problem – and there are lots of very good ideas that have been suggested that might die for the lack of development without just such an impetus.

What can we do about this. . .?

If there is any serious interest from clubs in getting going on a project to repopulate ham radio, we'll do everything we can here at 73 to help. Perhaps some buttons saying, "I'm a HAM – ask me about it" would be helpful? How about a poster for radio stores, high schools, and bulletin boards giving a very brief promo on ham radio – and then a place to put your club meeting place and time? Or even someone to call for further information?

We are at work on a very basic booklet describing ham radio which will be available for clubs to give out at public demonstrations or for TV stations to send out in response to a ham program.

Is there a TV station or a radio station without at least one ham? Unlikely. Perhaps we can get ham clubs to put on some programs on local stations telling about local ham activities – and educating the average man.

I realize that this idea will meet with a lot of resistance at your club. You may be surprised to find that there are some club members who are against just about anything constructive – but for heaven's sakes don't let these old foggies (of any age) slow you down.

Let's show Japan a growth rate for hams that will set them back on their obis.

And, in case of war. . .?

Of course there is no possible chance of there being another big war, so we really don't have to worry about having a healthy electronics industry for that. But if, by chance, one of our brinksmanships springs a leak, perhaps we can do our best to keep Japan on our side this time so we can buy our equipment from them.

Amateurs who were around during WWII will remember that not only were hams in extremely short supply, but so was ham gear. Most of us sold our ham receivers to the government – at list price, by the way.

And suppose that by some weird circumstance Japan turned up on the other side next time? Again. Just remember what Commissioner Robert E. Lee had to say in his talk reported on Page two and his quote from Gőering. Will we be the ones to learn the hard way to pay attention to history? Gőering said that one of the major factors which lost the war for Germany was the discouraging of amateur radio – which came to haunt them when we moved ahead of them so rapidly in the development of radar. Radar could have saved their subs – and could easily have had a profound effect on the outcome of the war.

Buy now and pay very little later. . .

With inflation continuing, not a few amateurs are holding their money, wondering just what to do about the situation. Perhaps this is a poor time to hold money.

Our new president has, as of this writing, shown no stomach to cope with inflation. I won't get into a philosophical or political hassle with you over what really should be done – and I'm sure a whole lot of 73 readers who work for the government would not like to read suggestions about firing half of the government – or putting the heat on Congress to stop spending money dammit. So, as far as can be seen right now, inflation will be continuing for quite some time to come, and may well get a lot worse.

This is the best time to make major purchases, things that will be costing a lot later – or which will be resellable for a lot more later. Not a few pieces of ham gear sell for more now than they cost new a few years ago, as you know. If you like to buy on time, you have it even better for you get your equipment and then pay for it later with shrunken dollarettes. About the *only* thing that is going down in value is *money*.

Look at what has been happening to ham gear prices. The Emergency Beacon Dream rig started out at about $1000 and is now up to $1500. This has happened to several other rigs and will be happening to a lot more – watch. The chap who ordered a $1000 EB-144 will be able to turn around and make a profit when he gets his rig – if he can bear to part with it.

This is an excellent time to buy your equipment – before your money shrinks any further.

Is the Morse Code dying? Or is it just wounded?

Probably no religious belief is more subject to emotional reaction than faith in the Morse Code.

A great many amateurs believe in The Code. It is sacrosanct with them and they truly believe about Code being able to get through when the chips are down – about CW rigs being simpler and less expensive than phone rigs – and about CW contacts being a better class of contact than a phone contact.

Another large group of amateurs figure all those arguments are hogwash and that if God had intended us to whistle at each other he would have built us that way.

There is much to be said on both sides, of course.

During the old AM days it was a fact that CW could get through when phone couldn't make it, either because of weak signals or QRM. Sideband changed that a lot and the margin between the two is much narrower today. A confirmed CW man may not yet be aware of the change to sideband and may still be using this old argument.

How about CW rigs being less expensive than phone rigs? Well, for years that was certainly the case. In the early 30's a phone rig was mighty expensive, so most of us used CW – about 90 percent as a matter of fact. Today, if you'll check the Heath catalog, you'll find that there are sideband rigs available for less than CW rigs! Fact. How much is a used Heath HW sideband transceiver these days? You can't get on the air with anything much cheaper than that. They're only $112.50 brand new.

It used to be that a knowledge of CW was of value to the military in case of war, but now they have automated and seem to have little interest in code any longer. Other than the ham bands, where do you hear much CW?

In Japan they did away with the code requirement and now they have more licensed amateurs than we do in the U.S. The number of amateurs here has been dropping gradually for over ten years and amateur radio appears to many as a dying hobby as a result.

On the credit side of the ledger is the fact that Morse Code is awfully easy to learn these days. Old timers who struggled with code records and W1AW would be astounded to find out how utterly simple it is now to learn the code using the modern teaching techniques. Even that lengendary hump at ten words per minute has just about been eliminated. Thousands of new amateurs have picked up the code in a matter of a few hours using the latest cassette system which 73 Magazine has made available. This starts with a one hour introductory tape, at the end of which many people have learned all the letters, numbers and punctuation needed to pass the Novice exam. Next they practice with a one hour code group cassette sent at six words per minute. This gives them the margin for error they need to copy code at 5 wpm under the stress of an exam – even under the eye of an FCC inspector. The 14 wpm cassette takes just a few hours more to master. As far as we know not one single person who has been able to copy these tapes has managed to fail the FCC code test.

One of the petitions hanging fire with the FCC has to do with permitting Techs to use CW in the Novice bands. While this won't teach code as fast as a cassette, it certainly will help to create more of an interest in CW for Techs, and that seems beneficial.

CW afficionados maintain that they have more fun using CW than phone, and there is no reason to doubt this. Many amateurs have long felt that interest in CW might grow if the FCC reduced its requirements to perhaps 5 wpm for all classes of license. If the use of CW were promoted as a skill and as enjoyable instead of a fearsome threat keeping hundreds of thousands of people from becoming amateurs, the CW bands might start to fill up again.

Emphasis on code certificates, contests at hamfests, and plenty of articles on the subject in the ham magazines could help take the bad feelings about code out of the collective amateur mind. Who knows, when pride of accomplishment and fun are the motivating forces behind code instead of fear of failure before the FCC, we might enter a whole new era in amateur radio.

The use of fear and the threat of punishment to drive people onward has failed utterly all through history. Better the carrot than the stick, to coin an aphorism, and CW zealots would do well to give this some serious thought before CW disappears completely. The use of CW has dwindled from about 90 percent of all ham operations to somewhat less than 10 percent, so obviously something has been done wrong. If changes in the system are not soon forthcoming we could well see the end of the Morse Code.

The FCC is in the process of updating their technical exams for all ham licenses to bring them into line with current amateur practice – reflecting amateur interest in RTTY, SSTV, ATV, satellite work, FM, repeaters, synthesizers, solid state, digital techniques, etc. This means that perhaps for the first time the amateur technical exams will have more of an effect on the passing or failing of the license test than the code part of the exam.

Looking at the FCC official figures for the last three reported months for the FCC given Tech exams we find that of 275 tests given less than 6 percent managed to flunk the written part of the test – and most amateurs would agree that the Tech written test is a whole lot harder than copying code at five words per minute. Yet less than 65 percent of those who tried for the Tech license made it! The code toppled one third of those who took the exam.

The Extra Class applicants did a bit better, with 75 percent of them passing the code test and 84 percent passing the written. The code is still, by far, the determining factor and not technical knowledge. Is this what we really want? Is this situation in the best interests of amateur radio and the

growth of our hobby?

What do *you* think about the code? Should we continue to require the ability to copy at 13 per for the General and 20 per for the Extra? The 5 words per minute we require for the Novice and Tech licenses meets the requirements of the ITU, so there is no international agreement that we have to worry about. Should we plan to depend in the future on a technical exam as the entry requirement into the hobby instead of a skill — the code?

CB is not what a lot of amateurs think it is. . .

More and more amateurs, attracted to CB by the traffic information service on channel 10 (channel 19, west of the Mississippi), are finding that when the skip is not coming in the band is seldom crowded and is able to provide quite enjoyable contacts.

Many readers of 73, who ask not to be named (for obvious reasons), say that they have found that modest amplifiers are absolutely necessary for any kind of reliable communications — with a level of about 25 watts input being normal.

Even in New York and other large cities there are seldom times when several are not usable without interference. Sure, there are some nuts playing records on one or two channels — the CB counterpart to the mystery ka-chunkers on repeaters — but for the most part the contacts are not all that different from those on some of the ham bands.

The amateur who spends much time in his car is the one who can definitely benefit from CB. It is nice to be warned a few minutes before you come to a traffic tieup on an expressway so you can route around it. It's nice, some drivers feel, to have a good idea of where the police may have set up a speed trap — particularly in the day when the legal speed is 55 and the traffic is moving at 65 to 70. At least we don't have to worry about weighing stations the way truckers do. They find CB a blessing when it helps them avoid a fine for being overloaded.

73 would like to hear from amateurs who are using CB — and get more input for the readers on how things are in your area.

Let's make "Ham" a term to be proud of. . .

More and more CB articles in newspapers and on television news reports are calling CBers hams. Either we get busy and fight back vigorously or we give up and let CBers get that label by default.

There are some vocal amateurs who don't like the name "ham." It is not dignified. One dedicated anti-ham ham has virtually made a career out of grumbling about this — in his club bulletin — in letters to Ham Radio magazine — etc. But perhaps there are some reasons to hold on to that appellation. Perhaps we would be throwing away a good PR lever if we were to abandon that term which has stuck with us from the antiquity of spark days.

The term "ham" has a lot more grab to it than "amateur radio." Fact. This means that if we use it properly we can get a lot of mileage out of it as a way of getting interest and attention. "Hams" is a lot easier to say, print and even think about than "amateur radio operators." The term is well enough known today so even "radio hams" is redundant. You need a little something like this to get people's attention.

Where, oh where, is Dean Burch these days?. . .

One of the questions that invariably comes up at hamfest and club talks is the CB proposal to grab a lump of our 220 MHz band.

As far as I can see, this is still up in the air, waiting on political matters. Insiders at the FCC report that virtually no one there is in favor of making any new CB bands — and certainly not out of a ham band — but they realize that the decision will probably be a political one over which they will have little say.

Lacking any concrete data on this, I'd like to speculate.

From what I've been able to find out, the main pressure for the proposal came from Dean Burch, erstwhile FCC Chairman. I have no idea what argument the EIA used to win Mr. Burch over so unshakably, even in the face of stiff resistance from the people in the FCC. But, someway, it appears that the EIA has won unswerving loyalty to the idea.

When Burch went from the FCC to the White House to work with Nixon he apparently did not lose his power noticeably as far as his influence on the 220 CB proposal was concerned.

When Nixon moved to San Clemente we stopped hearing about Burch — but now it seems highly likely that he is still with Nixon and working from California. A recent report said that virtually the entire Whie House staff went with Nixon and is working out there, paid for out of Ford's White House maintenance fund.

In view of the expose of the deal between Nixon and Ford reported in New York Magazine which resulted in Nixon stepping down and then getting pardoned in advance for anything and everything and which apparently even includes a pardon for Haldeman — unless the article scotches that — it appears that Nixon will be doing a good deal of the running of the government, using his same old staff. If this does work out as reported it is very possible that Burch will be able to keep up the pressure on behalf of the EIA and for the 220 CB plan to go through.

The idea of Nixon still being in the president business as a semi-silent partner to Ford and making deals on behalf of foreign countries is unsettling and it is possible that Congress may be able to do something about it now that the deal has been exposed. Apparently one of the last things that Ford wants is to have Nixon start releasing any of the hundreds of tapes made of his conversations with Nixon — tapes of at least 85 separate occasions when he met with Nixon at the White House and was unaware that he was being taped — and tapes of over a hundred candid phone conversations, also made without his knowledge. It is

hinted rather strongly that the fear of these tapes being disclosed brought on the deal which included the pardon and the resultant power that Nixon still seems to hold.

Haldeman figures in this as the one man who also knows what is on most of the tapes and probably the only one with a good index to them. This is why Ford is expected to pardon Haldeman.

Well, we'll see — and hope that amateur radio doesn't get chopped up as a result of these sordid political messes.

Hotline vs Ham Radio Report

One of the fun things about writing the bi-weekly Hotline is watching the "competition" and seeing what scoops they get — what they miss — and making sure that Hotline is a lot better.

Some of the news is difficult to get and every now and then we get beaten to a story, but not often. There is a good deal of satisfaction to opening up the competition and going through with a blue pencil and marking all of the stories that appeared in the previous issue of Hotline. . .and this often covers a substantial part of the HR Report.

The Ham Radio answer to the 73 Magazine newspages — the Presstop page (amazingly similar to QST's League Lines) — condenses the meat of the HR Report.

Of course Hotline has a great advantage over HR Report in that there is vastly more space available for news. The average issue of Hotline runs two to three times the number of words of HRR. There is much to be said about having everything under one roof as far as efficiency and cutting costs are concerned. Report is written by an amateur in Chicago, set in type on an ordinary typewriter, sent to another town to be printed — and back again to be mailed. Hotline is written right at 73 Magazine — the type is set by 73 — the artwork is prepared there — the photographs — negatives are shot in the 73 photo lab — printing plates made — Hotline is printed in two colors — folded, addressed and mailed — all at 73. Report has to use one color and can't have photos and has to come out as a typewritten page while the Hotline comes out as a small newspaper, complete with illustrations, photos, and any length the news determines — four, six or even eight pages when there is a long FCC docket or two to be published in detail.

The efficiency of the operation has made it possible to not only put out a more up todate newsletter, but to do it at substantially lower cost. Report costs $12 per year, Hotline is only $8.

Open Letter to CQ's Publisher

Your publisher's message in the October issue of CQ — your thinnest issue since August 1955 indicates that you are having serious problems. In the event that CQ should cease publication some provision should be made to keep the amateurs who have invested their hard earned money in subscriptions from losing out completely.

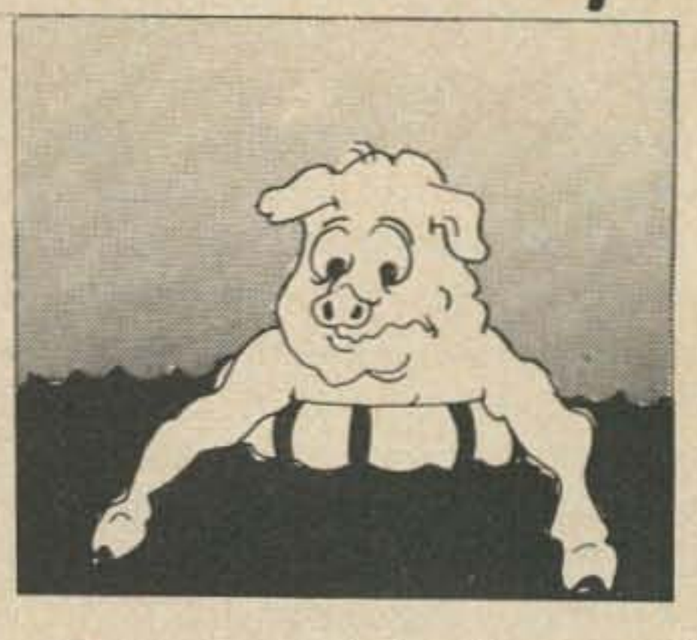
Also, it would be a shame to have some of the contests which CQ has run for many years disappear — for instance the World Wide DX Contest.

I would like to state that 73 Magazine stands ready to take on the fulfillment of circulation (except for free or duplicate subs and things like that), and the continuation of some of the CQ sponsored contests.

CQ has many times in the past performed valuable services for amateur radio and I am sure that many amateurs will join me in expressing genuine regret should it be necessary to cease publication. My collection of the vintage years of CQ stands proudly on my bookshelf.

Wayne Green — Publisher 73

Ham Help



This column is for those needing help in obtaining their amateur radio license.

If you need help, let 73 know — don't be bashful — the readers are solid gold and are anxious to help you. If you would like to help, let 73 know about that plus your area of expertise, if any, so we can list you for either general help or as a technical advisor.

The following need some help — can *you* spare some time? Clubs in particular take note.

Ted Rappaport
517 East Main Street
Cambridge City IN 47327
Ph. 476-2923

Larry G. Griffis
SP/5 E-5
Department of The Army
Hdqts, U.S. Support Activity Iran
APO New York 09205

Robert M. Gallery
4058 Batterylane
Apt. 114
Bethesda MD 20014
Ph. 301-652-5332

Lennie Fekula
Rd 1
Hickery PA 15340
Ph. 412-356-7316

Ernest F. Rubino WA6RPP
1925 Otay Lakes Rd Sp #88
Chula Vista CA 92010

Jerome F. Coplan
4433 Troo St.
Kansas City MO 64110

The RAM asse. ARC
c/o Monte Tremont
3 East Princeton Avenue
Pleasantville NJ 08232
Ph. 609-646-2200

Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

SELL: ROBOT SSTV Models 80 Camera and 70 Monitor. Original cartons and instruction books. Excellent condition. $500.00. Gordon Buckner WØVZK, Box 721, Marshall MO 65340.

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck a peice for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard and complete.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

TV-3B/U NAVY portable tube tester, good working condition. $25. WA1TEJ, 100 Granite Street, Londonderry NH 03053.

AN/FRR-23 (AN/SRR-13) general coverage modular receiver with book, excellent condition. $100. WA1TEJ, 100 Granite Street, Londonderry NH 03053.

RCA SENIOR VOLTOHMYST – professional grade VTVM, new, never used. $50. WA1TEJ, 100 Granite Street, Londonderry NH 03053.

INSTRUCTION MANUALS thousands available for test equipment, military electronics. Send $1.00 (refundable first order) for listing. Service of Tucker Electronics, Box 1050, Garland TX 75040.

TWO PLASTIC HOLDERS frame and display 40 QSL's for $1.00, or 7 holders enhance 140 cards for $3.00 – from your dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin TN 37066.

YOUR SWAP-N-SELL ads run free in TRADIO, a public service publication of Wichita Amateur Radio Society, Box 4391 Wichita Falls TX 76308.

FROM UNIVERSITY-Sound 4 C 15 W Woffers in unopened cartons. Retail $169 each. Will sell at $100.00 ea. Write Cassette Headquarters, P.O. Box 431, Jaffrey, N.H.

CLEANING OUT: parts, antennas, equipment, accessories, magazines. Bargains. No junk. Write SASE, Dave Schearer, K3SWL, 826 North Fifth, Reading PA 19601.

NEARSIGHTED? Improve your sight, whether nearsighted or farsighted, with tested exercises, sound theory. Hardbound. Ham discount $7.00 ppd. M. Windolph, 3140 Meramec, St. Louis MO 63118.

PERSONAL ATTENTION plus the best cash deal anywhere is what you receive at QUEEN CITY ELECTRONICS in the heart of the Midwest. Queen City carries all major brands including Drake, Tempo, Kenwood, Yaesu, Swan, Regency, Clegg, Standard, Icom, Genave. . .write or phone us for your equipment needs. Queen City Electronics, Inc., 7404 Hamilton Avenue, Cincinnati, Ohio 45231. (513) 931-1577.

FOR SALE: Like new Swan 500 CX with ac TR-4 with ac and Regency HR-2S. Make offer – must sell. WB4SUY 615 728-4613, P.O. Box 402, Manchester TN 37355. Ron Reeves.

AMSAT/OSCAR 6-7 SLIDES set of 5, $1.25 lift-off and equipment proceeds AMSAT. K6PGX, P.O. Box 463, Pasadena CA 91102.

FREE: 12 Extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Yaesu, Kenwood, Swan, Atlas, Standard, Clegg, Icom, Hallicrafters, Tempo, Ten-Tec, Venus, Alpha, Hy-Gain, Cush-Craft, Mosley and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

2 METER FM. MOBILE "CARTOP" ANTENNAS – 1/4 Wave and 1/2 Wave models. Unique, secure, instant mount. No magnets; no drilling holes. Omnidirectional – unlike trunk lid mounts. Tuneable 1:1 SWR. Money-back guarantee. 1/4 Wave Model $16.95*; 1/2 Wave $18.50*. *Add $1.00 shipping and handling. (Conn. residents – Sales tax). MARSH DEVICES, P.O. Box 154, Old Greenwich CT 06870. Literature available.

FROM UNIVERSITY-Sound 4 C 15 W Woffers in unopened cartons. Retail $169 each. Will sell at $1.00 each. Write Cassette Headquarters, P.O. Box 431, Jaffrey, N.H.

FOR SALE – Drake L-4B linear amplifier. Still in packing cartons. Asking $610.00. Joseph J. Schoffhauser, 78 Geer Avenue, Norwich CT 06360.

EQUIPMENT FOR SALE: DX-60 with HG-10 VFO, $50; HX-20 with AC-supply, $50; SX-111, $50; ARC-5 rcvr, 80m, with AC-supply, $15; ARC-5 xmtr, 40M, $10; Redline keyer, similar to TO-5, $20; SR-160 with AC & mobile supplies, $150. Larry Osolkowski, WB2HFU, 87 Park Avenue, Hamburg NY 14075.

WANTED: Hallicrafters SX-88 for parts, any condition considered. KØMNA, 4805 Sullivan, Wichita KS 67204.

FOR SALE: SB-301 3 filters, all 10 mtr crystals, SB-600 speaker, cal. and 6 and 2 meter converters with manual $250.00. Call Jim W1VYB (617) 922-3850.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

1101A RAM: $2.25; 1103 RAM: $3.00 2513, 2516: Char. Gen: $12.75 ELECTRONIC DISCOUNT SALES, 138 N. 81st Street, Mesa AZ 85207.

NOW PAYING $2000.00 and up for ARC-94/618T ARC-102/618T. $1200.00 and up for ARC-51BX. $1500 and up for 490T-1 antenna couplers. We also need these control boxes — C-6287/ARC-51BX C-6476/ARC-51BX C-714E-2. We also need R-1051 receivers RT-662/Grc-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have and want to sell or trade. We also sell. What do you need? D&R Electronics, R.D. 1 Box 56, Milton PA 17847. Phone (717) 742-4604. 9:00 AM—9:00 PM.

TECH MANUALS for govt. surplus gear — $6.50 each: R-390/URR, R-220/URR, URM-25D, CV-591A/URR, CV-278/GR, TRM-1, TS-382D/U, TS-497B/URR, TT-63A/FGC, URM-32. W3IHD, 7218 Roanne Drive, Washington DC 20021.

MERRY XMAS and Happy New Year from WØCVU. First amateur in the world awarded the RSGB EMPIRE AWARD on two way SSB in 1962. Chas. W. Boegel, Jr., 1500 Center Point Rd. NE, Cedar Rapids IA 52402.

HOW INTELLIGENT ARE YOU? Test reveals IQ in hour. Self-scoring, very accurate! Money back guarantee! Send $2.00 Chuck WA6NPP, Box 186-C, Monterey Park CA 91754.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

EQUIPMENT CLOSEOUT

The following equipment has been purchased by 73 Magazine for test or has been received in lieu of payment for ads. Most gear is either brand new in the original cartons or else like new after a few days of testing in the 73 labs.

MITS 908M Calculator w/p.s./case (4143) new	$ 79
Heath IC-2009 calculator—brand new ($92)	$ 79
Signal One CX7-A—tested—perfect—like new—fantastic	$1989
Concord video monitor VM-12—tested ($400)	$ 199
Regency 450 MHz scanner — ($200) like new	$ 139
Varitronics PA-50 2m amp ($110) brand new 10w in 50 Wout	$ 89
RP tone burst gen—5 freq—TB-5 exe ($37.50)	$ 25
Regency HR-6 ($240) six meter 10w xcvr 12ch	$ 189
Regency ACT-R8H/L Scr ($160) VHF/UHF Sch scr receiver	$ 129
Standard SR-C826M (4398) 10w 12ch 2m xcvr used	$ 265
Regency HR-2MS ($319) 2m 15w xcvr with 8ch scanner	$ 259
SBE SB-450TRC ($180) 450 MHz transverter	$ 139
Regency Pocket scanner 4 channel ACT-P4H ($120)	$ 89
Cobra 220 MHz Transceiver 10w 12ch ($300)	$ 255
Standard 14U 2m 22ch superfantastic VOX ($510) demo	$ 429
Pacificom 2m HT—brand new—($250)	$ 169

All Prices fob: UPS collect.
73 Magazine — Peterborough NH 03458

HOT SPRINGS, ARK. DEC. 7

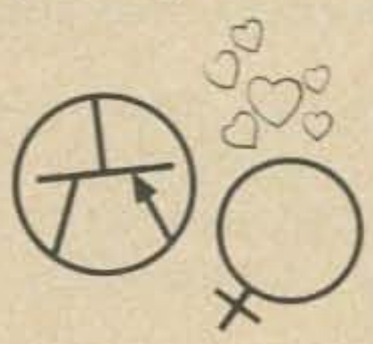
The Annual Banquet of the Arkansas DX Association will be held on Saturday, December 7, 1974, in Hot Springs, Arkansas. The featured speakers will be Jim Rafferty WA9UCE/6 who will give a slide, movie and tape presentation of the KP6KR Kingman Reef DXpedition; and San Hutson K5QHS who will give a slide presentation of his recent Martinique, Guadeloupe and Dominica DXpedition. Registration and reservations will be handled by W5QKR, RFD 2, Box 254, Hot Springs, Arkansas 71901 and further details may be obtained from him.

PASSAIC NJ
DEC 23 — JAN 1

The Knight Raiders VHF Club K2DEL will sponsor a VHF Activity Week December 23, 1974 thru January 1, 1975. Contacts may be made on any band above 50 MHz. Participants who work the club station and 5 club members will receive a Knight Raiders Award certificate. Those who work at least 10 of the 16 municipalities in Passaic County will receive a Passaic County Award certificate. Stations within Passaic County are eligible for both awards. A one dollar fee must be sent for each certificate for the cost of handling and postage. Send fee(s) and logs to: Knight Raiders VHF Club, P.O. Box 1054, Passaic, New Jersey 07055.

OAK PARK, MICH JAN. 12

Oak Park Amateur Radio Club's sixth annual swap and shop at the Frost Junior High School Cafetorium, 23261 Scotia, Oak Park, Michigan.



LEE ADDRESS

Continued from page 118

as it is now constituted. There are 148 .member countries of the Union, around 90 of which regularly attend conferences. Each nation has an equal vote. Many of them are years away from having the kind of sophisticated communications as ourselves, yet frequencies are reserved for the day when they might have them. Conversely, countries with great demands for frequencies for Amateurs, such as ourselves and a few others throughout the world, find minimal support if any at all from countries which have never fostered Amateur Radio and have little interest in voting additional allocations.

A concrete example of this kind of situation occurred during the recent Maritime Conference when a United States' position on coastal maritime stations was supported by only six other votes. Unless there are other diplomatic considerations of overriding importance, I would favor the United States exploring the possibility of negotiating more desired resolutions to our problems with other nations having common interests in a roughly parallel state of development, rather than attempt to deal with the entire membership of the I.T.U.

However, we proceed and whatever the results, Amateurs of the future will look back with some judgement as to what was done on their behalf. The QCWA can be an influential force in this planning stage for the future of Amateur Radio. Recognizing the present transitional phases of communications, there was never a better opportunity to improve your allocation status, especially in the high frequency portion of the spectrum. I don't mean it will be easy nor pre-ordained. But if it is to ever happen, the 1979 Conference is the arena for the decision.

Your Amateur Satellite program is well on its way. OSCAR 7 is due to be launched any day now, if it hasn't already happened. I envisage the day when Amateurs will have a global satellite system utilizing near geostationary orbits for their satellites. The areas of innovation have probably passed from the terrestrial sphere to the spacial arena, but that should be no insurmountable barrier to Amateurs' contributions to future technical developments. Circumstances may well inhibit individual inventions in such a complicated field. But in a professional capacity with the background of Amateur Radio, innovation can be enhanced and I believe that Amateurs will continue to make a large contribution in the technical field.

By now you should know that I believe in Amateur Radio. I believe it is a valuable aspect of our life. And I shall do everything in my power to assist in its continued well-being, looking toward its further contributions to our national telecommunication requirements. I wish you all the best of success.

HAMS AID HONDURAS

Continued from page 3.

supplies relayed by Honduras-based amateurs.

Most of the United States' amateurs were members of the American Radio Emergency Corps and other service organizations that operate long-established emergency communication networks and train regularly in preparation for emergencies such as that in Honduras.

Much of the emergency amateur radio activity was centered in the Miami area. The week after Fifi struck, a team of bilingual amateurs from Miami's Sociedad Internationale de Radio Aficionados flew to Honduras to assist operations there.

Eighty-five percent of the communication in Honduras is now handled by amateur radio, and the activity is expected to continue until normal communications are fully restored.

Among amateurs involved in the relief operations were Omar Parades, HR1OP, and Jonathan R. Toeldo, HR1RT, Tegucigalpa, Honduras; Frank V. Savat, WA5YOI, Shreveport, La.; John W. Christy, WØUKD, Minneapolis, Minn.; Charles A. Giannetta, WA3RSQ, Bethlehem, Pa.; Rafael Estevez, WA4ZZG, Hialeah, Fla.; J. H. Goodwind, VE3DPQ, a Canadian living in Miami; and Jose A. Pignatta, LU2BZ, Parana, Argentina.

50 MHz BAND

Continued from page 9.

Herb Brier, long time amateur radio columnist for assorted magazines has been on the shelves for some time now. After careful consideration I would have to say that it doesn't come off too well. Much of the material is a rehash of early ARRL VHF Handbooks which are a much better buy at $2.50 than this book is at $5.95. Early VHF history is covered a la W1HDQ but not as well. A repeater primer is included for anyone interested in the very basics. About the only mention of six meter equipment is a cumbersome converter and an enormous 500 W amplifier for 50—450 complete with plug-in coils. The construction illustrated is for the most part (and for the lack of a better word) "amateurish". No PC layouts are provided for items as complicated as a 2 M FM transceiver. Anyone who has ever tried to build VHF solid state equipment knows that the diagram is just the starting point. Getting it to work requires a great deal more effort and a fixed layout helps greatly to tie down the variables. Another feature is a 50 W tube type 2 M CW rig. The book is not up to the standards we have come to expect from the authors. In my opinion you would be better off to invest in an ARRL or RSGB VHF Handbook or a year's subscription to VHF Communications.

. . . WAØABI

Support Ham Radio — Have A Ham For Dinner

73 gift gallery

DIGITAL CONTROL OF REPEATERS

softbound $5 hardbound $7

Here's a book for the FMer who wants to design and build a digital repeater control system. Contains sections on repeaters, basic logic functions, logic circuit design, control systems, support circuits, mobile installations, touch-tone, plus a special section on a "mini" repeater control system.

4 STUDY GUIDES NOVICE GENERAL ADVANCED EXTRA

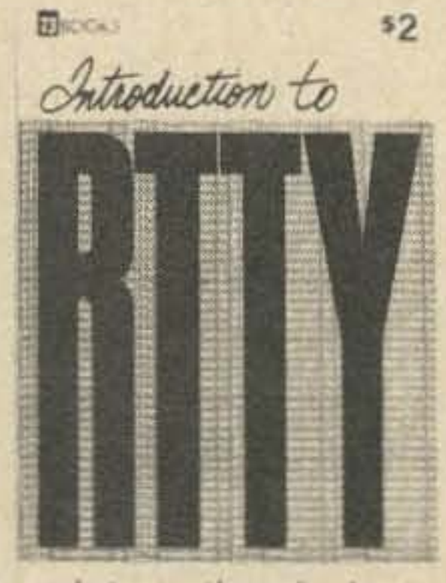
FCC exams got you scared? Frustrated by theory fundamentals? There's no need to worry. 73's four License Study Guides will help you breeze through any of the four touch exams! They are the ONLY guides which cover ALL the material you will have to know. Many amateurs find that one quick reading through our guides is enough to get them through with no sweat.

INTRODUCTION TO RTTY

$1

In this book the world of radio-teletype is explained in an easily understood manner for the beginner.

The last part of this book contains a bibliography of everything published about RTTY since 1952.



RTTY HANDBOOK

$6

A comprehensive book covering all areas of radio teletype, from getting started with the basic principles, what equipment to procure and how to make it work.

DIODE CIRCUITS HANDBOOK

$1

115 diode circuits including power supply application, regulators, ac meter applications, receiver detectors for AM-FM-SSB, noise limiters, squelch, AGC, varicap tuning, audio clippers.

FM REPEATER CIRCUITS MANUAL

hardbound $7
softbound $5

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail. All aspects covered, from the operator to the antenna.

73 USEFUL TRANSISTOR CIRCUITS

$1

Useful transistor circuits for audio, receivers, transmitters and test equipment. 47 chapters with circuit diagrams for each, complete with component values, etc.

VHF PROJECTS FOR AMATEUR AND EXPERIMENTER

$5

A must for the VHF op. Opening chapters on operating practices and getting started in VHF, both AM and FM, followed by 58 chapters on building useful test equipment, modifying existing and surplus gear.

TRANSISTOR PROJECTS

$3

Crammed full of home construction projects, from receivers to transmitters and all in between. Chapters include such articles as zener diodes, how they work, how to use, test and buy them; integrated circuits; how to design transistor amplifiers; and many more.

SOLID STATE PROJECTS

$4

More than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to a ham TV receiver. This collection will help you become more intimately acquainted with zeners. ICs and varactors, etc.

VHF ANTENNA HANDBOOK

$3

Would you believe that the secret to success in VHF/UHF is in the antenna system? This is no earth shaking discovery, but it's true. A complete, detailed book with descriptions, dimensions, tuning data, diagrams and photos.

DX HANDBOOK with MAP

$3

How to work DX, how to get QSLs, country lists, award lists, QSL bureaus, maps of the world, great circle maps centered on major U.S. cities. Wall size DX map of the world included.

SLOW SCAN TELEVISION HANDBOOK

hardbound $7
softbound $5

This excellent book tells all about it, from its history and basics to the present state-of-the-art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment and much more.

COAX HANDBOOK

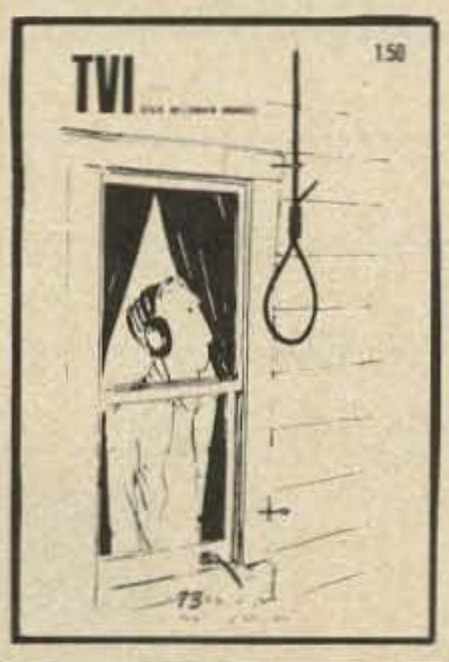
$3

All about coaxial cables, connectors and applications. It's all here — pictures, part numbers and specifications for all types. Includes lengths for different types for quarter, half and full wave feedlines.

FASCINATING WORLD OF RADIO COMMUNICATIONS

$4

All about broadcast band DXing, tuning the tropical DX bands, DXing radio amateurs, antennas for shortwave, radio licenses, pioneers in electricity and radio, commercial broadcast stations, WWV, etc.



TVI

$1.50

Discusses all types of interference problems in great detail with recommended steps to cure these problems. Good for both the amateur and citizens band operator. Try this cure and suffer no longer.

73 CERTIFICATES WAAS $1

Worked Almost All States — Proof of your having worked 49 of the 50 states.

ALL MODE DXDC $1

An award for 2-way communications with 10 countries using CW-SSB-RTTY-SSTV modes.

DXDC $1

Available for those who present proof of contact (copy of log) with 10 different countries.

SSTV-DXCC $1

For 2-way Slow Scan Television communications with 10 countries.

LAPEL BADGES $1

Name and call identifies you at club meetings, hamfests, busted pot parties. Hand engraved by skilled New Hampshire craftsman with loving care.

RTTY-DXDC $1

All operating award for those who have submitted proof of 2-way teletype communications with 10 countries.

CUSTOMIZED DX BEARING CHART $4

An amateur who works for a big computer company has a program which permits him to plug in your location and have it print out the bearings of all the countries of the world from your shack.

73 BINDERS $5

These binders are a gorgeous red and come with the nicest set of year stickers you've ever seen. The perfect thing for storing your issues of 73 so that they won't get lost or spilt on, or into the hands of the Jr. Op. Dress up your shack with these binders.

WORLD DX MAP $2

This is the same wall-sized DX map that is included with the DX Handbook except it comes to you rolled up instead of folded. This is so you can put it on the wall or have it framed.

CALL LETTER DESK PLATE $2

How about dressing up your operating table with a desk plate showing your first name and call? These embossed desk plates are nice — and inexpensive. No zero available, sorry. There is room for twenty letters and spaces total.

U.S. MAPS $1

These wall sized maps show the states and call area. They are specially designed for coloring to show your progress toward the Worked All States award of ARRL. They come in groups of four.

73 gift gallery

73 Magazine, Peterborough NH 03458

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

SEND ME:

	PRICE
_____	_____
_____	_____
_____	_____
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SIGNATURE _____

CARD # _____

EXPIRATION DATE _____

TOTAL _____

☐ master charge THE INTERBANK CARD ☐ Your BANKAMERICARD welcome here

☐ CHECK
☐ BILL ME

STARTLING LEARNING BREAKTHROUGH

You'll be astounded at how really simple the theory is when you hear it explained on these tapes. Nine year old children have used our cassette course to breeze through their novice exam! Three tapes of theory and one of questions and answers from the latest novice exams give you the edge you need to do likewise.

Most cassettes these days sell for $6 and up. But 73 is interested in helping get more amateurs, not being in the tape business. So we're giving you the complete set of four tapes for the incredibly low price of ONLY $13.95. And they'll play on any cassette player on the market!

SET OF 4 TAPES ONLY $13.95

ORDER TODAY !

Scientists have proven that you learn faster by listening than by reading because you can play a cassette tape over and over in your spare time — even while you're driving! You get more and more info each time you hear it.

You can't progress without solid fundamentals. These four hour-long tapes give you all the basics you'll need to pass the Novice exam easily. These days, the exam changes so fast that you can't memorize for it any more. Besides, this way you'll have an understanding of the basics which will be invaluable to you for the rest of your life! Can you afford to take your Novice exam without first listening to your tapes?

73 MAGAZINE, PETERBOROUGH, NH 03458

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CLUBS•CLUBS•CLUBS

great trade offer

We will swap you a year's FREE subscription to 73 HOTLINE for a year's subscription to your club's bulletin. How can you lose ? Just complete the form below and return. . .

— — — — — — — — — — — — — — — — — —

Name _____ Call _____

Address _____

City _____ State _____ Zip _____

1974

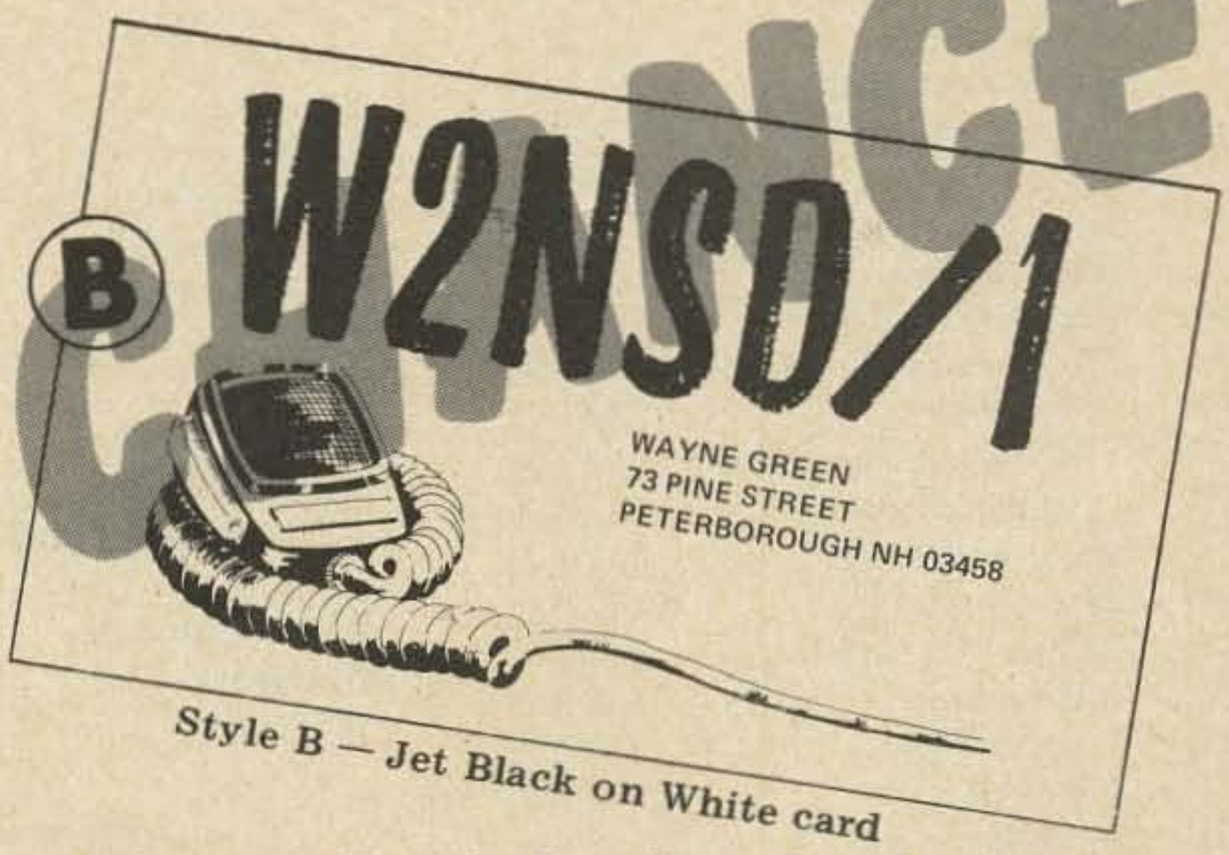
Article Index

QSLs for 1¢

Offer Valid Until Midnight, December 31, 1974

Style A — Black type on Blue world

- two styles
- QSO info back
- two colors
- LOW PRICES



Style B — Jet Black on White card

While the cost of almost everything keeps spiraling upward, 73 has kept the price of these beautiful QSLs at rock-bottom. When we started selling *Top Quality* QSLs last year for a **PENNY-A-PIECE** (postpaid yet!) it was a fantastic deal; this year it's the next best thing to having an oil well in your own backyard!

ORDER — AND PAY	
250	**$6** (2.5¢ ea)
500	**$10** (2¢ ea)
1000 . . .	**$15** (1.5¢ ea)
2000	**$20** (1¢ ea)

These QSLs are printed on *Fine Quality Glossy Card Stock* and are as good or better than cards sold elsewhere for several times the price. We can offer this fantastic low price, because we "gang print" orders between other jobs in our own print shop which keeps the costs way down and we pass the savings on to you. If you haven't been QSLing as much as you'd like to because of the cost of cards, do you really have an excuse anymore? Get some cards and help improve the image of U.S. Amateurs.

□ □ □ □ □ □ □ □ □ □ □ □ □ □ *ORDER BLANK* □ □ □ □ □ □ □ □ □ □ □ □ □ □

Name _____ Call _____
(First and last name is most friendly)

Address _____
(as brief as possible and still get through the mail)

City _____ State _____ ZIP _____ County _____
(a must) (if desired on the card)

Style
A □
B □

Awards to be listed on card _____
(if desired)

□ **250** □ **500** □ **1000** □ **2000** cards

Foreign Orders: Add following amounts for shipping and handling. (Parcel Post)

250 — $1.75 **1000 — $4.00**
500 — $2.25 **2000 — $6.25**

Check local Post Office for air rates . .

Amount enclosed $_____

A product of 73 Magazine, Peterborough NH

NOVICE

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SCHEMATIC OF THE MONTH

S-METERS

SSTV

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CASSETTE RECORDERS

Hi-Fi Cassette Deck — GO FIRST CLASS!

The Toshiba PT-490 is one of the latest and newest state of the art cassette decks — ideal for the finest of hi-fi setups as well as many ham applications. With this deck you can make the clearest and sharpest of slow scan programs. The pause control allows you to put your program together picture by picture without loss of sync. The PT-490 is a stereo cassette deck — one of the few that not only stop at the end of a tape, but will also automatically play both sides of a tape or even work endlessly, if you desire. Hi-fi addicts will appreciate the choice of three bias settings for matching any type of tape — the stereo mike inputs — the separate input and output slider pots — the tape drive which is virtually foolproof, permitting the use of even the 180 minute tapes, instant reverse from fast forward to fast rewind without tape mangling — the separate level meters — the headphone monitoring jack — the counter for loacing exact spots on cassettes — and other such valuable features. Dolby, of course!

PT-490 Cassette Deck .... $349.50 (free, with above, 35 C-60 Cassettes!).

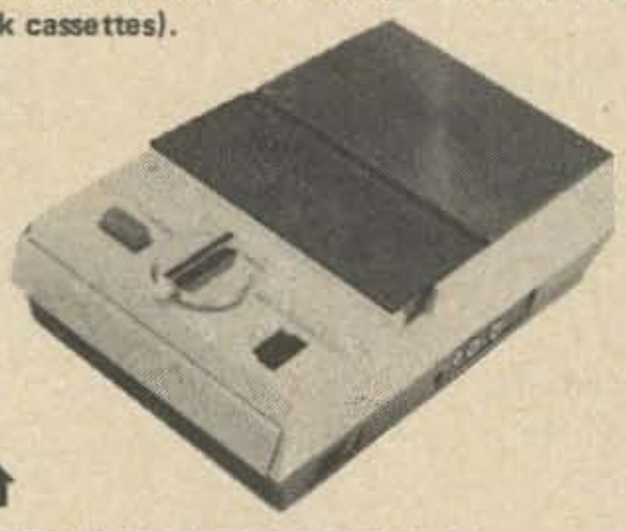
BATTERY PORTABLE

Features: keyboard control — locking fast forward and rewind keys so you don't have to stand and hold them — peak modulation indicator — 120 vac — self contained batteries — external 6v supply — 220 vac also — mike input — line input — earphone/line output — remote start/stop — automatic recording level circuit — very easy unit to use — versatile — adequate for SSTV — excellent for code tapes and not too hi-fi music. $32.95

Panasonic RS-261US

One of the best buys in a medium priced cassette deck — has about everything you could ask for — automatic stop at end of tape — individual stereo dB meters — mike or line stereo inputs — stereo-mono switch for input — individual level controls — pause control for instant start and stop of tape — makes editing a pleasure. Has headphone jack for monitoring. Fantastic unit for SSTV — makes the steadiest pictures you ever saw. Go first class for a change.

RS-261US Deck ..... $99.00 (free, with above, while they last, $15 worth of blank cassettes).



ECONOMY PORTABLE

Features: Rotary control for ease of use with one hand (like in the car) — peak indicator — automatic level circuit for optimum recording level at all times — 117 vac — built in batteries — remote stop-start mike input — line input — earphone/line output — fine unit for voice or Morse code study — adequate for lo-fi music — excellent bargain at the price. $23.95

CAR CASSETTE PLAYER — 12vdc — stereo — with two stereo speakers — volume and tone controls, balance control — fast forward for tape and reject button. Now carry hi-fi with you in the car — slow scan TV — touchtone tapes — your favorite records on cassettes.

Car Cassette Player. . .Special. . .$49.95 plus UPS collect charges.

BLANK CASSETTES

Low noise tape cassettes — excellent quality

C-60 60 minutes. . . 99¢ (reg $1.29)

C-90 90 minutes. . .$1.49 (reg $1.79)

C-90 Extra Hi-fi. . .$2.25 (reg $2.99)

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4000AE	$ .55
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4002AE	.59
4004AE	5.90
4006AE	3.90
4007AE	.65
4008AE	3.60
4009AE	.95
4010AE	.95
4011AE	.54
4012AE	.54
4013AE	1.19
4014AE	3.80
4015AE	3.80
4016AE	1.15
4017AE	2.94
4018AE	3.20
4019AE	1.30
4020AE	4.20
4021AE	3.80
4022AE	2.75
4023AE	.54
4024AE	2.30
4025AE	.54
4026AE	9.90
4027AE	1.35
4028AE	2.95
4029AE	5.40
4030AE	1.25
4035AE	1.80
4037AE	4.00
4040AE	4.70
4041AE	3.35
4042AE	2.95
4043AE	2.95
4044AE	2.95
4048AE	1.50
4049AE	1.35
4050AE	1.35
4051AE	5.40
4056AE	3.50
4060AE	4.95
4069AE	.90
4076AE	4.30

Schottky TTL

SN74S00N	$ .80
SN74S02N	.80
SN74S03N	.80
SN74S04N	.80
SN74S08N	.80
SN74S10N	.80
SN74S11N	.80
SN74S20N	.80
SN74S30N	.80
SN74S32N	.80
SN74S40N	.80
SN74S41N	.80
SN74S64N	.80
SN74S74N	1.30
SN74S85N	6.10
SN74S86N	2.90
SN74S112N	2.50
SN74S113N	1.50
SN74S133N	1.00
SN74S138N	4.50
SN74S139N	3.90
SN74S140N	1.00
SN74S151N	3.30
SN74S153N	3.30
SN74S154N	3.40
SN74S157N	2.70
SN74S158N	3.00
SN74S160N	6.60
SN74S161N	6.60
SN74S174N	4.75
SN74S175N	4.00
SN74S181N	11.50
SN74S189N	5.10
SN74S194N	3.30
SN74S195N	4.40
SN74S251N	4.20
SN74S253N	4.20
SN74S275N	3.20
SN74S258N	3.70
SN74S260N	.90
SN74S280N	5.70
SN74S289N	5.00
93S10	6.80
93S16	6.80
93S21	3.50
93S22	3.20
93S48	3.70

HIGH SPEED TTL

74H00N	.34
74H01N	.49
74H04N	.36
74H05N	.38
74H08N	.44
74H10N	.44
74H11N	.44
74H15N	.38
74H20N	.39
74H40N	.36
74H74N	.69

SPECIFICATION SHEEETS: $.25 ea.

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XR205K Only $28.00

Here's a highly versatile lab instrument at a fraction of the cost of conventional unit. Kit includes two XR205 IC's, data & applications, PC board (etched & drilled, ready for assembly) and detailed instructions.

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LM354A: 6-27V, 2.80W, 8Ω		2.50
TAA611B12: 6-15V, 1.15W, 8Ω		1.60
TAA621A12: 6-27V, 1.40W, 8Ω		2.00
TBA641B11: 6-18V, 2.20W, 4Ω		3.00
TBA800: 5-30V, 4.70W, 8Ω		2.20
TBA810AS: 4-20V, 2.50W, 4Ω		3.00
TBA820: 3-16V, 0.75W, 4Ω		1.70
TCA830: 5-20V, 2.00W, 4Ω		2.20
TCA940: 6-24V, 6.50W, 8Ω		4.40

Power Transistors

BU204	3A	1300V	$4.14
BU205	3A	1500V	4.95
BU206	3A	1700V	5.94
BU207	6A	1300V	5.85
BU208	6A	1500V	6.93
BU209	6A	1700V	8.64

2N512B	$3.00
2N1136	1.50
2N1483	1.20
2N1534	1.00
2N1540	1.10
2N1544	.90
2N3053	.35
2N3055	.95
2N3375	5.50
2N3442	2.20
2N3730	1.70
2N3731	2.00
2N3732	1.50
2N3771	2.20
2N3772	2.30
2N3773	3.40
2N3789	3.00
2N3866	.95
2N4347	1.60
2N4348	2.00
2N4395	1.30
2N4427	1.10
2N5109	2.10
2N5322	.92
2N5323	.70
2N6099	.80
2N6101	.80
2N6103	.90

DUAL LOW NOISE OP AMP

LM331N:
V_{io} = 6mV
I_{ie} = 1000nA
I_b = 2000nA
Noise = 1.5dB
$2.20

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SI-1025E	25W	18.00
SI-1050E	50W	25.40

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LM104H	6.50
LM105H	5.10
LM105F	8.50
LM109H	9.50
LM109K	6.30
LM200H	3.80
LM204H	4.70
LM205H	3.00
LM209H	3.50
LM209K	3.70
LM300H	.90
LM300N	1.40
LM304H	1.40
LM305H	1.10
LM305AH	1.40
LM305N	1.20
LM309H	1.75
LM309K	1.95
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LM340-06K	2.60
LM340-08K	2.60
LM340-12K	2.60
LM340-15K	2.60
LM340-18K	2.60
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209	Red	$ .25
209	Yellow	.35
209	Green	.35

.160"dia.

216	Red	.25
216	Yellow	.30
216	Green	.30

.200"dia.

220	Red	.25
220	Yellow	.30
220	Green	.30

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SLA11	Green	4.25
SLA21	Orange	4.25
SLA2	±1 Red	2.25
SLA12	±1 Grn	2.25
SLA22	±1 Org	2.25
SLA3	Red	7.50
SLA4	Red	7.50
XAN72	Red	2.50
XAN52	Green	2.50

Optoisolator

MCT2 1.45

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LM301A	TO-5	$.90
LM301AM	Mini-dip	.75
LM301AN	Dip	1.10
LM302H	TO-5	.95
LM302N	Dip	1.40
LM306H	TO-5	2.80
LM307H	TO-5	.90
LM307M	Mini-dip	.90
LM308H	TO-5	1.20
LM308AH	TO-5	5.00
LM310H	TO-5	1.40
LM311H	TO-5	1.70
LM318H	TO-5	2.50
LM555CM	Mini-dip	.95
LM709CH	TO-5	.45
LM709CN	Dip	.45
LM710CH	TO-5	.60
LM710CN	Dip	.75
LM715CH	TO-5	4.30
LM725CH	TO-5	5.00
LM733CH	TO-5	1.50
LM733CN	Dip	1.50
LM741CH	TO-5	.45
LM741CM	Mini-dip	.44
LM747CH	TO-5	1.90
LM747CN	Dip	.90
LM748CN	Dip	.40
LM3046CN	Dip	.95
LM3054CN	Dip	1.50

Phase Locked Loops

LM567CM	Mini-dip	2.10

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LM336K: 12V, 500mA	2.90
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7401N	.23	7476N	.59	74151N	.75
7402N	.22	7480N	.66	74152N	2.25
7403N	.22	7481N	1.21	74153N	1.12
7404N	.25	7482N	1.01	74154N	1.63
7405N	.29	7483N	1.01	74155N	1.49
7406N	.38	7484N	3.01	74156N	1.49
7407N	.48	7485N	2.49	74157N	1.19
7408N	.24	7486N	.49	74158N	1.54
7409N	.54	7489N	2.99	74160N	1.50
7410N	.24	7490N	.75	74161N	1.35
7411N	.29	7491N	1.29	74162N	1.50
7412N	.51	7492N	.84	74163N	1.50
7413N	.78	7493N	.84	74164N	1.89
7414N	2.81	7494N	1.29	74165N	1.89
7416N	.46	7495N	.88	74166N	1.98
7417N	.64	7496N	.88	74170N	2.55
7420N	.19	7497N	1.51	74173N	1.79
7421N	.51	74100N	1.45	74174N	1.52
7423N	.49	74105N	.54	74175N	1.50
7425N	.39	74107N	.48	74176N	1.69
7426N	.29	74108N	.91	74177N	1.69
7427N	.35	74109N	.91	74180N	2.49
7428N	.51	74110N	.71	74181N	3.85
7430N	.22	74111N	.91	74182N	1.19
7432N	.28	74114N	.91	74184N	2.89
7433N	.61	74115N	.91	74185N	2.29
7437N	.44	74118N	.91	74190N	2.89
7438N	.44	74119N	.81	74191N	2.89
7439N	1.01	74121N	.54	74192N	1.49
7440N	.19	74122N	.89	74193N	1.39
7441AN	1.16	74123N	.95	74194N	1.35
7442N	.98	74125N	1.39	74195N	.99
7445N	.98	74126N	1.39	74196N	2.39
7447N	1.39	74128N	1.21	74197N	2.39
7448N	1.29	74132N	2.05	74198N	2.59
7450N	.23	74136N	.91	74199N	4.48
7451N	.28	74141N	1.89	74200N	5.05
7453N	.25	74145N	1.79	74221N	1.75
7454N	.26	74147N	2.95	74251N	1.75
7460N	.24	74148N	3.55	74278N	2.95
7470N	.30			74279N	.92
7472N	.39			74293N	.92
7473N	.46			74298N	2.55
7474N	.38				

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74L02N	.34
74L03N	.39
74L04N	.39
74L10N	.34
74L20N	.39
74L42N	1.62
74L47N	1.62
74L51N	.34
74L73N	.74
74L74N	.89
74L90N	1.62
74L93N	1.74
74L95N	1.62
93L00	1.50
93L01	1.60
93L08	3.40
93L09	1.80
93L10	2.80
93L11	4.20
93L12	1.80
93L14	1.70
93L16	3.20
93L18	3.50
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93L22	1.80
93L24	2.80
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9312PC	1.20
9314PC	1.30
9316PC	1.50
9318PC	2.30
9321PC	1.20
9322PC	1.30
9324PC	2.00
9328PC	2.50
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Available in beige, green, orange and black. (List 1st, 2nd, and 3rd choices in colors for all above phones.)

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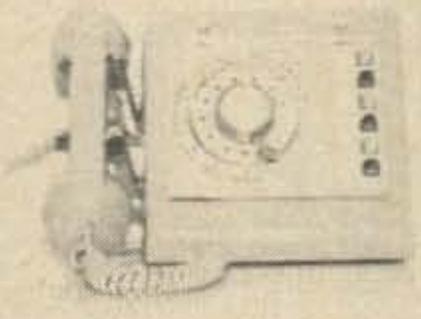

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DuPage FM

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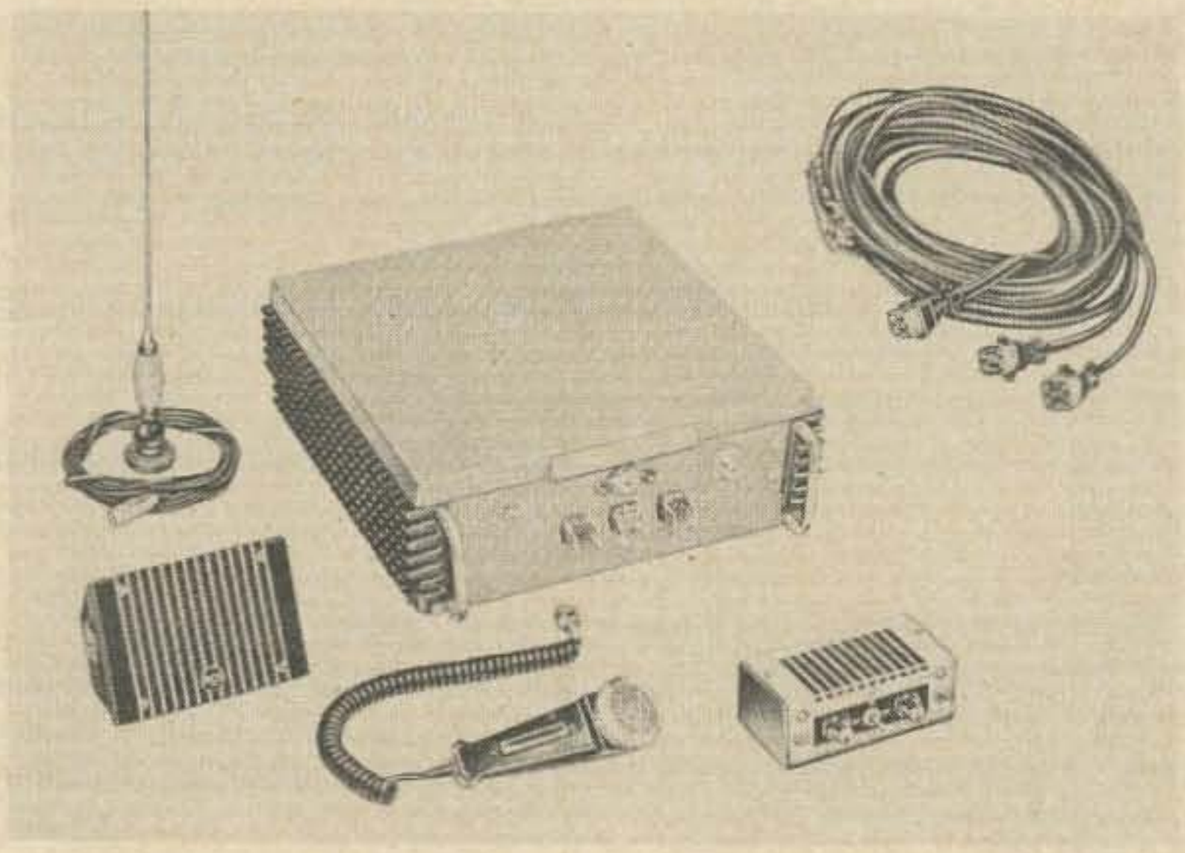
Have yourself a Merry Christmas with one of these RCA Specials

The RCA LowDrain series mobile radio has been a workhorse for several years. These units feature a transistor power supply, and a receiver that is transistorized from the second mixer through the audio states.

Standby drain is only 2.2 amps, which is ideal for Amateurs, Civil Defense and other volunteers. These units are fully NARROW-BANDED.



SIX TO TEN METERS. CMFT-50 covers 25 to 54 mc without changing coils. Fifty watts output. With accessories, regularly $125.00 for December only $100.00.

TWO METERS. CMCT-30 covers 148 to 174 mc. Thirty watts output. Regularly $100.00 for December only $85.00 with accessories.

SCANNING CONTROL HEADS. We have a few RCA Scanning control heads still left. These heads scan across four channels and lock on to an active channel. When activity ceases the head resumes its scanning activity. This is a solid state head which uses LEDs to indicate the scanning activity and the channel being received. The input requirements are 12 vdc and raw audio from the discriminator. With schematic of the logic. (Shipping weight 4 pounds) Used $75.00 each

Send your check or money order to

DU PAGE FM INC. P.O. Box 1 Lombard, Ill. 60148
(312) 627-3540

TERMS: All items sold as is. If not as represented return for exchange or refund (our option) shipping charged prepaid within 5 days of receipt. Illinois residents must add 5% sales tax. Personal checks must clear before shipment. All items sent shipping charges collect unless otherwise agreed. Accessories do not include crystals, relay or antennas.

IF YOU CAN SOLDER, YOU CAN BUILD YOUR OWN

Clock/Calendar

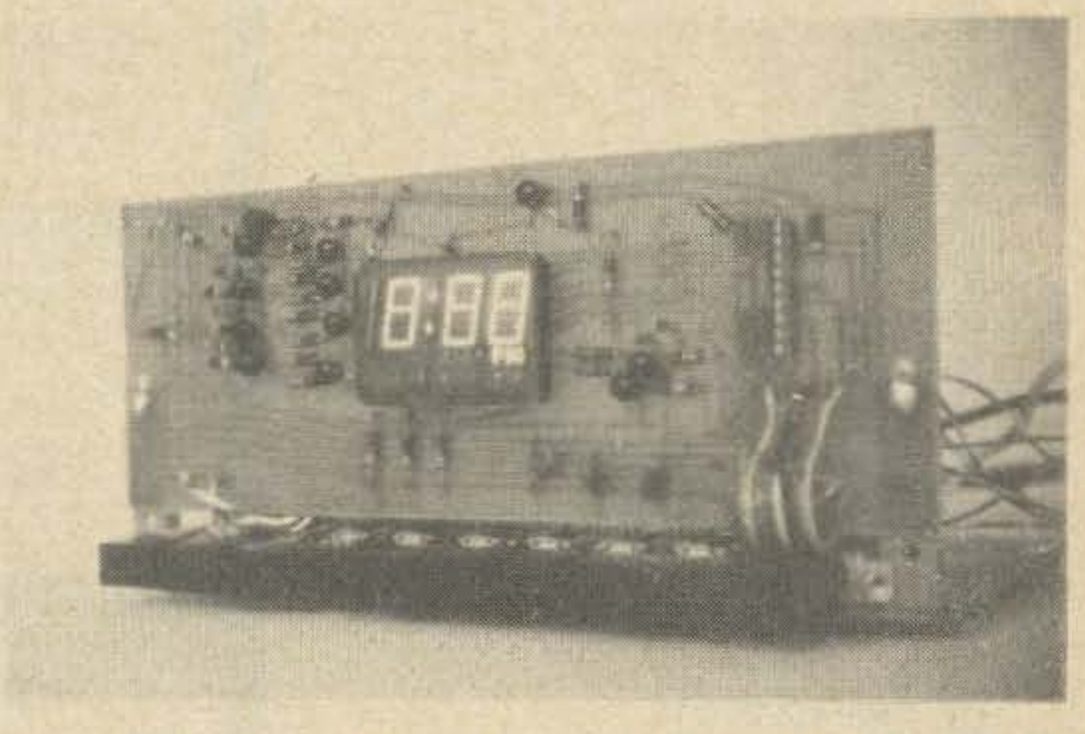
SOLID STATE SYSTEMS, INC. has available a CLOCK/CALENDAR kit containing over 120 separate electrical components.

The clear, simplified instructions include step by step construction procedures and ample illustrations which will quickly take you through construction of this versatile Clock/Calendar.

THE KIT FEATURES:

* **DISPLAY OF DATE WITH MONTH AND DAY** - displays month and day automatically, through year, except for February 29.
* **DISPLAY OF TIME ON 12 HOUR CYCLE** - hours and minutes displayed with A.M. and P.M. indicators.
* **A 24 HOUR ALARM OPTION** - this also includes a snooze button which delays alarm an additional 10 minutes.
* **A 9 HOUR 59 MINUTE TIMING OPTION** - this allows operation of any pluggable 600 watt, 120 volt, 5 amp, 60 Hz electrical device such as a radio, room light, stereo or coffee pot.
* **EASILY VISIBLE SPERRY® DISPLAY** - this display is highly visible in a well lighted room.

An attractive case may be fabricated of wood, plexiglas, metal or whatever you feel would make an appropriate show-case for your finished kit.



PLEASE NOTE: These kits do not include cases.

This kit when completed is a sophisticated device which offers many additional features due to its flexibility, here are two examples of what can be done with this device:

1. You may set the timer to play your radio for 15 minutes at bedtime, then the alarm allows you the option of waking up to the radio in the morning all automatically.
2. You may set the alarm to later start an appliance which will operate for the duration of the setting on the timer.

TO ORDER:

Order Number **01-12241** - **BASIC CLOCK** - This kit does not include the 24 hour alarm option or the 9 hour 59 minute appliance timer option. Price ..... $49.95.

Order Number **02-12241** - **COMPLETE CLOCK**, This kit includes all available options. Price ..... $65.00.

SOLID STATE SYSTEMS, INC.

SEND YOUR ORDERS TO:
SOLID STATE SYTEMS, INC.
P. O. BOX 617
COLUMBIA, MISSOURI 65201

OR PHONE (TOLL FREE)
800-325-2981 – 800-325-2983

Your BANKAMERICARD

master charge

INTERNATIONAL ELECTRONICS UNLIMITED

DIGITAL INTEGRATED CIRCUITS

	Ea.		Ea.		Ea.
7400	$ .19	7447	$1.15	74141	$1.23
7401	.19	7448	1.15	74145	1.15
7402	.19	7450	.24	74150	1.09
7403	.19	7451	.27	74151	.89
7404	.22	7453	.27	74153	1.29
7405	.22	7454	.39	74154	1.59
7406	.39	7460	.19	74155	1.19
7407	.39	7464	.39	74156	1.29
7408	.25	7465	.39	74157	1.29
7409	.25	7472	.36	74161	1.39
7410	.19	7473	.43	74163	1.59
7411	.29	7474	.43	74164	1.89
7413	.79	7475	.75	74165	1.89
7415	.39	7476	.47	74166	1.65
7416	.39	7483	1.11	74173	1.65
7417	.39	7485	1.39	74176	1.09
7420	.19	7486	.44	74177	.99
7422	.29	7489	2.75	74180	1.09
7423	.35	7490	.76	74181	3.65
7425	.39	7491	1.29	74182	.89
7426	.29	7492	.79	74184	2.69
7427	.35	7493	.79	74185	2.19
7430	.22	7494	.89	74190	1.59
7432	.29	7495	.89	74191	1.59
7437	.45	7496	.89	74192	1.49
7438	.39	74100	1.65	74193	1.39
7440	.19	74105	.49	74194	1.39
7441	1.09	74107	.49	74195	.99
7442	.99	74121	.57	74196	1.09
7443	.99	74122	.53	74197	.99
7444	1.10	74123	.99	74198	2.19
7445	.99	74125	.69	74199	2.19
7446	.99	74126	.79	74200	7.95

LOW POWER TTL

74L00	.33	74L51	.33	74L90	1.69
74L02	.33	74L55	.33	74L91	1.45
74L03	.33	74L71	.33	74L93	1.69
74L04	.33	74L72	.49	74L95	1.69
74L06	.33	74L73	.69	74L98	2.79
74L10	.33	74L74	.69	74L164	2.79
74L20	.33	74L78	.79	74L165	2.79
74L30	.33	74L85	1.25		
74L42	1.69	74L86	.69		

HIGH SPEED TTL

74H00	.33	74H21	.33	74H55	.39
74H01	.33	74H22	.33	74H60	.39
74H04	.33	74H30	.33	74H61	.39
74H08	.33	74H40	.33	74H62	.39
74H10	.33	74H50	.33	74H72	.49
74H11	.33	74H52	.33	74H74	.59
74H20	.33	74H53	.39	74H76	.59

8000 SERIES TTL

8091	.59	8214	1.69	8811	.69
8092	.59	8220	1.69	8812	1.10
8095	1.39	8230	2.59	8822	2.59
8121	.89	8520	1.29	8830	2.59
8123	1.59	8551	1.65	8831	2.59
8130	2.19	8552	2.49	8836	.49
8200	2.59	8554	2.49	8880	1.33
8210	3.49	8810	.79		

9000 SERIES TTL

9002	.39	9309	.89	9601	.99
9301	1.14	9312	.89	9602	.89

Please specify data sheets required with order. Add $.50 per data sheet for items priced less than $1.00 each.

CMOS

74C00	.39	74C74	1.15	74C162	3.25
74C02	.55	74C76	1.70	74C163	3.25
74C04	.75	74C107	1.50	74C164	3.50
74C08	.75	74C151	2.90	74C173	2.90
74C10	.65	74C154	3.50	74C195	3.00
74C20	.65	74C157	2.19	80C95	1.50
74C42	2.15	74C160	3.25	80C97	1.50
74C73	1.55	74C161	3.25		

4000 SERIES RCA-EQUIVALENT

CD4001	.55	CD4013	1.20	CD4023	.55
CD4009	.85	CD4016	1.25	CD4025	.55
CD4010	.85	CD4017	2.95	CD4027	1.35
CD4011	.55	CD4019	1.35	CD4030	.95
CD4012	.55	CD4022	2.75	CD4035	2.85

MEMORIES

1101	256 bit RAM MOS	1.75
1103	1024 bit RAM MOS	4.95
5260	1024 bit RAM Low Power	3.95
7489	64 bit RAM TTL	2.75
8223	Programmable ROM	4.95

10% OFF ON ORDERS OVER $25.00

LOGIC PROBE KIT

- Ten nano/sec capability
- Checks TTL & DTL logic
- Dual slope memory
- Internal 5V regulator

Kit is complete with all necessary components, case, probe, complete instructions and logic chart. $19.95

TRANSISTOR GRAB BAG

PNP & NPN
Yield 50% + Good
Good for use as segment drivers 30/$1.00

POWER SUPPLY SPLITTER KIT

- Ground reference for positive & negative output from single supply — any DC source to 20V
- Balanced output adjustment
- 1 amp-current capability with sink
- increase usefulness of your power supply

Complete with all components & instructions $4.95

18 PIN CALCULATOR KIT

- MM 5736 18 PIN Calc. Chip four function 6 Digit
- A pair of 3-in-1 PAKS (6 digit) LED NSN 33
- One 75492 HEX Digit driver

Schematic and instructions included. You supply switches, keyboard and battery for complete calculator. $9.95

CALCULATOR CHIPS

5001	LSI (40-Pin) Add, subtr., mult. & div., 12-dig. Data supplied with chip	$3.95 ea.
	Data only — Refundable with purchase	1.00
5002	LSI similar to 5001 exc. des. for battery operated - Data supplied with chip	7.95 ea.
	Data only — Refundable with purchase	1.00
5005	LSI (28 pin) Full 4 funct. mem. 12-dig. displ. & calc. 7 seg. mltplx. outp. Data suppl. w/chip	8.45 ea.
	Data only — Refundable with purchase	1.00
MM5736	18 Pin, 6-dig., add, subtr., mult., div.	3.95 ea.

DIGITAL CLOCK CHIPS

MM 5311	28-pin any readout 6-dig. BCD mux with spec. sheet	9.95 ea.
MM 5312	24-pin any readout 4 digit lpps output BCD mux with spec. sheet	6.95 ea.
MM 5313	28-pin any readout 6 digit lpps BCD mux with spec. sheet	7.95 ea.
MM 5314	24-pin LED-Incandescent readout mux 6-digit with spec. sheet	8.95 ea.
MM 5316	40-pin norm. alarm set snooze alarm-timer 12 or 24-hr. operat. with spec. sheet	12.95 ea.

LED's

MV10B	Visible red TO 18		.25 ea.
MV50	Axial leads micromini dome	.25 ea.	5/1.00
MV5020	Jumbo clear dome visible red	.35 ea.	3/1.00
ME4	Infra red (invisible) diff. dome		.60 ea.

DISPLAYS

MAN1	Red, 7 seg., .270"	$2.50 ea.
MAN2	Red alpha numeric, .32"	4.95 ea.
MAN3A	Red, 7 seg., .127" in line leads	.79 ea.
MAN3M	Red, 7 seg., .127" staggered leads	1.15 ea.
MAN4	Red, 7 seg., .190"	2.15 ea.
MAN5	Green, 7 seg., .270"	2.95 ea.
MAN7	Red, 7 seg., .270"	1.39 ea.
MAN8	Yellow, 7 seg., .270"	3.95 ea.
MAN66	.75" high direct viewing LED	4.65 ea.
DL707	Red, 7 seg., .3"	2.15 ea.

OPTO ISOLATORS

MCD2	Diodes	$1.09 ea.
MCT2	Transistor	.69 ea.

PHASE LOCKED LOOPS

560	Phase Locked Loop	DIP	2.75 ea.
561	Phase Locked Loop	DIP	2.75 ea.
562	Phase Locked Loop	DIP	2.75 ea.
565	Phase Locked Loop	DIP	2.65 ea.
566	Function Generator	MINI DIP	2.75 ea.
567	Tone Generator	MINI-DIP	2.95 ea.

LINEAR INTEGRATED CIRCUITS

300	Pos V Reg (super 723)	TO-5	$ .79 ea.
301	Hi performance AMP	MINI-DIP, TO-5	.32 ea.
301	Voltage Follower	TO-5	.79 ea.
304	Negative Voltage Regul.	TO-5	.89 ea.
305	Positive Voltage Regul.	TO-5	.95 ea.
307	Op AMP (super 741)	MINI-DIP, TO-5	.35 ea.
308	Micro Power Op Amp	MINI-DIP	1.10 ea.
309H	5 V Regulator 200 ma	TO-5	1.10 ea.
309K	5 V 1A Regulator	TO-3	1.65 ea.
310	Voltage Follower Op Amp	TO-5	1.19 ea.
311	Hi perf. Volt. Compartr.	MINI-DIP, TO-5	1.05 ea.
319	Hi-Speed Dual Compartr.	DIP	1.29 ea.
320	Neg. Reg. 5.2, 12, 15	TO-3	1.35 ea.
324	Quad Op Amp	DIP	1.95 ea.
339	Quad Comparator	DIP	1.69 ea.
340T	Pos. Volt. Reg. (6V-8V-12V-15V-18V-24V)	TO-220	1.95 ea.
370	AGC/Squelch AMPL	TO-5 or DIP	1.15 ea.
372	AF-IF Strip-detector	DIP	.79 ea.
373	AM/FM/SSB Strip	DIP	3.25 ea.
376	Pos. Volt. Regulator	MINI-DIP	.59 ea.
377	2W Stereo amp	DIP	2.69 ea.
380	2 Watt Audio Amp	DIP	1.29 ea.
380-8	.6W Audio amp	MINI-DIP	1.25 ea.
381	Low-Noise Dual Pre-Amp	DIP	1.79 ea.
382	Low-Noise Dual Pre-Amp	DIP	1.79 ea.
550	Prec. Voltage Regulator	DIP	.79 ea.
555	Timer	MINI-DIP	.99 ea.
703	RF-IF AMP	MINI-DIP	.45 ea.
709	Operational AMPL	TO-5 or DIP	.29 ea.
711	Dual Different. Compar.	DIP	.29 ea.
723	Voltage Regulator	DIP	.59 ea.
739	Dual Hi Perf. Op AMP	DIP	1.19 ea.
741	Comp. Op AMP	MINI-DIP, TO-5	.35 ea.
747	Dual 741 Op Amp	TO-5 or DIP	.79 ea.
748	Freq. Adj. 741	MINI-DIP	.39 ea.
1303	Stereo Pre-Amp	DIP	.89 ea.
1304	FM Mulpx Stereo Demod	DIP	1.19 ea.
1307	FM Mulpx Stereo Demod	DIP	.82 ea.
1458	Dual Comp. Op. Amp.	MINI-DIP	.69 ea.
LH2111	Dual LM 211 Volt. Comp.	DIP	1.95 ea.
3065	TV-FM Sound System	DIP	.69 ea.
3075	FM Det.-LMTR & Audio Pre-Amp	DIP	.79 ea.
3900	Quad Amplifier	DIP	.59 ea.
3905	Precision Timer	DIP	.65 ea.
7524	Core Mem Sense AMPL	DIP	1.89 ea.
7525	Core Mem Sense AMPL	DIP	.89 ea.
7534	Core Mem Sense Amp	DIP	2.59 ea.
7535	Core Mem Sense Amp	DIP	1.15 ea.
8038	Function Generator	DIP	4.95 ea.
75451	Dual Peripheral Driver	MINI-DIP	.39 ea.
75452	Dual Peripheral Driver	MINI-DIP	.39 ea.
75453	(351) Dual Periph. Driver	MINI-DIP	.39 ea.
75491	Quad. seg. driver for LED readout	DIP	1.55 ea.
75492	Hex digit driver	DIP	1.69 ea.

Please specify which data sheets are required with order. Add $.50 per data sheet for items priced less than $1.00 each.

TRANSISTOR SPECIAL

Hi Voltage Power Transistors — Prime Quality

Typically 40 Beta at 50 MHz. 10W, 1A max TO-5

NPN	400 VOLT	$2.45 ea.	With combined
NPN	300 VOLT	1.20 ea.	total of 100
NPN	200 VOLT	.75 ea.	trans — 15% Off

All items are new, unused surplus parts—tested functional. Satisfaction is guaranteed. Shipment will be made via first class mail — postage paid — in U.S., Canada and Mexico within three days from receipt of order. Minimum order — $5.00. California residents add sales tax.

(408) 659-4773

INTERNATIONAL ELECTRONICS UNLIMITED
P.O. BOX 1708 MONTEREY, CALIF. 93940 USA

ADD A DIGITAL CLOCK TO YOUR SHACK

6 DIGIT CLOCK KIT

Contains — MM5313 — 6 MAN7 — all digit interface IC's and all components needed less pwr xfmr and case $27.95

4 DIGIT CLOCK KIT

Contains — MM5312 — 4 MAN7 — all digit interface IC's and all components needed less pwr xfmr and case $22.95

2 METER FM HEADQUARTERS

NEW extended hours convenient location at ERICKSON COMMUNICATIONS

only **STANDARD** sells more STANDARDS than Erickson...and here's why

ERICKSON SPECIAL !
SRC-146A with

- *Charger*
- *"Stubby" antenna*
- *Leather case*
- *Ni-Cads*
- *94/94, 34/94 and one channel of your choice*

List Price:	$369.00
YOU SAVE:	50.00
YOUR PRICE: only	$319.00

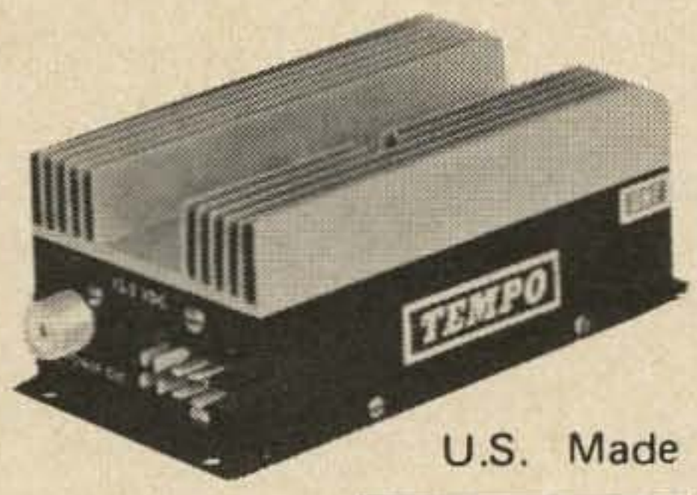
Shipped prepaid for cashier's check or M.O.

SYNTHESIZED !

Inoue's New
IC-230

- 162+ channels, simplex or offset (600 kHz) for repeaters
- All modular construction
- Super hot MOSFET/helical coil .4μV receiver
- AVAILABLE NOW ! . . . only **$489.00**

TEMPO SOLID-STATE POWER AMPS



U.S. Made

MODEL	DRIVE POWER	OUTPUT POWER	PRICE
1202	5-25 watts	100-135 watts	$228
1202B	1-2.5 watts	120-130 watts	$239
802	5-12 watts	70-90 watts	$190
802B	1-2.5 watts	80-90 watts	$195
502	5-15 watts	35-55 watts	$110
502B	1-2.5 watts	45-50 watts	$130
302	1-2.5 watts	30-35 watts	$93
152	1 watt	15 watts	$59

And many more from SBE/Clegg/ICOM/Kenwood/Tempo/Antenna Specialists/Larsen

Make ERICKSON your headquarters for all your FM needs . . .

SEND QSL FOR COMPLETE SPECIFICATIONS

ERICKSON COMMUNICATIONS

4135 Main Street Skokie, IL 60076 (312) 677-2161

Extended hours: Days 9 – 4:30, Monday through Saturday;
Evenings 6:30 – 9, Monday, Thursday, Friday

SOLID STATE SURPLUS
.... four months later

Dear Customer,

Four months ago we ran our first ad in these pages. You may even remember the "just what the world needs. . .another surplus place?" banner which said, in effect, we aim to do things a little differently.

Those of you who have ordered from us know what we're about. . .hobbyist parts at truly competitive prices, fast turnaround, no backordering. . .and judging from your reaction, this is what you want.

For those reading about us for the first time, a few comments. One, we *do not publish a catalog,* for two reasons. First, our "catalog" is this page – it lists every product we sell. (A couple of months ago, we had an ad saying "Solid State Surplus proudly announces its first catalog." The point of the ad was that the ad itself is our catalog, although we didn't manage to make that point too clearly. . . I guess that's what happens when you let electronics freaks do the advertising.) There's another reason why we don't have a catalog: We'd have to charge more for our parts. When you send in your 65¢ for a regulator, you want to pay for the regulator, not the price of mailing catalogs out to other people. We are trying to avoid anything that would force higher prices. . .hence, no catalog. What's for sale is listed in the ad.

Another comment: we enjoy dealing with you, our friends and customers. We appreciate the notes, the comments and the criticisms, too. If you have something you feel like saying to us, go right ahead; we've all got big ears and we listen hard. The increased interest in the 4016, for example, is what put it in our repertoire of ICs. . .and who knows what we'll come up with in the months ahead?

But to return to the present, here's what we sell now. You know the rest; spiffy data sheets, orders filled (usually airmail) within 48 hours of receipt, no backordering, and individual testing of each part. . .just what the world needs, another surplus place.

SOLID STATE SURPLUS

LM 309K 5V 1A regulator $1.20
LM 311M high performance comparator $1.00
LM 339 dip quad comparator $1.50
LM 555 timer $.85
LM 723D adjustable precision voltage regulator $.65
LM 741 mini compensated op amp $.45
LM 747 dip dual 741 $.70
LM 3900 dip quad op amp $.45
LM 4250 TO5 programmable op amp $2.00
LM 1558 mini dip dual 741 $.75
NE 531 minidip hi slew op-amp $1.25
CD 4016 quad analog switch $1.00

ABOVE MATERIAL IS GUARANTEED FUNCTIONAL, RETESTED MATERIAL. USER SATISFACTION GUARANTEED FOR HOBBY AND EXPERIMENTAL APPLICATIONS.

SOLID STATE SURPLUS
BOX 255
MONTE RIO CA 95462

TTL

7400	$ .18	7475	.75	74182	.89
7401	.19			74184	2.30
7402	.19	7476	.47	74185	2.19
7403	.19	7480	.50	74187	6.00
7404	.21	7482	1.75	74190	1.50
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7406	.39	7485	1.10	74192	1.35
7407	.39	7486	.44	74193	1.35
7408	.25	7488	3.00	74194	1.39
7409	.25	7489	2.75	74195	.95
7410	.19	7490	.79	74196	1.25
7411	.29	7491	1.29	74197	.99
7412	.40	7492	.79	74198	2.19
7413	.79	7493	.79	74199	2.19
7416	.39	7494	.89	74200	6.95
7417	.39	7495	.89		
7418	.25	7496	.89		
7420	.19	74100	1.50		
7421	.35	74107	.47		
7423	.35	74121	.55		
7425	.39	74122	.47		
7426	.29	74123	.99		
7427	.35	74125	.60		
7429	.40	74126	.79		
7430	.22	74141	1.15		
7432	.29	74145	1.10		
7437	.45	74150	1.05		
7438	.39	74151	.89		
7439	.50	74153	1.29		
7440	.19	74154	1.25		
7441	1.08	74155	1.19		
7442	.99	74156	1.29		
7443	.99	74157	1.29		
7444	1.10	74160	1.65		
7445	1.10	74161	1.39		
7446	1.10	74163	1.59		
7447	1.10	74164	1.89		
7448	1.10	74165	1.89		
7450	.24	74166	1.65		
7451	.27	74170	3.00		
7453	.27	74173	1.65		
7454	.39	74174	1.85		
7459	.25	74175	1.85		
7460	.19	74176	.89		
7470	.45	74177	.89		
7472	.36	74180	1.05		
7473	.43	74181	3.50		
7474	.42				

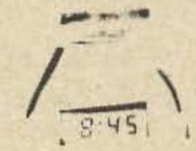
20% Discount for 100 Pieces Combined 7400

CMOS

CD4001	$ .55
CD4002	.55
CD4007	1.25
CD4009	.85
CD4010	.65
CD4011	.55
CD4012	.55
CD4013	1.10
CD4016	1.25
CD4017	2.50
CD4019	1.25
CD4020	1.50
CD4023	.55
CD4025	.55
CD4027	1.25
CD4030	.60
MC3022	2.00
74C00	.35
74C04	.69
74C20	.65
74C173	2.50

8000 SERIES	
8091	.59
8092	.59
8095	1.39
8123	1.59
8130	2.19
8200	2.59
8210	3.49
8223	4.00
8288	1.15
8520	1.29
8826	5.00
8880	1.33

Christmas $PECIAL$



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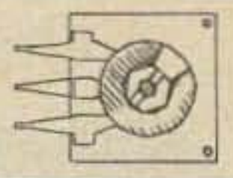

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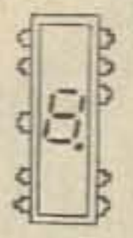

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7404	.25	7492	.80
7405	.25	7493	.80
7406	.45	7495	.90
7407	.45	7496	.85
7408	.25	74107	.50
7409	.25	74121	.60
7410	.20	74122	.60
7411	.30	74123	1.10
7413	.85	74125	.65
7416	.45	74126	.65
7417	.45	74141	1.25
7420	.20	74150	1.70
7430	.20	74151	1.00
7432	.30	74153	1.40
7437	.50	74154	1.70
7438	.50	74157	1.40
7440	.20	74161	1.50
7442	1.10	74163	1.70
7446	1.45	74164	2.00
7447	1.45	74165	2.00
7448	1.45	74166	1.75
7450	.20	74174	2.20
7451	.20	74175	2.20
7453	.20	74176	1.60
7454	.20	74177	1.35
7473	.45	74181	3.90
7474	.45	74192	1.50
7475	.80	74193	1.45
7476	.50	74195	1.00
7483	1.10	74200	8.00

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2mfd	.10	.12	
5mfd	.10	.12	
10mfd	.11	.13	.16
30mfd	.12	.20	.28
50mfd	.13		
100mfd	.15	.30	.45
200mfd	.20		.70
500mfd	.28	.75	
1000mfd	.50		

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2N2907 (PNP) TO–18	.25	.20
TO–92 general purpose NPN & PNP transistors, beta > 100, breakdown > 40v	$ .08 each	$5.95/100

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N–CHANNEL:	**SIMILAR TO:**	
NJF10	2N4416, MPF102	3/$1.00
NJF11	2N4091–93	4/$1.00
NJF12	2N4338–41	4/$1.00
NJF13	2N3089	3/$1.00
NJF14	2N4221–22	4/$1.00
P–CHANNEL:		
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PJF14	2N2608	1/$1.00

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CALCULATOR CHIPS

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Data alone ..... 50 cents

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CMOS HEX INVERTER, dual inline package. 3-18 volt range, dual diode protection against static charge. Dielectrically isolated complimentary MOS. $1.00 each 12 for $10.00

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Calculator Basics

6-8-12 DIGIT Your Choice **$16.95**

BASIC KIT #1 — includes case, all-function Flex Key Keyboard, Cal Tech CT5002 calculator chip, 9-digit Antex LED display with built-on individual magnifiers, plus sheets. **16.95**

BASIC KIT #2 — same as Basic #1 except calculator chip is National 8-digit MM5725. **16.95**

BASIC KIT #3 — same as Basic #1 except calculator chip is National 6-digit MM5736 and 75492. **16.95**

12 DIGIT BASIC #4 — Key parts include: CT5001 chip, 4-3 digit readouts, factory etched PC board, case, carrying case, 2-resistor networks, decimal switch. Wild Rover Keyboard with ON-OFF switch diagrams. **Sale $24.95**

8-DIGIT MINI CALCULATOR BASIC KIT #6 — world's smallest. Needs least amount of components to complete kit. Includes CT-5030 chip, mini case, with lens, key-board, with on-off and constant switches & percentage. 9-digit array (Hewlett Packard). Includes diagrams. p.c. board **$19.95.**

8-DIGIT "TEXAS INSTRUMENT" BASIC KIT #7 — includes T-I keyboard, 1KS149, standard 4-function. With T-I calculator chip TMS-0128, p.c. board, case, lens. Microswitch (on-off). 9-digit ANTEX array; in-cludes diagram. **$19.95.**

MINI CALCULATOR BASIC KIT #8 — 4-Function Same as **KIT #6** except less percentage and constant. Includes CT-5031 chip, **$17.95.**

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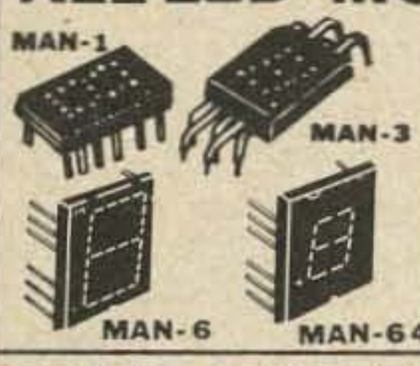

MONSANTO TYPE	CHAR. HT.	SALE EACH	Quantity Discounts
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☐ MAN-3	.12	1.00	3 for $2.50
☐ MAN-6	.60	4.50	3 for $12.
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*35 LED matrix

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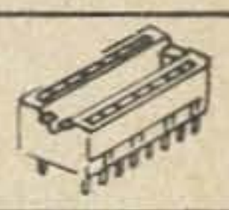

☐ 14-Pin, DIP	$.45		
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☐ 16-Pin, DIP	.50	☐ 14-Pin, Wire Wrap	.69c
☐ TO-5, 8 or 10-Pins	.29	☐ 16-Pin, Wire Wrap	.89c
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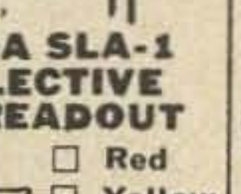
OPCOA SLA-1 REFLECTIVE LED READOUT



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☐ SN7401	.22
☐ SN7402	.24
☐ SN7403	.22
☐ SN7404	.27
☐ SN7405	.24
☐ SN7406	.79
☐ SN7407	.48
☐ SN7408	.27
☐ SN7409	.27
☐ SN7410	.22
☐ SN7411	.31
☐ SN7412	.55
☐ SN7413	.89
☐ SN7414	2.25
☐ SN7415	.45
☐ SN7416	.45
☐ SN7417	.50
☐ SN7420	.22
☐ SN7421	.50
☐ SN7422	.29
☐ SN7423	.32
☐ SN7425	.35
☐ SN7426	.31
☐ SN7427	.35
☐ SN7430	.24
☐ SN7432	.28
☐ SN7437	.45
☐ SN7438	.49
☐ SN7440	.22
☐ SN7441	1.19
☐ SN7442	1.02
☐ SN7443	1.19
☐ SN7444	1.02
☐ SN7445	1.09
☐ SN7446	1.19
☐ SN7447	1.19
☐ SN7448	1.19
☐ SN7450	.27
☐ SN7451	.28
☐ SN7453	.28
☐ SN7454	.39
☐ SN7455	.28
☐ SN7460	.26
☐ SN7461	.26
☐ SN7462	.39
☐ SN7464	.39
☐ SN7465	.39
☐ SN7470	.49
☐ SN7471	.55
☐ SN7472	.42
☐ SN7473	.52
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☐ SN7475	.91
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☐ SN74114	.95
☐ SN74121	.49
☐ SN74122	.55
☐ SN74123	1.09
☐ SN74125	.65
☐ SN74126	.89
☐ SN74139	1.25
☐ SN74140	2.50
☐ SN74141	1.19
☐ SN74145	1.19
☐ SN74148	2.95
☐ SN74150	1.19
☐ SN74151	.99
☐ SN74153	1.39
☐ SN74154	1.69
☐ SN74155	1.29
☐ SN74156	1.45
☐ SN74157	1.45
☐ SN74158	1.45
☐ SN74160	1.85
☐ SN74161	1.59
☐ SN74163	1.75
☐ SN74164	2.85
☐ SN74165	2.85
☐ SN74166	1.85
☐ SN74173	1.85
☐ SN74174	2.25
☐ SN74175	1.99
☐ SN74176	1.25
☐ SN74177	1.25
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☐ SN74181	3.95
☐ SN74182	1.05
☐ SN74185	2.34
☐ SN74187	2.34
☐ SN74192	1.59
☐ SN74193	1.59
☐ SN74194	1.89
☐ SN74195	1.10
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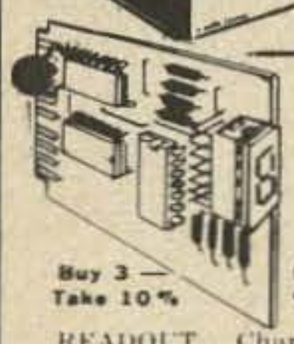

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READOUT	Char.	Maker
☐ MAN-1	.27 h.	Monsanto
☐ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

* Pin-for-pin MAN-1, ** Pin-for-pin MAN-4, elec. char. same

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December ~ 1974

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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	3	3	3	3	3	7	14	14A	14
ARGENTINA	7A	7	7	7	7	7	14	14A	14A	21	21	14
AUSTRALIA	14	7B	7B	3B	7	7	7B	7A	14	14	14	14
CANAL ZONE	7A	7	7	7	7	7	7A	14A	21	21	21	14
ENGLAND	7	7	7	3	7	7B	7A	14A	14A	14	7B	7
HAWAII	14	7B	7	7	7	7	3A	3	7B	14A	21	14A
INDIA	7	7	7B	7B	7B	7B	7B	14B	7B	7B	7B	7
JAPAN	14B	7B	7B	7B	7	7	3	7	7B	7B	7B	14B
MEXICO	7A	7	7	7	7	7	7	14	14A	21	14A	14
PHILIPPINES	7A	7B	7B	7B	7B	3A	3A	7	7	7B	3B	7
PUERTO RICO	7	7	3A	3A	3A	3A	7A	14	14	14	14	14
SOUTH AFRICA	7B	7	7	7	7B	7B	14	14A	21	21	14	14
U.S.S.R.	7	7	3	3	7	7B	7B	14	14	7B	7B	7B
WEST COAST	14	7	7	3A	7	7	7	7A	14	14A	14A	14

CENTRAL UNITED STATES TO:

ALASKA	14	7	7	3	3	3	3	3	7	14	14	14A
ARGENTINA	14	7	7	7	7	7	7B	14A	14A	21	21	14
AUSTRALIA	14	7A	7B	7B	7	7	3B	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14A	21	21	21	14A
ENGLAND	7	7	7	3	7	7	7B	14	14	14B	7B	7B
HAWAII	14	7A	7	7	7	7	3A	3	7B	14A	21	21
INDIA	7	7	7B	3B	7B	7B	3B	7	7	7B	7B	7B
JAPAN	14	7B	7B	3B	3	3	3	3	7	7B	7B	14
MEXICO	7A	7	7	3	3	3	3	7	14	14	14	14
PHILIPPINES	14	7B	7B	3B	3B	3	3	3	7	7B	7B	7A
PUERTO RICO	7	7	7	7	7	7	7	14	14A	14A	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14A	21	14A	14
U.S.S.R.	7	7	3	3	7	7	7B	14	7B	7B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3	7	14	14	14A
ARGENTINA	14	7A	7	7	7	7	7B	14	14	14	21	21
AUSTRALIA	21	14	14	7B	7	7	7B	7B	7A	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14A
ENGLAND	7B	7	7	3	7	7	3B	7B	14	14B	7B	7B
HAWAII	14A	14	7	7	7	7	7	3	7	14A	21	21
INDIA	7B	14B	7B	3B	3B	7B	3B	7	7	7	7B	7B
JAPAN	21	14	7B	3A	3	3	3	3	7	7	7B	14
MEXICO	14	7	7	3A	7	7	3A	7	14	21	21	14
PHILIPPINES	14A	14	7B	7B	3B	3B	3	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14A	14
SOUTH AFRICA	14	7	7	3A	7B	7B	7B	7A	14	14A	14	14
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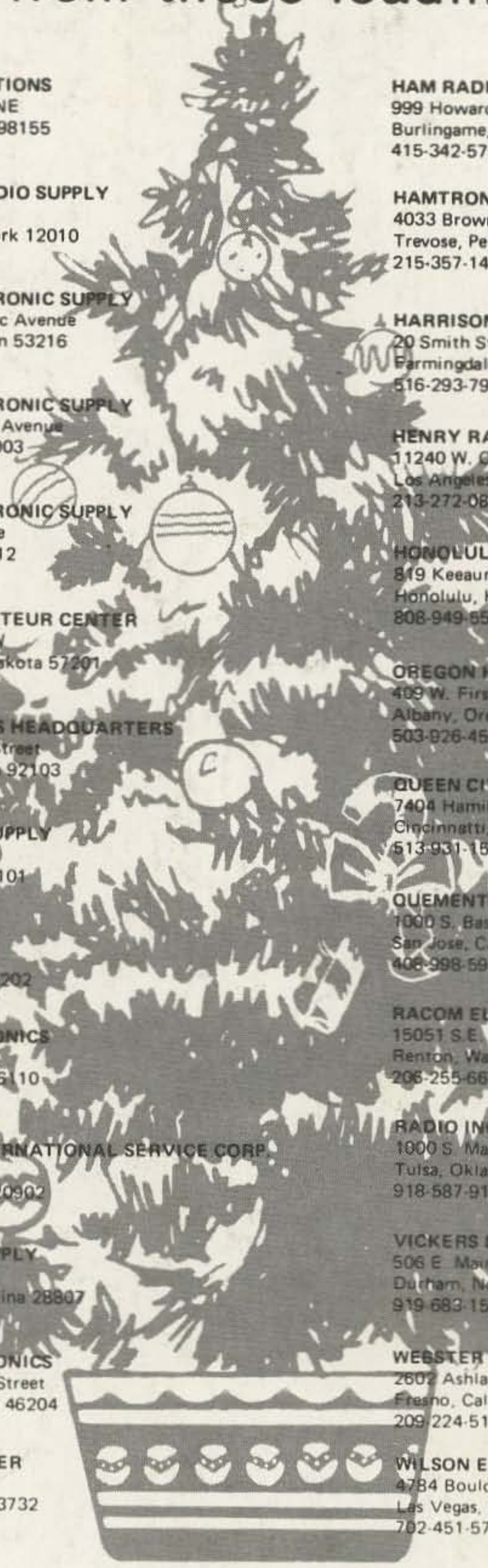

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